Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor

DOE/EIS-0250F-S2D

and

Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada

DOE/EIS-0369D

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5. CUMULATIVE IMPACTS

This chapter presents the results of the DOE analysis of potential cumulative impacts under the Proposed Action for the Caliente rail alignment and the Mina rail alignment. The analysis considers impacts associated with past, present, and reasonably foreseeable future and continuing actions along with potential impacts from each of the rail alignments.

Glossary terms are shown in ***bold italics***.

5.1 Introduction

Cumulative Impact: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

The U.S. Department of Energy (DOE or the Department) combined potential ***impacts*** reported in Chapter 4 of this Rail Alignment EIS with the potential impacts of other relevant past, present, and ***reasonably foreseeable future actions*** in the ***region of influence*** for each rail alignment. These combined impacts are called ***cumulative impacts***. Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500 to 1508) that implement the procedural requirements of the National Environmental Policy Act (42 United States Code [U.S.C] 4321 *et seq.*) (NEPA) require a cumulative impacts analysis as part of the environmental impact statement (EIS) process. In conducting this analysis, DOE followed the guidelines in CEQ handbook *Considering Cumulative Effects Under the National Environmental Policy Act* (DIRS 103162-CEQ 1997, all).

5.1.1 REGIONS OF INFLUENCE

The regions of influence for this cumulative impacts analysis encompass the potentially affected areas specific to the Caliente and Mina rail alignments. For the cumulative impacts analysis, the resource-specific regions of influence would generally be the same as those for the resource areas described in Chapter 3 and used for impact analysis reported in Chapter 4 of this Rail Alignment EIS. Table 3-1 and Table 3-78 list the regions of influence for each resource area within the Caliente and Mina rail alignment areas, respectively. The Caliente and Mina rail alignments share the same region of influence between Goldfield and the Yucca Mountain Repository, in Esmeralda and Nye Counties. The Caliente rail alignment region of influence also includes Lincoln County, while the region of influence for the Mina rail alignment also includes the Walker River Paiute Reservation and Lyon and Mineral Counties. Clark County, Churchill County, and Washoe County are generally excluded from the cumulative impacts regions of influence except as needed to maintain consistency with individual resource analyses, such as socioeconomics or air quality. Because the Caliente and Mina rail alignment regions of influence are different for much of their routes, some of the past, present, and reasonably foreseeable activities and projects affecting cumulative impacts for each rail alignment are also different, as described in this chapter.

5.1.2 APPROACH AND ANALYTICAL PERSPECTIVE

DOE used the following approach, analytical perspective, and considerations to perform this cumulative impacts analysis:

- Where analysis indicated a potential for cumulative impacts, information is quantified to the extent feasible (for example, land disturbance and water demand); however, the analysis is primarily ***qualitative***.
- The analysis considers federal, state and local government, and private activities.
- Projects included in the analysis have potential interaction in time (the foreseeable future) or space with the effects from implementation of the ***Proposed Action*** or the ***Shared-Use Option***.
- Effects from past and existing projects and activities are primarily considered in the Chapter 3 and Chapter 4 discussions for each resource area (such as mining and grazing).
- DOE considers reasonably foreseeable actions as those future actions for which there is a reasonable expectation that the action could occur, such as a Proposed Action under analysis, a project that has already started, or a future action that has obligated funding.
- Assessment of whether potential impacts would be beneficial or adverse would in many cases depend on individual and group values, beliefs, and goals, and would vary from location to location within the cumulative impacts regions of influence.

DOE has assessed potential cumulative impacts under the Proposed Action qualitatively and quantitatively to the extent available information allows. Not all quantitative information is additive because of different methodologies or conflicting regions of influence.

DOE identified activities relevant to the cumulative impacts analysis from reviews of information available from government agencies, such as environmental impact statements, land-use and natural resource management plans, and from private organizations. DOE reviewed this information for relevance to this cumulative impacts analysis based on potential geographical and temporal relationships with construction and operation of the proposed rail line along either the Caliente or Mina rail alignment. Not all actions identified in this analysis would have cumulative impacts on all resource areas.

This section describes some future actions only in general terms because the projects are in an early stage of planning or development, or they are broad concepts of activity (for example, BLM resource management planning). This analysis focuses more on geographic interaction of projects than timing of interactions because the actual timeframes for many of the reasonably foreseeable future actions are uncertain.

The approach taken for this cumulative impact analysis is consistent with the intent of CEQ regulations at 40 CFR 1502.22, *Incomplete or Unavailable Information*. This regulation directs agencies how to proceed when evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information. While information describing the characteristics and potential effects of other projects and activities within the regions of influence is primarily qualitative and, in some cases is incomplete or unavailable, there is sufficient information to complete a fair disclosure and hard look at potential cumulative impacts in the Caliente and Mina regions of influence.

5.1.3 RELATIONSHIP OF THIS ANALYSIS TO THE YUCCA MOUNTAIN REPOSITORY CUMULATIVE IMPACTS ANALYSIS

The Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (the Yucca Mountain FEIS) (DIRS 155970-DOE 2002, all) provided an analysis of potential cumulative impacts associated with construction and operation of a repository at Yucca Mountain. The portion of that analysis relevant and still valid to the Caliente and Mina rail alignments (DIRS 155970-DOE 2002) is incorporated in this cumulative impacts analysis for the proposed railroad, as appropriate.

To evaluate the potential environmental impacts, including cumulative impacts, of the revised repository design and operational plans, DOE has prepared *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1) (Repository SEIS), which includes an analysis of cumulative impacts as they relate to the Yucca Mountain Repository. Sections 5.2.1.2.1 and 5.3.1.2.1 include a description of the repository, as currently proposed, and additional context about the repository as a reasonably foreseeable action. This Rail Alignment EIS cumulative impacts analysis incorporates updated cumulative impacts information from the Repository SEIS, as appropriate.

5.1.4 RESPONSIBILITY FOR MITIGATION OF CUMULATIVE IMPACTS

DOE is responsible for impacts associated with activities for which it is the project proponent. The Department would plan and design the Caliente and Mina rail alignments to avoid sensitive and regionally important resources like Wilderness Areas and Wilderness Study Areas and to avoid or minimize impacts to sensitive environmental areas (such as wetlands) and to private property. In addition, the Department would construct and operate the proposed railroad in compliance with all applicable requirements. Actions undertaken by other proponents are subject to a variety of environmental requirements to avoid, minimize, or otherwise reduce adverse impacts on the environment.

To help comply with requirements and to eliminate or reduce potential environmental impacts, the Department would implement a variety of engineering, site planning actions, and ***best management practices***, all of which are parts of the Proposed Action (see Chapters 2 and 7). The DOE best management practices include the practices, techniques, methods, processes, and activities commonly accepted and used throughout the construction and railroad industries that facilitate compliance with applicable requirements and that provide an effective and practicable means of preventing or minimizing the environmental impacts of an action. Such practices would avoid, minimize, or otherwise reduce the direct and indirect environmental impacts of the DOE Proposed Action, thereby avoiding or minimizing contributions to direct, indirect, and cumulative environmental impacts along either the Caliente or Mina rail alignment cumulative impacts region of influence.

To the extent the Proposed Action would contribute cumulatively to impacts to regional resources, or to other activities such as BLM land management activities, DOE could take additional actions to reduce any identified impacts associated with its Proposed Action, as practicable (see Chapter 7). DOE continues to coordinate with public- and private-sector project proponents to foster adequate consideration of cumulative environmental issues. As part of its NEPA responsibilities, the Department would perform additional NEPA analysis related to the proposed railroad, if required.

5.1.5 ORGANIZATION OF THE ANALYSIS

Section 5.2 summarizes potential cumulative impacts associated with implementing the Proposed Action along the Caliente rail alignment. Section 5.3 summarizes potential cumulative impacts associated with implementing the Proposed Action along the Mina rail alignment. Section 5.4 summarizes combined repository and Nevada rail transportation impacts.

5.2 Caliente Rail Alignment

Sections 5.2.1 and 5.2.2 summarize the projects and activities considered in the Caliente rail alignment cumulative impacts analysis. Figure 5-1 shows the locations of these major projects and activities, including:

1. Southwest Intertie Project
2. Southern Nevada Water Authority Groundwater Development Project
3. Nevada Test and Training Range
4. Timbisha Shoshone Trust Land
5. Yucca Mountain Geologic Repository
6. Nevada Test Site
7. Coyote Springs Development Project
8. Union Pacific Railroad Operations
9. Toquop Energy Project
10. BLM Disposal of Public Land – Lincoln County Land Sales

This section also considers other relevant projects and actions that are not depicted on the map, such as:

- BLM planning and management actions – There are a variety of BLM past, present, and reasonably foreseeable actions within the three BLM management areas (Ely, Battle Mountain, and Las Vegas) relevant to the Caliente rail alignment.
- Various rights-of-way – Many future utility or other right-of-way corridors are not depicted in Figure 5-1 because specific routes are not known. For example, DOE and the BLM are preparing a programmatic environmental impact statement for potential designation of energy corridors on federal land in western states (70 *Federal Register* [*FR*] 56647, September 28, 2005).
- Energy and mineral development activities.
- Other regional economic development plans and activities within Lincoln, Nye, and Esmeralda Counties.

The Caliente rail alignment ranges in length from about 528 to 541 kilometers (328 to 336 miles), depending on the alternative segments considered. As a linear project, land disturbance and other direct impacts would be most likely to occur within the relatively narrow ***construction right-of-way*** and the narrower ***operations rights-of-way***. However, other direct and indirect impacts for some resources could occur outside of these rights-of-way.

To evaluate the potential for cumulative impacts, DOE identified and reviewed public and private actions in the Caliente rail alignment region of influence to determine if the impacts associated with these actions could coincide in time or space with potential impacts from construction and operation of the proposed Caliente rail alignment. Only those projects and activities DOE believes would have the potential for cumulative impacts are identified herein. In some cases, similar actions have been grouped together and listed by category of action.

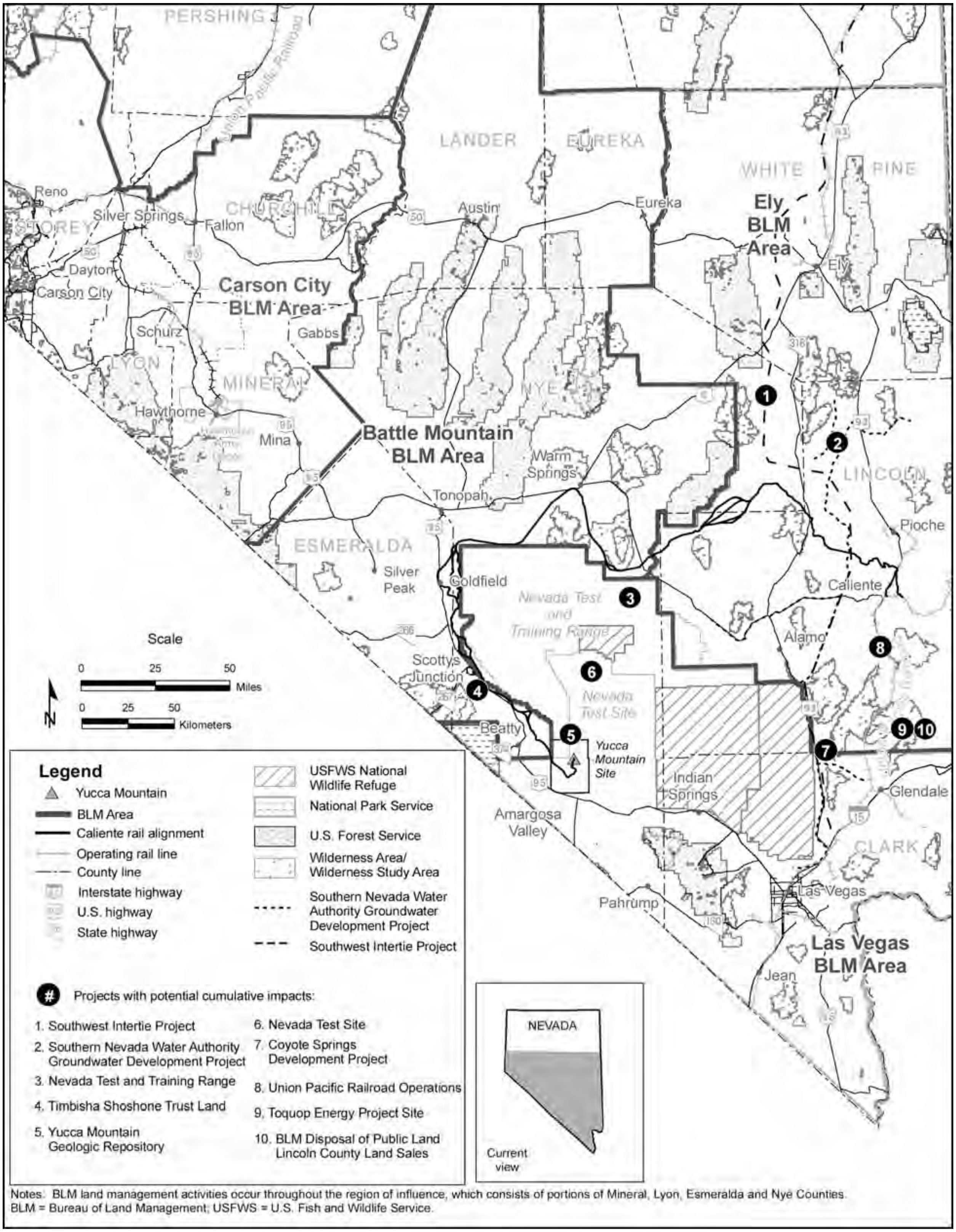

Figure 5-1. Major reasonably foreseeable future actions and continuing activities in the Caliente rail alignment cumulative impacts region of influence.

5.2.1 PROJECTS AND ACTIVITIES INCLUDED IN THE CUMULATIVE IMPACTS ANALYSIS – CALIENTE RAIL ALIGNMENT

5.2.1.1 Past and Present Actions

The descriptions of existing (baseline) environmental conditions (Chapter 3) and impacts (Chapter 4) associated with the various environmental resource regions of influence for the Caliente rail alignment considered in this Rail Alignment EIS include the relationships between proposed railroad construction, operation, abandonment, and past and present actions such as:

- Operations at major federal facilities such as the Yucca Mountain Geologic Repository, Nevada Test and Training Range, and Nevada Test Site
- BLM resource management planning and land management uses
- Traditional land uses such as regional ranching, mining, and recreation
- Military operations
- Residential, commercial, and industrial development activities associated with growth in the Caliente rail alignment cumulative impacts region of influence

Reasonably foreseeable future actions and the continuation of existing actions in the Caliente rail alignment cumulative impacts region of influence were also considered. Figure 5-1 shows the locations of individual projects and activities.

5.2.1.2 Reasonably Foreseeable Future and Continuing Federal Actions

Sections 5.2.1.2.1 through 5.2.1.2.6 describe reasonably foreseeable future and continuing federal agency actions that could result in cumulative impacts when combined with the potential impacts of constructing and operating the proposed railroad along the Caliente rail alignment.

5.2.1.2.1 Yucca Mountain Geologic Repository

The Proposed Action in this Rail Alignment EIS is directly related to the proposed geologic repository at Yucca Mountain, which is a reasonably foreseeable project that would have potential cumulative impacts in the Caliente rail alignment region of influence (see Figure 5-1, Project #5). In the Yucca Mountain FEIS (DIRS 155970-DOE 2002, all) and the *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (the Repository SEIS; DOE/EIS-0250F-S1 DOE proposes to construct, operate and monitor, and eventually close a ***geologic repository*** for the ***disposal*** of 70,000 metric tons (77,000 tons) of heavy metal of ***spent nuclear fuel*** and ***high-level radioactive waste*** at Yucca Mountain in Nye County, Nevada. DOE proposed to dispose of spent nuclear fuel and high-level radioactive waste in the repository using the natural geologic features of the mountain and engineered barriers as a total system to help ensure long-term ***isolation*** of the materials from the accessible environment. As analyzed in the Repository SEIS, the repository design and associated construction and operation plans require the following:

- DOE spent nuclear fuel and high-level radioactive waste would be placed in disposable canisters at the DOE sites, and as much as 90 percent of the commercial spent nuclear fuel would be placed in ***transportation, aging, and disposal*** (TAD) canisters at the commercial sites prior to shipment. This is the preferred method of receipt. The remaining commercial spent nuclear fuel (about 10 percent) would be transported to the repository in ***dual-purpose canisters*** (canisters suitable for storage and transportation), or would be uncanistered.

- Most spent nuclear fuel and high-level radioactive waste would be transported from 72 commercial and four DOE sites to the repository in Nuclear Regulatory Commission-certified transportation casks placed on trains dedicated only to these shipments. Some shipments, however, would be transported to the repository by truck over the Nation's highways.
- At the repository, DOE would conduct waste handling activities to manage thermal output of the commercial spent nuclear fuel and to package the spent nuclear fuel into TAD canisters. The disposable canisters and TAD canisters would be placed into ***waste packages*** for disposal in the repository. A waste package is a container that consists of the barrier materials and internal components in which DOE would place the canisters that contained spent nuclear fuel and high-level radioactive waste.
- DOE would place approximately 11,000 waste packages, containing no more than a total of 70,000 metric tons (77,000 tons) of heavy metal, spent nuclear fuel, and high-level radioactive waste in the repository at Yucca Mountain.
- When authorized by the Nuclear Regulatory Commission, the repository would be closed permanently. The design for construction would allow for phased construction of the surface and subsurface facilities that would be compatible with constrained funding.
- The surface and subsurface facilities and associated infrastructure, such as the onsite road and water distribution networks and emergency response facilities, would be constructed in phases to accommodate the expected receipt rates of spent nuclear fuel and high-level radioactive waste.
- DOE also would construct a four-lane access road that would extend from U.S. Highway 95 to the existing access road at Gate 510. This access road might be constructed using a phased approach, with initial construction of two lanes, and the road being widened later. The Department would also build a suitable intersection at U.S. Highway 95.
- DOE assumes that the following facilities would be constructed outside the repository land withdrawal area: a training facility near Yucca Mountain to support the Project Prototype Testing and the Operator Training and Qualification programs; temporary accommodations for construction workers; a proposed Sample Management Facility to consolidate, upgrade, and improve storage and warehousing for scientific samples and materials, perhaps near the Town of Amargosa Valley; and a marshalling yard and warehouse, a proposed leased facility that would consolidate material shipment and receipt into a 0.2-square-kilometer (50-acre) facility to allow for off-site receipt, transfer, and staging of materials required to perform construction activities at the Yucca Mountain site.

The Nuclear Regulatory Commission, through its licensing process, would regulate repository construction, operation and monitoring, and closure. Repository operations would only begin after the Commission granted DOE a license to receive and possess spent nuclear fuel and high-level radioactive waste. DOE is currently preparing an application for construction authorization.

The Yucca Mountain FEIS and the Repository SEIS evaluate the cumulative impacts of two additional inventories (Modules 1 and 2), which include spent nuclear fuel and high-level radioactive waste in addition to that of the Proposed Action inventory, and other radioactive wastes generally considered unsuitable for near-surface disposal. Inventory Module 1 or 2 could have cumulative impacts on the operation of the proposed railroad. Regarding potential cumulative impacts from Inventory Module 1 or 2, there would be no cumulative construction impacts because the need for a new railroad would not change; that is, whichever rail alignment DOE selected in which to build the proposed railroad to serve the Yucca Mountain FEIS Proposed Action would also serve Module 1 or 2. In addition, because the planned annual shipment rate of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository would be about the same for Module 1 or 2 and the FEIS Proposed Action, the only cumulative operations impacts would result because of the annual increase of shipments for Module 1 or 2. Because Modules 1 and 2 exceed the NWPA disposal limit of 70,000 metric tons (77,000 tons) of heavy metal considered in the Repository SEIS, the emplacement of any such waste at Yucca Mountain would require legislative action by Congress unless a second licensed repository was in operation. The 70,000 metric tons of heavy metal limit is comprised of 63,000 metric tons (69,000 tons) of heavy metal from commercial utilities and 7,000 metric tons (7,000 tons) of heavy metal from DOE.

DOE is preparing the *Disposal of Greater-Than-Class-C Low-Level Radioactive Waste Environmental Impact Statement* (DOE/EIS-0375) (72 *FR* 40135, July 23, 2007). That EIS will address the disposal of wastes with concentrations greater than Class C, as defined in U.S. Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE Low-Level Radioactive Waste and ***transuranic*** waste having characteristics similar to Greater-Than-Class-C waste and that otherwise do not have a path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low-level waste disposal in a geologic repository; in intermediate depth boreholes; and in enhanced near surface facilities. Candidate locations for these disposal facilities are the Idaho National Laboratory; the Los Alamos National Laboratory and Waste Isolation Pilot Plant in New Mexico; the Nevada Test Site and the proposed Yucca Mountain Repository; the Savannah River Site in South Carolina; the Oak Ridge Reservation in Tennessee; and the Hanford Site in Washington. DOE will also evaluate disposal at generic commercial facilities in arid and humid locations. The Draft Yucca Mountain SEIS evaluates the potential cumulative impacts of disposal of these wastes at Yucca Mountain as a reasonably foreseeable action, which are included in Inventory Module 2. Current repository design plans do not accommodate disposal of Greater-Than-Class-C low-level radioactive waste.

DOE is preparing the *Programmatic Environmental Impact Statement for the Global Nuclear Energy Partnership* (DOE/EIS-0396). Global Nuclear Energy Partnership (GNEP) would encourage expansion of domestic and international nuclear energy production while reducing nuclear proliferation risks, and reduce the volume, thermal output, and ***radiotoxicity*** of spent nuclear fuel before disposal in a geologic repository. DOE anticipates that its Programmatic EIS will evaluate a range of alternatives, including a proposal to recycle spent nuclear fuel and separate many of the high-heat ***fission products*** and the uranium and transuranic components. The full implementation of GNEP would involve the construction and operation of advanced reactors, which would be designed to generate energy while destroying the transuranic elements. DOE also anticipates evaluating project-specific proposals to construct and operate an advanced fuel-cycle research facility at one or more DOE sites.

The United States uses a “once through” fuel cycle in which a nuclear power reactor uses nuclear fuel only once, and then the utility places the spent nuclear fuel in storage while awaiting disposal. GNEP would establish a fuel cycle where the uranium and transuranic materials would be separated from the spent nuclear fuel and reused in thermal and/or advanced nuclear reactors. GNEP would not diminish in any way the need for the nuclear waste disposal program at Yucca Mountain, because under any fuel recycle scenario, high-level radioactive waste will continue to be produced and require disposal.

DOE anticipates that by about 2020 the commercial utilities will have produced about 86,000 metric tons (95,000 tons) of heavy metal of spent nuclear fuel, which exceeds the DOE disposal limit of 63,000 metric tons (69,000 tons) of heavy metal of commercial spent nuclear fuel at the Yucca Mountain Repository. If DOE were to decide, in a GNEP Record of Decision, to proceed with its proposal to recycle spent nuclear fuel, the Department anticipates that the necessary facilities would not commence operations until 2020 or later. Although the spent nuclear fuel-recycling concept has not yet been implemented and the capacity of a separations facility has not been determined, one or more separations facilities could be designed with a total capacity sufficient to recycle the spent nuclear fuel discharged by commercial utilities. Consequently, the Department believes there would be no change in the spent nuclear fuel and high-level radioactive waste inventory, and therefore the number of casks of spent nuclear fuel and high-level radioactive waste shipped to the Yucca Mountain repository analyzed under the Proposed Action in this Rail Alignment EIS would remain unchanged (that is, the shipment of approximately 9,500 casks containing spent nuclear fuel and high-level radioactive waste).

Overall, development of a GNEP fuel cycle has the potential to decrease the amount (number of assemblies) of spent nuclear fuel that would require geologic disposal, but would increase the number of casks of high-level radioactive waste requiring disposal in a geologic repository in the long term. Consequently, recycling of commercial spent nuclear fuel could affect the nature of the inventory that represents the balance of Inventory Module 1 (that is, commercial spent nuclear fuel in amounts greater than 63,000 metric tons [69,000 tons] of heavy metal). Nevertheless, given the uncertainties inherent at this time in estimating the amount of spent nuclear fuel and high-level radioactive waste that would result from full or partial implementation of the GNEP closed fuel cycle, this Rail Alignment EIS analyzes rail transportation within Nevada of approximately 9,500 casks of spent nuclear fuel and high-level radioactive waste.

5.2.1.2.2 Nevada Test Site (Continuation of Activities)

The Nevada Test Site, adjacent to the Nevada Test and Training Range, engages in a number of defense-related material and management activities, waste management, environmental restoration, and non-defense research and development (see Figure 5-1, Project #6). The Nevada Test Site was established in 1951 as the Nation's proving ground for developing and testing nuclear weapons. The site is on land administratively held by the BLM, but the Nevada Test Site land was withdrawn for use by the Atomic Energy Commission and its successors (including DOE). At present, the DOE National Nuclear Security Administration manages the site. It consists of about 3,200 square kilometers (800,000 acres) of land.

The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all) described existing and projected future actions at the Nevada Test Site. That EIS was followed by a *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 162638-DOE 2002, all). DOE activities at the Nevada Test Site include stockpile stewardship and management (helping ensure the U.S. nuclear weapon stockpile is safe, secure, and reliable), materials disposition (removal of nuclear materials in a safe and timely manner), and nuclear emergency response. Activities at the Nevada Test Site since the 1996 EIS and 2002 supplement analysis have continued to support these missions in accordance with federal law, DOE policies and missions, and NEPA requirements. There are a number of other programmatic DOE waste management initiatives that can affect current and potential future operations at the Nevada Test Site, many of which require NEPA analyses. The Nevada Test Site also produces annual environmental reports that describe program activities and related environmental issues and activities.

DOE is currently preparing the *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement–Complex 2030* (Complex Transformation Supplemental PEIS [formerly known as the Complex 2030 SEIS]; DOE/EIS-0236-S4). That SEIS will analyze the environmental impacts of the continued transformation of the United States nuclear weapons complex by implementing the National Nuclear Security Administration's vision of the complex as it would exist in 2030, and alternatives to that action. Part of the proposed action in that SEIS is to identify one or more sites for conducting National Nuclear Security Administration flight test operations. Existing Department of Defense and DOE test ranges (for example, the White Sands Missile Range in New Mexico and the Nevada Test Site in Nevada) would be considered as alternatives to the continued operation of the Tonopah Test Range in Nevada.

Another part of the proposed action in the Complex Transformation Supplemental PEIS is to accelerate dismantlement activities. The DOE sites that will be considered as potential locations for the consolidated plutonium centers and consolidation of Category I (high strategic significance) and II (moderate strategic significance) special nuclear materials include Los Alamos National Laboratory, the Nevada Test Site, the Pantex Plant, the Y-12 National Security Complex, and the Savannah River Site.

DOE manages several types of radioactive and hazardous waste (***low-level radioactive waste***, ***mixed low-level waste*** [referred to as mixed waste], transuranic waste, high-level radioactive waste, and ***hazardous waste***) generated by past and present nuclear defense research activities at many DOE sites across the United States, including the Nevada Test Site. The Department manages each of those waste types separately because they have different components, levels of radioactivity, and regulatory requirements. DOE needs facilities like the Nevada Test Site to manage its radioactive and hazardous wastes to maintain safe, efficient, and cost-effective control of these wastes; comply with applicable federal and state laws; and protect public health and safety and the environment. In *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DIRS 101816-DOE 1997, all) DOE evaluated the environmental impacts of managing the five waste types. The Nevada Test Site will continue to be a major facility involved in DOE waste management programs, including serving as a disposal site for certain waste types generated off the site, and for on-site wastes primarily from environmental restoration and remediation activities.

The Nevada Test Site is a candidate disposal location for Greater-Than-Class-C Low-Level Radioactive Waste which is currently being examined in the *Disposal of Greater-Than-Class-C Low-Level Radioactive* Waste *Environmental Impact Statement* (DOE/EIS-0375). That DOE EIS will address the disposal of wastes with concentrations greater than Class C, as defined in Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE low-level radioactive waste and transuranic waste having characteristics similar to Greater-Than-Class-C low-level waste and that might not have an identified path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low level waste disposal in a geologic repository; in intermediate-depth boreholes; and in enhanced near-surface facilities.

Table 5-1 lists and briefly describes recent environmental assessments that describe Nevada Test Site operations.

Table 5-1. Recent environmental assessments describing Nevada Test Site operations.

Title	Description
Environmental Assessment for Relocation of Technical Area 18 capabilities and materials from the Los Alamos National Laboratory to the Nevada Test Site (DIRS 162639-DOE 2002, all)	DOE completed relocation of Technical Area 18 operational capabilities and materials from the Los Alamos National Laboratory to the Nevada Test Site in November 2005. Relocation included the transport of about 2.4 metric tons (2.6 tons) of special nuclear material and approximately 10 metric tons (11 tons) of natural and depleted uranium and thorium, as well as support equipment, some of which would have radioactive contamination, associated with the operations. A Finding of No Significant Impact was issued.
Environmental Assessment for Defense Logistics Agency Transfer of Waste to DOE and Finding of No Significant Impact (DIRS 172280-DLA 2003, all; DIRS 172281-DOD 2003, all)	The Defense Logistics Agency of the Department of Defense issued an environmental assessment of its proposal to transfer thorium nitrate from the Defense National Stockpile Center to DOE for disposal as a low-level radioactive waste at the Nevada Test Site. The Agency issued a Finding of No Significant Impact in November 2003 (DIRS 172281-DOD 2003, all). The Defense Logistics Agency made eight shipments of low-level thorium waste (about 310 cubic yards [10,800 cubic feet]) in 2004 (DIRS 182346-DOE 2005, all).

5.2.1.2.3 BLM Resource Planning and Management

The presence of BLM-administered public land is a very important factor affecting how and where activities occur within Caliente rail alignment regions of influence. Many private and federal projects, including the proposed ***railroad***, would involve use of BLM-administered public land. Therefore, these projects would require BLM-issued ***right-of-way grants*** before they could proceed. Right-of-way grants have two general forms: linear (applicable to such projects as transmission lines, railroads, and pipelines), and nonlinear (applicable to projects at one specific location). Rights-of-way on BLM-administered land are extensive in the region. These rights-of-way vary tremendously in size and scope of activity.

The BLM administers most of the land through which the Caliente rail alignment would pass. The BLM manages these lands through a multiple-use concept (which means managing public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people) in accordance with the Federal Lands Policy and Management Act of 1976 (43 U.S.C. 1732, *et seq*.) and other federal legislation. The management framework for each BLM planning area is documented in a resource management plan. The Caliente rail alignment would cross three BLM planning areas (Ely, Battle Mountain, and Las Vegas). The Battle Mountain and Las Vegas planning areas are operating under resource management plans adopted in 1998 and 1997, respectively (DIRS 176043-BLM 1998, all; DIRS 173224-BLM 1997, all). The Ely planning area is currently operating under terms of the Schell and Caliente Management Framework Plans approved in 1983 and 1981, respectively, and the Egan Resource Management Plan approved in 1987. The Caliente rail alignment would pass through areas outlined in the Schell and Caliente Management Framework Plan. The Ely Field Office issued a Draft Resource Management Plan in 2005 (DIRS 174518-BLM, 2005, all), which when finalized, will replace the existing plans within the Ely planning area. Because the Ely Resource Management Plan is still in draft form and has not yet been adopted by the BLM, the Schell, Caliente, and Egan land-use plans provide the basis for planning activities in the Ely planning area.

The BLM manages public lands in accordance with the existing management goals and objectives in applicable plans, and takes various specific actions on the affected public lands. There are many land uses on BLM-administered land in the region of influence; livestock grazing is a major use. The BLM activities to plan for and manage the public lands it administers have a major role in balancing competing needs and resources, and in determining the scope and locations of public and private activities on public lands.

5.2.1.2.4 BLM Disposal of Public Land – Lincoln County Land Sales

Based on the terms of federal legislation, the BLM is implementing the following laws that authorize disposing of (selling) public lands in southern Nevada (See Figure 5-1, Project #10). These land disposals are driven by two primary legislative initiatives, as follows:

- Lincoln County Land Act of 2000 – This Act (Public Law 106-298) identified approximately 53square kilometers (13,000 acres) in the southeastern corner of Lincoln County near Mesquite, Nevada, for sale. In February 2005, the BLM sold this acreage to private interests for $47.5 million. Ten percent of the proceeds of this sale go to Lincoln County, and the remainder is earmarked for archaeological preservation and development of a multi-species habitat conservation plan in Lincoln County.
- Lincoln County Conservation, Recreation and Development Act of 2004 – This Act (Public Law 108-424) provides for the sale of up to 360 square kilometers (90,000 acres) in Lincoln County.

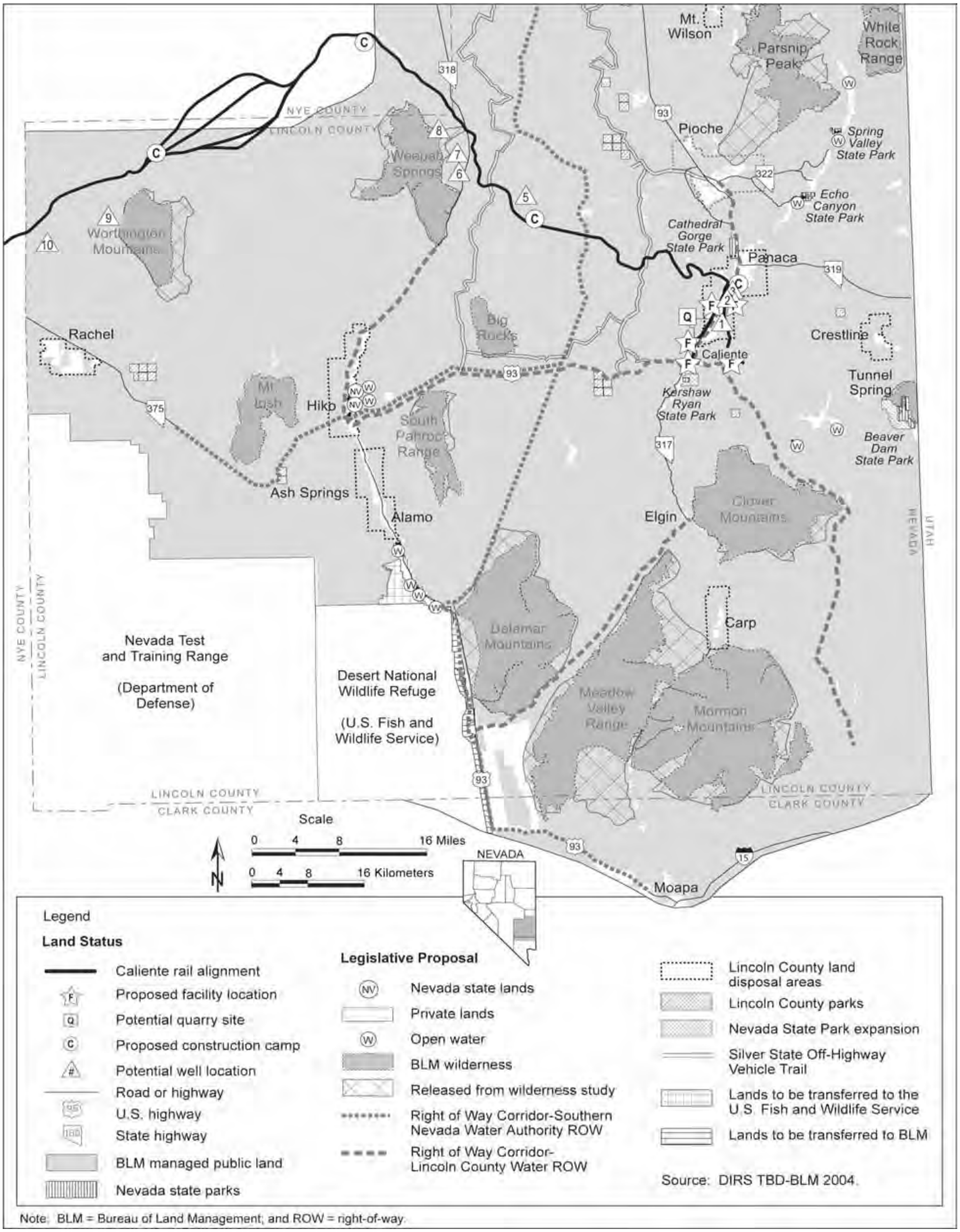

Figure 5-2. Lincoln County Conservation, Recreation, and Development Act activities.

The lands that would be eligible for sale will be identified in the Final Ely Resource Management Plan, which is currently being prepared by the BLM and is scheduled for completion in 2007. The Act will affect the growth and development in the Caliente rail alignment region of influence. See Figure 5-2 for the locations of activities and projects related to this Act. In addition to the planned BLM land disposals, the Act provides for:

– Designation of 14 new wilderness areas (consisting of 3,100 square kilometers [770,000 acres]) of BLM-administered land in Lincoln County, and release of 1,000 square kilometers (250,000 acres) of land from the BLM wilderness study area status.

– Establishment of nonexclusive utility corridors for the Southern Nevada Water Authority and the Lincoln County Water District/Vidler Water Company totaling 740 kilometers (460 miles) as rights-of-way for water pipelines and associated facilities to convey water in Clark and Lincoln Counties.

– Movement of an undeveloped right-of-way from the east side of U.S. Highway 93 to an existing utility corridor on the west side of the highway. Coyote Springs Investment will pay the Federal Government for the appreciated value of the property due to adding the right-of-way to their property.

– Establishment of a 420-kilometer (260-mile) Silver State Off-Highway Vehicle Trail along a series of existing backcountry roads that are currently open and used by off-highway vehicle enthusiasts, subject to the BLM preparation of a management plan for this trail.

– Transfer of about 35 square kilometers (8,500 acres) of BLM-administered land to the Desert National Wildlife Range, and transfer of about 34 square kilometers (8,400 acres) of Desert National Wildlife Range land to the BLM to facilitate the utility corridor for the Coyote Spring Investment development.

– Conveyance of up to 61 square kilometers (15,000 acres) of BLM-administered land to Lincoln County for conservation of natural resources or for public parks, with specific lands to be identified based on consultation between the county and the BLM.

In addition to the disposals required by the federal legislation described above, about 92 square kilometers (22,622 acres) have been identified for potential disposal in the vicinity of Goldfield, about 23 square kilometers (5,765 acres) have been identified for potential disposal near Scottys Junction, and 160 square kilometers (39,432 acres) have been identified for potential disposal near Beatty.

5.2.1.2.5 Nevada Test and Training Range (Continuation of Activities)

The U.S. Air Force operates the Nevada Test and Training Range in south-central Nevada (see Figure 5-1, Project #3), a national test and training facility for military equipment and personnel consisting of approximately 12 million square kilometers (3 million acres). Military training maneuvers and jet aircraft are commonly visible in the Caliente rail alignment cumulative impacts region of influence. In 2005, the U.S. Air Force designated the Indian Springs Air Force Auxiliary Airfield to Creech Air Force Base and expanded its mission and infrastructure to play a major role in the war on terrorism. The base is home to two key military operations: the MQ-1 unmanned aerial vehicle and the Unmanned Aerial Vehicle Battle laboratory.

The 1,600-square-kilometer (390,000-acre) BLM-administered National Wild Horse Management Area is within the boundary of the Nevada Test and Training Range. More than 3,200 square kilometers (800,000 acres) of the Nevada Test and Training Range comprise the Desert National Wildlife Range. The U.S. Air Force and the U.S. Fish and Wildlife Service jointly manage this area.

In *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (DIRS 103472-USAF 1999, all) the U.S. Air Force addressed potential environmental consequences of extending the land withdrawal in order to continue using the Nevada Test and Training Range lands for military use. Activities at the Nevada Test and Training Range change, as necessary, to meet military test and training needs.

In 2004, the BLM prepared a resource management plan for about 8,900 square kilometers (2.2 million acres) of withdrawn public lands within the Nevada Test and Training Range (DIRS 178102-BLM 2004, all). The plan guides the management of the affected Nevada Test and Training Range natural resources 20 years into the future (2024). The decisions, directions, allocations, and guidelines in the plan are based on the primary use of the withdrawn area for military training and testing purposes.

Table 5-2 lists and briefly describes recent environmental assessments that describe Nevada Test and Training Range operations.

Table 5-2. Recent environmental assessments describing Nevada Test and Training Range operations.

Title	Description
Final Environmental Assessment for Increased Depleted Uranium Use on Target 63-10, Nevada Test and Training Range (DIRS 181607-USAF 2006, all)	The proposed action was to increase the use of depleted uranium ammunition at the Nevada Test and Training Range to meet ongoing test and training requirements for A-10 aircraft. The Air Force was to increase the number of depleted uranium rounds authorized to be fired on Target 63-10 from 7,900 to 19,000 annually. The environmental assessment evaluated five resource areas—air quality, soils and water resources, health and safety, hazardous and radioactive materials and waste, and biological resources—in detail to identify potential environmental consequences. The Air Force issued a Finding of No Significant Impact.
Final Environmental Assessment for Predator Force Structure Changes at Indian Springs Air Force Auxiliary Field, Nevada (DIRS 172314-USAF 2003, all)	The proposed action included changes to personnel assignments, upgrades to existing facilities, construction of new facilities, and extension of a runway by 120 meters (400 feet). The Air Force completed facilities for the Predator unmanned aerial vehicles in 2006. The Air Force issued a Finding of No Significant Impact.
Expeditionary Readiness Training Course Expansion, Final Environmental Assessment, Creech AFB (DIRS 182838-USAF 2006, all)	Environmental assessment to increase the number of Security Forces personnel trained at the Regional Training Center at Silver Flag Alpha and Creech AFB, Nevada, from an existing 2,520 to 6,000 students per year. The Air Force issued a Finding of No Significant Impact.
Wing Infrastructure Development Outlook, Final Environmental Assessment, Nellis AFB (DIRS 182839-USAF 2006, all)	The proposed action consists of 630 Wing Infrastructure and Development Outlook projects in 11 categories as classified under 32 CFR Part 989, *Air Force EIAP*. A total of 18 new construction and demolition projects are proposed for Creech Air Force Base. On the Nevada Test and Training Range, the proposed action would implement four new construction projects at four locations. At Tonopah Test Range, three new construction projects are planned along with the demolition of 10 buildings. The Air Force issued a Finding of No Significant Impact.
Draft Range 74 Target Complexes Environmental Assessment Nevada Test and Training Range, Nevada (DIRS 182840-USAF 2007, all)	The proposed action is to construct and operate three target complexes in mountainous terrain in Range 74 of the Nevada Test and Training Range at Saucer Mesa, Limestone Ridge, and Cliff Springs. The Saucer Mesa target array would employ both large-scale live and inert munitions; the Limestone Ridge sites would employ large-scale inert munitions; both target sites would employ small-scale live munitions. The Cliff Springs target complex would be laser and simulated attack targets and no munitions would be used. The Air Force issued a Finding of No Significant Impact.
A Final Base Realignment and Closure Environmental Assessment for Realignment of Nellis Air Force Base (DIRS 181492-USAF 2007, all)	The proposed action would affect the Nevada Test and Training Range by adding 1,400 F-16 sorties flown from Nellis Air Force Base, although they would not cause total annual sortie operations to exceed the current maximum of 300,000 at the Nevada Test and Training Range. The environmental assessment evaluated noise, air quality, socioeconomics and infrastructure, water and soil resources, biological resources, cultural resources, and hazardous materials and waste. The Air Force issued a Finding of No Significant Impact.

5.2.1.2.6 Timbisha Shoshone Trust Land (Federal Action)

The Secretary of the Interior issued a draft report to Congress (DIRS 103470-Timbisha Shoshone Tribe [n.d.], all) describing a plan to establish trust lands for people of the Timbisha Shoshone Tribe in portions of the Mojave Desert in eastern California and southwestern Nevada (see Figure 5-1, Project #4). On November 1, 2000, the President signed the Timbisha Shoshone Homeland Act (Public Law 106-423) to provide a permanent land base for the Timbisha Shoshone Tribe within its ancestral homeland in five separate parcels. Lands in the designated area for tribal purposes were then identified, including land parcels containing water rights. The parcel near Scottys Junction (about 11 square kilometers [2,800 acres]) is approximately 3.2 kilometers (2 miles) from the proposed Caliente rail alignment. The Timbisha Shoshone Tribe is actively evaluating economic development opportunities on this Scottys Junction parcel. The locations and nature of these future development opportunities are not known and are not considered to be reasonably foreseeable for the purpose of this analysis.

5.2.1.3 Reasonably Foreseeable Future Non-Federal Actions

Non-federal and private actions in the Caliente rail alignment region of influence primarily consist of energy development, infrastructure development, groundwater development projects, continued Union Pacific railroad operations, residential development, and general economic development initiatives and efforts. As noted above, many of these privately sponsored projects would interact with the BLM land management policies and procedures because of a need to acquire right-of-way grants to initiate proposed activities on BLM-administered land.

5.2.1.3.1 Power Plants, Transmission Lines, Pipelines, and Other Infrastructure

Various power companies and public utilities have proposed locations for new power plants in southern Nevada due to substantial population and economic growth in southern California, Arizona, and southern Nevada. Much of this recent and proposed development is in Clark County. In addition to the power plants, regional infrastructure developments include natural gas pipelines and transmission lines that provide fuel and transmit electricity. Recently completed projects or reasonably foreseeable projects that could result in cumulative impacts near the proposed Caliente rail alignment and associated facilities are listed below. It is likely that other power plants, transmission lines, pipelines, and other infrastructure would be built in the proposed Caliente rail alignment region of influence in the future, but the locations and timing of other future projects are not known at this time. Additionally, the region holds the potential for wind, solar, and geothermal energy development, although the magnitude and specific locations of these energy development projects are not known.

- <u>Southwest Intertie Project</u> (see Figure 5-1, Project #1) – LS Power Associates acquired the right-of-way, which is approximately 870 kilometers (540 miles) long, originally granted by the BLM in 1994 for a transmission line that would run from near Twin Falls, Idaho, to the Dry Lake Valley northeast of Las Vegas. The power line would connect the Nevada Power Company and Sierra Pacific Power Company electrical generation and transmissions systems.

- <u>Toquop Energy Power Project</u> (see Figure 5-1, Project #9) – This proposed power plant would be near Mesquite in Lincoln County, about 160 kilometers (100 miles) northeast of Las Vegas, on BLM-administered lands. In September 2003, the BLM issued to the proponent, Toquop Energy, Inc., a right-of-way to build the proposed 1,100-megawatt natural-gas fired power plant and associated facilities. However, since then, the project plan has changed to a 750-megawatt coal-fired power plant, in the same location as originally proposed. The BLM has determined that the proposed changes warrant the preparation of a new NEPA analysis and has initiated an environmental impact statement on the revised project concept (71 *FR* 8869, February 21, 2006).

In addition to the power plant itself, the project would require an approximate 50-kilometer (30-mile) rail spur, transmission lines, water, and a new access road.

- Various utilities in the Caliente rail alignment cumulative impacts region of influence have recently been constructed and are being planned, including new cable lines (for example, fiber optic lines) and other facilities (such as wireless towers) that would require BLM right-of-way grants or use of private land in the area. The BLM has designated certain corridors in the area that should be used for most utility purposes; however, use of other BLM-administered land requiring new right-of-way grants has traditionally been considered on a case-by-case basis. To identify appropriate right-of-way corridors throughout the western United States, including Nevada, DOE and the BLM are preparing a programmatic EIS (*Designation of Energy Corridors on Federal Land in the 11 Western States*; 70 *FR* 56647, September 28, 2005). This effort could include changes to the rights-of-way in the Caliente rail alignment cumulative impacts region of influence in future years but any such changes are unknown at this time.

5.2.1.3.2 Groundwater Development Projects

As part of its effort to augment future water supplies, the Southern Nevada Water Authority has initiated plans to develop groundwater for which it holds rights and applications in Clark, Lincoln, and White Pine Counties (see Figure 5-1, Project #2). The groundwater proposed for development involves seven hydrographic areas. These hydrographic areas generally lie along the east side of the state from an area north of the Las Vegas Valley, north into Lincoln County, and then extending into White Pine County. One of the hydrographic areas involved in the plan is hydrographic area 181 (Dry Lake Valley), which is west of the City of Caliente. The proposed Caliente rail alignment would pass through hydrographic area 181. The proposed project would develop and convey about 250 million cubic meters (204,000 acre-feet) per year of groundwater through a series of water wells, pipelines, and other infrastructure. The groundwater planned for development includes both existing and future permitted water rights, as permitted by the Nevada State Engineer. Of the total annual water planned for development, the Southern Nevada Water Authority would produce about 210 million cubic meters (170,000 acre-feet) per year for use by its purveyor members in the Las Vegas Valley, and about 44 million cubic meters (36,000 acre-feet) per year for conveyance to the Lincoln County Water District under terms of a February 2006 cooperative agreement between the two entities (DIRS 178053-Southern Nevada Water Authority 2006, all). The project would also involve electricity substations, transmission lines, pumping stations, a water storage facility, and a water treatment facility.

Final locations for individual well fields, and the number of wells in each valley, have not yet been determined, but preliminary exploratory areas have been identified, and water rights applications have been submitted for some proposed new wells at some specific locations (described below) that could lie within the region of influence used for groundwater resources as determined through the impacts analysis. In August 2004, the Southern Nevada Water Authority filed an application with the BLM to obtain necessary rights-of-way for the proposed system of regional water supply facilities associated with the project. The BLM has begun development of an EIS (70 *FR* 18043, April 8, 2005) to identify and disclose the environmental effects associated with this project. Scoping for the project was originally conducted in 2005; however, because of refinements in project plans, scoping for the project was reopened in July 2006.

As described in Section 3.2.6.2, applications have been filed for a proposed irrigation well that would be within approximately 1.7 kilometers (1.1 miles) of a DOE-proposed well location in Dry Lake Valley (hydrographic area 181), and an application has been filed for a proposed municipal well that would be located within approximately 1.7 kilometers of a DOE-proposed new well location in Pahroc Valley (hydrographic area 208). Each application gives 5 years as the minimum time period required for the construction of works and an estimated time required to complete the application of water to beneficial use of 10 years, as of the date the application was submitted (either December 1998 or October 2005). Applications have also been submitted for proposed municipal wells that would be approximately 1.5 kilometers (0.9 mile) northeast of another DOE-proposed new well location in area hydrographic 208, and approximately 1 kilometer (0.6 mile) northeast of another DOE-proposed well location in hydrographic area 208, respectively (Section 3.2.6.2). Both applications are under request-for-proposal status and according to the applications, the minimum time for construction of works (pumping station, pipelines, reservoirs, and distribution system) is 20 years for each proposed well. Section 5.2.2.6 evaluates the potential for cumulative impacts if these proposed well applications were to be approved and the wells installed and pumped contemporaneously with the DOE-proposed groundwater withdrawals.

The Lincoln County Land Act Groundwater Development and Utility Right of Way Project would include a projected 8 production water wells in the Tule Desert hydrographic basin and up to 10 production water wells in the Clover Valley hydrographic basin, cumulatively producing over 28 million cubic meters (23,000 acre-feet) of groundwater per year. A system of pipelines would collect the pumped water for conveyance through a main transmission pipeline southeast to the Lincoln County Land Act development area near Mesquite. Associated facilities would include power distribution and transmission and communications lines to be placed in the utility right-of-way to provide power and communication for the project facilities. A natural gas pipeline would parallel the water pipeline from the existing Kern River Natural Gas pipeline. The BLM initiated an EIS on this project (71 *FR* 16340, March 31, 2006) to evaluate potential impacts associated with this project.

As described in Section 3.2.6.3.3 of this Rail Alignment EIS, an application has been filed for a proposed municipal well that would be approximately 1.2 kilometers (0.8 mile) southwest of a DOE-proposed new well location in Garden Valley (hydrographic area 172). The municipal well would have a proposed production rate of up to 10,200 liters (2,690 gallons) per minute and would operate year round. The application lists an estimated time to construct this new well of 5 years and lists the estimated time required to complete the application of water to beneficial use as 10 years, as of the date the application was submitted (October 2005). The current status of this well is listed by the Nevada Division of Water Resources as "Ready for Action." Section 5.2.2.6 evaluates the potential for cumulative impacts if these proposed well applications were to be approved and the wells installed and pumped contemporaneously with the DOE-proposed groundwater withdrawals.

The Kane Springs Valley Groundwater Development Project would consist of up to seven water production wells along Kane Springs Road north of the Coyote Springs development site. The project is being proposed by the Lincoln County Water District, and would result in the groundwater withdrawal of about 6.17 million cubic meters (5,000 acre-feet) of groundwater per year. Ancillary facilities would include lateral pipelines, power distribution and communications lines, and access roads. The BLM initiated an EIS on this project to evaluate potential impacts associated with this project (71 *FR* 16340, March 31, 2006).

As with the other BLM EIS processes under way, BLM could not issue the necessary right-of-way grants for any of the water development projects, and the projects could not be initiated, until the EIS process was complete and the BLM decision was to allow the developments. In addition, the Nevada State Engineer must approve any proposed water production and grant approval for the use of groundwater for any project in Nevada (Nevada Revised Statutes, Chapters 532 through 538). The proposed rights-of-way for the proposed groundwater development projects are all based on terms of the Lincoln County Conservation, Recreation and Development Act of 2004 (see Section 5.2.2.6).

5.2.1.3.3 Union Pacific Railroad Operations

Under the Caliente Implementing Alternative evaluated in this Rail Alignment EIS, rail transportation of spent nuclear fuel and high-level radioactive waste would originate in or near the City of Caliente from the Union Pacific Railroad mainline track (see Figure 5-1, Project #8). The existing relevant portion of the Union Pacific Railroad track enters Nevada from Utah, with the track generally trending southwest into the Caliente area. From Caliente, the track continues southwest into Las Vegas. Union Pacific Railroad operations are well established in the area, and as of 2005, approximately 25 trains pass through Caliente each day on the Union Pacific Railroad track.

5.2.1.3.4 Coyote Springs Development Project

As outlined in Section 5.2.1.2.4, the BLM sold approximately 53 square kilometers (13,000 acres) of land in Lincoln County to a private entity, Coyote Springs Investment, LLC, which is in the process of turning the land into a housing development. The Coyote Springs Development Project would be a planned community about 80 kilometers (50 miles) north of Las Vegas (see Figure 5-1, Project #7). The planned development area consists of about 170 square kilometers (43,000 acres) in the Coyote Spring Valley. About one-third of the land held by Coyote Springs Investment, LLC, is in Clark County and two-thirds is in Lincoln County. As envisioned, the community would consist of a series of neighborhoods and villages located among open space corridors. Initially, the community focus would be on second-home development and development of a destination resort concept centering on golf courses. Over time, there would be more traditional community development, with ultimate development occurring over 40 years. Development would begin in the Clark County portion of the land, with plans for about 47,500 residential units, together with commercial and recreational facilities. The BLM stated that public services such as water, roads, law enforcement, emergency services, sewer, and power, must be established before home construction could begin on the land. Water for the potential new housing developments on the land might come from the Tule Springs area of Lincoln County. In addition, a new road from Caliente to Mesquite might be built to provide additional land access to these areas. The road would be about 130 kilometers (80 miles) long with a 30-meter (100-foot)-wide construction right-of-way. Coyote Springs Development, LLC, has not yet obtained water rights to provide for full build-out, and this could be a limiting factor for the development.

5.2.1.3.5 Other Regional Economic Development

Cumulative impacts issues associated with regional economic development actions include socioeconomic effects and overall growth in the region of influence. All of the counties and cities in the Caliente rail alignment region of influence have expressed a desire for economic development. The Lincoln County government is preparing for extensive growth (for example, Coyote Springs and population growth through BLM land disposals) with expansion of the county planning department, development of a Strategic Tourism Plan, and refinement of economic development strategies. Examples of Lincoln County economic development include the Meadow Valley Industrial Park and the Alamo Industrial Park (that would use land obtained through a BLM land disposal).

Nye and Esmeralda Counties also are pursuing growth and development opportunities. Economic development plans and tourism enhancement concepts have also been developed in those areas. Pahrump will continue to grow and urbanize with its proximity to Las Vegas. A perceived need for support to the Nevada Test Site has led to designation of the Nevada Science and Technology Corridor by the Economic Development Authority for Nye County. The Science and Technology Corridor extends from Indian Springs in Clark County in the south to Tonopah in the north, passing through the Pahrump Valley, Mercury (entrance to the Nevada Test Site), Amargosa Valley, Beatty and Goldfield, with industrial park and technology initiatives associated with the Tonopah Aeronautics and Technology Park, the Nevada Science and Technology Park in Amargosa Valley, and the Pahrump Center for Technology Training and

Development. The continuing BLM land sales and other development in the area indicate an increasing trend toward and desire for economic development, especially in Lincoln County. The locations and nature of specific future development opportunities are not known and are not considered to be reasonably foreseeable for the purpose of this analysis.

Nye County has completed a Yucca Mountain Project Gateway Area Concept Plan with proposed activities for the area around the entrance to the proposed repository site (DIRS 182345-Giampaoli 2007, all). This plan presents Nye County's conceptual, multi-phased land-use guidance for communities adjacent to and near the site entrance area. Nye County proposed this plan with the objective that land development occurs in an orderly and consistent manner and to increase opportunities for industrial and commercial development beneficial to the repository program. Nye County views this plan as a starting point for development of the infrastructure, institutional capacity, and facilities to support the proposed repository. The county developed the plan to use and manage existing initiatives while expanding and improving the area.

5.2.2 POTENTIAL CUMULATIVE IMPACTS – CALIENTE RAIL ALIGNMENT

Located in portions of Lincoln, Esmeralda, and Nye Counties, the Caliente rail alignment cumulative impacts region of influence covers millions of acres of land, most of which is BLM-administered public land. Most of the land in the Caliente rail alignment region of influence is undeveloped, although much of it has been affected by human activity such as ranching, mining, and recreation.

Potential cumulative impacts are often discussed herein within the context of the existing regulatory framework (primarily federal and state laws and regulations) and the BLM resource management planning goals and objectives. For example, the existing regulatory frameworks for water and air consider a regional and cumulative impacts perspective, in that regulatory decisions consider the potential effects from other projects and a proposed action. As the primary regional land manager, BLM planning and management actions consider the cumulative effects for many resources through stated planning goals and objectives, which often are based on quantitative criteria.

The following analysis of the cumulative impacts associated with the Caliente rail alignment is organized by resource area, with Sections 5.2.2.1 through 5.2.2.15 summarizing potential cumulative impacts in the same order of resource discussions in Chapter 4.

5.2.2.1 Physical Setting

5.2.2.1.1 Disturbance of Physical Resources

Physical resources consist of resources, conditions, and characteristics such as physiography, soils, and geology. As construction of any project in the area occurs, there would be a potential for changes to the physical setting because land would be disturbed through activities such as cuts and fills, and constructing new structures such as buildings and bridges. The proposed railroad would be one of many new sources of change to physical resources that would continue the trend of increasing land disturbance and modifications of the natural physical environment. In large-scale projects that involve substantial ground disturbance, natural features are considered in project design, construction, operations, and potential abandonment plans, which would tend to limit direct, indirect, and cumulative impacts. The proposed railroad would disturb only a small percentage of land in the Caliente rail alignment cumulative impacts region of influence.

Given the large amount of land potentially available for development of existing and reasonably foreseeable projects, and the small percentage of potentially available land required for the proposed railroad, overall cumulative impacts to physical setting in the Caliente rail alignment region of influence would be small.

5.2.2.1.2 Known or Potentially Contaminated Soils

The major sources of existing soil contamination in the Caliente rail alignment region of influence include mining and the Nevada Test Site. Mining activities in the region have occurred for many years, with mining wastes still remaining from older operations before the regulatory framework required waste management and clean-up. Nevada Test Site contamination has been described in recent NEPA documentation (DIRS 101811-DOE 1996, all; DIRS 162638-DOE 2002, all). Historic contamination of soils resources at the Nevada Test Site resulted primarily from radioactive-waste management sites and nuclear testing activities. Environmental restoration and remediation is occurring at contaminated Nevada Test Site locations in accordance with the facility's Environmental Restoration Program. For most of the contaminated soils within the Nevada Test Site boundary, DOE is planning a characterization and long-term monitoring program. Contaminated areas on the Nevada Test Site are generally defined and access is restricted for safety and security reasons. Spills of hazardous materials are possible from the projects described in this section; however, the current regulatory framework to manage and control hazardous materials and wastes ensures that actions are in place to minimize any impacts.

While any potential impacts associated with hazardous materials and wastes from current and future mining operations in the region are controlled through the existing regulatory framework, mining wastes from past mining extraction and processing activities, especially in the Goldfield area, remain a concern related to soil contamination.

The proposed railroad could result in very localized contamination of soils through occasional spills (such as fuel, oil, and solvents). However, such incidents would be minor in scope and quickly mitigated in accordance with plans and regulations. All existing and foreseeable projects would be subject to the same regulations. Cumulative impacts related to contamination of soils would likely be small.

5.2.2.2 Land Use and Ownership

5.2.2.2.1 Land Use Changes

Many of the past, present, and reasonably foreseeable future actions in the Caliente rail alignment region of influence result in land use changes. Changes in land uses can also alter land ownership, land management responsibilities, and preclude future activities from these areas. More than 97 percent of the land the proposed Caliente rail alignment and associated facilities would disturb is on BLM-administered land in Lincoln, Nye, and Esmeralda Counties. The BLM manages more than 55,700 square kilometers (13.7 million acres) in those three counties. One of the primary land uses in and around the proposed Caliente rail alignment on those BLM-administered lands is grazing. Regional grazing activities are often affected by BLM land management plans and activities.

Other existing and reasonably foreseeable major land uses in the Caliente rail alignment region of influence include:

- Yucca Mountain Repository – About 6.3 square kilometers (1,600 acres) of land disturbance, most of which would be on the Nevada Test Site (already withdrawn for Nevada Test Site activities).
- Nevada Test and Training Range – About 12,000 square kilometers (3 million acres) of land the U.S. Air Force has withdrawn for special-purpose use, with about 530 square kilometers (130,000 acres) of that land disturbed by Air Force tactical target complexes and associated infrastructure.

- Nevada Test Site – About 3,200 square kilometers (800,000 acres) of land DOE has withdrawn for special-purpose use (about 4.12 square kilometers [1,020 acres]) of this land would be used by the proposed Yucca Mountain railroad).
- Coyote Springs Development Project – About 170 square kilometers (43,000 acres) of land.
- Lincoln County Land Act of 2000 – Completed disposal of about 53 square kilometers (13,000 acres) of BLM-administered land.
- Lincoln County Conservation, Recreation, and Development Act of 2004 – Approved disposal of up to 360 square kilometers (90,000 acres) of BLM-administered land in Lincoln County (specific locations to be determined as part of the BLM Ely Resource Management Plan process; the Draft Ely Resource Management Plan (DIRS 174518-BLM 2005, all), includes alternatives and assessment for disposal of about 140 square kilometers (34,000 acres), with various linear rights-of-way of about 61 square kilometers (15,000 acres).
- Rights-of-way corridors that may be established when DOE and the BLM complete the Energy Corridor programmatic EIS (70 *FR* 56647, September 28, 2005).

The proposed Caliente rail alignment would disturb up to 165 square kilometers (40,000 acres) of BLM land, most of which would be within the construction right-of-way. Therefore, the proposed Caliente rail alignment would directly affect about 0.3 percent of the BLM-administered land in the three counties. This disturbance would include construction and operation of the proposed rail line, facilities, quarries, water wells, construction camps, and access roads. While the amount of disturbed land would be relatively small compared to the total amount of BLM-administered land, this disturbance could also result in indirect effects beyond the direct disturbance area.

Considering both the proposed railroad and existing and reasonably foreseeable land uses and land ownership, cumulative impacts from land-use changes would be small.

5.2.2.2.2 Existing or Potential Land-Use Conflicts

The Federal Government administers most of this land in the Caliente rail alignment cumulative impacts region of influence, with the BLM, DOE, and the U.S. Air Force acting as the major federal land managers. Private land holdings are small, and generally associated with the towns in the Caliente rail alignment region of influence. Traditional land uses in most of the Caliente rail alignment region of influence that would be directly and indirectly affected include grazing and wildlife management. Much of this land is not extensively disturbed, although it has been modified through activity such as grazing.

Over time, human activity in the area, while relatively minor, has begun to change the natural and traditional conditions, and land-use conflicts occasionally result from this human activity. The Nevada Test Site and Nevada Test and Training Range lands have been withdrawn for special purpose and use. Both of these areas are inaccessible to the general public and land use is that of "dominant use," in which the specific DOE and U.S. Air Force missions, respectively, for these lands have ultimate priority over all other potential land uses. However, around these primary regional land uses are other uses, including mineral development, recreation, urban development, and rights-of-way for various infrastructure. All of these activities and land uses result from a much more intensive land usage involving human activity.

BLM land management goals allow for management of the land for special purposes (protection of cultural resources, wilderness designations or study areas, protection of wildlife habitat, or visual resource management), but with increasing development in the Caliente rail alignment region of influence there are more occurrences of land-use conflicts. As noted in Chapter 4 of this Rail Alignment EIS, construction and operation of a railroad along the Caliente rail alignment would have potential direct and indirect conflicts with grazing uses, access to grazing infrastructure, access to mineral resources, recreational resources, other linear rights-of-way (for example, utility corridors), and wildlife movement patterns in some locations. Potential land-use conflicts resulting from a railroad along the Caliente rail alignment would be similar in scope to some of the other linear rights-of-way proposed in the region of influence (such as water pipelines and transmission lines) but more extensive in scope compared to many of the other projects, which are generally smaller on a linear scale or at a specific location. Even with the existing and reasonably foreseeable land-use changes, the region as a whole would continue its traditional ways, with grazing and wildlife habitat as major land uses, and cumulative impacts related to land-use conflicts would be small.

5.2.2.2.3 Energy and Mineral Development

Existing and potential future energy and mineral development occurs in various locations throughout the Caliente rail alignment cumulative impacts region of influence. In addition to the traditional energy and mineral development (primarily hard-rock mining, industrial mineral development, and limited oil and gas development), more recently, this development includes geothermal resources and wind energy. The BLM administers energy and mineral development on public lands. Today's energy development environment includes a mix of old and new, involving both non-renewable and renewable resource development. Wind-energy development on the BLM-administered lands could be one of the biggest changes in the future landscape, because wind-energy opportunities are growing and the BLM-administered land is valued for possible wind-energy locations. Depending on the number and size of each new proposed wind-energy site, land requirements for development of this resource could be substantial.

Because of the scope and extent of typical mining operations, mineral resources that become actual operating mines could result in environmental and land-use issues. Within the Caliente rail alignment region of influence, most mining and energy-development activities would occur on federal lands, and the BLM will have a major role in mitigating and monitoring potential effects through its mining and reclamation requirements, NEPA, and other elements of the regulatory framework. Mineral exploration will continue to occur in many parts of the Caliente rail alignment region of influence, and some level of conflict from mining exploration and development with other land uses could be unavoidable.

Any potential conflict of the proposed railroad with energy and mineral development would be small in scope and occur in localized areas, and the effects of any such conflicts would be mitigated through the existing regulatory framework and BLM policies and plans. All existing and foreseeable projects would be subject to regulatory requirements and BLM policies and plans related to energy and mineral development. Therefore, cumulative impacts resulting in land-use conflicts related to energy and mineral development along the Caliente rail alignment would be small.

5.2.2.2.4 BLM Land Sales and Other Disposals

The BLM has identified a number of land parcels in the Caliente rail alignment region of influence that have been or will be removed from government ownership and disposed of through auctions or agreements with local governments. These BLM land disposals will continue, and will either directly or indirectly, enhance the potential for growth and urbanization in the Caliente rail alignment region of influence, as the land is changed from generally undeveloped to private lands available for residential or other development, or to government lands available for utility corridors, airports, or parks.

In many cases, these BLM land disposals would result in permanent land-use changes. With private land at a premium in the area, private-sector developer interest in the BLM land disposals will likely continue. These changes in land use could cause increasing urbanization and economic development in the Caliente rail alignment cumulative impacts region of influence.

While the proposed railroad would operate within the regional context of BLM land disposal efforts and any related implications and effects, it would have no affect on, nor would it be affected by, BLM land disposal efforts.

5.2.2.2.5 Recreational Land Use

Public lands in the Caliente rail alignment region of influence provide a number of diverse recreation opportunities, and the BLM has designated certain lands as recreation management areas. Demand for recreation is increasing as more people move to and recreate in the Caliente rail alignment cumulative impacts region of influence. Dispersed recreation, the principal opportunities available within the Caliente rail alignment region of influence, requires a variety of sites but needs no special facilities. These opportunities include caving, photography, automobile touring, backpacking, bird watching, hunting, primitive camping, hiking, rock climbing, and competitive and non-competitive off-highway vehicle events. Water-based recreation in the Caliente rail alignment region of influence is extremely limited. Increased demand for off-highway vehicle use from the increasing regional population, including the Las Vegas area, has been noted and is expected to continue. Many areas of BLM-administered land in Clark County previously used for off-highway vehicle recreation have been closed, causing a shift in use into the BLM Ely District. As growth and development occur in the Caliente rail alignment cumulative impacts region of influence, recreational resources will continue to be in demand, but the potential for conflict with recreational resources also will increase. Recreational resource locations, quality, and availability will evolve as the Caliente rail alignment region of influence changes.

The Lincoln County Conservation, Recreation, and Development Act of 2004 (Public Law 108-424) included such recreation initiatives as the designation of wilderness areas and the Silver State Off-Highway Vehicle Trail. Table 5-3 lists the wilderness designations, and the amount of land designated as wilderness area in Lincoln County. The wilderness-area designations provide wilderness characteristics such as solitude, primitive conditions, and unconfined recreation in these areas. DOE has sited the proposed Caliente rail alignment to avoid wilderness areas.

Table 5-3. Lincoln County wilderness designations from Public Law 108-424.

Wilderness Area	Designated as wilderness (square kilometers)[a]
Weepah Springs	210
Worthington Mountains	130
Big Rock	57
Mt. Irish	130
South Pahroc Range	100

a. To convert square kilometers to square miles, multiply by 0.38610.

The BLM has a major role in recreation opportunities in the Caliente rail alignment region of influence. BLM field offices are evaluating opportunities for new Areas of Critical Environmental Concern and Special Recreation Management Areas that would provide both passively and actively managed recreation opportunities. There are substantial management efforts to focus off-highway recreation opportunities to appropriate designated areas. For example, the Silver State Off-Highway-Vehicle Trail is a 420-kilometer (260-mile) combination of existing backcountry roads that are currently open and being used by off-highway vehicle enthusiasts. The Lincoln County Conservation, Recreation, and Development Act of 2004 provided for the creation of a Silver State Trail Management Plan to minimize impacts on natural resources and to protect cultural and archaeological resources. The Act also provides for the temporary closure of the Trail in the event that there are unintended adverse impacts on resources associated with the Trail. The proposed Caliente rail alignment would intersect the Silver State Off-Highway-Vehicle Trail in three places; however, the BLM and DOE could effectively manage those intersections.

Cumulative impacts to access to and use of recreational resources along the Caliente rail alignment would be small.

5.2.2.2.6 BLM Rights-of-Way

As urbanization and other development occurs in the Caliente rail alignment region of influence, the need for utility and other rights-of-way will increase. This has already begun to occur and will likely continue in the future in various parts of the Caliente rail alignment cumulative impacts region of influence. The BLM has developed certain preferred corridors over federal lands that it uses to the maximum extent possible for linear rights-of-way, such as for utilities. This keeps many right-of-way purposes together in one location instead of spreading them out over more dispersed areas. However, the BLM also acknowledges the need for exceptions to these standard rights-of-way locations. *Approved Caliente Management Framework Plan Amendment and Record of Decision for the Management of the Desert Tortoise* (DIRS 174200-BLM 2000, p. 27) states that the BLM would "[g]rant power distribution lines 69 kilovolt or less, local telephone, water distribution pipelines and facilities, local fiber optic loops and cable lines outside of designated corridors on a case-by-case basis." Proposed other future projects involving pipelines, railroads, transmission lines, etc., would all change land uses along a linear route if approved through the BLM right-of-way approval process. The BLM also has seen increasing demand for nonlinear rights-of-way, and will continue to grant rights-of-way for these nonlinear projects such as power plants, construction camps, and communication-tower sites.

The land use changes authorized by a BLM right-of-way grant would also have the potential to impact other resource areas as those land-use changes occur. Before approval of right-of-way applications, the BLM will evaluate the impacts of the projects through appropriate NEPA evaluation. Use of land for right-of-way purposes is consistent with BLM regulations and planning processes, and any land-use changes or disturbances associated with those rights-of-way are mitigated to the extent possible and according to BLM policies. As required for the issuance of rights-of-way, the project proponent would prepare and submit to the BLM a Plan of Development for each proposed right-of-way. The Plan of Development would describe the methods and procedures to be used to construct the proposed action on the right-of-way, including site-specific stipulations, terms, and conditions to satisfy all BLM requirements. Certain rights-of-way are long-term in nature and result in unavoidable impacts through land disturbance and the exclusion of other land uses now or in the future.

Utility and other right-of-way crossings are common to linear projects such as roads, railroads, and pipelines. Land areas for the Caliente rail alignment, construction camps, quarries, and access roads would cross or overlap up to 34 existing or proposed utility rights-of-way. Land areas for the proposed railroad facilities could also overlap existing or proposed utility rights-of-way. This situation would be typical for other linear rights-of-way. The crossings would be accomplished with small impact using standard engineering procedures and appropriate design details.

Cumulative impacts to BLM rights-of-way and right-of-way holders would be small.

5.2.2.2.7 Other BLM Land-Management Actions

The Federal Land Policy Management Act of 1976 (Public Law 94-579) mandates the BLM to manage its public lands from a multiple-use perspective. The Federal Land Policy Management Act specifically mentions balancing renewable and non-renewable resources, including but not limited to recreation, range, timber, minerals, watershed, wildlife, fish, natural, scenic, scientific, and historic values. Therefore, the BLM mission to manage the lands to meet multiple-use objectives is challenging, because many of the resources and associated values often conflict.

Within the context of the Caliente rail alignment cumulative impacts region of influence, the BLM planning process and management goals and objectives within their plans are key determinants of the compatibility of the proposed Caliente rail alignment with other projects in the Caliente rail alignment region of influence. Because the BLM is and will remain the major land manager in and around the Caliente rail alignment region of influence, BLM land-management goals, objectives, and subsequent land-management actions will largely determine if and how new projects and activities occur.

BLM objectives and goals within the resource management plans can serve to encourage or restrict activities in certain locations. Areas needing special management attention (such as Areas of Critical Environmental Concern) are also identified in the planning process to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. Multiple-use management goals and objectives become more challenging as cumulative development and land-use changes encroach on open land in the Caliente rail alignment region of influence.

The proposed Caliente rail alignment would cross several BLM planning areas. The Las Vegas and Tonopah Resource Management Plans and the Schell and Caliente Management Framework Plans (within the Ely planning district) would be applicable to the proposed location of the Caliente rail alignment. The Ely BLM Field Office is currently preparing an updated Resource Management Plan, which would replace the Schell and Caliente Management Framework Plans when formally adopted. When finalized, the Ely District Resource Management Plan will serve as the initial effort to implement the Eastern Nevada Landscape Restoration Project, which is eastern Nevada's regional program to put into practice the national BLM priority to revitalize the ecological condition of the Great Basin through the Great Basin Restoration Initiative.

These programs and resource management plans require a number of public and private partnerships and a collaborative approach to land management and planning. Grazing operations are a major BLM land-management program in the Caliente rail alignment region of influence. Grazing results in both direct and indirect cumulative impacts to vegetation, habitats, and wildlife in the Caliente rail alignment region of influence. The environmental impacts associated with grazing operations are a function of the location, timing, intensity, duration, and frequency of grazing. Grazing animals directly affect plant communities through trampling and nutrient redistribution. The most noticeable impacts occur around waters, salt blocks, fence lines, and other areas where animals concentrate. With proper grazing management, these concentration areas are limited in extent and mitigated regularly through management procedures such as movement of salt blocks and water hauls. While grazing can stimulate growth of some plants and provide other benefits, it can also reduce plant abundance, density, and vigor, especially in sandy soils.

Ultimately, BLM land management efforts and content of the resource management plans will play a major role in the magnitude, location, and extent of direct, indirect, and cumulative impacts in the Caliente rail alignment region of influence, and in the relative balance among multiple uses and resource values chosen for the public lands. DOE recognizes the importance of these land management actions and encourages readers to review specific resource management plans for more detailed information.

5.2.2.2.8 Urbanization and Economic Development Initiatives

Even without the increased urbanization and economic development caused by the BLM land disposals or expansion of the Las Vegas metropolitan complex northward into the Caliente rail alignment cumulative impacts region of influence, the urbanized areas in the Caliente rail alignment region of influence have generally planned for and solicited ways to grow and increase urbanization. Concepts such as industrial-park development, airport expansion, increased retail opportunities, and housing are prominent goals of the public and private sectors in the Caliente rail alignment region of influence.

The Coyote Springs development and the Toquop Township (24 kilometers [15 miles] northwest of Mesquite in southern Lincoln County) are examples of major potential community development sites. The Coyote Springs development has entered its initial development phase and is planned to include a full suite of homes, zoning regulations, services, and infrastructure in direct association with the BLM land sales of the 53 square kilometers (13,000 acres) of public land resulting from the Lincoln County Land Act of 2000. This trend is likely to continue, with land-use and ownership changes and potential land-use conflicts becoming an increasing issue and challenge for the future.

With or without the proposed railroad, urbanization and economic development activities, while increasing, would not generally change the overall undeveloped character of the Caliente rail alignment region of influence.

5.2.2.3 Aesthetic Resources

Cumulative impacts to aesthetic resources from the proposed railroad and other regional activities would primarily result from modifications to natural ***viewsheds***. The natural setting of the Caliente rail alignment region of influence includes vast and expansive viewsheds typical of much of the western United States. The open spaces and wide vistas offer interesting cloud, weather, and landscape interactions. Human activity disturbs the natural viewsheds with land disturbances such as buildings, roads, removal of vegetation, power lines, equipment, and vehicles. Any activity that disturbs substantial areas of land can result in visual impacts from fugitive dust and ground scars. Additionally, most man-made structures are designed and built for their functionality and safety, not for their visual appeal. For example, projects with construction-related equipment, facilities, and activities can include the presence of workers, camps, vehicles, machinery, lay-down yards, and dust.

The presence of the railroad would be an identifiable change to the regional viewsheds from some observation points and provide a noticeable contrast with natural visual attributes. The passage of a train would attract the attention of an observer, both because of the noise associated with the train and the change in the landscape, especially if the train were to fall in the foreground or middle ground of the viewshed. Visual impacts of passing trains would be temporary, but visual impacts of the track would be long-term.

Visual resources within the region of influence have been considered through application of the BLM Visual Resource Management System (see Sections 3.2.3 and 4.2.3 and Appendix D of this Rail Alignment EIS). This system identifies and classifies the BLM-administered lands within established visual resource objectives, and proposed activities are evaluated within the visual resource management framework to consider consistency with the visual resource objectives. Without restoration and reclamation efforts, ground disturbances in the regional environment would last for long periods. The magnitude and extent of potential visual impacts vary based on the number of viewers affected, distance and atmospheric conditions of viewing, degree of visual contrast compared to existing visual attributes, viewer sensitivity to the visual changes, and compatibility with existing land uses. BLM generally requires ground disturbances to be restored and reclaimed as part of project approval.

For the Caliente rail alignment, analysis using the BLM Visual Resource Management System indicated that the proposed railroad could be inconsistent with visual resource management objectives in the areas of the Caliente-Indian Cove Staging Yard during construction, in Garden Valley during railroad construction and operations, and in some other sites of rock cuts and fills during construction and operations. As shown in Appendix D, lands that have potential restrictive visual resource objectives (Classes I and II) are not prevalent in the region of influence.

There would be no known interactions of the proposed railroad with other reasonably foreseeable activities that would affect a Class I or Class II area in the Caliente region of influence.

5.2.2.4 Air Quality and Climate

Emissions of concern in the Caliente rail alignment region of influence include ***fugitive dust*** and emissions resulting from the operation of machinery and equipment. Construction activities such as surface disturbance and use of haul trucks in the Caliente rail alignment region of influence would generate fugitive dust. Fugitive dust is a type of nonpoint source air pollution (small airborne particles that do not originate from a specific point). These ***particulate matter*** emissions are regulated according to their size (aerodynamic diameter equal to or less than 2.5 micrometers [$PM_{2.5}$] and 10 micrometers or less [PM_{10}]). Fugitive dust is generally controlled through the application of water, or in some cases, application of a chemical compound designed to minimize dust emissions. Most of the projects and activities identified in this analysis would generate some level of fugitive dust. The plumes associated with fugitive dust generation are often localized to the area being disturbed and are temporary. In arid areas such as the Caliente rail alignment cumulative impacts region of influence, generation and control of fugitive dust will always be a concern. Exhaust emissions from the operation of machinery and equipment include sulfur dioxide, oxides of nitrogen, volatile organic compounds, and carbon monoxide.

There is a comprehensive air quality permitting system in Nevada to evaluate and approve only those projects that are allowable within quantitative air quality thresholds. The Nevada Division of Environmental Control, Bureau of Air Pollution Control, has established and implemented air pollution control requirements in Nevada Revised Statutes 445B.100 through 445B.825, inclusive, and Nevada Revised Statutes 486A.010 through 486A.180, inclusive. The Bureau of Air Pollution Control has jurisdiction over air quality programs in all counties in the state except Washoe and Clark. The Bureau of Air Pollution Control also has jurisdiction over all fossil fuel-fired units in the state that generate steam for electrical production. The Caliente rail alignment would be subject to the permitting requirements noted above, and would occur in air basins that are either in attainment or unclassifiable. The State of Nevada will not grant permits for activities that cannot show compliance with the applicable federal and state regulations will not be permitted.

The air quality impact analysis for the Caliente rail alignment assessed potential impacts through several means including air quality modeling of maximum concentrations relevant to National Ambient Air Quality Standards. The analysis concluded that emissions during construction or operation of the rail line or any associated facilities would be in conformance with applicable standards with the possible exception of the 24-hour National Ambient Air Quality Standards for PM_{10}, which could be exceeded from quarry operations at South Reveille Valley during the construction phase. DOE would be required to prepare an application for a Dust Control Permit and a Surface Area Disturbance Permit Dust Control Plan and submit them to the Nevada Division of Environmental Protection Bureau of Air Pollution Control prior to quarry development. It is likely that the requirements of the plan would greatly reduce fugitive dust particulate matter emissions, thus reducing the possibility of exceeding National Ambient Air Quality Standards.

Potential cumulative impacts to air quality from construction and operation of the proposed railroad along the Caliente rail alignment would be small, but could approach moderate if the potential violation of the National Ambient Air Quality Standards noted above occurred.

5.2.2.5 Surface-Water Resources

5.2.2.5.1 Changes in Drainage, Infiltration Rates, and Flood Control

Construction of major projects in previously undeveloped areas often results in changes to natural drainage. Construction could include regrading that would allow runoff from a number of minor drainage channels to collect in a single culvert or pass under a single bridge, which would result in water flowing from a single location on the downstream side rather than across a broader area. This would cause some localized changes in drainage patterns, but this probably would occur only in areas where natural drainage channels are small. Compaction of soil during construction could reduce water infiltration rates and change natural runoff and drainage patterns. However, some activities would disturb and loosen the ground for some time, which could cause higher infiltration rates.

Construction in washes or other flood-prone areas probably would reduce the area through which floodwaters naturally flow. This could result in water building up, or ponding, on the upstream side of crossings during flood events, and then slowly draining through the culverts or bridges. These alterations to natural drainage, sedimentation, and erosion would be unlikely to increase future flood damage, increase the impact of floods on human health and safety, or cause significant harm to the natural and beneficial values of the floodplains.

One special area of drainage/flooding concern, however, involves the Meadow Valley Wash area near the City of Caliente. The Caliente alternative segment would start next to Meadow Valley Wash in an area where the wash is joined by Clover Creek, and travel up Meadow Valley alternatively running adjacent to, or crossing the wash. The Federal Emergency Management Agency has studied Meadow Valley Wash, Antelope Canyon Wash, and Clover Creek Wash for flooding potential within the corporate limits of the City of Caliente and for some portions of Lincoln County. One-hundred-year water surface elevations and regulatory floodways have been established for these watercourses within the area studied. Encroachment into the floodway is prohibited unless it can be determined that such an encroachment into the floodway portion of the floodplain does not cause any increase in the water surface elevations for these watercourses. The area has a history of flooding events that can affect the roads, trails, and Union Pacific rail lines. In January 2005, a substantial flooding event occurred in the Meadow Valley Wash area. The BLM is currently involved in a multi-agency evaluation of remedial actions to avoid drainage/flooding issues in the area. The presence of the proposed railroad in this area has raised concerns about the potential interaction of railroad operations with future flooding events; these concerns and issues are currently being evaluated through the multi-agency evaluation and appropriate measures to reduce direct, indirect, or cumulative impacts would be identified through that process.

Overall effects would generally be localized to each specific project, and these concerns and potential impacts are factored into project design considerations as standard engineering and construction operating procedures. While cumulative impacts would be small, the risks and localized impacts from a flood event such as that experienced in the Meadow Valley Wash area in 2005 cannot be totally eliminated.

As a long linear project of up to 541 kilometers (336 miles) long (DIRS 180916-Nevada Rail Partners 2007, Table E-2), a rail line along the Caliente rail alignment would pose new surface drainage challenges because of the existing characteristics of terrain, topography, soils, and physical features. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the rail roadbed (subgrade) and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and to allow movement of equipment to the construction initiation points.

Project planning and best management practices would help avoid or reduce potential impacts from the proposed railroad or other ongoing or reasonably foreseeable future actions. Potential cumulative impacts due to changes in drainage, infiltration rates, and flood control would be very small and localized.

5.2.2.5.2 Spill and Contamination Potential

Major construction activities and other projects in the region of influence would use materials including petroleum products (fuels and lubricants) and coolants (antifreeze) necessary to operate construction equipment, and could include solvents used in cleaning or degreasing actions. A release or spill of contaminants to a stream or river would have the greatest potential for adverse environmental impacts; a release of contaminants to dry impermeable soil would have the least potential for adverse impacts. Spill-control and management plans (and standard operating procedures for the construction industry) would reduce the likelihood of spills. Railroad construction and operation along the Caliente rail alignment would be typical of major activities that use materials that could cause contamination through spills.

While the risk of a spill and associated water contamination cannot be totally eliminated, risks can be managed through regulatory controls so that the resulting cumulative impacts would be small.

5.2.2.6 Groundwater Resources

Increasing urbanization and other development in the Caliente region of influence presents the challenge of matching water supply with water demand. Because water availability is a potential resource constraint in the Caliente rail alignment region of influence over time, water demand can be both competitive among potential users and controversial among users and the general public. To allocate water uses, the State of Nevada uses a water permit application process coordinated by the State Engineer. Once granted, water rights in Nevada have the standing of both real and personal property. It is possible to buy or sell water rights and change the water's point of diversion, manner of use, and place of use by filing the appropriate application with the State Engineer. Overall, because the water permitting and allocation process considers the broad range of factors noted above, the process serves as a way to manage potential cumulative impacts of water demand and use within each basin.

Representative existing and reasonably foreseeable water users in the Caliente rail alignment region of influence include:

- Agriculture, which consumes the most water in the Caliente rail alignment region of influence. Based on groundwater usage data compiled by the U.S. Geological Survey, during calendar year 2000, approximately 46 percent of groundwater withdrawals in the State of Nevada were for irrigation, about 26 percent were for mining purposes, and the remainder were for drinking-water systems, geothermal production, and other uses.
- The Toquop power plant, the FEIS for which (DIRS 174208-BLM 2003, all) estimates future water needs associated with a portion of recent BLM land dispositions and the Coyote Springs residential development (at build out) to be roughly 140 million cubic meters (115,000 acre-feet) per year.
- The Clark, Lincoln, and White Pine Groundwater Development Project (Southern Nevada Water Authority) (DIRS 175909-Hafen et al. 2003, all), which would result in water withdrawal and transfer of up to 250 million cubic meters (200,000 acre-feet) per year.
- The combined effects of the Lincoln County Land Act Groundwater Development Project and the Kane Springs Valley Groundwater Development Project (DIRS 175909-Hafen et al. 2003, all), which would produce more than 35 million cubic meters (28,000 acre-feet) of water per year for conveyance to other locations.

- Groundwater withdrawals, which if approved, would be associated with the specific water-rights applications that have been submitted for proposed new municipal or irrigation wells in hydrographic areas 181, 208, and 172 (see Section 5.2.1.3.2).
- Recently constructed or planned power plants (water-cooled) in the Apex and Moapa areas, which require about 8 million to 9 million cubic meters (6,500 to 7,000 acre-feet) of water per year. The air-cooled power plants in those areas require less than 123,000 cubic meters (100 acre-feet) of water per year.
- The Nevada Test Site, which uses about 830,000 cubic meters (673 acre-feet) of water per year.
- Grazing activity in the 38 allotments around the proposed Caliente rail alignment, which demands about 600,000 cubic meters (500 acre-feet) of water per year.
- The Yucca Mountain Repository, which would have demands ranging from about 218,000 to 527,000 cubic meters (176 to 427 acre-feet) of water per year between calendar years 2010 and 2013 (this represents the period of the highest water demand for the proposed railroad project). The Repository would use approximately 76,700 to 397,000 cubic meters (62 to 322 acre-feet) of water per year in calendar year 2014 through completion of operation.

Excluding the large agricultural water use in the Caliente rail alignment region of influence, cumulative water use for the projects described above could total more than 430 million cubic meters (350,000 acre-feet) per year. Overall, the share of water that would be committed to construction and operation of the proposed railroad would represent a small portion of water use in the Caliente rail alignment region of influence, which would still be dominated by agriculture. Committed groundwater resources already exceed annual perennial yield values (a measure of available groundwater supply replenished each year through recharge) within some of the groundwater basins (hydrographic areas) that would be affected by the proposed railroad. Based on the proposed locations of new wells in specific hydrographic areas along the Caliente rail alignment, additional groundwater appropriations would be needed in 19 hydrographic areas. However, committed (cumulative) groundwater resources currently exceed estimated perennial yields in eight of these hydrographic areas (146, 149, 170, 173A, 203, 204, 228, and 229). One of these eight hydrographic areas (229) and two other hydrographic areas (144 and 145) the rail would cross have low perennial yields. Five of these areas are State of Nevada-designated groundwater basins. While designated groundwater basins are not considered closed to additional appropriations, the State Engineer could impose additional restrictions and preferred uses of the water in these designated basins.

A number of scenarios have been developed to assess the potential effects of the proposed Caliente rail alignment's contribution to cumulative water demand in the Caliente rail alignment cumulative impacts region of influence. The assumption used for developing these scenarios is that proposed railroad construction and operation and associated quarry and rail facility construction and operation water demands would be met through installing and withdrawing groundwater from new wells. Pumping in individual wells would occur primarily over 9 months to support construction, over 2 to 3 years at quarry sites, and over the rail system operational period for the rail facilities. Total water withdrawals associated with the proposed railroad could substantially exceed annual perennial yield values for hydrographic areas 145 and 229, and could represent approximately 99 percent of the annual perennial yield in hydrographic area 227A. In other areas, water withdrawals associated with the railroad could range from less than 1 percent to as high as 57 percent of the annual perennial yield value.

A proposed new irrigation well in Dry Lake Valley would have an average pumping rate of approximately 17,000 liters (4,488 gallons) per minute and the would operate year round This application is currently under protest. If this well application were to be approved and the well installed and used contemporaneously with a nearby proposed well location (location DLV3), analysis results indicate that the proposed new DLV3 well location would lie within the radius of influence of this irrigation well and the DLV3 well location would therefore not be viable. In that event, DOE could obtain the water required from one or more alternative proposed well locations from which the simultaneous pumping from that well location or locations and the proposed municipal well would not impact each other's operation, water could be obtained from an existing water rights holder, or one or more other best management practices could be implemented to preclude cumulative impacts from occurring.

The proposed new municipal well that would be northeast of a DOE-proposed new well location (PahV9) in Pahroc Valley would have an average pumping rate of up to 10,200 liters (2,690 gallons) per minute, and would operate year round. If this municipal well application were to be approved and the well installed and used contemporaneously with the DOE-proposed well(s) at location PahV9, analysis results indicate that, depending on the transmissivity (hydraulic conductivity) of the host consolidated rock unit aquifers involved, withdrawal of groundwater at a rate of up to approximately 920 liters (244 gallons) per minute from an equivalent single well at the PahV9 could either not, or might, impact pumping operations at the proposed new municipal well location, and vice versa. The 920-liter-per-minute pumping rate used in the analysis comprises the total withdrawal rate required for well locations PahV7, PahV8, and PahV9 combined and, therefore, represents a very conservative assumption. If hydraulic conductivities of the host aquifers are similar to values estimated in some published reports (such as DIRS 176852-Drici et al. 1993, p. 56), the proposed municipal well and the DOE-proposed well(s) at location PahV9 would not be expected to impact each other's operations if the two well locations were to be pumped simultaneously and the average pumping rate at location PahV9 were as high as 924 liters (244 gallons) per minute. Alternatively, if host aquifer hydraulic conductivity values were lower, if necessary, the average pumping rate imposed at location PahV9 could be restricted to a sufficiently low value (with the remainder of the required water acquired from locations PahV7 and/or PahV8), some of the required amount of water could be obtained from an existing water rights holder, if needed, or one or more other best management practices could be implemented to preclude potential impacts resulting from simultaneous groundwater withdrawals from the PahV9 location and the proposed new municipal well location.

Water rights applications have been submitted for two proposed municipal wells that would be approximately 1.5 kilometers (0.9 mile) northeast of, and approximately 1 kilometer (0.6 mile) northeast of, two DOE-proposed new well locations in hydrographic area 208, respectively. These water rights have not yet been granted and given the relatively long timeframes (20 years) estimated for completing the infrastructure components required for these wells, even if the applications were approved, these wells would likely be placed into use at a time beyond the proposed railroad projected 4- to 10-year construction phase. Therefore, DOE did not evaluate potential cumulative impacts from these proposed future municipal supply wells.

A water rights application has been submitted for a proposed municipal well that would be approximately 1.2 kilometers (0.8 mile) southwest of a DOE-proposed new well location (GV10) in Garden Valley (hydrographic area 172). At present, the Nevada Department of Water Resources lists the status of this well as "Ready for Action." The well has an estimated time to construct of 10 years. If this well application were to be approved and the well installed and used contemporaneously with the DOE-proposed GV10 well(s), the GV10 well location would lie within the radius of influence of this municipal well; therefore, the GV10 well location would not be viable. In that event, the Department could (1) obtain the required water from one or more alternative DOE-proposed wells from which the simultaneous pumping from that well(s) and the proposed municipal well would not impact each other's operation; (2) obtain water from an existing water rights holder; or (3) or implement one or more other best management practices to preclude cumulative impacts.

By utilizing one or more specific approaches or a combination of approaches for obtaining groundwater for construction of the proposed railroad (including approaches that are tailored to a hydrographic area's unique groundwater conditions), potential cumulative impacts to groundwater resources would be minimized. New groundwater withdrawals could, depending on the withdrawal rate; the hydrogeologic conditions present at the proposed pumping location and in the surrounding area; and the location and characteristics of nearby groundwater resource features, cause some decrease in the amount of water that might be available to an existing well having an associated water right, to an existing spring discharge, or to a downgradient groundwater basin.

Overall, the needs of the proposed railroad would represent a small portion of the current cumulative water usage within the Caliente rail alignment region of influence, which in some locations would continue to exceed perennial yield values.

5.2.2.7 Biological Resources

5.2.2.7.1 Habitat Loss and Fragmentation

The past, present, and reasonably foreseeable future actions in the Caliente rail alignment cumulative impacts region of influence would result in noticeable cumulative land disturbance. Existing activities such as the Nevada Test and Training Range and the Nevada Test Site have already resulted in land disturbance, and projects such as the various proposed rights-of-way and the Coyote Springs development would continue this trend. Such land disturbances result in altered natural biological and ecological conditions, and directly serve to reduce the amount of natural land available as habitat and open space.

The primary adverse construction-related impacts to vegetation communities from ground disturbance are the physical destruction or removal of the vegetation, and the permanent or temporary removal or compaction of the topsoil or other growing medium for the plants. These effects would occur with any major activity resulting in ground disturbance, including the proposed railroad. As more activity occurs, the cumulative loss of vegetative communities and associated habitats would increase. Management of these effects would typically be considered in project planning and mitigation, including projects on BLM-administered land. Much of the emphasis in land management in the Caliente rail alignment region of influence concerns the maintenance or reconstruction of healthy habitats.

Habitat destruction leads to direct impacts such as wildlife injury and mortality, alteration of behavior and movement patterns, and the indirect impacts of reduced vegetative health, reduced biological diversity, and locally degraded ecological function. When extensive habitat fragmentation occurs, the individuals or populations of particular species may have difficulty surviving. Habitat destruction arises from a number of sources, including projects that involve land disturbance, land management actions including wild horse and burro management. Though any project that causes disturbance of vegetation contributes to habitat fragmentation, linear projects that impose any degree of impediment to movements, like the proposed railroad, amplify the potential effects. A number of utility and water rights-of-way are anticipated in the eastern portion of the proposed Caliente rail alignment, with many of these crossing the Caliente rail alignment.

Measures to avoid, minimize or otherwise reduce impacts are typically implemented by project proponents and encouraged by government agencies and generally include actions to reduce or avoid habitat fragmentation and loss. Such actions would include minimizing land disturbance, using existing roads, interim reclamation, combined roads/utility rights-of-way for pipelines and cables, noise reduction, centralization of facilities, and employee training and education.

In areas proposed for railroad operational purposes, the impacts to vegetation would typically be moderate in scope, and cumulatively add to habitat loss and fragmentation. However, in areas slated for short-term use during construction, such as construction camps, revegetation and reclamation efforts would result in replacement of topsoil, reseeding of native species, monitoring for success, and eventual return of a native vegetation community somewhat comparable to predisturbance conditions.

Cumulative impacts due to habitat loss and fragmentation would be small to moderate through the construction and operations phases throughout the Caliente rail alignment region of influence.

5.2.2.7.2 Invasive Species and Noxious Weeds

Invasive species and noxious weeds naturally move into new areas over time, but this occurrence has been accelerated in many areas through human activity, either intentionally or by accident. In many cases these plants have been moved into North America from another continent. They have been accidentally introduced through contaminated grain or hay, or sometimes intentionally introduced for erosion control or as ornamentals. In addition, livestock and vehicles can cause invasive species and noxious weeds to spread, birds could carry seed, or the species can be brought in with contaminated fill dirt. Regardless of how they were introduced, invasive species and noxious weeds possess characteristics that allow them to compete aggressively with native vegetation. Invasive species and noxious weeds impact native plants, animals, and natural ecosystems by:

- Reducing biodiversity
- Altering hydrologic conditions
- Altering soil characteristics
- Altering fire intensity and frequency
- Interfering with natural succession
- Competing for pollinators
- Displacing rare plant species
- Replacing complex communities with single-species monocultures

From a cumulative impacts perspective, any time land is disturbed and native vegetation is lost there is an opportunity for noxious weeds to replace the native vegetation. While the BLM and other land owners/managers in the area have implemented programs to minimize this potential, invasion of noxious weeds cannot always be prevented. Therefore, coordinated multi-agency management actions and efforts are needed to mitigate the effects from cumulative land disturbance. Management of noxious and invasive weeds is essential for restoration of native plant community health and resiliency. If noxious and invasive weeds were not managed, they would continue to gradually replace more desirable native species throughout the Caliente rail alignment region of influence.

Linear disturbances such as pipelines, roads, utility corridors, or rail alignments that cross relatively undisturbed land have the potential to exacerbate the spread of these species into areas not previously affected. As the invasive or noxious weeds become established along the linear features they spread to adjacent areas, affecting the plant and animal communities beyond the actual disturbance, and are able to out-compete native species by responding more rapidly to the infrequent availability of water.

These impacts could occur as a result of railroad construction and operation and from existing or foreseeable projects, but strict adherence to best management practices would reduce the potential for impacts. Cumulative impacts due to the introduction and spread of invasive species and noxious weeds would be small.

5.2.2.7.3 Special-Status Species

Habitat for several special-status species would be disturbed and individuals of several of the species could be killed or injured during construction and operation of the proposed Caliente rail alignment. Implementation of best management practices, making minor adjustments to site locations during final design, and conducting pre-construction clearance surveys would substantially reduce these potential impacts. Through the NEPA and permitting processes, each proposed project and land management planning effort in the Caliente rail alignment region of influence will face challenges for the protection of various special-status species. There are a number of special-status species that could be affected by cumulative impacts in the Caliente rail alignment region of influence. Recent attention has focused on several specific species, including the desert tortoise and greater sage grouse, as discussed below.

The Mojave population of the desert tortoise (*Gopherus agassizii*) is listed as threatened under the Endangered Species Act of 1973 (16 U.S.C. 1531 to 1544). It is found within the proposed Caliente rail alignment only in the southwestern-most 48 kilometers (30 miles), from the Beatty Wash area to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 55 to 72). The desert tortoise is found in southern California, parts of southern Utah, and in the southern portions of Nevada, with the tortoises potentially affected by railroad construction and operation at the extreme northern extent of their range. While relative abundance of the tortoise is low in much of the Caliente rail alignment region of influence, every action that could disturb soil or vegetation within the tortoise's range has potential cumulative impacts of loss or fragmentation of the species' habitat or the direct mortality of individual desert tortoises,

The BLM resource management plans sometimes place restrictions on other activities (such as grazing, wild horse and burro abundance, off-road vehicle use, mineral activities) so that desert tortoise or other special status species habitat can be protected. However, off-road vehicle use, shooting, and collecting of individuals continue to affect tortoise populations. Habitat protection efforts for the desert tortoise are coordinated among a number of federal, state, and local governmental agencies, with the cumulative impact perspective a major factor in determining allowable impacts to the tortoise. Restoration plans and habitat conservation plans also affect the required mitigation measures, best management practices, and standard operating procedures for the protection of the desert tortoise or other special-status species.

In early 2005, the U.S. Fish and Wildlife Service completed its status review of the greater sage-grouse (*Centrocercus urophasianus*) throughout its range and determined that the species does not warrant protection under the Endangered Species Act at this time. The BLM would maintain habitats used by the greater sage-grouse in consideration of the priorities identified in the BLM National Sage-Grouse Conservation Strategy. This strategy considers that the greater sage-grouse has been substantially affected throughout the Great Basin by habitat loss due to residential development and the associated infrastructure; habitat degradation from heavy grazing, drought, and invasive and noxious weeds; habitat fragmentation from development of roads and other rights-of-way; and other activities throughout the Caliente rail alignment region of influence. A number of projects within the Caliente rail alignment region of influence, including the potential for wind-energy projects and associated infrastructure, have the potential to directly affect this species in a number of areas. The proposed Caliente rail alignment could pass near a small portion of previously used sage-grouse habitat, but it is not expected that the project would have direct, indirect, or cumulative impacts on this species.

Private landowners, corporations, state or local governments, or other non-federal landowners who wish to conduct activities on their land that might incidentally harm (or "take") wildlife listed as endangered or threatened must first obtain an incidental take permit from the U.S. Fish and Wildlife Service. To obtain a permit, the applicant must develop a Habitat Conservation Plan designed to offset any harmful effects the proposed activity might have on the species. Multi-species Habitat Conservation Plans are underway in two places in the Caliente rail alignment region of influence: (1) the Coyote Springs area and (2) in southern Lincoln County in the area of the recent BLM land disposal. Additionally, there is a single species (desert tortoise) Habitat Conservation Plan being developed in the Pahrump area of Nye County. These plans would support development of private lands while accounting for the potentially affected species.

No major effects on special status species are projected to result from construction and operation of the proposed railroad along the Caliente rail alignment. DOE would conduct any required consultation with the U.S. Fish and Wildlife Service in accordance with the Endangered Species Act. There is a substantial regulatory framework, to which all projects are subject, that serves to evaluate and protect special status species. Therefore, cumulative impacts to special status species would be small.

5.2.2.7.4 Wildfires

Wildfires are a major environmental concern throughout the Caliente rail alignment region of influence due to the generally dry climate and the increasing presence of invasive plant species. When they occur, wildfires have a significant and long-term impact on vegetation, wildlife, other natural resources, and human safety. The most important biological effects of fires include:

- Loss of native plant communities
- Decreased stability of watershed and soils
- Decreased or degraded wildlife habitat
- Increase in potential for invasive species spread
- Overall disruptions to ecological function

Sources of regional wildfires are both natural (for example, lightning) and human caused. With increased activity in the Caliente rail alignment region of influence, the potential for future human-caused fires increases. Because the BLM administers most of the land in the Caliente rail alignment region of influence, the BLM has primary fire-avoidance and fire-fighting responsibilities in the Caliente rail alignment region of influence.

Both the proposed railroad project and other reasonably foreseeable future actions would likely implement appropriate fire-avoidance strategies in consultation with the BLM. Potential cumulative impacts from wildfires would be small.

5.2.2.8 Noise and Vibration

5.2.2.8.1 Railroad Noise

The Union Pacific Railroad is the predominant ***Class I commercial railroad*** in Nevada and has operated in the state for many years. Noise associated with Union Pacific Railroad operations is part of the existing environment, specifically in the area of Caliente where the presence of the railroad is very evident. The sounds associated with the Union Pacific Railroad in and near the City of Caliente include wayside noise (noise generated by the cars and locomotives) and horn sounding. The individual operating rules of each railroad require train engineers to sound horns when approaching most grade crossings. Horn sounding is generally not required at private crossings. Wayside noise and horn sounding are common in Caliente and other portions of the existing Union Pacific Railroad routes.

The Toquop Energy Project could involve a new short rail spur of about 50 kilometers (30 miles) in an isolated part of Lincoln County south of Caliente. This spur would connect with the Union Pacific Railroad system but would be in an area that would not have any identifiable noise receptors.

Transportation of spent nuclear fuel and high-level radioactive waste casks along the Caliente rail alignment would result in as many as eight one-way trips per week. Train activity associated with supply and maintenance of the Yucca Mountain Repository is also proposed (as many as seven one-way trips per week), as is Caliente rail alignment maintenance activity (about two one-way trips per week), for a total of about 17 one-way trips per week. During construction, the completed portions of the rail line could also be used to deliver ballast to construction areas.

Potential noise impacts (as evaluated through noise modeling near Caliente, in Garden Valley, and in Goldfield) would be expected to be small. Construction and operation of a railroad along the Caliente rail alignment would introduce railroad noise into areas of the Caliente rail alignment region of influence that previously had none. This could result in annoyance for some people.

5.2.2.8.2 Urban Noise

As the population increases in Lincoln, Nye, and Esmeralda Counties, existing towns will grow and new residential areas will develop characteristics of more urban areas. Urban noise includes automobiles, construction activities, barking dogs, and other human activities generally within an identifiable community. At present, urban noise in the Caliente rail alignment region of influence is limited because there are only a few cities and communities. However, with economic development and growth goals throughout the Caliente rail alignment region of influence, the number and scope of urbanized areas is expected to increase. Urban noise is generally localized and is differentiated from aircraft and railroad noise sources, which move with the source from one location to another, while urban noise is within identifiable geographic borders associated with the locations of populations.

The proposed railroad would have a very small effect on urbanization in the area, and its effect on urban noise in the Caliente rail alignment region of influence would be small. Cumulative impacts related to urban noise would be small.

5.2.2.8.3 Aircraft Noise

Noise from aircraft engines and sonic booms is common throughout most of the Caliente rail alignment cumulative impacts region of influence, and can cause “startle” and annoyance effects. The noise associated with military aircraft is consistent with the “dominant use” of the area for military and defense-related activities at the Nevada Test and Training Range. Any noise effects associated with Nevada Test and Training Range missions would be considered necessary and unavoidable. Commercial air traffic also contributes to noise impacts in the region of influence.

The proposed railroad project would not contribute to cumulative aircraft noise.

5.2.2.8.4 Vibration

Vibration can be perceived on land surfaces and within buildings with certain types of activities. Construction activity is one of the more common sources of vibration, but railroad construction vibration would be very localized and typically minor in scope and duration. In the Caliente rail alignment cumulative impacts region of influence, other possible sources of vibration include occasional testing activities at the Nevada Test and Training Range and sonic booms from aircraft-related military activities in the airspace above the region of influence. These events would also tend to be short term and localized.

Cumulative impacts from vibration would be small.

5.2.2.9 Socioeconomics

The economy in the Caliente rail alignment cumulative impacts region of influence has traditionally been based on mineral development and livestock grazing. However, the economy in the region of influence is changing, just as land uses are changing. New economic drivers include services, retirement communities, and tourism, including recreation opportunities.

While the proposed railroad would be a major development in the Caliente rail alignment region of influence, its long-term economic development potential would be limited and would primarily be related to construction activities. This pattern of larger magnitude, short-term construction impacts followed by relatively small, long-term operations impacts for linear projects (for example, pipelines and transmission lines) is not uncommon in the Caliente rail alignment region of influence. If the Shared-Use Option were chosen and implemented, there would be greater potential for positive economic development benefits compared to the Proposed Action.

Population growth in the Caliente rail alignment cumulative impacts region of influence is projected to occur in existing residential areas such as Caliente and Tonopah, but also in new areas such as Coyote Springs and the BLM land-disposal areas in Lincoln County. It is uncertain if there is sufficient economic development growth potential in these areas to support all of the desired growth. It is possible that some areas would grow at the expense of other areas, or that recently developed plans for growth turn out to be unrealistic. Provision of housing to meet market demand is a private-sector activity, with the private-housing sector assumed to build to the needed level to meet housing demand at the appropriate locations. One of the factors that will affect how and where growth occurs is the availability of infrastructure to support the growth. Beyond the traditional infrastructure needs like roads, sewer, water, and public buildings, modern infrastructure such as the availability of fiber optic lines might also affect growth patterns. For example, the availability of fiber-optic lines or other high-technology infrastructure is likely to be a substantial growth discriminator for both businesses and individuals. The locations of and extent to which factors such as fiber-optic lines would ultimately affect growth cannot be projected at this time.

The recent and potential future BLM land disposals have the potential to provide land for private sector projects such as housing, industrial or commercial facilities, or other developments. In addition to the growth opportunities presented by the BLM land disposals, the proposed Coyote Springs community would be comprised of about 170 square kilometers (43,000 acres), about two-thirds of which would be in Lincoln County and one-third of which would be in Clark County). As envisioned, the development would be a series of neighborhoods with villages nestled between open-space corridors. It is planned to consist of both second-home residents and commuters to Las Vegas (about 80 kilometers [50 miles] away), with initial plans to focus on a role as a destination vacation location. At final build-out, the development could provide about 47,500 residential housing units. However, the development has not procured sufficient water rights for build-out, and the ability to reach its build-out objectives is primarily dependent on water availability.

As part of the Shared-Use Option analysis for this Rail Alignment EIS, the existing decisionmakers for Lincoln, Nye, and Esmeralda Counties, and the City of Caliente clearly stated their objective to grow and develop with additional business enterprises. Esmeralda County is working on a plan to relocate the Goldfield airport to a point west of the community, and develop a light industrial/manufacturing complex adjacent to the airport. The City of Caliente is working on the redevelopment of a 0.24 square kilometer (60-acre) industrial park south of the city, and Lincoln County is working aggressively to attract new business from Southern California and Las Vegas to the area.

The State of Nevada has developed population projections for the Caliente rail alignment cumulative impacts region of influence (DIRS 178807-Hardcastel 2006, all) as follows:

- Esmeralda County is projected to have a small decrease in population from 2005 to 2026
- Lincoln County is projected to add only about 2,000 persons from 2005 to 2026
- Nye County is projected to add more than 32,000 persons from 2005 to 2026

The Nevada State Demographer develops population projections for Nevada counties, which are always subject to change with new information. For example, the full potential growth from Coyote Springs and the BLM land disposals in Lincoln County over the next 20 years would increase population growth beyond the State Demographer's projections for Lincoln County.

Nye County's projected growth continues a recent trend, with growth in Pahrump very evident over the past several years. Growth in Pahrump is being driven by low-cost land, proximity to the Las Vegas metropolitan area, and relocation of retirees to the area. Growth in Nye County is also linked directly to existing and future Yucca Mountain Site operations.

As discussed in Section 4.2.9 of this Rail Alignment EIS, DOE used an economic model to estimate potential socioeconomic impacts of the proposed rail line (DIRS 182251-REMI 2007, all). The model includes consideration of construction and operation employment and wages, project-related spending, and other parameters that could affect the socioeconomic environment. The model included a future baseline of socioeconomic parameters that would represent a cumulative impacts baseline without the proposed railroad (see Table 3-61 of this Rail Alignment EIS).

Consistent with the methodology established in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 4-43), most of the construction workers for the proposed railroad are assumed to be residents of Clark County. This assumption is made because the construction sectors in Nye, Lincoln, and Esmeralda Counties are not large enough to provide enough workers for construction activities. Therefore, it is not surprising that Clark County is projected to attain the largest levels of construction-related employment, income, and spending effects from the proposed project, followed by Nye, Lincoln, and Esmeralda Counties. Lincoln County would experience the largest employment percentage increase during construction with an estimated increase of about 6 percent above baseline conditions.

Employee locations for the operations phase would follow the same general pattern and relative magnitude of the construction phase, but there would be fewer operations jobs than construction jobs. Gains in employment during the operations phase would be felt most strongly in Lincoln County, where the peak percentage change in average annual employment is projected to be 4 percent above baseline conditions during full operations. Esmeralda County is the only other county in the region of influence projected to experience more than a 1-percent change in average annual employment at any point during the operations phase (3-percent change).

Population changes that would result from railroad construction and operations are also projected to generally follow this pattern. During the construction phase, the upper bound of increase to population would be about 2 percent or less of the future cumulative population baseline in all four counties. The operations phase population change would have the largest percentage increase compared to the cumulative baseline in Lincoln County (about a 3-percent average annual increase over the baseline).

Strains on housing infrastructure during the construction phase would not be anticipated, because most construction workers could be housed in construction camps at strategic locations along the proposed Caliente rail alignment, rather than in nearby communities. Contractors might elect to use commercially available facilities for housing construction personnel at locations such as Caliente, Tonopah, Goldfield, Beatty, and Pahrump. There would be enough vacant housing in these locations to absorb both construction and operations personnel.

Some infrastructure impacts would be expected where construction activities or operating facilities were near communities. For example, construction workers, including those from the proposed railroad, could strain the existing health care service capacity in the Caliente rail alignment region of influence, particularly in Caliente, Goldfield, and Tonopah. The operations-related population gains could also result in identifiable effects on health and education-related services.

The road network in the Caliente rail alignment region of influence consists generally of two-lane highways and unpaved roads. In rural, less populated parts of the Caliente rail alignment cumulative impacts region of influence, roads are adequate to handle existing and projected future traffic flow. However, the array of new and proposed activities throughout the Caliente rail alignment cumulative impacts region of influence would have the potential to strain parts of the existing roadway infrastructure.

Railroad project-related road traffic would result in small increases in some areas but construction of the proposed railroad itself would not materially affect traffic volumes on local roads because most construction materials would be transported using rail, and most construction employees and contractors would be housed in construction camps linked to the work site by access roads. Cumulative traffic levels in the region would likely continue to increase as overall regional growth and development occurs.

Any road improvement and maintenance responsibilities in the region of influence are handled by the Nevada Department of Transportation through a Statewide Transportation Plan and a Statewide Transportation Improvement Program. The Statewide Transportation Improvement Program includes a 3-year list of federally funded and regionally important non-federally funded transportation projects and programs consistent with the goals and strategies of the Statewide Transportation Plan. Routine highway improvements and maintenance projects for the period 2006 through 2015 have been identified for Lincoln, Nye, and Esmeralda Counties as part of the Nevada Department of Transportation planning processes. The level of cumulative traffic changes would generally not be sufficient for major upgrades of regional roads.

Overall, the proposed railroad project would have a small impact on economic development and growth, housing and community infrastructure, and traffic in the Caliente rail alignment region of influence. While there is some limited potential for induced growth impacts, the specific locations and scope of these actions is unknown at this time, and any such actions are projected to be small. Cumulative impacts to socioeconomics in the Caliente rail alignment region of influence would be small.

5.2.2.10 Occupational and Public Health and Safety

5.2.2.10.1 Nonradiological Health and Safety

Throughout the Caliente rail alignment region of influence, continuing and reasonably foreseeable activities have the potential to result in occupational injuries or fatalities including, but not necessarily limited to sources such as tripping, being cut on equipment or material, dropping heavy objects, and catching clothing in moving machine parts, and other types of accidents. Other occupational risks include biological hazards, dust and soils hazards, air quality hazards, transportation accidents, and noise hazards. Biological hazards include potential human health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human health effects from exposure to inhalable soils and dusts containing hazardous constituents, and potential occupational encounters with unexploded ordnance.

While occupational injuries or fatalities are unavoidable with human activity, the public and private facilities within the Caliente rail alignment region of influence cumulative activity area are highly regulated. There is a substantial regulatory framework for occupational health and safety, with the Occupational Safety and Health Administration programs and regulations forming the basis for protection of workers. Through DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, the Department has prescribed the Occupational Safety and Health Act Standards that contractors are to meet in their work at government-owned, contractor-operated facilities. The Department of Labor, Bureau of Labor Statistics, measures occupational incident rates, including total recordable cases, lost workday cases, and fatalities, associated with the work environment.

There are no data on injury/illness incident rates for the Caliente rail alignment cumulative impacts region of influence, but injury/illness incidence rates in Nevada are generally higher than those in the United States as a whole. The economic segments with the highest injury/illness incidence rates in Nevada are construction and goods-producing industries.

Additional traffic is a concern with the construction phases of reasonably foreseeable projects. The construction phase of a project not only brings construction workers to the work sites, but also means an increase in slow-moving and bulky traffic involving the transportation of construction equipment. Use of trucks for hauling hazardous or other dangerous materials is also an increasing concern as traffic increases on the road network. To minimize traffic impacts at the entrance to the Yucca Mountain Site, a new interchange with U.S. Highway 95 at the site entrance has been proposed for both traffic flow and safety reasons. Increased traffic would not necessarily mean an increase in the rate of traffic accidents, but the number of accidents would increase if the rate of traffic accidents stayed the same and traffic increased. Therefore, transportation safety concerns would increase and there could be an increased workload for traffic-accident responders in the Caliente rail alignment region of influence with the cumulative growth in traffic.

An estimated 9,500 casks would be transported to the repository by rail along the Caliente rail alignment. Nonradiological occupational health and safety impacts are projected as follows:

- Construction and operations activities for the Caliente rail alignment are projected to result in approximately 880 recordable incidents, approximately 520 lost-workday accidents, and approximately three fatalities.
- Vehicular-related fatalities related to worker commuting are projected to result in an estimated 14 vehicular-related fatalities for the Caliente rail alignment.
- Rail-related accidents and rail-related fatalities related to the movement of cask trains, maintenance trains, and supply trains are projected to result in 16 rail-related accidents and two rail-related fatalities for the Caliente alignment.

Under Module 1, approximately 22,000 casks would be transported to the repository by rail and under Module 2, approximately 24,000 casks would be transported to the repository by rail. To estimate the cumulative health and safety impacts of Module 1 and Module 2, the impacts of the Proposed Action were increased by the ratio of the number of casks transported in Module 1 or Module 2 versus the Proposed Action. For Module 1, the nonradiological health and safety impacts noted above would increase by a factor of approximately 2.3 over the impacts under the Proposed Action. For Module 2, nonradiological safety impacts would increase by a factor of approximately 2.4 over the impacts under the Proposed Action.

Other regional activities would also cumulatively add to the totals beyond the railroad-related impacts, but cumulative nonradiological health and safety impacts in the Caliente rail alignment region of influence would be small within the context of the overall region of influence.

5.2.2.10.2 Radiological Health and Safety

Existing and reasonably foreseeable future activity (such as the Nevada Test Site and Yucca Mountain Repository activity managed by DOE) in the Caliente rail alignment region of influence involves the storage, handling, transportation, use, and disposal of radioactive materials and wastes. There is an extensive regulatory framework associated with transportation safety, and the proposed railroad would operate in compliance with these laws and regulations. For example, DOE complies with U.S. Department of Transportation regulations regarding the transportation of radioactive materials. DOE also uses U.S. Environmental Protection Agency protective action guides (identifying projected dose levels at which specified actions should be taken) and actions designed to limit doses and impacts in the event of a transportation accident resulting in releases of radioactive material. The regulatory framework and implementation of appropriate standard operating procedures would reduce the potential for accidents. Coordination of plans for proposed railroad construction and operation with local emergency response providers would be important to limit the potential for accidents, and for an effective response to an accident should one occur.

There is a small risk of radiological impacts to workers and the general public from external radiation exposure during normal operations and incident-free transportation. Staff at the Nevada Test Site and the Yucca Mountain Repository would be separate, and it is not anticipated that there would be cumulative exposures to workers from both operations. The modes of transportation of radioactive wastes for the Nevada Test Site (shipment by truck) and the Yucca Mountain Repository (shipment by rail) would differ. Radiological impacts associated with rail operations would be higher under Repository SEIS Module 1 or 2 operations compared to the Repository SEIS Proposed Action level of transportation. The radiological risk relationships among the repository, the proposed Caliente rail alignment, and Nevada Test Site operations is summarized below.

As part of the Repository SEIS process, DOE estimated that 9 to 28 latent cancer fatalities for members of the public would result from Yucca Mountain Repository construction, operations, monitoring, and closure for the population within the 80-kilometer (50-mile) repository region of influence. The estimated latent cancer fatalities correspond to a total collective dose of 15,000 to 46,000 person-rem, and the projected population within the repository region of influence is 120,000 persons. The region of influence for the Yucca Mountain Repository extends 80 kilometers (50 miles) to the northwest from the repository site boundary along the rail corridor, approximately to Scottys Junction; the remainder of the Caliente rail alignment is outside of the Yucca Mountain Repository region of influence. Population within the area where the rail alignment region of influence and the Yucca Mountain Repository region of influence coincide (between the repository boundary and the Scottys Junction area) would receive radiation dose from both the repository and from the railroad operations. Members of the public along the rail line but outside of the region of influence of the Yucca Mountain Repository would receive a negligible radiation dose from the repository.

For members of the public along the rail line, DOE estimated that there could be up to 1.3×10^{-4} latent cancer fatalities, corresponding to a collective population dose of 0.2 person-rem for the Caliente alignment. Therefore, for members of the public situated along the rail alignment, the radiological impacts of operation of the Caliente rail line would be a very small contribution to the overall radiological impacts of the Yucca Mountain Repository.

The estimated radiological dose to members of the public from Nevada Test Site operations in 2005 was 0.2 mrem per year; the maximum radiation dose was 2.3 mrem per year at the northwest corner of the Nevada Test Site boundary. Dose at off-site populated locations between 20 kilometers and 80 kilometers (12 to 50 miles) from this location would experience much lower radiation doses due to wind dispersion (*Nevada Test Site Environmental Report 2005,* DIRS 182285-Wills 2006, Table 8-4, p. 8-2.) The collective population dose from Nevada Test Site operations was below 0.6 person-rem in 2004 (*Nevada Test Site Environmental Report 2005,* DIRS 182285-Wills 2006, Table 8-3, p. 8-8.) Radiation dose from Nevada Test Site operations would be a very small contribution to the overall radiological impacts of the Yucca Mountain repository.

Operation of the proposed railroad along the Caliente rail alignment under the Proposed Action would result in a small contribution to cumulative radiological health and safety impacts. Cumulative radiological impacts in the Caliente rail alignment region of influence would be small.

5.2.2.11 Utilities, Energy, and Materials

5.2.2.11.1 Utilities

From a cumulative impacts perspective within the Caliente alignment region of influence, utility crossings are and will continue to be commonplace, with little impact other than minor ground disturbance. The proposed railroad project would contribute to regional utility and other right-of-way crossings, which are common to linear projects such as roads, railroads, and pipelines. Land areas for the rail line, construction camps, quarries, and access roads would cross or encroach upon existing or proposed utility rights-of-way in a variety of locations. Land areas for railroad operations support facilities could also encroach upon existing or proposed utility rights-of-way. This situation would be typical for other rights-of-way in the region, meaning that the cumulative region of influence would have hundreds of utility and other right-of-way crossings for the various existing and reasonably foreseeable projects in the region. The crossings would be accomplished with small impacts using standard engineering procedures and appropriate design details.

Many regional activities, including the proposed railroad, would increase demands on public water systems, wastewater systems, telecommunications systems, electric power systems, and other utilities. However, regional service providers are projected to be able to adjust to any increasing demand, and overall cumulative impacts to utilities would be small.

5.2.2.11.2 Energy and Materials Usage

Large projects such as pipelines, transmission lines, and power plants that could occur within the Caliente rail alignment cumulative impacts region of influence require materials and energy to construct and operate. Energy and material resources necessary for construction or operation of these projects are often obtained within regional or, in some cases, national markets.

For this Rail Alignment EIS, DOE analyzed cumulative energy and materials supply and demand from a regional perspective. Energy and materials (for example, steel and concrete) that would be needed for construction and operation of the proposed railroad are not constrained in regional markets, and proposed railroad needs would represent a small percentage of the cumulative annual materials use within the Caliente rail alignment cumulative impacts region of influence.

While the regional markets for various construction-related materials and energy sources will continue to grow as the region develops, there is no evidence of potential limits to growth from constrained material or energy supplies. Cumulative impacts from energy and materials usage in the Caliente rail alignment region of influence would be small.

5.2.2.12 Hazardous Materials and Waste

5.2.2.12.1 DOE Waste-Management Activities

DOE has had existing waste-management programs at the Nevada Test Site for several decades. While Site missions have changed over time (with an emerging focus on national security, energy, and environmental issues), waste management and disposal at the Site has been one of the primary long-term land uses. There are two active waste-management and disposal sites on the Nevada Test Site:

- Area 5 occupies 2.9 square kilometers (720 acres) and is in Frenchman Flat north of Mercury, Nevada.
- Area 3 occupies 0.53 square kilometer (130 acres) north of Mercury in Yucca Flat.

Environmental restoration efforts are under way at various locations throughout the Nevada Test Site. The Nevada Test Site waste-management program currently includes management and disposal operations for hazardous waste, mixed waste, and low-level radioactive waste. Transportation of the waste is accomplished by truck from both on-site and off-site sources. There are no plans for Nevada Test Site activities to include use of the proposed Caliente rail alignment for shipment of wastes.

The proposed railroad would not contribute to cumulative impacts associated with DOE waste-management activities on the Nevada Test Site.

At present, Yucca Mountain Repository-development efforts are focused on preparing an application to the U.S. Nuclear Regulatory Commission for authorization to construct the repository for spent nuclear fuel and high-level radioactive waste. Proposed operations at the Yucca Mountain Site are discussed in detail in the Yucca Mountain FEIS and the Repository SEIS.

5.2.2.12.2 Sanitary and Construction Wastes

As the populated areas in the Caliente rail alignment cumulative impacts region of influence expand, the volume of sanitary waste generated will also expand. Project proponents are legally required to dispose of nonhazardous and nonradiological construction and other solid waste in appropriately permitted solid waste landfills. Nevada has 24 operating municipal landfills with a combined capacity to accept more than 11,000 metric tons (12,000 tons) of waste per day. However, the number of operating landfills has decreased substantially over the past 15 years, and while there is sufficient capacity to accept waste for the state of Nevada as a whole, there are some areas, such as Pahrump, that have limited capacity for future years.

Construction- and operations-related waste that would be associated with the proposed railroad would add only a fraction of a percent to the total waste stream in the state. If there were a constraint to landfill capacity at some future time, additional land would be needed to expand or open a new landfill. Because of the scarcity of private land in the Caliente rail alignment region of influence, any land used for this purpose might need to come from BLM-administered federal land. As an alternative to local government landfill provision, private companies can also be expected to seek business opportunities to provide solid- and hazardous-waste management, transportation, and disposal.

DOE would store and use hazardous materials (such as oil, gasoline and solvents) during the construction phase, and would control and manage these materials in accordance with the extensive federal and state regulatory framework. Other major projects would have similar waste streams, and project plans and requirements would call for disposal of such wastes in permitted facilities and materials management according to accepted industry practices.

The proposed railroad’s contribution to impacts from the generation and management of sanitary and construction wastes would be small. Cumulative impacts to waste disposal facilities in the Caliente rail alignment region of influence would be small.

5.2.2.13 Cultural Resources

Cultural resources include historic and archeological sites, buildings, structures, landscapes, and objects. Most reasonably foreseeable projects in the Caliente rail alignment cultural resources region of influence will involve at least some ground disturbance. With that ground disturbance, cultural resources could be destroyed, damaged, or discovered for recovery or mitigation. As part of the evaluation of proposed projects on federal land, the existing regulatory framework requires that cultural resources be identified and protected. With information on the location of a proposed project, and the estimated extent of ground disturbance, cultural resource specialists can be called on to perform appropriate surveys and inventories of cultural resources in the potentially disturbed area. Once discovered, the sites of cultural resources are kept confidential to reduce the potential for vandalism or theft of the resources.

Because cultural resources are typically on or below the ground, they can be damaged by other activities such as off-highway vehicle use. As the major land manager in the Caliente rail alignment region of influence, the BLM has an extensive cultural resource management program and manages federal land with protection of cultural resources as a key management objective. Once ground is disturbed and facilities are constructed on the land, the opportunity for identification of cultural resources is usually lost. Therefore, the BLM and other land managers in the area (like DOE on the Nevada Test Site and the U.S. Air Force on the Nevada Test and Training Range) employ cultural resource specialists and involve tribal representatives, as appropriate. Commonly, mitigation for any ground disturbance in the Caliente rail alignment region of influence includes the involvement of these cultural resource specialists as potential cultural resources are discovered. Other activities occurring on federal land, such as off-road vehicle use and rock collecting, can cause unintended adverse impacts to cultural resources. Mission activities occurring at the Nevada Test Site, the Nevada Test and Training Range, and the Yucca Mountain Repository also can cause unintended adverse impacts to cultural resources.

The problem of vandalism to and theft of cultural resources is prevalent throughout the western United States. The Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.9-5) notes that the trend of degradation to cultural resource sites is increasing at a rapid rate as the population increases in the Caliente rail alignment region of influence. Land-management agencies such as the BLM make extensive attempts to protect cultural resource locations, but the areas to be managed are often so vast that patrols by law enforcement are not effective in protecting these sites. DOE, the BLM, and other federal agencies in the Caliente rail alignment region of influence are committed to public education and employee training regarding the protection of cultural resources.

Visitors could also be drawn to the area for purposes of curiosity and sight-seeing. Based on the extent of cultural resource site finds within BLM-administered land and the Nevada Test Site, and data collected to date on the Caliente rail alignment, there could be a large number of cultural resources in the Caliente rail alignment region of influence. For example, the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.9-1) notes that approximately 12,000 cultural resource sites covering a time span of more than 10,000 years have been identified within the Ely District. It is likely that only a portion of any currently undiscovered sites would ultimately be found eligible for the *National Register of Historic Places*.

The railroad would be a major new construction project introduced into a remote area. Beyond the implications of ground disturbance and permanent and temporary use areas, railroad construction and operations would bring employees, visitors, and equipment into an area where prior access was limited. If right-of-way roads remain open to the public, there could be an increase in off-road vehicles traveling along newly constructed roads and illegal use of lands. As the number of visitors increases, so does the potential for vandalism and damage to cultural resources. There is an extensive regulatory framework to manage and protect cultural resources.

Impacts to cultural resources in the Caliente rail alignment region of influence would be small because the Department would conduct intensive field surveys and implement mitigation measures, including avoidance. Other project proponents would be subject to the same regulatory framework and BLM policies and procedures. Cumulative impacts to cultural resources in the Caliente rail alignment region of influence would be small.

5.2.2.14 Paleontological Resources

Regional protection, management, and impact issues in relation to paleontological resources are similar to those for cultural resources. Any type of ground disturbance could disturb or destroy known or yet identified paleontological resources. Impacts to paleontological resources would generally be measured by physical damage to fossil-bearing formations through excavation or surface disturbance. The primary cumulative impact mechanisms that could affect paleontological resources include excavations or surface disturbances associated with approval and implementation of BLM rights-of-way, off-highway vehicle use, minerals development, land disposals, and special designations. Many BLM management activities, however, serve to protect and mitigate impacts to paleontological resources. As noted in the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 4.10-1), knowledge of the outcrop pattern of geologic units, and the kinds and quality of the fossils produced by such units, is a critical management tool for land-use decisionmaking where fossils might be involved. Potential effects on paleontological resources from ground disturbance would continue to be a major regional concern for the BLM from both resource management planning and rights-of-way evaluation perspectives.

Paleontological resources are considered valuable and are collected in the Caliente rail alignment region of influence for their cultural, scientific, and recreational values. Therefore, these resources are sometimes removed from federal lands. While common invertebrate fossils such as plants, mollusks, and trilobites can be collected for personal use in reasonable quantities, the lack of regular site monitoring and public education about fossil collecting has led to increased illegal commercial taking of paleontological resources. Paleontological resources are also vulnerable to intentional or unintentional vandalism. The specific locations of some identified paleontological resources are kept confidential to avoid vandalism or theft.

The most likely locations of currently unknown paleontological resources can be identified based on geological characteristics, and potential impacts can be avoided or minimized through careful project planning and implementation. Most formations the rail line would cross are volcanic and would not contain paleontological resources. Therefore, the proposed railroad project would not contribute to cumulative impacts to paleontological resources.

5.2.2.15 Environmental Justice

5.2.2.15.1 Potential Effects to Low-Income or Minority Populations

Environmental justice impacts result when high and adverse human health or environmental impacts fall disproportionately on low-income and minority populations. If high and adverse impacts are found to have disproportionate impacts on environmental justice populations as compared to the general population in the area, the impacts would be mitigated to the extent practicable by the federal agencies involved in the proposed action.

Based on individual and group values, beliefs, and goals among stakeholders and other interested parties, there are different perspectives on the potential effects of activities in the Caliente rail alignment region of influence on low-income or minority populations. The American Indian Resource Document (DIRS 174205-Kane et al. 2005) discusses cultural resources, American Indian values and their relationship to environmental justice, and broader American Indian values. DOE considers the American Indian Writers Subgroup conclusions to be responsible opposing viewpoints for purposes of its environmental justice responsibilities.

DOE has concluded that there are no identifiable human health or environmental impacts associated with the proposed railroad that would disproportionately affect low-income or minority populations, nor has the Department identified any special pathways for impacts (such as subsistence hunting and gathering) in the Caliente region of influence.

Cumulative impacts to low-income or minority populations along the Caliente rail alignment would be would be small, if any.

5.2.2.15.2 Economic Opportunity

Existing and reasonably foreseeable projects and activities in the Caliente rail alignment region of influence would present economic opportunities for some people in the area. Economic opportunities include employment, wages, revenue from business operation, and other economic stimuli associated with growth and development. DOE and other project proponents in the Caliente rail alignment region of influence have a legally mandated equal opportunity approach to these economic opportunities. Any potential for economic gain would be distributed equally to people or businesses in the area that seek employment or business opportunity.

While not all people would gain economically from the cumulative group of projects and activities, the opportunity for gain does not favor one population group or another based on minority or income status.

5.3 Mina Rail Alignment

Sections 5.3.1 to 5.3.2 summarize the projects and activities considered in the cumulative impacts analysis for the Mina rail alignment. Figure 5-3 shows the locations of these major projects and activities, including the:

1. Naval Air Station Fallon
2. Federal actions on the Walker River Paiute Reservation
3. Hawthorne Army Depot
4. Walker River Basin Restoration
5. Monte Cristo’s Castle (proposed state park)
6. Timbisha Shoshone Trust Land (federal land transfer)
7. Yucca Mountain Geologic Repository
8. Nevada Test Site
9. Nevada Test and Training Range

This section also considers other relevant projects and actions that are not depicted on the map, such as:

- BLM planning and management actions – A variety of BLM past, present, and reasonably foreseeable actions are located within the three BLM management areas (Carson City, Battle Mountain, and Las Vegas) relevant to the Mina rail alignment.
- Various rights-of-way – Many future utility or other rights-of-way corridors are not depicted in Figure 5-3 because specific routes are not known. For example, DOE and the BLM are preparing a programmatic environmental impact statement for potential designation of energy corridors on federal land in western states (70 *FR* 56647, September 28, 2005).
- Energy and mineral development activities.
- Other regional economic development plans and activities within Nye, Esmeralda, Lyon, and Mineral Counties.

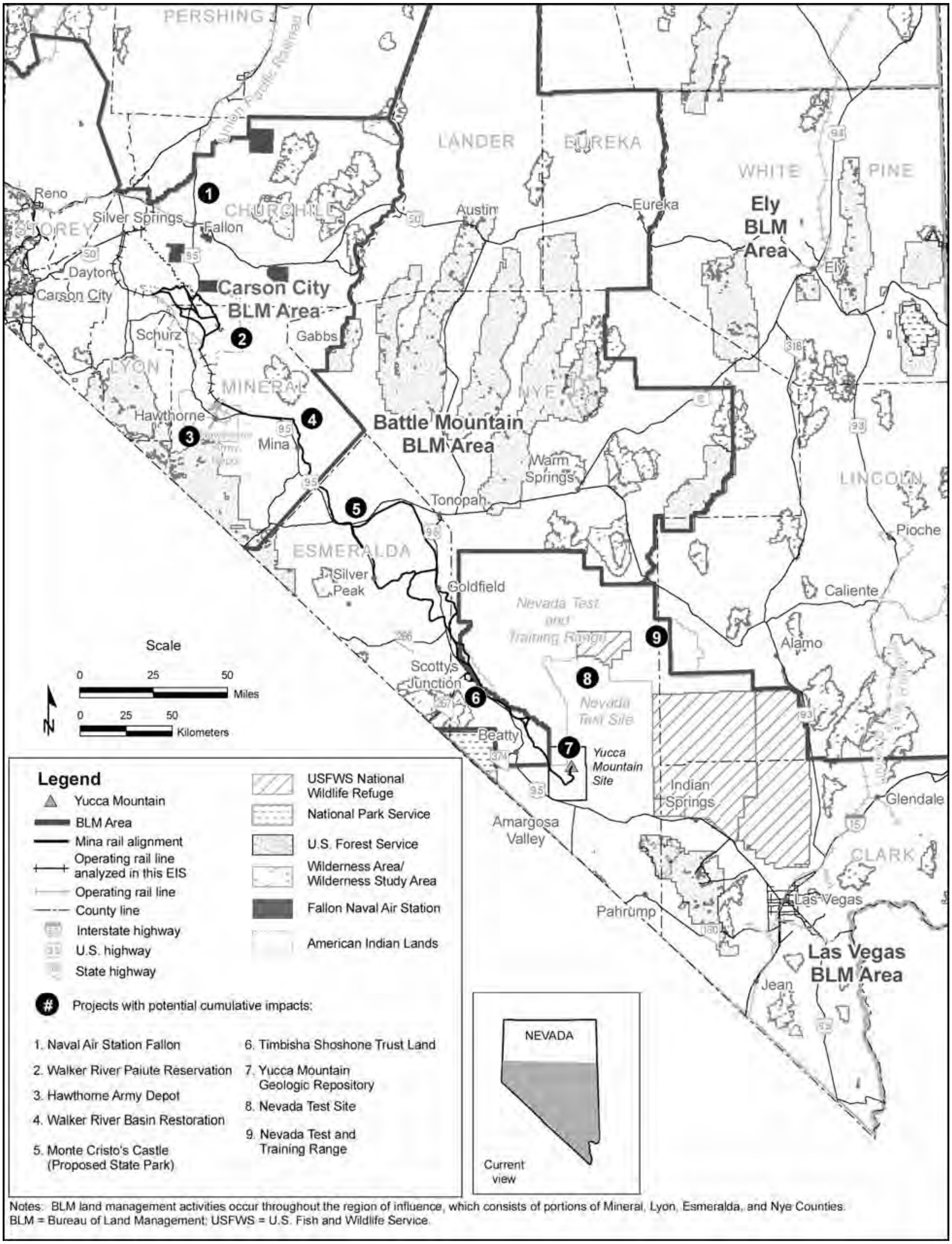

Figure 5-3. Major reasonably foreseeable future actions and continuing activities in the Mina rail alignment cumulative impacts region of influence.

The Mina rail alignment ranges in length from about 469 to 502 kilometers (281 to 312 miles), depending on the alternative segments considered. As a linear project, land disturbance and other direct impacts would be most likely to occur within the relatively narrow construction and operations rights-of-way. However, there could be other direct and indirect impacts for some resources outside the rights-of-way.

To evaluate the potential for cumulative impacts, DOE identified and reviewed public and private actions in the Mina rail alignment region of influence to determine if the impacts associated with these actions could coincide in time or space with potential impacts from railroad construction and operations along the Mina rail alignment. Only those projects and activities DOE believes would have the potential for cumulative impacts are identified herein. In some cases, similar actions have been grouped together and listed by category of action.

5.3.1 PROJECTS AND ACTIVITIES INCLUDED IN THE CUMULATIVE IMPACTS ANALYSIS – MINA RAIL ALIGNMENT

5.3.1.1 Past and Present Actions

The descriptions of existing (baseline) environmental conditions (Chapter 3) and impacts (Chapter 4) associated with the various environmental resource regions of influence for the Mina rail alignment considered in this Rail Alignment EIS include the relationships between proposed railroad construction, operation, and abandonment and past and present actions such as:

- Operations at major federal facilities such as the Yucca Mountain Geologic Repository, Nevada Test and Training Range, Nevada Test Site, Hawthorne Army Depot, and Naval Air Station Fallon
- BLM resource management planning and land management uses
- Traditional land uses such as regional ranching, mining, and recreation
- Military operations
- Walker River Basin restoration activities
- Residential, commercial, and industrial development activities associated with growth in the Mina rail alignment cumulative impacts region of influence; including the Pahrump area and the Reno-Carson City area adjacent to the northern portion of the Mina rail alignment region of influence.

Reasonably foreseeable future actions and the continuation of existing actions in the Mina rail alignment cumulative impacts region of influence were also considered. Figure 5-3 shows the locations of individual projects and activities.

5.3.1.2 Reasonably Foreseeable Future and Continuing Federal Actions

Sections 5.3.1.2.1 through 5.3.1.2.8 describe reasonably foreseeable future and continuing federal agency actions that could result in cumulative impacts when combined with the impacts of constructing and operating a railroad along the Mina rail alignment.

5.3.1.2.1 Yucca Mountain Geologic Repository

The Proposed Action in this Rail Alignment EIS is directly related to the proposed geologic repository at Yucca Mountain, which is a reasonably foreseeable project that would have potential cumulative impacts in the Mina rail alignment region of influence (see Figure 5-3, Project #7). In the Yucca Mountain FEIS

(DIRS 155970-DOE 2002, all) and the *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (the Repository SEIS; DOE/EIS-0250F-S1 DOE proposes to construct, operate and monitor, and eventually close a geologic repository for the disposal of 70,000 metric tons (77,000 tons) of heavy metal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain in Nye County, Nevada. DOE proposed to dispose of spent nuclear fuel and high-level radioactive waste in the repository using the natural geologic features of the mountain and engineered barriers as a total system to help ensure long-term isolation of the materials from the accessible environment. As analyzed in the Repository SEIS, the repository design and associated construction and operation plans require the following:

- DOE spent nuclear fuel and high-level radioactive waste would be placed in disposable canisters at the DOE sites, and as much as 90 percent of the commercial spent nuclear fuel would be placed in transportation, aging, and disposal (TAD) canisters at the commercial sites prior to shipment. The remaining commercial spent nuclear fuel (about 10 percent) would be transported to the repository in dual-purpose canisters (canisters suitable for storage and transportation), or would be uncanistered.
- Most spent nuclear fuel and high-level radioactive waste would be transported from 72 commercial and four DOE sites to the repository in Nuclear Regulatory Commission-certified transportation casks placed on trains dedicated only to these shipments. Some shipments, however, would be transported to the repository by truck over the Nation's highways.
- At the repository, DOE would conduct waste handling activities to manage thermal output of the commercial spent nuclear fuel and to package the spent nuclear fuel into TAD canisters. The disposable canisters and TAD canisters would be placed into waste packages for disposal in the repository. A waste package is a container that consists of the barrier materials and internal components in which DOE would place the canisters that contained spent nuclear fuel and high-level radioactive waste.
- DOE would place approximately 11,000 waste packages, containing no more than a total of 70,000 metric tons (77,000 tons) of heavy metal, of spent nuclear fuel and high-level radioactive waste in the repository at Yucca Mountain.
- When authorized by the Nuclear Regulatory Commission, the repository would be closed permanently. The design for construction would allow for phased construction of the surface and subsurface facilities that would be compatible with constrained funding.
- The surface and subsurface facilities and associated infrastructure, such as the onsite road and water distribution networks and emergency response facilities, would be constructed in phases to accommodate the expected receipt rates of spent nuclear fuel and high-level radioactive waste.
- DOE also would construct a four-lane access road that would extend from U.S. Highway 95 to the existing access road at Gate 510. This access road might be constructed using a phased approach, with initial construction of two lanes, and the road being widened later. The Department would also build a suitable intersection at U.S. Highway 95.
- DOE assumes that the following facilities would be constructed outside the repository land withdrawal area: a training facility near Yucca Mountain to support the Project Prototype Testing and the Operator Training and Qualification programs; temporary accommodations for construction workers; a proposed Sample Management Facility to consolidate, upgrade, and improve storage and warehousing for scientific samples and materials, perhaps near the Town of Amargosa Valley; and a marshalling yard and warehouse, a proposed leased facility that would consolidate material shipment and receipt into a 0.2-square-kilometer (50-acre) facility to allow

for offsite receipt, transfer, and staging of materials required to perform construction activities at the Yucca Mountain site.

The Nuclear Regulatory Commission, through its licensing process, would regulate repository construction, operation and monitoring, and closure. Repository operations would only begin after the Commission granted DOE a license to receive and possess spent nuclear fuel and high-level radioactive waste. DOE is currently preparing an application for construction authorization.

The Yucca Mountain FEIS and the Repository SEIS evaluate the cumulative impacts of two additional inventories (Modules 1 and 2), which include spent nuclear fuel and high-level radioactive waste in addition to that of the Proposed Action inventory, and other radioactive wastes generally considered unsuitable for near-surface disposal. Inventory Module 1 or 2 could have cumulative impacts on the operation of the proposed railroad. Regarding potential cumulative impacts from Inventory Module 1 or 2, there would be no cumulative construction impacts because the need for a new railroad would not change; that is, whichever rail alignment DOE selected in which to build the proposed railroad to serve the Yucca Mountain FEIS Proposed Action would also serve Module 1 or 2. In addition, because the planned annual shipment rate of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository would be about the same for Module 1 or 2 and the FEIS Proposed Action, the only cumulative operations impacts would result because of the annual increase of shipments for Module 1 or 2. Because Modules 1 and 2 exceed the NWPA disposal limit of 70,000 metric tons (77,000 tons) of heavy metal considered in the Repository SEIS, the emplacement of any such waste at Yucca Mountain would require legislative action by Congress unless a second licensed repository was in operation. The 70,000 metric tons of heavy metal limit is comprised of 63,000 metric tons (69,000 tons) of heavy metal from commercial utilities and 7,000 metric tons (7,000 tons) of heavy metal from DOE.

DOE is preparing the *Disposal of Greater-Than-Class-C Low-Level Radioactive Waste Environmental Impact Statement* (DOE/EIS-0375) (72 *FR* 40135, July 23, 2007). That EIS will address the disposal of wastes with concentrations greater than Class C, as defined in U.S. Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE Low-Level Radioactive Waste and transuranic waste having characteristics similar to Greater-Than-Class-C waste and that otherwise do not have a path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low-level waste disposal in a geologic repository; in intermediate depth boreholes; and in enhanced near surface facilities. Candidate locations for these disposal facilities are the Idaho National Laboratory; the Los Alamos National Laboratory and Waste Isolation Pilot Plant in New Mexico; the Nevada Test Site and the proposed Yucca Mountain Repository; the Savannah River Site in South Carolina; the Oak Ridge Reservation in Tennessee; and the Hanford Site in Washington. DOE will also evaluate disposal at generic commercial facilities in arid and humid locations. The Draft Yucca Mountain SEIS evaluates the potential cumulative impacts of disposal of these wastes at Yucca Mountain as a reasonably foreseeable action, which are included in Inventory Module 2. Current repository design plans do not accommodate disposal of Greater-Than-Class-C low-level radioactive waste.

DOE is preparing the *Programmatic Environmental Impact Statement for the Global Nuclear Energy Partnership* (DOE/EIS-0396). Global Nuclear Energy Partnership (GNEP) would encourage expansion of domestic and international nuclear energy production while reducing nuclear proliferation risks, and reduce the volume, thermal output, and radiotoxicity of spent nuclear fuel before disposal in a geologic repository. DOE anticipates that its Programmatic EIS will evaluate a range of alternatives, including a proposal to recycle spent nuclear fuel and separate many of the high-heat fission products and the uranium and transuranic components. The full implementation of GNEP would involve the construction and operation of advanced reactors, which would be designed to generate energy while destroying the transuranic elements. DOE also anticipates evaluating project-specific proposals to construct and operate an advanced fuel-cycle research facility at one or more DOE sites.

The United States uses a "once through" fuel cycle in which a nuclear power reactor uses nuclear fuel only once, and then the utility places the spent nuclear fuel in storage while awaiting disposal. GNEP would establish a fuel cycle where the uranium and transuranic materials would be separated from the spent nuclear fuel and reused in thermal and/or advanced nuclear reactors. GNEP would not diminish in any way the need for the nuclear waste disposal program at Yucca Mountain, because under any fuel recycle scenario, high-level radioactive waste will continue to be produced and require disposal.

DOE anticipates that by about 2020 the commercial utilities will have produced about 86,000 metric tons 995,000 tons) of heavy metal of spent nuclear fuel, which exceeds the DOE disposal limit of 63,000 metric tons (69,000 tons) of heavy metal of commercial spent nuclear fuel at the Yucca Mountain Repository. If DOE were to decide, in a GNEP Record of Decision, to proceed with its proposal to recycle spent nuclear fuel, the Department anticipates that the necessary facilities would not commence operations until 2020 or later. Although the spent nuclear fuel-recycling concept has not yet been implemented and the capacity of a separations facility has not been determined, one or more separations facilities could be designed with a total capacity sufficient to recycle the spent nuclear fuel discharged by commercial utilities. Consequently, the Department believes there would be no change in the spent nuclear fuel and high-level radioactive waste inventory, and therefore the number of casks of spent nuclear fuel and high-level radioactive waste shipped to the Yucca Mountain repository analyzed under the Proposed Action in this Rail Alignment EIS would remain unchanged (that is, the shipment of approximately 9,500 casks containing spent nuclear fuel and high-level radioactive waste).

Overall, development of a GNEP fuel cycle has the potential to decrease the amount (number of assemblies) of spent nuclear fuel that would require geologic disposal, but would increase the number of casks of high-level radioactive waste requiring disposal in a geologic repository in the long term. Consequently, recycling of commercial spent nuclear fuel could affect the nature of the inventory that represents the balance of Inventory Module 1 (that is, commercial spent nuclear fuel in amounts greater than 63,000 metric tons [69,000 tons] of heavy metal). Nevertheless, given the uncertainties inherent at this time in estimating the amount of spent nuclear fuel and high-level radioactive waste that would result from a full or partial implementation of the GNEP closed fuel cycle, this Rail Alignment EIS analyzes rail transportation within Nevada of approximately 9,500 casks of spent nuclear fuel and high-level radioactive waste.

5.3.1.2.2 Nevada Test Site (Continuation of Activities)

The Nevada Test Site, adjacent to the Nevada Test and Training Range, engages in a number of defense-related material and management activities, waste management, environmental restoration, and non-defense research and development (see Figure 5-3, Project #8). The Nevada Test Site was established in 1951 as the Nation's proving ground for developing and testing nuclear weapons. The site is on land administratively held by the BLM, but the Nevada Test Site land was withdrawn for use by the Atomic Energy Commission and its successors (including DOE). At present, the DOE National Nuclear Security Administration manages the site. It consists of about 3,200 square kilometers (800,000 acres) of land.

The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all) described existing and projected future actions at the Nevada Test Site. That EIS was followed by a *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 162638-DOE 2002, all). DOE activities at the Nevada Test Site include stockpile stewardship and management (helping ensure the U.S. nuclear weapon stockpile is safe, secure, and reliable), materials disposition (removal of nuclear materials in a safe and timely manner), and nuclear emergency response. Activities at the Nevada Test Site since the 1996 EIS and 2002 supplement analysis have continued to support these missions in accordance with federal law, DOE policies and missions, and NEPA requirements. There are a number of other programmatic DOE waste management initiatives that can affect current and potential future operations at the Nevada Test Site, many of which require NEPA analyses. The Nevada Test Site also produces annual environmental reports that describe program activities and related environmental issues and activities.

DOE is currently preparing the *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement–Complex 2030* (Complex Transformation Supplemental PEIS [formerly known as the Complex 2030 SEIS]; DOE/EIS-0236-S4). That SEIS will analyze the environmental impacts of the continued transformation of the United States nuclear weapons complex by implementing the National Nuclear Security Administration's vision of the complex as it would exist in 2030, and alternatives to that action. Part of the proposed action in that SEIS is to identify one or more sites for conducting National Nuclear Security Administration flight test operations. Existing Department of Defense and DOE test ranges (for example, the White Sands Missile Range in New Mexico and the Nevada Test Site in Nevada) would be considered as alternatives to the continued operation of the Tonopah Test Range in Nevada.

Another part of the proposed action in the Complex Transformation Supplemental PEIS is to accelerate dismantlement activities. The DOE sites that will be considered as potential locations for the consolidated plutonium centers and consolidation of Category I (high strategic significance) and II (moderate strategic significance) special nuclear materials include Los Alamos National Laboratory, the Nevada Test Site, the Pantex Plant, the Y-12 National Security Complex, and the Savannah River site.

DOE manages several types of radioactive and hazardous waste (***low-level radioactive waste***, ***mixed low-level waste*** [referred to as mixed waste], transuranic waste, high-level radioactive waste, and ***hazardous waste***) generated by past and present nuclear defense research activities at many DOE sites across the United States, including the Nevada Test Site. The Department manages each of those waste types separately because they have different components, levels of radioactivity, and regulatory requirements. DOE needs facilities like the Nevada Test Site to manage its radioactive and hazardous wastes to maintain safe, efficient, and cost-effective control of these wastes; comply with applicable federal and state laws; and protect public health and safety and the environment. In *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DIRS 101816-DOE 1997, all) DOE evaluated the environmental impacts of managing the five waste types. The Nevada Test Site will continue to be a major facility involved in DOE waste-management programs, including serving as a disposal site for certain waste types generated off the site, and for on-site wastes primarily from environmental restoration and remediation activities.

The Nevada Test Site is a candidate disposal location for Greater-Than-Class-C Low-Level Radioactive Waste which is currently being examined in the *Disposal of Greater-Than-Class-C Low-Level Radioactive* Waste *Environmental Impact Statement* (DOE/EIS-0375). That DOE EIS will address the disposal of wastes with concentrations greater than Class C, as defined in Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE low-level radioactive waste and transuranic waste having characteristics similar to Greater-Than-Class-C low-level waste and that might not have an identified path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low level waste disposal in a geologic repository; in intermediate-depth boreholes; and in enhanced near-surface facilities.

Table 5-1 lists and briefly describes recent environmental assessments that describe Nevada Test Site operations.

5.3.1.2.3 BLM Resource Planning and Management

The presence of public land administered by the BLM is a very important factor affecting how and where activities occur within the region of influence. Many private and federal projects in the regions of influence, including the proposed railroad, would involve use of BLM-administered federal land. Therefore, these projects would require BLM-issued right-of-way grants before they could proceed. Right-of-way grants have two general forms: linear (applicable to such projects as transmission lines, railroads, and pipelines), and non-linear (applicable to projects at one specific location). Rights-of-way on BLM-administered land are extensive in the region. These rights-of-way vary tremendously in size and scope of activity.

Similar to the Caliente rail alignment, the BLM also administers most of the public lands along the proposed Mina rail alignment. The BLM manages these lands through a multiple-use concept (which means managing public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people) in accordance with the Federal Lands Policy and Management Act of 1976 (43 U.S.C. 1732, et seq.) and other federal legislation. The proposed Mina rail alignment would cross three BLM planning areas (Carson City, Battle Mountain, and Las Vegas). The Carson City Field Office manages its federal lands through a Consolidated Resource Management Plan developed in 2001. The Carson City Field Office was previously divided into eight planning units, all of which were consolidated into the 2001 Carson City Resource Management Plan. The Battle Mountain and Las Vegas planning areas are operating under resource management plans adopted in 1998 and 1997, respectively (DIRS 176043-BLM 1998, all; DIRS 173224-BLM 1997, all). There are many land uses on BLM-administered federal land in the region of influence, with grazing use being a major source of activity.

As directed by Federal legislation, the BLM Carson City Field Office may issue leases for geothermal resources located in multiple areas within the Mina rail alignment cumulative impacts region of influence. The development of any geothermal resources would be guided by BLM land and resource management policies and procedures established in the applicable resource management plans.

5.3.1.2.4 Walker River Paiute Reservation (Federal Actions)

The Walker River Paiute Reservation consists of more 130 square kilometers (323,000 acres) of land between Yerington, Nevada, and Walker Lake (See Figure 5-3, Project #2). Although the Reservation is recognized as a sovereign entity under the non-federal actions discussion below, federal agencies could also be taking actions on the reservation. The Bureau of Indian Affairs operates the Weber Dam and Weber Reservoir, which impounds water from the Walker River just north of the community of Schurz for use on the Reservation. Constructed in the 1930’s, the dam needs several repairs and modifications to address a number of deficiencies identified as a result of inspections and a safety analysis conducted in the 1980s under the Bureau of Indian Affairs Dam Safety Maintenance and Repair Program, created as part of the Indian Dams Safety Act. Additionally, the U.S. Fish and Wildlife Service is involved in recovery efforts for the threatened Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*). Lahontan cutthroat trout are stocked in Walker Lake and occur in the Walker River upstream to Weber Reservoir. Weber Dam currently blocks movement further upstream, and prevents spawning by cutthroat trout; however, in the near future a fish ladder might be developed at that dam to allow fish movement. Re-establishment of a self-sustaining population of Lahontan cutthroat trout in the Walker River system is a prerequisite for recovery of this species (see also Sections 5.3.1.3.1 and 5.3.1.3.4 below).

5.3.1.2.5 Nevada Test and Training Range (Continuation of Activities)

The U.S. Air Force operates the Nevada Test and Training Range in south-central Nevada (see Figure 5-3, Project #9), a national test and training facility for military equipment and personnel consisting of approximately 12 million square kilometers (3 million acres). Military training maneuvers and jet aircraft are commonly visible in the Mina rail alignment cumulative impacts region of influence. In 2005, the U.S. Air Force designated the Indian Springs Air Force Auxiliary Airfield to Creech Air Force Base and expanded its mission and infrastructure to play a major role in the war on terrorism. The base is home to two key military operations: the MQ-1 unmanned aerial vehicle and the Unmanned Aerial Vehicle Battle laboratory.

The 1,600-square-kilometer (390,000-acre) BLM-administered National Wild Horse Management Area is within the boundary of the Nevada Test and Training Range. More than 3,200 square kilometers (800,000 acres) of the Nevada Test and Training Range comprise the Desert National Wildlife Range. The U.S. Air Force and the U.S. Fish and Wildlife Service jointly manage this area.

In *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (DIRS 103472-USAF 1999, all), the U.S. Air Force addressed potential environmental consequences of extending the land withdrawal in order to continue using the Nevada Test and Training Range lands for military use. Activities at the Nevada Test and Training Range change, as necessary, to meet military test and training needs.

In 2004, the BLM prepared a resource management plan for about 8,900 square kilometers (2.2 million acres) of withdrawn public lands within the Nevada Test and Training Range (DIRS 178102-BLM 2004, all). The plan guides the management of the affected Nevada Test and Training Range natural resources 20 years into the future (2024). The decisions, directions, allocations, and guidelines in the plan are based on the primary use of the withdrawn area for military training and testing purposes.

See Table 5-2 for a list and brief description of recent environmental assessments that describe Nevada Test and Training Range operations.

5.3.1.2.6 Hawthorne Army Depot

The Hawthorne Army Depot occupies approximately 590 square kilometers (147,000 acres) in Mineral County, Nevada (see Figure 5-3, Project #3). Hawthorne Army Depot was commissioned in 1930 as a Naval Ammunition Depot, transferred to the Army in October 1977, and renamed Hawthorne Army Ammunition Plant. It was converted to a government-owned, contactor-operated installation in December 1980. In 1994, the name changed back to the Hawthorne Army Depot. Control of Hawthorne Army Depot is maintained by the U.S. Army, which is responsible for the plans, installation, operation, and equipment of the Depot. The mission of Hawthorne Army Depot is to support the Army, Air Force, and Navy. It also has the capabilities to receive, maintain, store, and issue ammunition and explosive ordnance items. The Hawthorne Army Depot also has the responsibility to renovate, recover, or dispose of unserviceable ammunition and explosives. These latter operations are referred to as demilitarization activities.

The primary ordnance areas at Hawthorne Army Depot extend over 400 square kilometers (100,000 acres) that cross U.S. Highway 95. This area is surrounded on its northeast, east, south, and west sides by fencing and on its north and northwest sides by a boundary line that includes a portion of Walker Lake. The southern one-third of Walker Lake is within the ordnance area. The Mount Grant watershed is in the northwest part of the installation. This watershed consists of about 180 square kilometers (45,000 acres), and is a resource that Hawthorne Army Depot maintains to supply its primary potable water needs. Hawthorne Army Depot has 2,572 buildings and structures, which are comprised of offices, production buildings, ammunition storage magazines, and warehouses. The Depot is bordered by public grazing lands administered by the BLM, and the installation completely surrounds the town of Hawthorne. Hawthorne Army Depot is planning to construct a rail siding, known as the Wabuska Spur, which would increase the Depot's outloading capacity.

5.3.1.2.7 Naval Air Station Fallon

Naval Air Station Fallon is in the Lahontan Valley of west-central Nevada, approximately 113 kilometers (70 miles) east of Reno and 10 kilometers (6 miles) southeast of the city of Fallon (See Figure 5-3, Project #1). Naval Air Station Fallon administers approximately 32 square kilometers (7,900 acres) of withdrawn and acquired land associated with the air station and approximately 95 square kilometers (234,000 acres) of land associated with the Fallon Range Training Complex. The Fallon Range Training Complex airspace overlies portions of Washoe, Lyon, Churchill, Pershing, Mineral, Nye, Lander, and Eureka Counties, most of which is BLM-administered public land.

In January of 2000, the Navy and BLM issued the *Final Environmental Impact Statement: Proposed Fallon Range Training Complex Requirements Naval Air Station Fallon, Nevada* (DIRS 182891-Department of the Navy, BLM 2000, all). The Naval Strike and Air Warfare Center at Naval Air Station Fallon proposes to implement changes at the Fallon Range Training Complex to meet Chief of Naval Operations mandated training requirements resulting from the real world threat environment. The proposed changes would allow the Navy to update and consolidate Navy training on public and Navy-administered lands and to update existing airspace overlying these lands. The changes evaluated in the EIS include developing new fixed and mobile electronic warfare sites, developing new tracking instrumentation subsystem sites, developing additional targets at two of its training ranges, laying fiber optic cable to two training ranges, utilizing Navy-administered lands in Dixie Valley for close-air-support training, performing Hellfire missile and high altitude weapons delivery training at two of its training ranges, and changes to special-use airspace. The EIS provided a comprehensive evaluation of the environmental impacts, including cumulative impacts, associated with the Navy's proposed changes.

5.3.1.2.8 Timbisha Shoshone Trust Land (Federal Action)

The Secretary of the Interior issued a draft report to Congress (DIRS 103470-Timbisha Shoshone Tribe [n.d.], all) describing a plan to establish trust lands for people of the Timbisha Shoshone Tribe in portions of the Mojave Desert in eastern California and southwestern Nevada (See Figure 5-3, Project #6). On November 1, 2000, the President signed Bill S. 2102 (Public Law 106-423) to provide a permanent land base for the Timbisha Shoshone Tribe within its ancestral homeland in five separate parcels. Lands in the designated area for tribal purposes were then identified, including land parcels containing water rights. The parcel near Scottys Junction (about 11 square kilometers [2,800 acres]) is approximately 3.2 kilometers (2 miles) from the proposed Mina rail alignment. The Timbisha Shoshone Tribe is actively evaluating economic development opportunities on this Scottys Junction parcel. The locations and nature of these future development opportunities are not known and are not considered to be reasonably foreseeable for the purpose of this analysis.

5.3.1.3 REASONABLY FORESEEABLE FUTURE NON-FEDERAL ACTIONS

Non-federal and private actions in the Mina rail alignment cumulative impacts region of influence primarily involve mineral resource development projects, Walker River Paiute Tribal activities, and some residential and general economic development initiatives and efforts. As previously noted, many of these privately sponsored projects would interact with the BLM land management policies and procedures through the need to acquire right-of-way grants to initiate proposed activities on BLM-administered land.

5.3.1.3.1 Walker River Paiute Reservation

The Walker River Paiute Reservation consists of over 130 square kilometers (323,000 acres) of land between Yerington, Nevada and Walker Lake (see Figure 5-3, Project #2). The 2000 census reported a population of 853 people residing on the Reservation. The rural community of Schurz is the only community within the boundaries of the Reservation. Land use on the Reservation consists primarily of open range used for cattle grazing or other agricultural activities. The Department of Defense Branchline from Wabuska extends south through the Reservation to its termination point at the Hawthorne Army Depot.

5.3.1.3.2 Power Plants, Transmission Lines, Pipelines, and Other Infrastructure

There are transmission lines, pipelines, and telecommunications infrastructure within the Mina rail alignment cumulative impacts region of influence, which holds the potential for wind, solar, and geothermal energy development, although the magnitude and specific locations of these energy development projects are not known. As indicated in Section 5.3.1.2.6, the BLM may issue geothermal leases within the Mina rail alignment region of influence. The approval of any leases and subsequent development of geothermal resources would be subject to environmental review and would be guided by BLM resource management plans.

The BLM has designated certain corridors in the area that should be used for most utility purposes; however, use of other BLM-administered land requiring new right-of-way grants has traditionally been considered on a case-by-case basis. As previously noted, the DOE and BLM Energy Corridor programmatic EIS (70 *FR* 56647, September 28, 2005) is an attempt to identify appropriate right-of-way corridors throughout the western United States, including Nevada. This effort could influence the location of rights-of-way in the Mina rail alignment cumulative impacts region of influence in future years.

5.3.1.3.3 Mining

The Mina rail alignment cumulative impacts region of influence contains a variety of mineral resources, with mining claims filed in accordance with BLM requirements and several operating mines. Establishment of mining claims on federal land do not necessarily ever lead to actual development of mining operations on those sites. Major cumulative impact issues involving mining projects include potential land-use conflicts and wastes from operations. Mineral resource locations of note within the region of influence include:

- Nevada Western Silica Corporation holds mining claims for a large, high grade silica deposit near Lida Junction, south of Goldfield in Esmeralda County. There are at least 24 million cubic meters (32 million cubic yards) of silica on site. Both the Caliente and Mina rail alignments pass within 2.4 kilometers (1.5 miles) of the claims.

- Chemetall Foote Corporation runs an operation in Silver Peak, Nevada, that mines lithium carbonate. The company pumps lithium-rich groundwater to the ground surface and then collects the lithium powder as the water evaporates. Chemetall Foote Corporation pumps the groundwater on to dry lake beds in the Clayton Valley to facilitate the evaporation process. Once removed from the water, the raw lithium material is processed in an on-site plant into market-ready, lithium containing products.

- Metallic Ventures Gold holds mining claims near Goldfield in an historic district that produces high-grade gold. The project is currently in the pre-feasibility stage of development.

Mining activities are expected to continue within the Mina rail alignment cumulative impacts region of influence. Mining activities are heavily regulated and must comply with all applicable environmental laws, rules, and regulations. The BLM has an extensive regulatory framework for mineral resource development on federal lands that strives to balance mining activities and mineral extraction with other resource management goals.

5.3.1.3.4 Walker River Basin Restoration

The decline in water quality throughout the Walker River Basin, particularly in Walker Lake, and concerns related to the Lahontan cutthroat trout, have resulted in organized restoration efforts throughout the basin (See Figure 5-3, Project #4). Walker Lake water levels have dropped substantially since the late 1800s. In addition to the declining water level, levels of total suspended solids have also increased in Walker Lake. The increasing total dissolved solid levels along with other physical, biological, and chemical conditions in the watershed and lake have stressed fisheries and other aquatic life in the lake changing the resident fish population. The Walker Lake Working Group is a nonprofit organization building public support for developing a long-term solution to protect the lake without jeopardizing the upstream community. The Group has developed a restoration strategy focused on three objectives: (1) reestablishment of spawning runs of the Lahontan cutthroat trout; (2) providing sufficient water so that levels of total dissolved solids are low enough to support the Walker Lake ecosystem; and (3) acquiring and transferring water rights for environmental and recreational purposes.

5.3.1.3.5 Monte Cristo's Castle (Proposed State Park)

In 2005, a new state park was proposed near Blair Junction (See Figure 5-3, Project #5). If approved, the park would be known as Monte Cristo's Castle and would highlight the unique geology of the area. As proposed, the park would include approximately 23 square kilometers (5,800 acres) of land located just north of the intersection of U.S. 95 and State Route 265 at Blair Junction. As currently envisioned, the proposed park would include hiking areas and interpretive trails with displays about the unique geologic formations in the area. The Nevada State Legislature in June 2007 provided for establishment of the State Park, which would be on land currently administered by the BLM. To transfer the land to the State of Nevada for establishment of the State Park, the BLM would conduct an environmental assessment and other work required as part of the Recreation and Public Purpose Lease process.

5.3.1.3.6 Other Regional Economic Development

Cumulative impacts issues associated with regional economic development actions include socioeconomic effects and overall growth in the region of influence. South and east of the Carson City/Reno area, several regional economic development initiatives are on-going or planned in the northern portion of the Mina rail alignment cumulative impacts region of influence. For example, a county-owned airport near the community of Silver Springs, Nevada, plans to expands its operations, pave its runway, and promote the development of nearby industrial parks totaling approximately 3.8 square kilometers (950 acres). Western Nevada Rail Park is approximately 56 kilometers (35 miles) east of Reno along Alternate U.S. Highway 50. When complete, the rail park would include roughly 1 square kilometer (240 acres) of industrial park serviced by the Union Pacific Railroad mainline. A master-planned community is being developed near the community of Dayton, Nevada. The development contains approximately 12 square kilometers (2,900 acres) consisting of approximately 2,300 single family homes, 0.02 square kilometer (4 acres) of multi-family units, 0.11 square kilometer (27 acres) of commercial land, 1 square kilometer (240 acres) of industrial land, and 0.08 square kilometer (20 acres) for a resort/casino and an improved airstrip that is approximately 1,600 meters (5,400 feet) long. Infrastructure, including new elementary, middle and high schools, fire station, municipal water and wastewater utilities, community center and a health and fitness center, is already in place to support this development. Industrial parks in the Hazen area are also being developed, including a 9.3-square-kilometer (2,300-acre) development along the existing Union Pacific Railroad mainline. As the Reno and Carson City metropolitan areas continue to grow and expand, additional privately sponsored developments can be expected within the northern portion of the Mina rail alignment cumulative impacts region of influence.

Additionally, major transportation corridors such as U.S. Highway 95 through the region of influence into both the Reno and Las Vegas areas will continue to grow and expand, and present additional regional economic development opportunities. A perceived need for support to the Nevada Test Site has led to designation of the Nevada Science and Technology Corridor by the Economic Development Authority for Nye County. The Science and Technology Corridor extends from Indian Springs in Clark County in the south to Tonopah in the north, passing through the Pahrump Valley, Mercury (an entrance to the Nevada Test Site), Amargosa Valley, Beatty and Goldfield, with industrial park and technology initiatives associated with the Tonopah Aeronautics and Technology Park, the Nevada Science and Technology Park in Amargosa Valley, and the Pahrump Center for Technology Training and Development. The locations and nature of specific future development opportunities are not known and are not considered to be reasonably foreseeable for the purposes of this analysis.

Nye County has completed a Yucca Mountain Project Gateway Area Concept Plan with proposed activities for the area around the entrance to the proposed repository site (DIRS 182345-Giampaoli 2007, all). This plan presents Nye County's conceptual, multi-phased land-use guidance for communities adjacent to and near the site entrance area. Nye County proposed this plan with the objective that land development occurs in an orderly and consistent manner and to increase opportunities for industrial and commercial development beneficial to the repository program. Nye County views this plan as a starting point for development of the infrastructure, institutional capacity, and facilities to support the proposed repository. The county developed the plan to use and manage existing initiatives while expanding and improving the area.

5.3.2 POTENTIAL CUMULATIVE IMPACTS – MINA RAIL ALIGNMENT

Located primarily in portions of Esmeralda, Nye, Lyon, and Mineral Counties, the Mina rail alignment cumulative impacts region of influence covers millions of acres of land, most of which is federally managed public land. Most of the land in the Mina rail alignment cumulative impacts region of influence is undeveloped, although much of it has been affected by human activity such as ranching and mining.

Potential cumulative impacts are often discussed herein within the context of the existing regulatory framework (primarily federal and state laws and regulations) and the BLM resource management planning goals and objectives. For example, the existing regulatory frameworks for water and air consider a regional and cumulative impacts perspective, in that regulatory decisions consider the potential effects from other projects as well as a proposed action. As the primary regional land manager, BLM planning and management actions consider the cumulative effects for many resources through stated planning goals and objectives, which often are based on quantitative criteria.

The following analysis of the cumulative impacts associated with the Mina rail alignment is organized by resource area, with Sections 5.3.2.1 through 5.3.2.15 summarizing potential cumulative impacts in the same order of resource discussions in Chapters 3 and 4 of this Rail Alignment EIS.

5.3.2.1 Physical Setting

5.3.2.1.1 Disturbance of Physical Resources

Physical resources consist of resources, conditions, and characteristics such as physiography, soils, and geology. As construction of any project in the area occurs, there would be a potential for changes to the physical setting because land would be disturbed through activities such as cuts and fills and construction of new structures such as buildings and bridges. The proposed railroad would be one of many new sources of change to physical resources that would continue the trend of increasing land disturbance and modifications of the natural physical environment. In large-scale projects that involve substantial ground disturbance, natural features are considered in project design, construction, operations, and potential abandonment plans, which would tend to limit direct, indirect, and cumulative impacts. The proposed railroad would disturb only a small percentage of land in the Mina rail alignment cumulative impacts region of influence.

Given the large amount of land potentially available for development of existing and reasonably foreseeable projects, and the small percentage of potentially available land required for the proposed railroad, overall cumulative impacts to physical setting in the Mina rail alignment region of influence would be small.

5.3.2.1.2 Known or Potentially Contaminated Soils

The major sources of existing soil contamination problems in the Mina rail alignment region of influence are mining, the Nevada Test Site, and the Hawthorne Army Depot. Mining activities in the region have occurred for many years, with mining wastes still remaining from older operations before the regulatory framework required waste management and cleanup. The problems associated with the Nevada Test Site have been described in recent NEPA documentation (DIRS 101811-DOE 1996, all; DIRS 162638-DOE 2002, all). Historic contamination of soils resources on the Nevada Test Site is primarily from radioactive-waste management sites and past nuclear testing activities. Environmental restoration and remediation is occurring at contaminated Nevada Test Site locations in accordance with the facility's Environmental Restoration Program, but much of the contamination is long-term and the land and soil are not restorable to useful condition. For most of the contaminated soils within the Nevada Test Site boundary, DOE is planning only a characterization and long-term monitoring program. Contaminated areas on the Nevada Test Site are generally defined and access is restricted for reasons of safety and security. Spills of any hazardous materials are possible with regional activities, but the current regulatory framework to manage and control hazardous materials and wastes ensures that actions are in place to minimize any impacts.

The Hawthorne Army Depot has an Installation Restoration Program that outlines proposed future investigations and remedial actions at each Solid Waste Management Unit at the installation and other areas of concern. A total of 123 Defense Site Environmental Tracking System sites have been identified on Hawthorne Army Depot property. Soil and groundwater contamination issues exist with the primary contaminants of concern being compounds associated with explosives and heavy metals. Environmental restoration and remediation is ongoing at a number of sites. Other sites have achieved the status of "no further remedial action planned." Contaminated areas on the Hawthorne Army Depot are generally defined and access is restricted for reasons of safety and security.

Contaminated soils or spills can affect other resources such as water resources, biological resources, and land use. Spills of any hazardous materials are possible with regional activities, but the current regulatory framework to manage and control hazardous materials and wastes ensures that actions are in place to minimize any impacts. While any potential impacts associated with hazardous materials and wastes from current and future mining operations in the region are controlled through the existing regulatory framework, mining wastes from old mining extraction and processing activities, especially in the Goldfield area, remain a concern related to soil contamination.

The proposed railroad could result in very localized contamination of soils through occasional spills (such as fuel, oil, and solvents). However, such incidents would be minor in scope and quickly mitigated in accordance with plans and regulations. All existing and foreseeable projects would be subject to the same regulations. Cumulative impacts related to contamination of soils would likely be small.

5.3.2.2 Land Use and Ownership

5.3.2.2.1 Land Use Changes

Many of the past, present, and reasonably foreseeable future actions in the Mina rail alignment region of influence result in land use changes. Land use change can also alter land ownership, land management responsibilities, and preclude future activities from these areas. The vast majority of the land used for the proposed Mina rail alignment and associated facilities would be on BLM-administered land in Lyon, Mineral, Esmeralda, and Nye Counties. The BLM manages more than 45,000 square kilometers (11 million acres) in those four counties. One of the primary land uses in and around the proposed Mina rail alignment on those BLM-administered lands is grazing. Regional grazing activities are often affected by BLM land management plans and activities.

Other existing and reasonably foreseeable major land uses in the Mina rail alignment region of influence include:

- Yucca Mountain Repository – About 6.3 square kilometers (1,600 acres) of land disturbance, most of which would be on the Nevada Test Site (already withdrawn for Nevada Test Site activities).
- Nevada Test and Training Range – About 12,000 square kilometers (3 million acres) of land the U.S. Air Force has withdrawn for special-purpose use, with about 530 square kilometers (130,000 acres) of that land disturbed by Air Force tactical target complexes and associated infrastructure.
- Nevada Test Site – About 3,200 square kilometers (800,000 acres) of land DOE has withdrawn for special-purpose use.
- Naval Air Station Fallon and the Fallon Range Training Complex – Naval Air Station Fallon administers approximately 30 square kilometers (8,000 acres) of withdrawn and acquired land associated with the air station and 950 square kilometers (234,000 acres) of land associated with the Fallon Range Training Complex.
- Walker River Paiute Reservation – Approximately 1,300 square kilometers (323,000 acres) of land managed by the Walker River Paiute Tribal Council.
- Hawthorne Army Depot – Approximately 600 square kilometers (147,000 acres) of land managed by the Army for purposes of receiving, issuing, storing, renovating, inspecting, demilitarizing, and disposing of conventional ammunition. The Army is in the preliminary planning stages regarding an offer from a private firm of 40 square kilometers (10,000 acres) to expand the Army's military training and other missions.
- Reno and Carson City Expansion – A minimum of approximately 25 square kilometers (6,300 acres) of industrial, commercial, and residential developments associated with growth and expansion of the Reno and Carson City Metropolitan areas into the northern portion of the Mina rail alignment cumulative impacts region of influence.
- Hazen industrial parks – Two industrial parks are being developed at Hazen. The Great Basin Industrial Park, a 9.3-square-kilometer (2,300-acre) industrial and residential project is being developed alongside the existing Union Pacific Railroad mainline. Churchill County has already approved this project. The Rail Park, the Union Pacific Railroad mainline from the Great Basin Industrial Park, spans approximately 1.9 square kilometers (480 acres) and is currently in the planning stage.

- Right-of-way corridors that might be established when the DOE West-Wide Energy Corridor programmatic EIS (70 *FR* 56647, September 28, 2005) is completed.

The proposed Mina rail alignment would disturb up to 140 square kilometers (35,000 acres) of land, most of which would be within the construction right-of-way. Therefore, the proposed Mina rail alignment would directly affect about 0.25 percent of the BLM-administered land in the four counties. This disturbance would include construction and operation of the rail line, facilities, quarries, water wells, construction camps, and access roads. The Mina rail alignment would cross up to 15 separate grazing allotments. These 15 grazing allotments constitute about 11,700 square kilometers (2.9 million acres) of BLM-administered land. The approximate disturbance area associated with the proposed Mina rail alignment would constitute less than 1 percent of the land within those 15 grazing allotments. Within this regional perspective of nearby existing and reasonably foreseeable land uses and land ownership, the commitment of land for the proposed Mina rail alignment and associated facilities would constitute a small proportion of overall cumulative land commitment. Use of private land for the proposed rail line would be small, and the rail line would not displace existing or planned land uses on private lands over a substantial area, nor would it substantially conflict with applicable land use plans or goals.

Considering both the proposed railroad and existing and reasonably foreseeable land uses and land ownership, cumulative impacts from land-use changes would be small.

5.3.2.2.2 Existing or Potential Land-Use Conflicts

The Federal Government administers most of the land in the Mina rail alignment region of influence, with the BLM, DOE, and the Department of Defense (Air Force and Army) acting as the major federal land managers. The Mina rail alignment region of influence also includes Walker River Paiute Reservation lands. Private land holdings are small, and generally associated with Chemetall Foote Corporation's Lithium mine near Silver Peak and other towns in the Mina rail alignment region of influence. Traditional land uses in most of the Mina rail alignment region of influence that would be directly and indirectly affected include grazing, mining, and wildlife management. Much of this land is not extensively disturbed, although it has been modified through activity such as grazing and mining.

Over time, human activity in the area, while relatively minor on a regional basis, has begun to change the natural and traditional conditions, and land-use conflicts occasionally result from this human activity. The Nevada Test Site and Nevada Test and Training Range lands have been withdrawn for special purpose and use. Both of these areas are inaccessible to the general public and land use is that of "dominant use," in which the specific DOE and U.S. Air Force missions, respectively, for these lands have ultimate priority over all other potential land uses. Hawthorne Army Depot and Naval Air Station Fallon lands were also withdrawn for special use, are inaccessible to the general public, and land use is that of "dominant use" in which the specific Army and Navy missions, respectively, for these lands have ultimate priority over all other potential land uses. Walker River Paiute Reservation lands are managed by a sovereign tribal government and used by reservation inhabitants accordingly. Around these primary regional land uses are other uses, including mineral development, recreation, urban development, and rights-of-way for various infrastructure. All of these activities and land uses result from a much more intensive land usage involving human activity.

Railroad construction and operation along the Mina rail alignment could have direct and indirect conflicts with grazing uses, access to grazing infrastructure, access to mineral resources, recreational resources, other linear rights-of-way (for example, utility corridors), and wildlife movement patterns in some locations.

Even with the existing and reasonably foreseeable land-use changes, the region as a whole would continue its traditional ways, with grazing and wildlife habitat as major land uses, and cumulative impacts related to land-use conflicts would be small.

5.3.2.2.3 Energy and Mineral Development

Existing and potential future energy and mineral development occurs in various locations throughout the Mina rail alignment cumulative impacts region of influence. In addition to the traditional energy and mineral development (primarily hard-rock mining and industrial mineral development), more recently this development includes geothermal and wind resources. The BLM administers energy and mineral development, evaluates and approves various proposed mineral development operations, and evaluates and approves geothermal energy development projects on federal lands proposed by private companies. Today's energy development environment includes a mix of old and new, involving both nonrenewable and renewable energy resource development.

Because of the scope and extent of typical mining operations, mineral resources that become actual operating mines could result in environmental and land-use issues. Within the Mina rail alignment region of influence, most mining and energy-development activities would occur on federal lands, and the BLM will have a major role in mitigating and monitoring potential effects through its mining and reclamation requirements, NEPA, and other elements of the regulatory framework. Mineral exploration will continue to occur in many parts of the Mina rail alignment region of influence, and some level of conflict from mining exploration and development with other land uses could be unavoidable.

Any potential conflict of the proposed railroad with energy and mineral development would be small in scope and occur in localized areas, and the effects of any such conflicts would be mitigated through the existing regulatory framework and BLM policies and plans. All existing and foreseeable projects would be subject to regulatory requirements and BLM policies and plans related to energy and mineral development. Therefore, cumulative impacts resulting in land-use conflicts related to energy and mineral development along the Mina rail alignment would be small.

5.3.2.2.4 BLM Land Sales and Other Disposals

While specific initiatives for land disposals in the Mina rail alignment region of influence have not yet been developed, BLM has plans to designate for potential future disposal approximately 750 square kilometers (185,000 acres) of public lands in the area including: lands that are difficult and uneconomic to manage (for example, scattered parcels south of Hawthorne and in Smith and Mason Valleys, checkerboard lands near Fernley, Silver Springs and the Carson sink); land that would support community expansion (such as land west of Yerington, land surrounding the towns of Luning, Mina, Sodaville, Fallon, Gabbs, Reno, Verdi, and lands east of Montgomery Pass, near Honey Lake Valley and Dixie Valley); lands with possible agricultural potential (for example, Smith Valley, Mason Valley, Honey Lake Valley, and Edwards Creek); lands along the East Walker River identified for exchange to benefit Bureau programs.

Approximately 92 square kilometers (22,622 acres) have been identified for potential disposal in the vicinity of Goldfield, about 23 square kilometers (5,765 acres) have been identified for potential disposal near Scottys Junction, and 160 square kilometers (39,432 acres) have been identified for potential disposal near Beatty. Land disposal areas have also been identified near Coaldale Junction, Blair Junction, Silver Peak, and Millers.

While the proposed railroad would operate within the regional context of BLM land disposal efforts and any related implications and effects, the railroad would have no affect on, nor would it be affected by, BLM land disposal efforts.

5.3.2.2.5 Recreational Land Use

Public lands in the Mina rail alignment region of influence provide a number of diverse recreation opportunities, and the BLM has designated certain lands as recreation management areas. Demand for recreation is increasing as more people move to and recreate in the Mina rail alignment cumulative impacts region of influence. Dispersed recreation, the principal opportunities available within the Mina rail alignment region of influence, requires a variety of sites but needs no special facilities. These opportunities include caving, photography, automobile touring, backpacking, bird watching, fishing, hunting, primitive camping, hiking, rock climbing, and competitive and noncompetitive off-highway vehicle events. An example of increasing interest in recreation areas is the proposal for the Monte Cristo's Castle as a State Park near Blair Junction; this Park would highlight the unique geology of the area and include hiking areas and interpretive trails with displays about the geologic formations in the area.

The BLM has a major role in recreation opportunities in the Mina rail alignment region of influence. BLM field offices regularly evaluate new opportunities for recreational resources that would provide both passively and actively managed recreation opportunities. There are many such areas that BLM has designated for recreational use, such as a campground and other day-use facilities at Walker Lake, attracting about 35,000 visitors per year. Other forms of dispersed recreation in the region of influence include hunting, camping, and off-highway vehicle use. Increased demand for off-highway vehicle use from the increasing regional population, including the Las Vegas and Reno-Carson City areas, is expected to continue. Many areas of BLM-administered land in Clark County previously used for off-highway vehicle recreation have been closed, causing a shift in use into other BLM areas. As growth and development occur in the Mina rail alignment cumulative impacts region of influence, recreational resources will continue to be in demand, but the potential for conflict with recreational resources also will increase. Recreational resource locations, quality, and availability will evolve as the Mina rail alignment region of influence changes.

The Pahrump area is growing very rapidly for a variety of reasons. Both developed and undeveloped recreational opportunities in the area are abundant, with very easy access to public lands for activities such as hiking, camping, sightseeing, and rockhounding. The town of Pahrump is planning for development of approximately 6 square kilometers (1,500 acres) to be called the Last Chance Park on lands currently managed by the BLM and already used for various types of recreation. The plans include construction of access roads, restrooms, parking areas, and turn-outs, as well as the placing of signs, bike racks, benches, a pole-and-cable fence, trash cans and picnic tables. Much of the park would be dedicated to equestrian, hiking and biking paths, with the remainder allotted to all-terrain vehicle motorized use. Potential environmental impacts and issues will be identified and assessed through the NEPA process.

DOE has sited the proposed Mina rail alignment to avoid wilderness areas and other major recreational resources to the maximum extent practicable. Given the limited effects on regional population, the existence of vast regional recreational opportunities, and limited direct interaction of the railroad with recreational resources, cumulative impacts to access to and use of recreational resources in the Mina rail alignment region of influence would be small.

5.3.2.2.6 BLM Rights-of-Way

As urbanization and other development occur in the Mina rail alignment region of influence, the need for utility and other rights-of-way will increase. The BLM has developed certain preferred corridors over federal lands that it uses to the maximum extent possible for linear rights-of-way, such as for utilities. This keeps many right-of-way purposes together in one location instead of spreading them out over more dispersed areas.

The land-use changes authorized by a BLM right-of-way grant would also have the potential to impact other resource areas as those land-use changes occur. Before approval of right-of-way applications, the BLM will evaluate the impacts of the projects through appropriate NEPA evaluation. Use of land for right-of-way purposes is consistent with BLM regulations and planning processes, and any land-use changes or disturbances associated with those rights-of-way are mitigated to the extent possible and according to BLM policies. As required for the issuance of rights-of-way, the project proponent would prepare and submit to the BLM a Plan of Development for each proposed right-of-way. The Plan of Development would describe the methods and procedures to be used to construct the proposed action on the right-of-way, including site-specific stipulations, terms, and conditions to satisfy all BLM requirements. Certain rights-of-way are long-term in nature and result in unavoidable impacts through land disturbance and the exclusion of other land uses now or in the future.

Utility and other right-of-way crossings are common to linear projects such as roads, railroads, and pipelines. Land areas for the Mina rail alignment, construction camps, quarries, and access roads would cross or overlap existing or proposed utility rights-of-way in approximately 22 to 29 locations. Land areas for railroad operations support facilities could also overlap existing or proposed utility rights-of-way. This situation would be typical for other linear rights-of-way. The crossings would be accomplished with small impact using standard engineering procedures and appropriate design details.

Cumulative impacts to BLM rights-of-way and right-of-way holders would be small.

5.3.2.2.7 Other BLM Land-Management Actions

The Federal Land Policy Management Act of 1976 (Public Law 94-579) mandates the BLM to manage its public lands from a multiple-use perspective. The Federal Land Policy Management Act specifically mentions balancing renewable and nonrenewable resources, including but not limited to recreation, range, timber, minerals, watershed, wildlife, fish, natural, scenic, scientific, and historic values. Therefore, the BLM mission to manage the lands to meet multiple-use objectives is challenging, because many of the resources and associated values often conflict.

Within the context of the Mina rail alignment cumulative impacts region of influence, the BLM planning process and management goals and objectives within their plans are key determinants of the compatibility of the proposed railroad with other projects in the region of influence. As noted in Section 5.3.1, there are many continuing and reasonably foreseeable activities that involve the BLM. Because the BLM is and will remain the major land manager in and around the Mina rail alignment region of influence, BLM land-management goals, objectives, and subsequent land-management actions will largely determine if and how new projects and activities occur.

BLM objectives and goals within the resource management plans can serve to encourage or restrict activities in certain locations. Areas needing special management attention (such as Areas of Critical Environmental Concern) are also identified in the planning process to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. Multiple-use management goals and objectives become more challenging as cumulative development and land-use changes encroach on open land in the Mina rail alignment region of influence.

The Mina rail alignment would cross three BLM planning areas (Carson City, Battle Mountain, and Las Vegas). Each BLM Field Office manages lands within its administrative boundaries according to one or more Management Framework Plans or Resource Management Plans. The Carson City, Battle Mountain, and Las Vegas plans would be applicable to the Mina rail alignment. These programs and resource management plans require a number of public and private partnerships and a collaborative approach to land management and planning.

Grazing operations are a major BLM land-management program in the Mina rail alignment region of influence. Grazing results in both direct and indirect cumulative impacts to vegetation, habitats, and wildlife. Environmental impacts associated with grazing operations are a function of the location, timing, intensity, duration, and frequency of grazing. Grazing animals directly affect plant communities through trampling and nutrient redistribution. The most noticeable impacts occur around waters, salt blocks, fence lines, and other areas where animals concentrate. With proper grazing management, these concentration areas are limited in extent and mitigated regularly through management procedures such as movement of salt blocks and water hauls. While grazing can stimulate growth of some plants and provide other benefits, it can also reduce plant abundance, density, and vigor, especially in sandy soils.

Ultimately, BLM land-management efforts and the content of resource management plans will play a major role in the magnitude, location, and extent of direct, indirect, and cumulative impacts in the Mina rail alignment region of influence, and in the relative balance among multiple uses and resource values chosen for the public lands. DOE recognizes the importance of these land-management actions and encourages readers to review specific resource management plans for more detailed information. As discussed in Chapter 2 of this Rail Alignment EIS, the proposed railroad would be subject to BLM decisions and approval, and any effects of the railroad on BLM resource management planning, land-management activities, and BLM-managed natural resources would be implemented by BLM as appropriate. The proposed railroad's contribution to cumulative impacts to BLM land-management planning and actions in the Mina rail alignment region of influence would be small.

5.3.2.2.8 Urbanization and Economic Development Initiatives

In response to increased economic development goals in the region of influence, the urbanized areas in the Mina rail alignment region of influence have generally planned for and solicited ways to grow and develop. Concepts such as industrial-park development, airport expansion, increased retail opportunities, and housing are prominent goals of the public and private sectors in the Mina rail alignment region of influence. Several regional economic development initiatives are on-going or planned in the northern portion of the Mina rail alignment cumulative impacts region of influence. This trend is likely to continue, with land-use and ownership changes and potential land-use conflicts becoming an increasing issue and challenge for the future. However, it is likely that the rural nature of the overall Mina rail alignment cumulative impacts region of influence will remain largely in tact.

With or without the proposed railroad, urbanization and economic development activities, while increasing, would not generally change the overall undeveloped character of the Mina rail alignment region of influence.

5.3.2.3 Aesthetic Resources

Cumulative impacts to aesthetic resources from construction and operation of a railroad along the Mina rail alignment and other regional activities would primarily result from modifications to natural viewsheds. The natural setting of the Mina rail alignment region of influence includes vast and expansive viewsheds typical of much of the western United States. The open spaces and wide vistas offer interesting cloud, weather, and landscape interactions. Human activity disturbs the natural viewsheds with views of land disturbances such as buildings, roads, removal of vegetation, power lines, equipment, and vehicles. Any activity that disturbs substantial areas of land can result in visual impacts from fugitive dust and ground scars that create a contrast with the surrounding environment and draw the viewer's attention. Additionally, most man-made structures are designed and built for their functionality and safety, not for their visual appeal or compatibility with the visual character of the landscape. For example, projects with construction-related equipment, facilities, and activities can include the presence of workers, camps, vehicles, and machinery, lay-down yards, and dust. The likely addition of explosives bunkers at the Hawthorne Army Depot and projected wind-energy development are examples of other long-term visual changes that are reasonably foreseeable. Each type of project has its unique visual features, but generally, new projects would not be consolidated into any specific location within the region of influence.

While the area has a history of railroad use, the presence of a railroad and associated train traffic would be an identifiable change to the regional viewsheds from some observation points and provide a noticeable contrast with natural visual attributes. The passage of a train would attract the attention of an observer, both because of the noise associated with the train and the contrast with the landscape, especially if the train were to fall in the foreground or middle ground of the viewshed. Visual impacts of passing trains would be temporary, but visual impacts of the track would be long term.

Visual resources within the region of influence have been considered through application of the BLM Visual Resource Management System (see Sections 3.3.3 and 4.3.3 and Appendix D of this Rail Alignment EIS). This system identifies and classifies the BLM-administered lands within established visual resource objectives, and proposed activities are evaluated within the visual resource management framework to consider consistency with the visual resource objectives. Without restoration and reclamation efforts, ground disturbances in the regional environment would last for long periods. The magnitude and extent of potential visual impacts vary based on the number of viewers affected, distance and atmospheric conditions of viewing, degree of visual contrast compared to existing visual attributes, viewer sensitivity to the visual changes, and compatibility with existing land uses. The BLM generally requires ground disturbances to be restored and reclaimed as part of project approval.

For the Mina alignment, analysis using the Visual Resource Management System indicated that the proposed railroad would potentially be inconsistent with visual resource management objectives in the areas of the Schurz crossing of U.S. Highway 95 (construction), and some cuts and fills (during construction and operations). As shown in Appendix D, lands that have potentially restrictive visual resource objectives (such Classes I and II) are not prevalent in the region of influence.

There would be no known interactions of the proposed railroad with other reasonably foreseeable activities that would affect a Class I or Class II area in the Mina rail alignment region of influence.

5.3.2.4 Air Quality and Climate

Emissions of concern in the Mina rail alignment region of influence include fugitive dust and emissions resulting from the operation of machinery and equipment. Construction activities such as surface disturbance and use of haul trucks in the Caliente rail alignment region of influence would generate fugitive dust. Fugitive dust is a type of nonpoint source air pollution (small airborne particles that do not originate from a specific point). These particulate matter emissions are regulated according to their size (aerodynamic diameter equal to or less than 2.5 micrometers [$PM_{2.5}$] and 10 micrometers or less [PM_{10}]). Fugitive dust is generally controlled through the application of water, or in some cases, application of a chemical compound designed to minimize dust emissions. Most of the projects and activities identified in this analysis would generate some level of fugitive dust. The plumes associated with fugitive dust generation are often localized to the area being disturbed and are temporary. In arid areas such as the Mina rail alignment cumulative impacts region of influence, generation and control of fugitive dust will always be a concern. Exhaust emissions from the operation of machinery and equipment include sulfur dioxide, oxides of nitrogen, volatile organic compounds, and carbon monoxide.

There is a comprehensive air quality permitting system in Nevada to evaluate and approve only those projects that are allowable within quantitative air quality thresholds. The Nevada Division of Environmental Control, Bureau of Air Pollution Control, has established and implemented air pollution control requirements in Nevada Revised Statutes 445B.100 through 445B.825, inclusive, and Nevada Revised Statutes 486A.010 through 486A.180, inclusive. The Bureau of Air Pollution Control has jurisdiction over air quality programs in all counties in the state except Washoe and Clark. The Bureau of Air Pollution Control also has jurisdiction over all fossil fuel-fired units in the state that generate steam for electrical production. The Mina rail alignment would be subject to the permitting requirements noted above, and would occur in air basins that are either in attainment or unclassifiable. The State of Nevada will not grant permits for activities that cannot show compliance with the applicable federal and state regulations.

The air quality impact analysis for the Mina rail alignment assessed potential impacts through several means, including air quality modeling of maximum concentrations relevant to National Ambient Air Quality Standards. The analysis concluded the emissions during construction or operation of the rail line or any associated facilities would be in conformance with applicable standards, with the exception of the 24-hour standard for both PM_{10} and $PM_{2.5}$ near the construction right-of-way at Mina and Schurz during the relatively short construction period, and at the Staging Yard at Hawthorne and the potential Garfield Hills quarry. DOE would be required to prepare an application for a Dust Control Permit and a Surface Area Disturbance Permit Dust Control Plan and submit them to the Nevada Division of Environmental Protection Bureau of Air Pollution Control prior to the quarry and Staging Yard development. It is likely that the requirements of the plan would reduce fugitive dust emissions, thus reducing the possibility of exceeding National Ambient Air Quality Standards.

Potential cumulative impacts to air quality from construction and operation of the proposed railroad along the Mina rail alignment would be small, but could approach moderate if the potential violation of the National Ambient Air Quality Standards noted above occurred.

5.3.2.5 Surface-Water Resources

5.3.2.5.1 Changes in Drainage, Infiltration Rates, and Flood Control

Construction of major projects in previously undeveloped areas often results in changes to natural drainage. Construction could include regrading that would allow runoff from a number of minor drainage channels to collect in a single culvert or pass under a single bridge, which would result in water flowing from a single location on the downstream side rather than across a broader area. This would cause some localized changes in drainage patterns, but this probably would occur only in areas where natural drainage channels are small. Compaction of soil during construction could reduce water infiltration rates and change natural runoff and drainage patterns. However, some activities would disturb and loosen the ground for some time, which could cause higher infiltration rates.

Construction in washes or other flood-prone areas probably would reduce the area through which floodwaters naturally flow. This could result in water building up, or ponding, on the upstream side of crossings during flood events, and then slowly draining through the culverts or bridges. These alterations to natural drainage, sedimentation, and erosion would be unlikely to increase future flood damage, increase the impact of floods on human health and safety, or cause significant harm to the natural and beneficial values of the floodplains.

Insufficient inflow from the Walker River into Walker Lake would continue to jeopardize Walker Lake's future as a viable fishery, with or without the proposed railroad. If developed, the proposed railroad would not result in further inflow reductions into Walker Lake. Mitigation measures that could be implemented by the U.S. Fish and Wildlife Service or other entities could improve the chances for a viable fishery in the lake in future years.

As a long linear project of up to 502 kilometers (312 miles) long, the proposed Mina rail alignment would pose new surface drainage challenges because of the existing characteristics of terrain, topography, soils, and physical features. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the rail roadbed (subgrade) and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and to allow movement of equipment to the construction initiation points.

Project planning and best management practices would help avoid or reduce potential impacts from the proposed railroad or other ongoing or reasonably foreseeable future actions. Potential cumulative impacts due to changes in drainage, infiltration rates, and flood control would be very small and localized.

5.3.2.5.2 Spill and Contamination Potential

Major construction activities and other projects in the region of influence would use materials including petroleum products (fuels and lubricants) and coolants (antifreeze) necessary to operate construction equipment, and could include solvents used in cleaning or degreasing actions. A release or spill of contaminants to a stream or river would have the greatest potential for adverse environmental impacts; a release of contaminants to dry impermeable soil would have the least potential for adverse impacts. Other projects would face similar situations. Spill-control and -management plans (and standard operating procedures for the construction industry) would reduce the likelihood of spills. Construction and operation of the proposed railroad would be typical of major activities that use materials that could cause contamination through spills.

While the risk of a spill and associated water contamination cannot be totally eliminated, risks can be managed through regulatory controls so that the resulting cumulative impacts would be small.

5.3.2.6 Groundwater Resources

Existing and proposed future development within the Mina alignment region of influence presents the challenge of matching water supply with water demand. Because water availability is a potential resource constraint in the Mina rail alignment region of influence over time, water demand can be both competitive among potential users and controversial among users and the general public. To allocate water uses, the State of Nevada uses a water permit application process coordinated by the State Engineer. Once granted, water rights in Nevada have the standing of both real and personal property. It is possible to buy or sell water rights and change the water's point of diversion, manner of use, and place of use by filing the appropriate application with the State Engineer. Overall, because the water permitting and allocation process considers the broad range of factors noted above, the process serves as a way to manage potential cumulative impacts of water demand and use within each basin.

Representative existing and reasonably foreseeable water uses in the Mina rail alignment region of influence include:

- Public-supply/municipal, agricultural (stock watering), and mining uses collectively comprise approximately 87 percent of groundwater use within the Mina rail alignment region of influence.
- The Nevada Test Site uses about 830,000 cubic meters (673 acre-feet) of water per year.
- The Yucca Mountain Repository demands would range from about 218,000 to 527,000 cubic meters (176 to 427 acre-feet) of water per year between calendar years 2010 and 2013, which represents the period of the highest water demand for the Mina rail alignment project. The Repository would use approximately 76,700 to 397,000 cubic meters (62 to 322 acre-feet) of water per year in calendar year 2014 through completion of operation.

It is estimated that rail construction along the Mina rail alignment would use up to about 7.34 million cubic meters (5,950 acre-feet) of water, with about 80 percent of that water use occurring in the first 2 years of construction. About 23,000 cubic meters (17 acre-feet) of water would be needed annually during the operations phase. DOE would obtain water for construction and operation of the railroad from proposed new wells installed in various water basins along the Mina rail alignment.

Committed groundwater resources in the Mina rail alignment region of influence already exceed annual perennial yield values (a measure of available groundwater supply replenished each year through recharge) within some of the groundwater basins (hydrographic areas) that would be affected by the proposed railroad. Based on the proposed locations of new wells in specific hydrographic areas along the proposed Mina rail alignment, additional groundwater appropriations would be needed in 19 hydrographic areas. However, committed (cumulative) groundwater resources currently exceed estimated perennial yields in eight of these hydrographic areas (146, 149, 170, 173A, 203, 204, 228, and 229). One of these eight hydrographic areas (229) and two other hydrographic areas (144 and 145) that the Mina rail alignment would cross have low perennial yields. Five of these areas are State of Nevada-designated groundwater basins. While designated groundwater basins are not considered closed to additional appropriations, the State Engineer could impose additional restrictions and preferred uses of the water in these designated basins.

A number of scenarios have been developed to assess the potential effects of the Mina rail alignment's contribution to cumulative water demand in the cumulative impacts region of influence. Groundwater would need to be appropriated in 18 hydrographic areas. The assumption used for developing these scenarios is that water demands for railroad construction and operations along the Mina rail alignment would be met through installing and withdrawing groundwater from new wells, with pumping in individual wells at a constant rate occurring primarily over 9 months to support all rail-line construction water needs, over 2 to 3 years at quarry sites, and over the railroad operations period for facilities. Depending on the specific combination of alternative segments, total water withdrawals associated with the proposed railroad could exceed annual perennial yield values for hydrographic areas 123, 144, and 229, and could be as high as 48 percent, 57 percent, 82 percent, 87 percent, and 99 percent of the annual perennial yield in hydrographic areas 145, 228, 110A, 121B, 227A, respectively. In other areas, water withdrawals associated with the railroad would range from less than 1 percent to as high as approximately 28 percent of the annual perennial yield value.

By utilizing a combination of one or more specific approaches or methods to obtain water for construction (including methods that are tailored to a hydrographic area's unique groundwater condition), potential cumulative impacts to groundwater resources would be minimized. New groundwater withdrawals could, depending on the withdrawal rate; hydrogeologic conditions present at the proposed pumping location and in the surrounding area; and the location and characteristics of nearby groundwater resource features, cause some decrease in the amount of water that might be available to an existing well having an associated water right, to an existing spring discharge, or to a downgradient groundwater basin.

Overall, the needs of the proposed railroad would represent a small portion of the current cumulative water usage within the Mina rail alignment region of influence, which in some locations would continue to exceed perennial yield values.

5.3.2.7 Biological Resources

5.3.2.7.1 Habitat Loss and Fragmentation

Past, present, and reasonably foreseeable future actions in the Mina rail alignment cumulative impacts region of influence would result in noticeable cumulative land disturbance. Existing activities such as the

Nevada Test and Training Range, the Nevada Test Site, Naval Air Station Fallon and the Hawthorne Army Depot have already resulted in land disturbance and substantial changes to existing biological resources, and projects such as the various proposed industrial parks and master-planned communities in the northern portion of the Mina rail alignment cumulative impacts region of influence would continue this trend. Such land disturbances result in altered natural biological and ecological conditions, and directly serve to reduce the amount of natural land available as habitat and open space.

The primary adverse construction-related impacts on vegetation communities from ground disturbance would be the physical destruction or removal of vegetation, and the permanent or temporary removal or compaction of topsoil or other growing medium for the plants. These effects would occur with any major activity resulting in ground disturbance, including the proposed railroad. As more activity occurred, the cumulative loss of vegetative communities and associated habitats would increase. Management of these effects would typically be considered in project planning and mitigation, including projects on BLM-administered land. Much of the emphasis in land management in the Mina rail alignment region of influence concerns the maintenance or reconstruction of healthy habitats.

Habitat destruction would lead to direct impacts such as wildlife injury and mortality, alteration of behavior and movement patterns, and the indirect impacts of reduced vegetative health, reduced biological diversity, and locally degraded ecological function. When extensive habitat fragmentation occurs, the individuals or populations of particular species could have difficulty surviving. Habitat destruction arises from a number of sources, including projects that involve land disturbance, and land management actions including wild horse and burro management. Though any project that causes disturbance of vegetation contributes to habitat fragmentation, linear projects that impose any degree of impediment to movements, like the proposed railroad, amplify the potential effects.

Measures to avoid, minimize or otherwise reduce impacts are typically implemented by project proponents and encouraged by government agencies and generally include actions to reduce or avoid habitat fragmentation and loss. Such actions would include minimizing land disturbance, using existing roads, interim reclamation, combined roads/utility rights-of-way for pipelines and cables, noise reduction, centralization of facilities, and employee training and education.

The Hawthorne Army Depot has an Integrated Natural Resources Management Plan (DIRS 181899-USAF 2007, all), which is being used to ensure that natural resource conservation and Army mission activities are integrated and are consistent with federal stewardship requirements on mission lands. The plan describes an ecosystem-management approach that provides guidance to avoid the impacts of habitat loss and fragmentation, conserve biodiversity, and improve and enhance natural resource integrity while supporting sustainable economies and communities.

In areas proposed for railroad operations purposes, the impacts to vegetation would typically be moderate in scope, and cumulatively add to habitat loss and fragmentation. However, in areas slated for short-term use during the construction phase, such as construction camps, revegetation and reclamation efforts would result in replacement of topsoil, reseeding of native species, monitoring for success, and eventual return of a native vegetation community to conditions comparable to predisturbance conditions.

Cumulative impacts due to habitat loss and fragmentation would be small to moderate through the construction and operations phases throughout the Mina rail alignment region of influence.

5.3.2.7.2 Invasive Species and Noxious Weeds

Invasive species and noxious weeds naturally move into new areas over time, but this occurrence has been accelerated in many areas through human activity, either intentionally or unintentionally. In many cases, these plants have been moved into North America from another continent. They have been accidentally introduced through contaminated grain or hay, or sometimes intentionally introduced for erosion control or as ornamentals. In addition, livestock and vehicles can cause invasive species and noxious weeds to spread, birds could carry seed, or the species can be brought in with contaminated fill dirt. Regardless of how they were introduced, invasive species and noxious weeds possess characteristics that allow them to compete aggressively with native vegetation. Invasive species and noxious weeds impact native plants, animals, and natural ecosystems by:

- Reducing biodiversity
- Altering hydrologic conditions
- Altering soil characteristics
- Altering fire intensity and frequency
- Interfering with natural succession
- Competing for pollinators
- Displacing rare plant species
- Replacing complex communities with single-species monocultures

From a cumulative impacts perspective, any time land is disturbed and native vegetation is lost there is an opportunity for noxious weeds to replace the native vegetation. While the BLM and other land owners/ managers in the area have implemented programs to minimize this potential, invasion of noxious weeds cannot always be prevented. Therefore, coordinated multi-agency management actions and efforts are needed to mitigate the effects from cumulative land disturbance. Management of noxious and invasive weeds is essential for restoration of native plant community health and resiliency. If noxious and invasive weeds were not managed, they would continue to gradually replace more desirable native species throughout the Mina rail alignment region of influence.

Linear disturbances such as pipelines, roads, utility corridors, or rail alignments that cross relatively undisturbed land have the potential to exacerbate the spread of these species into areas not previously affected. As the invasive or noxious weeds become established along the linear features they spread to adjacent areas, affecting the plant and animal communities beyond the actual disturbance, and are able to outcompete native species by responding more rapidly to the infrequent availability of water.

These impacts could occur as a result of railroad construction and operation and from existing or foreseeable projects, but strict adherence to best management practices should reduce the potential for impacts. Cumulative impacts due to the introduction and spread of invasive species and noxious weeds would be small.

5.3.2.7.3 Special-Status Species

Habitat for several special-status species would be disturbed, and individual mortality of several of those special status species could occur during railroad construction and operations along the Mina rail alignment. Through the NEPA and permitting processes, each proposed project and land-management planning effort in the Mina rail alignment region of influence will face challenges for the protection of various special-status species. There are a number of special-status species that could be affected by cumulative impacts in the Mina rail alignment region of influence. Recent attention has focused on several specific species, including the desert tortoise and Lahontan cutthroat trout, as discussed below.

The Mojave population of the desert tortoise (*Gopherus agassizii*) is listed as threatened under the Endangered Species Act of 1973 (16 U.S.C. 1531 to 1544). It is found within the proposed Mina rail alignment only in the southwestern-most 48 kilometers (30 miles), from the Beatty Wash area to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 55 to 72). The desert tortoise is found in southern California, parts of southern Utah, and in the southern portions of Nevada, with the tortoises potentially affected by railroad construction and operation at the extreme northern extent of their range. While relative abundance of the tortoise is low in much of the Mina rail alignment region of influence, every action that could disturb soil or vegetation within the tortoise's range has potential cumulative impacts of loss or fragmentation of the species' habitat or the direct mortality of individual desert tortoises

The threatened Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) is stocked in Walker Lake and occurs upstream to Weber Reservoir. Weber Dam currently blocks movement further upstream, and prevents spawning by cutthroat trout. However, in the near future, a fish ladder might be developed at that dam to allow fish movement. Reestablishment of a self-sustaining population of Lahontan cutthroat trout in the Walker River system is a prerequisite for recovery of this species. With mitigation, the construction activities along the Mina rail alignment would have minimal effects on the trout, but the existing problem with Weber Dam blocking movement of the trout further upstream would remain.

The BLM resource management plans sometimes place restrictions on other activities (such as grazing, wild horse and burro abundance, off-road vehicle use, mineral activities) so that desert tortoise or other special status species habitat can be protected. However, off-road vehicle use, shooting, and collecting of individuals continue to affect tortoise populations. Habitat protection efforts for the desert tortoise are coordinated among a number of federal, state, and local governmental agencies, with the cumulative impact perspective a major factor in determining allowable impacts to the tortoise. Restoration plans and habitat conservation plans also affect the required mitigation measures, best management practices, and standard operating procedures for the protection of the desert tortoise or other special-status species.

Private landowners, corporations, state or local governments, or other non-federal landowners who wish to conduct activities on their land that might incidentally harm (or "take") wildlife listed as endangered or threatened must first obtain an incidental take permit from the U.S. Fish and Wildlife Service. To obtain a permit, the applicant must develop a Habitat Conservation Plan, designed to offset any harmful effects the proposed activity might have on the species. Multi-species Habitat Conservation Plans are underway in two places in the Caliente rail alignment region of influence: (1) the Coyote Springs area and (2) in southern Lincoln County in the area of the recent BLM land disposal. Additionally, there is a single species (desert tortoise) Habitat Conservation Plan being developed in the Pahrump area of Nye County. These plans would support development of private lands while accounting for the potentially affected species.

No major effects on special status species are projected to result from construction and operation of the proposed railroad along the Mina rail alignment. DOE would conduct any required consultation with the U.S. Fish and Wildlife Service in accordance with the Endangered Species Act. There is a substantial regulatory framework, to which all projects are subject, that serves to evaluate and protect special status species. Therefore, cumulative impacts to special status species would be small.

5.3.2.7.4 Wildfires

Wildfires are a major environmental concern throughout the Mina rail alignment region of influence due to the generally dry climate and the increasing presence of invasive plant species. When they occur, wildfires have a significant and long-term impact on vegetation, wildlife, other natural resources, and human safety. The most important biological effects of fires include:

- Loss of native plant communities
- Decreased stability of watershed and soils
- Decreased or degraded wildlife habitat
- Increase in potential for invasive species spread
- Overall disruptions to ecological function

Sources of regional wildfires are both natural (for example, lightning) and human caused. With increased activity in the Mina rail alignment region of influence, the potential for future human-caused fires increases. Because the BLM administers most of the land in the Mina rail alignment region of influence, the BLM has primary fire-avoidance and fire-fighting responsibilities in the Mina rail alignment region of influence.

Both the proposed railroad project and other reasonably foreseeable future actions would likely implement appropriate fire-avoidance strategies in consultation with the BLM. Potential cumulative impacts from wildfires would be small.

5.3.2.8 Noise and Vibration

5.3.2.8.1 Railroad Noise

In the Mina rail alignment cumulative impacts region of influence, there is an existing branchline extending from Hazen, Nevada, to the Hawthorne Army Depot. The noise associated with railroad operations is part of the existing environment, specifically in the Schurz area where the railroad's presence is very evident. The sounds associated with the existing branchline include wayside noise (noise generated by the cars and locomotives), and horn sounding. The individual operating rules of each railroad require train engineers to sound horns when approaching most grade crossings. Horn sounding is generally not required at private crossings. Wayside noise and horn sounding are common in Schurz and along other portions of the existing branchline.

Hawthorne Army Depot is planning to construct a rail siding, known as the Wabuska Spur, which would increase the Depot's outloading capacity. Increased rail capacity could cause increases in overall rail traffic on the existing branchline and could result in more wayside noise and horn sounding events more frequently near Hawthorne within the Mina rail alignment cumulative impact region of influence.

Transportation of spent nuclear fuel and high-level radioactive waste casks would result in as many as eight one-way trips per week along the Mina rail alignment. Train activity associated with supply and maintenance of the Yucca Mountain Repository is also proposed along the completed railroad (as many as seven one-way trips per week), as is rail line maintenance activity (about two one-way trips per week), for a total of about 17 one-way trips per week. During the construction phase, completed portions of the rail line would also be used to deliver ballast to construction areas.

Potential impacts from noise along the Mina rail alignment would be expected to be small. However, the proposed railroad would introduce or expand noise sources into areas of the Mina rail alignment region of influence that previously had very limited railroad noise. This could result in incremental annoyance effects for some people.

While adverse noise effects could increase for some people in the Mina rail alignment region of influence, railroad construction and operations along the Mina rail alignment would substantially reduce noise impacts for people in Schurz, because the existing rail line through Schurz would be eliminated and replaced by one of Schurz alternative segments. This would provide a substantial reduction in annoyance effects for people in Schurz.

5.3.2.8.2 Urban Noise

Urban noise includes automobiles, construction activities, barking dogs, and other human activities generally within an identifiable community. At present, urban noise in the Mina rail alignment region of influence is limited because there are only a few cities and communities. However, with economic development and growth goals throughout the region of influence, the number and scope of urbanized areas is expected to increase. Urban noise is generally localized and is differentiated from the aircraft and railroad noise sources, which move with the source from one location to another, while urban noise is within identifiable geographic borders associated with the locations of populations.

The proposed railroad would have a very small effect on urbanization in the area, and its effect on urban noise in the Mina rail alignment region of influence would be small. Cumulative impacts related to urban noise would be small.

5.3.2.8.3 Aircraft Noise

Aircraft-related noise from engines and sonic booms is common throughout the Mina rail alignment cumulative impact region of influence, and can cause “startle” and annoyance effects. The noise associated with military aircraft is consistent with the “dominant use” of the area for military and defense-related activities at the Nevada Test and Training Range and Naval Air Station Fallon. Any noise effects associated with the missions for the Nevada Test and Training Range or Naval Air Station Fallow would be considered necessary and unavoidable. Commercial air traffic also contributes to noise impacts in the region of influence.

The proposed railroad would not contribute to cumulative aircraft noise.

5.3.2.8.4 Vibration

Vibration can be perceived on land surfaces and within buildings with certain types of activities. Construction activity is one of the more common sources of vibration, but construction vibration would be very localized and typically minor in scope and duration. In the Mina rail alignment cumulative impacts region of influence, other possible sources of vibration include occasional testing activities at the Nevada Test and Training Range and sonic booms from aircraft-related military activities in the airspace above the region of influence. These events would also tend to be short-term and localized.

Cumulative impacts from vibration would be small.

5.3.2.9 Socioeconomics

The economic roots of the Mina rail alignment cumulative impacts region of influence have traditionally been based on mineral development, military operations and support, and livestock grazing. These activities will continue to be the primary economic drivers in the Mina rail alignment cumulative impacts region of influence. Additionally, the expansion of the Reno-Carson City metropolitan area in the northern reaches of the Mina rail alignment cumulative impacts region of influence will continue to occur, providing additional economic inputs. While a railroad in the Mina rail alignment would be a major development in the region of influence, its long-term economic development potential would be limited and would primarily be related to construction activities. If the Shared-Use Option were chosen and implemented, there would be greater potential for positive economic development benefits compared to the Proposed Action.

Population growth in the Mina rail alignment cumulative impacts region of influence has generally been stagnant in much of the area. However, growth and development is desired by many in the region. It is uncertain if there is sufficient economic development growth potential in these areas to support the desired growth. It is possible that some areas would grow at the expense of other areas, or that recently developed plans for growth turn out to be unrealistic. Provision of housing to meet market demand is a private-sector activity, with the private housing sector assumed to build to the needed level to meet housing demand at the appropriate locations. One of the factors that will affect how and where growth occurs is the availability of infrastructure to support the growth. Beyond the traditional infrastructure needs like roads, sewer, water, and public buildings, modern infrastructure such as the availability of fiber-optic lines might also affect growth patterns. For example, the availability of fiber-optic lines or other high-technology infrastructure is likely to be a substantial growth discriminator for both businesses and individuals. The locations of and extent to which factors such as fiber-optic lines would ultimately affect growth cannot be predicted at this time.

The potential future BLM land disposals identified in Section 5.3.2.2.4, if implemented, could have the potential to provide land for private-sector projects such as housing, industrial or commercial facilities, or other developments. In contrast to specific developments proposed on BLM land disposals in the Caliente rail alignment region of influence, such growth in the Mina rail alignment region of influence is not currently planned and the market for this type of developmental stimulus is uncertain.

The State of Nevada has developed population projections for the Mina rail alignment cumulative impacts region of influence (DIRS 178807-Hardcastle 2006, all) as follows:

- Esmeralda County is projected to have a small decrease in population from 2005 to 2026.
- Nye County is projected to add mover than 32,000 persons from 2005 to 2026.
- Lyon County is projected to add more than 41,000 persons from 2005 to 2026.
- Mineral County is projected to have a small decrease in population from 2005 to 2026.

The Nevada State Demographer develops population projections for Nevada counties, which are always subject to change with new information.

Nye County's projected growth continues a recent trend, with growth in Pahrump very evident over the past several years. Growth in Pahrump is being driven by low-cost land, proximity to the Las Vegas metropolitan area, and relocation of retirees to the area. Growth in Nye County is also linked directly to existing and future Yucca Mountain Site operations. Growth in Lyon County is due largely to its proximity to Carson City and Reno.

As discussed in Section 4.3.9, Socioeconomics, DOE used an economic model to estimate potential socioeconomic impacts of the proposed railroad (DIRS 182251-REMI 2007, all). The model includes consideration of construction and operations employment and wages, project-related spending, and other parameters that could affect the socioeconomic environment. The model included a future baseline of socioeconomic parameters that would represent a cumulative impacts baseline without the proposed railroad.

Consistent with the methodology established in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 4-43), most of the construction workers for the proposed Mina rail alignment are assumed to be residents of Clark County. This assumption is made because the construction sectors in Nye, Esmeralda, Lyon and Mineral Counties are not large enough to provide sufficient workers for the construction activities. Under this scenario, Clark County is projected to attain the largest levels of construction-related employment, income, and spending effects from the proposed project, followed by Mineral, Nye, Esmeralda, and Lyon Counties. Mineral County would experience the largest employment percentage increase during construction with an estimated increase of about 6 percent above baseline conditions.

The socioeconomic analysis also considers a second scenario, which assumes that half of the construction workers for the Mina rail alignment reside in the combined Washoe County-Carson City area, and the other half reside in Clark County. This second scenario is considered because Washoe County and Carson City might be more likely than Clark County to supply construction workers for the northern portions of the Mina rail alignment. With this second scenario, the beneficial economic effects on Clark County would obviously be reduced, while the Washoe County-Carson City area would gain some of these beneficial aspects of proposed railroad project. In any case, the overall effects of the proposed railroad along the Mina rail alignment on the Clark County or Washoe County economies would still be relatively small.

Employee locations for the operations phase would follow the same general pattern and relative magnitude of the construction phase, but there would be fewer operations jobs than construction jobs. Gains in employment during the operations phase would be felt most strongly in Esmeralda County, where the peak percentage change in average annual employment is projected to be 6.3 percent above baseline conditions during full operations. Mineral County is the only other county in the region of influence projected to experience more than a 1 percent change in average annual employment at any point during the operations phase (2.6 percent).

Population changes that would result from construction and operation of the proposed Mina rail alignment are also projected to generally follow this pattern. During the construction phase, the upper bound of increase to population would be about 3 percent or less of the future cumulative population baseline in all four counties. The operations phase population change would have the largest percentage increase compared to the cumulative baseline in Esmeralda County (about 7-percent average annual increase over the baseline). There are no projected impacts to population on the Walker River Paiute Reservation.

Strains on housing infrastructure during the construction phase would not be anticipated because most construction workers could be housed in construction camps at strategic locations along the proposed Mina rail alignment, rather than in nearby communities. Contractors might elect to use commercially available facilities for housing construction personnel at locations such as Hawthorne, Tonopah, Goldfield, Beatty, and Pahrump. There would be enough vacant housing stock in these locations to absorb both construction and operations personnel.

Some infrastructure impacts would be expected where construction activities or operating facilities were near communities. For example, construction workers, including those from the proposed Mina rail alignment, could strain the existing health care service capacity in the Mina rail alignment region of influence, and particularly in Hawthorne, Goldfield, and Tonopah. The operations-related population gains could also result in identifiable effects on health and education-related services.

The road network in the Mina rail alignment region of influence consists generally of two-lane highways and unpaved roads. U.S. Highway 95 is the major north-south highway in the region of influence. In rural, less populated parts of the Mina rail alignment cumulative impacts region of influence, roads are adequate to handle existing and projected future traffic flow. However, the array of new and proposed activities throughout the Mina rail alignment region of influence would have the potential to strain parts of the existing roadway infrastructure.

Railroad project-related road traffic would result in small increases in some areas but railroad construction would not materially affect traffic volumes on local roads because most construction materials would be transported using rail, and most construction employees and contractors would be housed in construction camps linked to the work site by access roads. There could be some traffic delays at existing rail-highway grade crossings, and grade separation might be necessary for some crossings in Churchill, Lyon, and Mineral counties. However, cumulative traffic levels in the region would likely continue to increase as overall regional growth and development occurs.

Any road improvement and maintenance responsibilities in the region of influence are handled by the Nevada Department of Transportation through a Statewide Transportation Plan and a Statewide Transportation Improvement Program. The Statewide Transportation Improvement Program includes a 3-year list of federally funded and regionally important non-federally funded transportation projects and programs consistent with the goals and strategies of the Statewide Transportation Plan. Routine highway improvements and maintenance projects for the period 2006 through 2015 have been identified for Lyon, Mineral, Esmeralda, and Nye Counties as part of the Nevada Department of Transportation planning processes. The level of cumulative traffic changes would generally not be sufficient for major upgrades of regional roads.

Overall, the proposed railroad project would have a small impact on economic development and growth, housing and community infrastructure, and traffic in the Mina rail alignment region of influence. While there is some limited potential for induced growth impacts, the specific locations and scope of these actions is unknown at this time, and any such actions are projected to be small. Cumulative impacts to socioeconomics in the Mina rail alignment region of influence would be small.

5.3.2.10 Occupational and Public Health and Safety

5.3.2.10.1 Nonradiological Health and Safety

Throughout the Mina rail alignment region of influence, continuing and reasonably foreseeable activities have the potential to result in occupational injuries or fatalities including, but not necessarily limited to sources such as tripping, being cut on equipment or material, dropping heavy objects, and catching clothing in moving machine parts, and other types of accidents. Other occupational risks include biological hazards, dust and soils hazards, air quality hazards, transportation accidents, and noise hazards. Biological hazards include potential human health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human health effects from exposure to inhalable soils and dusts containing hazardous constituents, and potential occupational encounters with unexploded ordnance.

While occupational injuries or fatalities are unavoidable with human activity, public and private facilities within the Mina rail alignment cumulative activity area are highly regulated. There is a substantial regulatory framework for occupational health and safety, with the Occupational Safety and Health Administration programs and regulations forming the basis for protection of workers. Through DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, the Department has prescribed the Occupational Safety and Health Act Standards that contractors are to meet in their work at government-owned, contractor-operated facilities. The Department of Labor, Bureau of Labor Statistics, measures occupational incident rates, including total recordable cases, lost workday cases, and fatalities, associated with the work environment.

There are no data on injury/illness incident rates for the Mina rail alignment cumulative impacts region of influence; however, injury/illness incidence rates in Nevada generally run higher than those in the United States as a whole. The economic segments with the highest injury/illness incidence rates in Nevada are construction and goods-producing industries.

Additional traffic is especially a concern with the construction phases of reasonably foreseeable projects. The construction phase of a project not only brings construction workers to the work sites, but also means an increase in slow-moving and bulky traffic involving the transportation of construction equipment. Use of trucks for hauling hazardous or other dangerous materials is also an increasing concern as traffic increases on the road network. To minimize traffic impacts at the entrance to the Yucca Mountain Site, a new interchange with U.S. Highway 95 at the site entrance been proposed for both traffic flow and safety reasons. Increased traffic would not necessarily mean an increase in the rate of traffic accidents, but the number of accidents would increase if the rate of traffic accidents stayed the same and traffic increased. Therefore, transportation safety concerns would increase and there could be an increased workload for traffic-accident responders in the Mina rail alignment region of influence with the cumulative growth in traffic.

From a transportation safety standpoint, railcars loaded with live munitions and ordnance currently travel between Wabuska and the Hawthorne Army Depot. A railroad along the Mina rail alignment would reduce health and safety risks associated with accidents involving existing rail traffic because the trains would be routed away from the populated community of Schurz via one of the Schurz alternative segments.

An estimated 9,500 casks would be transported to the repository by rail using the Mina alignment. Nonradiological occupational health and safety impacts are projected as follows:

- Construction and operations activities for the Mina rail alignment are projected to result in approximately 800 recordable incidents, approximately 470 lost-workday accidents, and approximately two fatalities.
- Vehicular-related fatalities related to worker commuting are projected to result in an estimated 13 vehicular-related fatalities for the Mina rail alignment.
- Rail-related accidents and rail-related fatalities related to the movement of cask trains, maintenance trains, and supply trains are projected to result in 16 rail-related accidents and one rail-related fatality for the Mina rail alignment.

Under Module 1, approximately 21,900 casks would be transported to the repository by rail, and under Module 2, approximately 22,600 casks would be transported to the repository by rail. To estimate the cumulative health and safety impacts of Module 1 and Module 2, the impacts of the Proposed Action were increased by the ratio of the number of casks transported in Module 1 or Module 2 versus the Proposed Action. For Module 1, the nonradiological health and safety impacts noted above would increase by a factor of approximately 2.3 over the impacts under the Proposed Action. For Module 2, nonradiological safety impacts would increase by a factor of approximately 2.4 over the impacts of under Proposed Action.

Other regional activities would also cumulatively add to the totals beyond the railroad-related impacts, but cumulative nonradiological health and safety in the Mina rail alignment region of influence would be small within the context of the overall region of influence.

5.3.2.10.2 Radiological Health and Safety

Existing and reasonably foreseeable future activity (such as the Nevada Test Site and Yucca Mountain Repository activity managed by DOE) in the Mina rail alignment region of influence involves the storage, handling, transportation, use, and disposal of radioactive materials and wastes. There is an extensive regulatory framework associated with transportation safety, and the proposed railroad would operate in compliance with these laws and regulations. For example, DOE complies with U.S. Department of Transportation regulations regarding the transportation of radioactive materials. DOE also uses U.S. Environmental Protection Agency protective action guides (identifying projected dose levels at which specified actions should be taken) and actions designed to limit doses and impacts in the event of a transportation accident resulting in releases of radioactive material. The regulatory framework and implementation of appropriate standard operating procedures would reduce the potential for accidents. Coordination of plans for proposed railroad construction and operations with local emergency response providers would be important to limit the potential for accidents, and for an effective response to an accident should one occur.

There is a small risk of radiological impacts to workers and the general public from external radiation exposure during normal operations and incident-free transportation. Staff at the Nevada Test Site and the Yucca Mountain Repository would be separate, and it is not anticipated that there would be cumulative exposures to workers from both operations. The modes of transportation of radioactive wastes for the

Nevada Test Site (shipment by truck) and the Yucca Mountain Repository (shipment by rail) would differ. Radiological impacts associated with rail operations would be higher under Yucca Mountain FEIS Modules 1 or 2 operations compared to the Repository SEIS Proposed Action level of transportation. The radiological risk relationships among the repository, the proposed Mina rail alignment, and Nevada Test Site operations are summarized below.

As part of the Repository SEIS process, DOE estimated that 9 to 28 latent cancer fatalities for members of the public would result from Yucca Mountain Repository construction, operations, monitoring, and closure for the population within the 80-kilometer (50-mile) region of influence of the repository site. The estimated latent cancer fatalities correspond to a total collective dose of 15,000 to 46,000 person-rem, and the projected population within the repository region of influence is 120,000 persons. The region of influence for the Yucca Mountain Repository extends 80 kilometers (50 miles) to the northwest from the repository site boundary along the rail corridor, approximately to Scottys Junction; the remainder of the Mina rail alignment is outside of the Yucca Mountain Repository region of influence. Population within the area where the rail alignment region of influence and the Yucca Mountain repository region of influence coincide (between the repository boundary and the Scottys Junction area) would receive radiation dose from both the repository and from the Mina rail line operation. Members of the public situated along the rail alignment but outside of the region of influence of the Yucca Mountain Repository would receive a negligible radiation dose from the repository.

For members of the public along the rail line, DOE estimated that there could be up to 8.5×10^{-4} latent cancer fatality, corresponding to a collective population dose of 1.4 person-rem, for the Mina rail alignment. Therefore, for members of the public situated along the rail alignment, the radiological impacts of railroad operations would be a very small contribution to the overall radiological impacts of the Yucca Mountain Repository.

The estimated radiological dose to members of the public from Nevada Test Site operations in 2005 was 0.2 mrem per year; the maximum radiation dose was 2.3 mrem per year at the northwest corner of the Nevada Test Site boundary. Dose at off-site populated locations between 20 kilometers and 80 kilometers (12 to 50 miles) from this location would experience much lower radiation doses due to wind dispersion (*Nevada Test Site Environmental Report 2005,* DIRS 182285-Wills 2006, Table 8-4, p. 8-2). The collective population dose from Nevada Test Site operations was below 0.6 person-rem in 2004 (*Nevada Test Site Environmental Report 2005,* DIRS 182285-Wills 2006, Table 8-3, p. 8-8.) Radiation dose from Nevada Test Site operations would be a very small contribution to the overall radiological impacts of the Yucca Mountain repository.

Operation of the proposed railroad along the Mina rail alignment under the Proposed Action would result in a small contribution to cumulative radiological health and safety impacts. Cumulative radiological impacts in the Mina rail alignment region of influence would be small.

5.3.2.11 Utilities, Energy, and Materials

5.3.2.11.1 Utilities

From a cumulative impacts perspective within the Mina rail alignment region of influence, utility crossings are and will continue to be commonplace with little impact other than minor ground disturbance. Utility and other right-of-way crossings are common to linear projects such as roads, railroads, and pipelines. Land areas for the proposed rail alignment, construction camps, quarries, and access roads would cross or encroach upon existing or proposed utility rights-of-way in a variety of locations. Land areas for operations support facilities could also encroach upon existing or proposed utility rights-of-way. This situation would be typical for other rights-of-way in the region. The crossings would be accomplished with small impact using standard engineering procedures and appropriate design details.

Many regional activities, including the proposed railroad, would increase demands on public water systems, wastewater systems, telecommunications systems, electric power systems, and other utilities. However, regional service providers are projected to be able to adjust to any increasing demand, and overall cumulative impacts to utilities would be small.

5.3.2.11.2 Energy and Materials Usage

Large projects such as pipelines, transmission lines, and power plants, that could occur within the Mina rail alignment cumulative impacts region of influence require materials and energy to construct and operate. Energy and material resources necessary for construction or operation of these projects are often obtained within regional or, in some cases, national markets.

For this Rail Alignment EIS, DOE analyzed cumulative energy and materials supply and demand from a regional perspective. Energy and materials (for example, steel and concrete) that would be needed for railroad construction and operations are not constrained in regional markets, and railroad needs would represent a small percentage of the cumulative annual materials use within the Mina rail alignment cumulative impacts region of influence.

While the regional markets for various construction-related materials and energy sources will continue to grow as the region develops, there is no evidence of potential limits to growth from constrained material or energy supplies. Cumulative impacts from energy and materials usage in the Mina rail alignment region of influence would be small.

5.3.2.12 Hazardous Materials and Waste

5.3.2.12.1 DOE Waste-Management Activities

DOE has had existing waste management programs at the Nevada Test Site for several decades. While the Site missions have changed over time (with an emerging focus on national security, energy, and environmental issues), waste management and disposal at the Site has been one of the primary long-term land uses. There are two active waste management and disposal sites on the Nevada Test Site:

- Area 5 occupies 2.9 square kilometers (720 acres) and is in Frenchman Flat north of Mercury, Nevada.
- Area 3 occupies 0.53 square kilometer (130 acres) north of Mercury in Yucca Flat.

Environmental restoration efforts are under way at various locations throughout the Nevada Test Site. The Nevada Test Site waste-management program currently includes management and disposal operations for hazardous waste, mixed waste, and low-level radioactive waste. Transportation of the waste is accomplished by truck from both on-site and off-site sources. There are no plans for Nevada Test Site activities to include use of the proposed Mina rail alignment for shipment of wastes.

The proposed railroad’s contribution to cumulative impacts associated with DOE waste-management activities on the Nevada Test Site would be small.

At present, Yucca Mountain Repository-development efforts are focused on preparing an application to the U.S. Nuclear Regulatory Commission for a authorization to construct the repository for spent nuclear fuel and high-level radioactive waste. The Yucca Mountain FEIS (DIRS 155970-DOE 2002, all) and the

Repository SEIS (DOE/EIS-0250F-S1, all) describe proposed operations at the Yucca Mountain Site in detail.

5.3.2.12.2 Sanitary and Construction Wastes

As the populated areas in the Mina rail alignment cumulative impacts region of influence expand and grow, the volume of sanitary waste generated will also expand. Project proponents are legally required to dispose of nonhazardous and nonradiological construction and other solid waste in appropriately permitted solid waste landfills. Nevada has 24 operating municipal landfills with a combined capacity to accept more than 11,000 metric tons (12,000 tons) of waste per day. However, the number of operating landfills has decreased substantially over the past 15 years, and while there is sufficient capacity to accept waste for the State of Nevada as a whole, there are some areas such as Pahrump that have limited capacity for future years.

Construction- and operations-related waste that would be associated with the proposed Mina rail alignment would add only a fraction of a percent to the total waste stream in the state. If there were a constraint to landfill capacity at some future time, additional land would be needed to expand or open a new landfill. Because of the relative scarcity of private land in the Mina rail alignment region of influence, any land used for this purpose might need to come from BLM-administered federal land. As an alternative to local government landfill provisions, private companies can also be expected to seek business opportunities to provide solid-and hazardous-waste management, transportation, and disposal.

DOE would store and use hazardous materials (such as oil, gasoline and solvents) during the Mina rail alignment construction, and would control and manage these materials in accordance with the extensive federal and state regulatory framework. Other major projects would have similar waste streams, and project plans and requirements would call for disposal of such wastes in permitted facilities and materials management according to accepted industry practices.

The proposed railroad's contribution to impacts from the generation and management of sanitary and construction wastes would be small. Cumulative impacts to waste disposal facilities in the Mina rail alignment region of influence would be small.

5.3.2.13 Cultural Resources

Cultural resources include historic and archeological sites, buildings, structures, landscapes, and objects. Most reasonably foreseeable projects in the Mina rail alignment cultural resources region of influence will involve at least some ground disturbance. With that ground disturbance, cultural resources could be destroyed, damaged, or discovered for recovery or mitigation. As part of the evaluation of proposed projects on federal land, the existing regulatory framework requires that cultural resources be identified and protected. With information on the location of a proposed project and the estimated extent of ground disturbance, cultural resource specialists can be called on to perform appropriate surveys and inventories of cultural resources in the potentially disturbed area. Once discovered, the sites of cultural resources are kept confidential to reduce the potential for vandalism or theft of the resources.

Because cultural resources are typically on or below the ground, they can be damaged by other activities such as off-highway vehicle use. As the major land manager in the Mina rail alignment region of influence, the BLM has an extensive cultural resource management program and manages federal land with protection of cultural resources as a key management objective. Once ground is disturbed and facilities are constructed on the land, the opportunity for identification of cultural resources is usually lost. Therefore, the BLM and other land managers in the area (for example, DOE on the Nevada Test Site and the U.S. Air Force on the Nevada Test and Training Range) employ cultural resource specialists and involve tribal representatives, as appropriate. Commonly, mitigation for any ground disturbance in the

Mina rail alignment region of influence includes the involvement of these cultural resource specialists as potential cultural resources are discovered. Other activities occurring on federal land, such as off-road vehicle use and rock collecting, can cause unintended adverse impacts to cultural resources. Mission activities occurring at the Nevada Test Site, the Nevada Test and Training Range, and the Yucca Mountain Repository also could cause unintended adverse impacts to cultural resources.

The problem of vandalism to and theft of cultural resources is prevalent throughout the western United States. Land-management agencies such as the BLM make extensive attempts to protect locations of cultural resources, but the areas to be managed are often so vast that patrols by law enforcement are not effective in protecting these sites. DOE, the BLM, and other federal agencies in the Mina rail alignment region of influence are committed to public education and employee training regarding the protection of cultural resources.

Visitors may also be drawn to the area for purposes of curiosity and sight-seeing. Based on the extent of cultural resource site finds on BLM-administered land and on the Nevada Test Site, and data collected to date on the proposed Mina rail alignment, there could be a large number of cultural resources in the Mina rail alignment region of influence. Also, it is likely that only a portion of any currently undiscovered sites would ultimately be found eligible for the *National Register of Historic Places*.

The railroad would be a major new construction project introduced into a remote area. Beyond the implications of ground disturbance and permanent and temporary use areas, railroad construction and operations would bring employees, visitors, and equipment into an area where prior access was limited. If right-of-way roads remain open to the public, there could be an increase in off-road vehicles traveling along newly constructed roads and illegal use of lands. As the number of visitors increases, so does the potential for vandalism and damage to cultural resources. There is an extensive regulatory framework to manage and protect cultural resources.

Impacts to cultural resources in the Mina rail alignment region of influence would be small because the Department would conduct intensive field surveys and implement mitigation measures, including avoidance. Other project proponents would be subject to the same regulatory framework and BLM policies and procedures. Cumulative impacts to cultural resources in the Mina rail alignment region of influence would be small.

5.3.2.14 Paleontological Resources

Regional protection, management, and impact issues relative to paleontological resources are similar to those of cultural resources. Any type of ground disturbance could disturb or destroy known or unknown paleontological resources. Impacts to paleontological resources would generally be measured by physical damage to fossil-bearing formations through excavation or surface disturbance. The primary cumulative impact mechanisms that could affect paleontological resources include excavations or surface disturbances associated with approval and implementation of BLM rights-of-way, off-highway vehicle use, minerals development, land disposals, and special designations. Many BLM management activities, however, serve to protect and mitigate impacts to paleontological resources. Knowledge of the outcrop pattern of geologic units, and the kinds and quality of the fossils produced by such units, is a critical management tool for land-use decision-making where fossils might be involved. Potential effects on paleontological resources from ground disturbance would continue to be a major regional concern of BLM from both resource management planning and rights-of-way evaluation perspectives. Most formations the rail line would cross are volcanic and would not contain paleontological resources.

Any paleontological resources are considered valuable and are often collected for their cultural, scientific, and recreational values. Therefore, these resources are sometimes removed from federal lands. While common invertebrate fossils such as plants, mollusks, and trilobites can be collected for personal use in reasonable quantities, the lack of regular site monitoring and public education about fossil collecting has led to increased illegal commercial taking of paleontological resources. Paleontological resources are also vulnerable to intentional or unintentional vandalism. The specific locations of some identified paleontological resources are kept confidential to avoid vandalism or theft.

The most likely locations of currently unknown paleontological resources can be identified based on geological characteristics, and potential impacts can be avoided or minimized through careful project planning and implementation. Most formations the rail line would cross are volcanic and would not contain paleontological resources. Therefore, the proposed railroad project would not contribute to cumulative impacts to paleontological resources.

5.3.2.15 Environmental Justice

5.3.2.15.1 Potential Effects to Low-Income and Minority Populations

Environmental justice impacts result when high and adverse human health or environmental impacts fall disproportionately on low-income and minority populations. If high and adverse impacts are found to have disproportionate impacts on environmental justice populations as compared to the general population of the area, the impacts would be mitigated to the extent practicable by the federal agencies involved in the proposed action.

Based on individual and group values, beliefs, and goals, there is a difference in perspective as to the potential effects of activities in the Mina rail alignment region of influence on low-income and/or minority populations among the different stakeholders and other interested parties. The American Indian Resource Document (DIRS 174205-Kane et al. 2005) discusses cultural resources, American Indian values and their relationship to environmental justice, and broader American Indian values. DOE considers the American Indian Writers Subgroup conclusions to be responsible opposing viewpoints for purposes of its environmental justice responsibilities. DOE has concluded that there are no identifiable environmental or human health impacts associated with the proposed railroad that would disproportionately affect low-income or minority populations. Additionally, there are no identified effects to special pathways (such as subsistence hunting and gathering) in the Mina rail alignment region of influence.

The largest concentration of low-income or minority populations along the Mina rail corridor occurs in Mineral County and on the Walker River Paiute Reservation. The corridor would cross American Indian tribal lands, with the four Schurz alternative segments almost entirely on the Walker River Paiute Reservation (DIRS 180222-BSC 2006). There are approximately 1.4 square kilometers (350 acres) of reservation lands in the corridor (DIRS 180222-BSC 2006). The population of the reservation, estimated to be 853 persons in 2000, is low-income and consists mainly of American Indians, a minority population. The poverty rate in Mineral County is 15 percent, which exceeds the rate of poverty (11 percent) in the State of Nevada, while the poverty rate of Walker River Paiute Reservation residents is 32 percent, nearly three times the rate of poverty in the state. The only moderate or large impacts that were identified relate to noise impacts from construction. These impacts would not occur on the Walker River Paiute Reservation; therefore, there would be no large and adverse effects that would disproportionately affect a low income or minority community and there are no special pathways that would result in disproportionately large and adverse effects to low income or minority communities.

DOE has concluded that there are no identifiable human health or environmental impacts associated with the proposed railroad that would disproportionately affect low-income or minority populations, nor has the Department identified any special pathways for impacts (such as subsistence hunting and gathering) in the Caliente region of influence.

Cumulative impacts to low-income or minority populations along the Caliente rail alignment would be would be small, if any.

5.3.2.15.2 Economic Opportunity

Existing and reasonably foreseeable projects and activities in the Mina rail alignment region of influence would present economic opportunities for some persons in the area. Economic opportunities include employment, wages, revenue from business operation, and other economic stimuli associated with growth and development. DOE and other project proponents in the Mina rail alignment region of influence have a legally mandated equal opportunity approach to these economic opportunities. Any potential for economic gain would be distributed equally to persons or businesses in the area that seek employment or business opportunity. While not all persons would gain economically from the cumulative group of projects and activities, the opportunity for gain does not favor one population group or another based on minority or income status.

Because there would be small changes in long-term population attributable to activities in the corridor, impacts or stresses to the housing stock, infrastructure systems, or social services would be unlikely. Socioeconomic impacts from railroad construction and operations along the Mina rail corridor would be small overall and would be unlikely to adversely or disproportionately affect the low-income or minority populations along the corridor.

5.4 Combined Repository and Nevada Rail Transportation Impacts

This section presents the total estimated environmental impacts for the proposed construction, operation, monitoring, and closure of the repository combined with the environmental impacts from the proposed Nevada transportation activities. As construction along the rail alignment approached the physical location of the repository and its surface facilities, the potential for impacts to overlap would increase.

Table 5-4 provides an overview of the total combined impacts of the proposed repository and railroad in Nevada within overlapping regions of influence. In most instances, DOE evaluated the potential impacts qualitatively and judged them to be small. However, there are several air quality and groundwater impacts from the repository and the railroad actions that DOE was able to sum and quantify:

- Air Quality. The air quality impacts from simultaneous construction of the proposed repository and of the railroad and associated rail facilities would not produce criteria air pollutant concentrations that exceeded the regulatory limit at the boundary of the analyzed repository land withdrawal area.
- Groundwater. Groundwater withdrawals would occur for both the repository and railroad actions from the same hydrographic area, specifically Area 227A, Jackass Flats. DOE has analyzed water demand from both actions to gauge overall impacts to groundwater resources in the Jackass Flats area. The highest combined annual water demand for railroad and repository activities would be below the Nevada State Engineer's ruling of perennial yield (the amount that can be withdrawn annually without depleting reserves) for the Jackass Flats hydrographic area. The combined demand would also be lower than the lowest estimated perennial yield for the western two-thirds of this hydrographic area. Coupled with the demand for Nevada Test Site activities in Jackass Flats, the total annual water demand would exceed the lowest estimated value of perennial yield for the western two-thirds of the hydrographic area during only one year. However, this estimated total combined water demand would still be below estimated values of perennial yield for the entire hydrographic area for all years. The combined repository and railroad actions would withdraw groundwater that would

Table 5-4. Summary of combined repository and Nevada railroad impacts (page 1 of 3).

Resource area	Summary of repository and Nevada rail transportation impacts that occur within overlapping regions of influence
Land use and ownership	About 12 square kilometers of disturbed land; 600 square kilometers of land withdrawn from public use.
Air quality	Nye County is the only location where Nevada rail transportation impacts would overlap the repository region of influence. The Nevada rail transportation emissions would be distributed over the entire county and only the southern portion of the emissions from Nye County would be within the repository region of influence. Modeled concentrations of criteria pollutants at the boundary of the repository land withdrawal area would not exceed regulatory limits during simultaneous construction of the repository and railroad. Concentrations of all criteria air pollutants except for particulate matter would be less than 6 percent of the regulatory limit. Concentrations of $PM_{2.5}$ would not exceed 37 percent, and concentrations of PM_{10} would not exceed 84 percent of the regulatory limit. The simultaneous operation of the repository and railroad would not exceed regulatory limits.
Hydrology	
Surface water	At least two of the drainage channels and floodplains (Busted Butte Wash and Drill Hole Wash) the rail line would cross would also be affected by construction of repository surface facilities.
Groundwater	Water identified for rail line construction includes 572 acre-feet (over 4 years) plus 6 acre-feet per year for operations, all from the same groundwater basin as for repository activities. A peak annual water demand of 530 acre-feet would result from the combined Nevada rail transportation and repository needs, but this high level would last only 1 year. The average annual water demand for the combined construction period would be 400 acre-feet. All of the combined water demand levels would be below the lowest estimate of the groundwater basin's perennial yield (580 acre-feet). The year of highest water demand would not result in a well drawdown that could affect the nearest public or private wells. Modeling for the Yucca Mountain FEIS showed small to moderate impacts from the Proposed Action groundwater withdrawals that are still applicable. The model's assumed withdrawal rate of 430 acre-feet per year is lower than the peak water demand, but over the life of the project, is still conservatively high.
Biological resources and soils	Loss of up to 12 square kilometers of desert soil, habitat, and vegetation, but no loss of rare or unique habitat or vegetation; adverse impacts to individual threatened desert tortoises and loss of a small amount of low-density tortoise habitat, but no adverse impacts to the species as a whole; reasonable and prudent measures would minimize impacts.
Cultural resources	Small potential for impacts; including three National Register-eligible prehistoric sites; opposing American Indian viewpoint.

Table 5-4. Summary of combined repository and Nevada railroad impacts (page 2 of 3).

Resource area	Summary of repository and Nevada rail transportation impacts in overlapping regions of influence
Socioeconomics	
New jobs (percent of workforce in affected counties	Peak increases would be small, less than 1 percent in the region, Clark County, and Nye County when construction of repository and the railroad overlap.
Peak real disposable income (million dollars)	For repository: In Clark County (2034), $58.3 million; in Nye County (2035) $27.5 million.
	For railroad: In Clark County (2011) $100.6 million; in Nye County (2012) $9.6 million.
Peak incremental gross regional product (million dollars)	For repository: In Clark County (2034), $98.7 million; in Nye County (2034) $68.9 million.
	For railroad: In Clark County (2012), $154.5 million; in Nye County (2012), $42.8 million.
Occupational and public health and safety	
Public, radiological	
Maximally exposure individual (probability of a latent cancer fatality)	Not applicable
Population (latent cancer fatalities)	Not applicable
Public, nonradiological	
Fatalities due to emissions	Not applicable
Workers (involved and noninvolved)	
Radiological (latent cancer fatalities)	Not applicable
Nonradiological fatalities (includes commuting traffic fatalities)	Not applicable
Accidents	
Public, Radiological	
Maximally exposed individual (probability of a latent cancer fatality)	Not applicable
Population (latent cancer fatalities)	Not applicable
Workers	Not applicable
Noise and vibration	Impacts to public would be small due to large distances from the repository to residences; workers exposed to elevated noise levels; controls and protection would be used as necessary.
Aesthetics	The exhaust ventilation stacks on the crest of Yucca Mountain could be an aesthetic aggravation to American Indians. If the Federal Aviation Administration required beacons atop the stacks, they could be visible for a great distance, especially west of Yucca Mountain.

Table 5-4. Summary of combined repository and Nevada railroad impacts (page 3 of 3).

Resource area	Summary of repository and Nevada rail transportation impacts in overlapping regions of influence
Utilities, energy, materials, and site services	Use of materials would be small in comparison to regional use; some effect on public water systems and public wastewater treatment facilities due to population growth from construction and operations employment; annual fossil-fuel use would be less than 7 percent of state-wide use during construction and less than 2 percent of state-wide use during operation; electric power delivery system to the Yucca Mountain site would have to be enhanced.
Waste and hazardous materials	Small impacts from nonhazardous waste (solid and industrial waste) disposal to disposal capacities of local solid waste facilities near Yucca Mountain in Nye, Esmeralda, Clark, and Lincoln counties.
Environmental justice	No high and adverse impact to population as a whole; no specific pathways for minority populations; therefore no high and adverse impacts to minorities and low income populations; opposing American Indian viewpoint.
Manufacturing repository components	Not applicable.
Airspace restrictions	Small impacts to airspace use; airspace restriction could be lifted once operations have been completed.

otherwise move into aquifers of the Amargosa Desert, but the combined water demand for the railroad, the repository, and Nevada Test Site activities in Jackass Flats would have, at most, small impacts on the availability of groundwater in the Amargosa Desert area in comparison with the quantities of water already being withdrawn there.

6. STATUTORY, REGULATORY, AND OTHER APPLICABLE REQUIREMENTS

This chapter identifies the permits and approvals, Federal Government and State of Nevada regulations, and Executive and DOE Orders that could apply to construction and operation of the proposed railroad.

Glossary terms are shown in ***bold italics***.

During proposed ***railroad*** construction and operations, the U.S. Department of Energy (DOE or the Department) would comply with applicable requirements, and has developed and is implementing a comprehensive approach to the permitting and approval processes that would ensure compliance.

As illustrated in Figure 6-1, compliance with regulatory requirements is the second step in the DOE approach to avoiding, minimizing or reducing environmental ***impacts***.

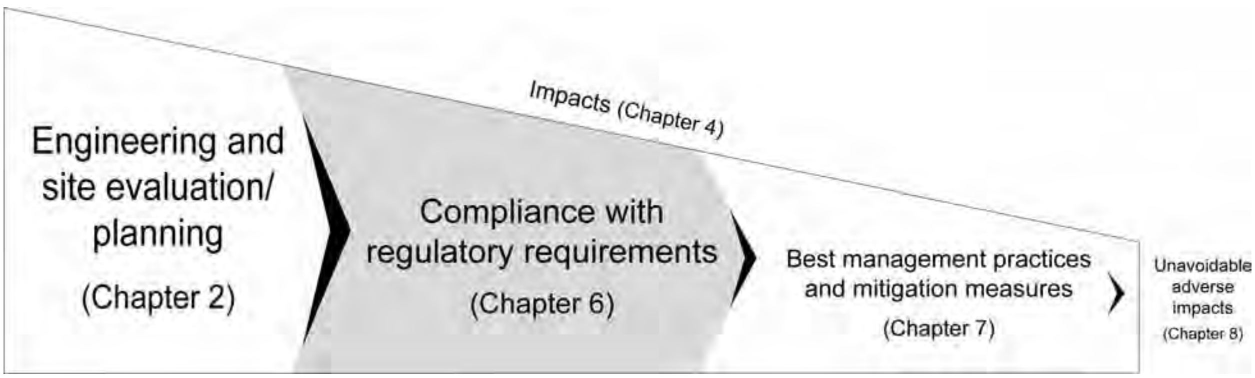

Figure 6-1. Multi-step approach to avoid, minimize, or reduce environmental impacts.

The chapter is organized as follows:

- Section 6.1 summarizes statutes and regulations that establish or affect DOE authority to construct and operate the proposed railroad.
- Section 6.2 identifies Surface Transportation Board (STB) requirements.
- Section 6.3 summarizes statutes and regulations that establish environmental protection requirements that could apply to construction and operation of the railroad.
- Section 6.4 identifies potentially applicable DOE Orders.
- Section 6.5 identifies U.S. Department of the Interior, Bureau of Indian Affairs, requirements.
- Section 6.6 identifies U.S. Department of the Interior, Bureau of Land Management (BLM), requirements.
- Section 6.7 identifies U.S. Army requirements.

Appendix A provides copies of the applicable *Federal Register* (*FR*) notices. Appendix B describes interagency and intergovernmental interactions.

6.1 Statutes and Regulations Establishing or Relating to DOE Authority to Propose, Construct, and Operate a Railroad in Nevada for Shipment of Spent Nuclear Fuel and High-Level Radioactive Waste to the Repository at Yucca Mountain

This section summarizes the statutes and regulations that establish or affect DOE authority to propose, construct, and operate the proposed railroad.

6.1.1 NUCLEAR WASTE POLICY ACT, AS AMENDED (42 UNITED STATES CODE [U.S.C.] 10101 *et seq.*)

The Nuclear Waste Policy Act, as amended (NWPA), establishes the Federal Government's responsibility for the ***disposal*** of ***spent nuclear fuel*** and ***high-level radioactive waste*** and generators' responsibility to bear the costs of disposal. The NWPA identified the ***Yucca Mountain Site*** in Nye County, Nevada, as the only site to be studied as a potential location for a ***geologic repository***. As part of its obligations under the NWPA, DOE is responsible for developing a system to transport spent nuclear fuel and high-level ***radioactive*** waste to the repository. On April 8, 2004, DOE published *Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV* (69 *FR* 18557) announcing the selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* 155970 (DIRS 155970-DOE 2002, all) as the mode of transportation for shipping spent nuclear fuel and high-level radioactive waste to Yucca Mountain and selected the Caliente ***rail corridor*** to evaluate alignments for a ***rail line***.

6.1.2 YUCCA MOUNTAIN DEVELOPMENT ACT OF 2002 (PUBLIC LAW 107-200)

On February 15, 2002, President George W. Bush approved the Secretary of Energy's recommendation of Yucca Mountain as the site for the development of a repository for the disposal of spent nuclear fuel and high-level radioactive waste. The House of Representatives approved the Yucca Mountain Site on May 8, 2002, as did the Senate on July 9, 2002. This approval of the site at Yucca Mountain became known as the Yucca Mountain Development Act, which the President signed into law on July 23, 2002. This Act is a joint resolution of the House of Representatives and Senate approving the site at Yucca Mountain, Nevada, for the development of a repository for the disposal of spent nuclear fuel and high-level radioactive waste, pursuant to the Nuclear Waste Policy Act of 1982, as amended.

6.1.3 ATOMIC ENERGY ACT, AS AMENDED (42 U.S.C. 2011 *et seq.*)

The Atomic Energy Act of 1954, as amended, provides fundamental jurisdictional authority to DOE and the U.S. Nuclear Regulatory Commission (NRC) over governmental and commercial use of nuclear materials. This Atomic Energy Act ensures proper management, production, possession, and use of radioactive materials. In accordance with the Atomic Energy Act, DOE established a system of requirements issued as DOE Orders.

The Atomic Energy Act gives the Nuclear Regulatory Commission specific authority to regulate the possession, transfer, ***storage***, and disposal of nuclear materials, and aspects of transportation packaging design for radioactive materials, including testing for packaging certification. Nuclear Regulatory Commission regulations applicable to the transportation of radioactive materials (10 Code of Federal Regulations [CFR] Parts 71 and 73) require that shipping ***casks*** meet specified performance criteria under both normal transport and hypothetical ***accident*** conditions. DOE and Nuclear Regulatory Commission regulations applicable to protection against ***radiation*** (10 CFR Parts 20 and 835) address occupational ***dose*** limits, public dose limits, survey and monitoring procedures, ***exposure*** controls, respiratory protection and controls, precautionary procedures, and related topics. DOE would comply with all applicable radiation protection regulations during operation of the proposed railroad.

6.2 Surface Transportation Board Requirements

If DOE selected the ***Shared-Use Option*** as part of the ***Proposed Action***, DOE would have to apply to the STB for a license to construct and operate the proposed rail line (known as a "certificate of public convenience and necessity"). If DOE did not select the Shared-Use Option, the STB would have no regulatory authority related to the Proposed Action. The Shared-Use Option involves operating the proposed railroad as a common-carrier railroad – one that holds itself out to the public for service and has an obligation to provide rail service to any and all shippers that request service along that line.

The STB has exclusive jurisdiction over the construction, acquisition, and operation of common-carrier railroads pursuant to the Interstate Commerce Act (as amended by the ICC Termination Act of 1995 [Public Law 104-88, 109 Stat. 803 (1995)]). To operate the proposed railroad under the Shared-Use Option, DOE would have to apply for a "license of public convenience and necessity" issued under 49 U.S.C. 10901 or under 49 U.S.C. 10502. The regulations prescribing how to apply for a license to construct and operate a rail line are provided in 49 CFR Part 1150. If the Department sought a license from the STB, the STB would subject the proposal to a careful review, including preparation of the environmental documentation required to meet STB obligations under the National Environmental Policy Act (NEPA), as provided in 49 CFR Part 1105.

The STB has jurisdiction over common-carrier rail lines that are part of the interstate rail network. This jurisdiction includes facilities and structures that are an integral part of rail transportation [49 U.S.C. 10501(b); 49 U.S.C. 10102(9)]. Section 10501(b) also states that "the remedies provided under this part are exclusive and preempt the remedies provided under federal and state law." The purpose of Section 10501(b) is to prevent a patchwork of local regulation from unreasonably interfering with interstate commerce. Thus, Section 10501(b) does not permit dual state and federal regulation of railroads or activities related to rail transportation at railroad facilities. This statutory framework, with supporting case law, supports the STB broad preemption authority.

The STB preemption authority applies to state or local regulation of matters directly related to the STB, and state or local pre-clearance or permitting requirements – such as zoning ordinances and environmental and land-use permitting requirements – that could be used to deny or defeat a railroad's ability to conduct its operations. Thus, a local or state body cannot deny a carrier the right to construct, develop, and maintain facilities or conduct operations, because this denial would create irreconcilable conflict with the STB's exclusive jurisdiction over such facilities and operations.

While exempt from traditional permitting, zoning, and land-use processes for railroad operations, railroads such as the one DOE proposes are not necessarily exempt from other applicable laws. The states retain the police powers reserved by the 10^{th} Amendment of the U.S. Constitution. Pursuant to the Commerce Clause, Article I, Section 8 of the U.S. Constitution, states can take appropriate actions to protect public health and safety so long as their actions do not regulate operations or unreasonably interfere with interstate commerce.

STB environmental regulations are set forth in 49 CFR Part 1105. These rules require consideration of various environmental statutes, including NEPA, the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 *et seq*.), and the Energy Policy and Conservation Act (42 U.S.C. 6361; Public Law 94-163). These rules combine the STB's former environmental and energy regulations; revise and clarify environmental and historic requirements; require service of environmental reports on certain state, federal, and local agencies; and reclassify and clarify the types of actions for which environmental and other historic reports and analyses are required. For railroads providing service to commercial interests, these regulations enable applicants, interested parties, and STB environmental staff to better identify and more expeditiously resolve environmental concerns associated with proposed actions. If DOE implemented the Shared-Use Option, this Rail Alignment EIS is intended to satisfy the STB environmental analysis requirements provided for in 49 CFR Parts 1105 and 1150.

6.3 Potential Statutes, Regulations, and Executive Orders Regarding Environmental Protection Requirements

This section summarizes, according to environmental topic, the statutes, regulations, and Executive Orders that set environmental protection requirements that could apply to construction and operation of the proposed railroad.

Table 6-1 is organized by environmental topic and is a comprehensive summary of the regulatory actions DOE could take for construction and operation of the proposed railroad. This table lists the permits, licenses, approvals, statutes or regulations, and agency associated with each regulatory action. Table 6-2 lists applicable federal codified regulations, Executive Orders, and other documents and directives.

Table 6-1. Potential permits, licenses, and approvals necessary for construction and operation of the proposed railroad in the State of Nevada (page 1 of 4).

Regulatory action	Statute or regulation[a]	Agency	Activity
Air Quality			
Air quality operating permit	NAC 445B.287 *et seq.*	Nevada Division of Environmental Protection	Demonstrate control of surface disturbances and emissions of criteria pollutants.
Water Quality and Use			
Stormwater discharge permit and other National Pollutant Discharge Elimination System permits	40 CFR Part 122 NAC 445A.266	U.S. Environmental Protection Agency Nevada Division of Environmental Protection	Control of stormwater discharges and point-source discharges.
Temporary permit to work in waterways (rolling stock permit)	NRS 445A.485 NAC 445A.266 through 445A.272	Nevada Division of Environmental Protection	Work in waterways of the state.
Section 404, permit to discharge dredge or fill materials to waters of the United States	Clean Water Act, Section 404 33 CFR Part 323	U.S. Army Corps of Engineers	Discharge dredge or fill materials into waters of the United States for bridges and culverts in interstate streams, dry washes, and wetlands.

Table 6-1. Potential permits, licenses, and approvals necessary for construction and operation of the proposed railroad in the State of Nevada (page 2 of 4).

Regulatory action	Statute or regulation[a]	Agency	Activity
Water Quality and Use (continued)			
Section 401, water quality certification by State of Nevada	Clean Water Act, Section 401 40 CFR 131	U.S. Army Corps of Engineers Nevada Division of Environmental Protection, Bureau of Water Quality Planning	Section 401 review requires state certification prior to issuance of Section 404 permit to discharge dredge or fill materials to waters of the United States. The request is made by U.S. Army Corps of Engineers to Nevada Division of Environmental Protection, Bureau of Water Quality Planning, to certify that the proposed activity will not violate state or federal water standards.
Water appropriation permit	NRS 533.324 through 533.435	Nevada State Engineer	Drill wells or use existing wells to withdraw groundwater to support rail construction.
Underground water and wells	NAC 534	Nevada State Engineer	Drill wells and use wells to withdraw groundwater to support rail construction.
Septic/sewage disposal permit	40 CFR Part 122 NAC 445A.810 through 445A.925 NAC 444.750 through 444.828	U.S. Environmental Protection Agency Nevada Division of Environmental Protection	Construct and operate temporary or permanent sanitary-sewage collection systems for construction camps and railroad operations facilities.
Hazardous Materials			
Hazardous materials storage permit	NAC 459 NAC 477.323	Nevada State Fire Marshal	Store and use hazardous materials, including explosives, associated with construction and operation of the proposed railroad.
Hazardous waste generation, storage, transportation, and disposal permit	Resource Conservation and Recovery Act (42 U.S.C. 6962), Subtitle C 40 CFR Part 261 40 CFR Part 262 40 CFR Part 263 40 CFR Part 264 40 CFR Part 268 40 CFR Part 270 40 CFR Part 273 40 CFR Part 279 NRS 459.400 to 459.600	U.S. Environmental Protection Agency Nevada Division of Environmental Protection	Transport, handle, treat, store, and dispose of Resource Conservation and Recovery Act hazardous wastes used during rail construction and operation.

Table 6-1. Potential permits, licenses, and approvals necessary for construction and operation of the proposed railroad in the State of Nevada (page 3 of 4).

Regulatory action	Statute or regulation[a]	Agency	Activity
Hazardous Materials (continued)			
Hazardous waste transportation approval, exemption, or permit	Hazardous Materials Transportation Act (49 U.S.C. 1801) 49 CFR Parts 171 to 180	U.S. Department of Transportation	Shipment of hazardous waste, including spent nuclear fuel and high-level radioactive waste.
Type B package approval	10 CFR Part 71	U.S. Nuclear Regulatory Commission	Shipment of spent nuclear fuel and high-level radioactive waste.
Cultural Resources			
Protection of cultural resources and development of programmatic agreement	National Historic Preservation Act (16 U.S.C. 470 *et seq.*) The Archaeological Resources Protection Act (16 U.S.C. 470aa *et seq.*) The Antiquities Act (16 U.S.C. 431 through 433) The American Indian Religious Freedom Act (42 U.S.C. 1996) The Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq.*) 36 CFR Part 79 36 CFR Part 800	Advisory Council on Historic Preservation Nevada State Historic Preservation Office	Protect cultural resources; applicable to all activities that disturb the land.
Ecology and Habitat			
Endangered species consultation	50 CFR Part 402	U.S. Fish and Wildlife Service	Protect listed threatened and endangered species and designated critical habitat; applicable to all activities that disturb the habitat of threatened and endangered species.
Land and Water Use			
Free-use permit for sand and gravel	43 CFR Part 3600	Bureau of Land Management	Use sand, stone, and gravel from public lands during construction of the rail line.

Table 6-1. Potential permits, licenses, and approvals necessary for construction and operation of the proposed railroad in the State of Nevada (page 4 of 4).

Regulatory Action	Statute or Regulation[a]	Agency	Activity
Land and Water Use (continued)			
Right-of-way reservations	43 CFR Part 2800	Bureau of Land Management	Obtain rights-of-way for access to land that is needed for construction, operation, and access to the rail line, roads, construction camps, borrow pits, and other facilities.
Permit for a ***public water system***	NAC 445A.602 through 445A.612	Nevada Division of Environmental Protection	Construct and operate a public water-supply system at construction camps and some railroad operations facilities.
Construction			
Communication system authorization	Communications Act 47 CFR Part 17 47 CFR Part 24	Federal Communications Commission	Construct and operate a radio system and install fiber optics.
Operating permit for construction/labor camps	NRS 444.130 *et seq.*	Nevada State Health Division	Maintain specified conditions for construction and labor camps in Nevada.
Permit to cross state highways (occupancy permit)	NRS 408.423 NRS 408.423 through 408.427 NAC 703.455	Nevada Department of Transportation Nevada Public Utilities Commission	Construct rail line across a state highway or occupy a highway right-of-way. Applies also to construction of access roads, water pipelines, and other infrastructure that would intersect highway rights-of-way.

a. CFR = Code of Federal Regulations; NAC = Nevada Administrative Code; NRS = Nevada Revised Statutes; RCRA = Resource Conservation and Recovery Act.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 1 of 11).

Regulation/Order	Title	Subject
Regulation[a]		
7 CFR Part 658	Farmland Protection Policy Act	Law minimizes the extent to which federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses.
10 CFR Part 20	Standards for Protection Against Radiation	Standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the Nuclear Regulatory Commission.
10 CFR Part 34	Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations	Requirements for the issuance of licenses for the use of sealed sources containing byproduct material and radiation safety requirements for persons using sealed sources in industrial radiography.
10 CFR Part 71	Packaging and Transportation of Radioactive Material	Requirements for packaging, preparation for shipment, and transportation of licensed fissile material.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 2 of 11).

Regulation/Order	Title	Subject
10 CFR Part 73	Physical Protection of Plants and Materials	Requirements for the establishment and maintenance of a physical protection system which have capabilities for the protection of special nuclear material.
10 CFR Part 75	Safeguards on Nuclear Material–Implementation of U.S./International Atomic Energy Agency Agreement	Establishes a system of nuclear material accounting and nuclear material control to implement the agreement between the United States and the International Atomic Energy Agency for the Application of Safeguards in the United States.
10 CFR Part 830	Nuclear Safety Management	Standards for governing the conduct of DOE contractors, DOE personnel, and other persons conducting activities (including providing items and services) that affect the safety of DOE nuclear facilities.
10 CFR Part 835	Occupational Radiation Protection	Radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities.
10 CFR Part 860	Trespassing on Department of Energy Property	Requirements for the protection and security of facilities, installations and real property subject to the jurisdiction or administration, or in the custody of, DOE.
10 CFR Part 1010	Conduct of Employees	Standards for conduct of employees of the Department of Energy, excluding employees of the Federal Energy Regulatory Commission.
10 CFR Part 1021	National Environmental Policy Act Implementing Procedures	Establishes the procedures that the Department of Energy (DOE) shall use to comply with section 102(2) of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4332(2)) and the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (40 CFR parts 1500-1508). To be used in conjunction with the CEQ Regulations.
10 CFR Part 1022	Compliance with Floodplain/Wetland Environmental Review Requirements	Policy and procedures for discharging DOE responsibilities under Executive Order 11988 and Executive Order 11990, including: DOE policy regarding the consideration of floodplain and wetland factors in DOE planning and decisionmaking; and DOE procedures for identifying proposed actions located in a floodplain or wetland, providing opportunity for early public review of such proposed actions, preparing floodplain or wetland assessments, and issuing statements of findings for actions in a floodplain.
25 CFR Part 162	Leases and Permits	Policies and procedures for lease of tribal lands, Bureau of Indian Affairs.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 3 of 11).

Regulation/Order	Title	Subject
25 CFR Part 169	Rights-of-Way Over Indian Lands	Procedures, terms, and conditions under which rights-of-way over and across tribal land, individually owned land, and government-owned land may be granted.
29 CFR Part 1910	Occupational Safety and Health Standards	Standards for industry and business for occupational safety and health.
29 CFR Part 1926	Safety and Health Regulations for Construction	Standards for safety and health for construction activities.
29 CFR Part 1960	Recordkeeping and Reporting	Basic program elements for occupational safety and health programs and related matters for federal employees.
33 CFR Part 323	Permits for Discharges of Dredged or Fill Material into Waters of the United States	Policies, practices, and procedures, to be followed by the Army Corps of Engineers to review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act.
36 CFR Part 79	Curation of Federally-Owned and Administered Archaeological Collections	Standards, procedures and guidelines to be followed by federal agencies to preserve collections of prehistoric and historic material remains, and associated records, recovered under the authority of the Antiquities Act, the Reservoir Salvage Act, section 110 of the National Historic Preservation, Act or the Archaeological Resources Protection Act.
36 CFR Part 296	Protection of Archaeological Resources: Uniform Regulations	Standards and procedures for federal land managers to provide protection for archaeological resources, located on public lands and Indian lands of the United States.
36 CFR Part 800	Protection of Historic and Cultural Properties	Procedures for federal agencies to meet statutory responsibilities for historic preservation concerns with the needs of historic properties.
40 CFR Part 50	National Primary and Secondary Ambient Air Quality Standards	National primary and secondary ambient air quality standards.
40 CFR Part 60	Standards of Performance for New Stationary Sources	Air standards of performance for new stationary Sources.
40 CFR Part 61	National Emission Standards for Hazardous Air Pollutants	Emission standards for hazardous air pollutants.
40 CFR Part 63	National Emission Standards for Hazardous Air Pollutants for Source Categories	Emission standards for hazardous air pollutants for source categories.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 4 of 11).

Regulation/Order	Title	Subject
40 CFR Part 68	Chemical Accident Prevention Provisions	List of regulated substances and threshold quantities, and accident prevention regulations, the petition process for adding or deleting substances to the list of regulated substances, the requirements for owners or operators of stationary sources concerning the prevention of accidental releases, and the State accidental release prevention programs.
40 CFR Part 112	Oil Pollution Prevention	Procedures, methods, equipment, and other requirements to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable waters of the United States or adjoining shorelines.
40 CFR Part 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System	Permit programs for the National Pollutant Discharge Elimination System that requires permits for the discharge of "pollutants" from any "point source" into "waters of the United States."
40 CFR Part 125	Criteria and Standards for National Pollutant Discharge Elimination System	Criteria and standards for technology-based treatment requirements for permits under the National Pollutant Discharge Elimination System.
40 CFR Part 131	Water Quality Standards	Requirements and procedures for developing, reviewing, revising, and approving water quality standards by the states for Section 404 Permits for Discharges of Dredged or Fill Material into Waters of the United States.
40 CFR Part 136	Guidelines for Establishing Test Procedures for Analysis of Pollutants	Guidelines for test procedures for analysis of pollutants to be used to perform measurements of waste constituents specified for a state having an approved National Pollutant Discharge Elimination System program.
40 CFR Part 141	National Primary Drinking Water Regulations	Primary standards for public drinking water supplies, including maximum contaminant levels, and sampling and analysis, monitoring and reporting, and recordkeeping requirements.
40 CFR Part 142	National Primary Drinking Water Regulations Implementation	Regulations for the implementation and enforcement of the national primary drinking water regulations contained in 40 CFR Part 141.
40 CFR Part 143	National Secondary Drinking Water Regulations	Secondary standards for public drinking water supplies that primarily affect the aesthetic qualities relating to the public acceptance of drinking water.
40 CFR Part 260	Hazardous Waste Management System: General	Definitions of terms, general standards, and overview information applicable to parts 260 through 265 and 268 that sets forth the requirements for hazardous waste generators, transporters, or owners or operators of treatment, storage, or disposal facilities.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 5 of 11).

Regulation/Order	Title	Subject
40 CFR Part 261	Identification and Listing of Hazardous Waste	Standards and criteria for identifying the characteristics of hazardous waste and for listing hazardous waste.
40 CFR Part 262	Standards Applicable to Generators of Hazardous Waste	Standards for generators of hazardous waste.
40 CFR Part 263	Standards Applicable to Transporters of Hazardous Waste	Standards for transporters of hazardous waste.
40 CFR Part 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Standards for hazardous waste treatment, storage, and disposal facilities.
40 CFR Part 265	Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Interim standards for hazardous waste treatment, storage, and disposal facilities.
40 CFR Part 268	Land Disposal Restrictions	Identifies hazardous wastes that are restricted from land disposal and defines treatment requirements for which an otherwise prohibited waste may be land disposed.
40 CFR Part 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program	Hazardous waste permit requirements, including application requirements, standard permit conditions, and monitoring and reporting requirements.
40 CFR Part 273	Standards for Universal Waste Management	Requirements for managing universal waste, including batteries, pesticides, thermostats, and lamps.
40 CFR Part 279	Standards for the Management of Used Oil	Standards for used oil generators, transporters, transfer facilities, collection centers, and processors and re-refineries.
40 CFR Part 302	Designation, Reportable Quantities, and Notification	Standards for designation, reportable quantities, and notification requirements for hazardous substances.
40 CFR Part 355	Emergency Planning and Notification	Establishes the list of extremely hazardous substances, threshold planning quantities, and facility notification responsibilities necessary for the development and implementation of state and local emergency response plans.
40 CFR Part 370	Hazardous Chemical Reporting: Community Right-to-Know	Reporting requirements that provide the public with important information on the hazardous chemicals in their communities for the purpose of enhancing community awareness of chemical hazards and facilitating development of state and local emergency response plans.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 6 of 11).

Regulation/Order	Title	Subject
40 CFR Part 372	Toxic Release Chemical Reporting: Community Right-to-Know	Requirements for informing the public and the communities surrounding covered facilities about the release of toxic chemicals under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986.
40 CFR Part 503	Standards for the Use or Disposal of Sewage Sludge	General requirements, pollutant limits, management practices, and operational standards for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works.
40 CFR Parts 1500 through 1508	Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act	Regulations applicable to and binding on all federal agencies for implementing the procedural provisions of the National Environmental Policy Act.
41 CFR Part 101	Federal Property Management Regulations	Introductory material concerning the Federal Property Management Regulations System: its content, types, publication, authority, applicability, numbering, deviation procedure, as well as agency consultation, implementation, and supplementation.
43 CFR Part 3	Preservation of American Antiquities	Permit requirements for the preservation of ruins, archeological sites, historic and prehistoric monuments and structures, objects of antiquity, historic landmarks, and other objects of historic and scientific interest.
43 CFR Part 7	Protection of Archaeological Resources	Implementing provisions of the Archaeological Resources Protection Act of 1979, as amended, by establishing uniform definitions, standards, and procedures to be followed by federal land managers in providing protection for archaeological resources, located on public lands and Indian lands of the United States.
43 CFR Part 1600	Planning, Programming, Budgeting	Establishes a process for the development, approval, maintenance, amendment, and revision of resource management plans, and the use of existing plans for public lands administered by the Bureau of Land Management.
43 CFR Part 2300	Land Withdrawals	Procedures implementing the Secretary of the Interior's authority to process federal land withdrawal applications and, where appropriate, to make, modify, or extend federal land withdrawals.
43 CFR Part 2800	Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act	Grants for necessary transportation or other systems and facilities which are in the public interest and which require the use of public lands for the purposes identified in 43 U.S.C. 1761, and administering, amending, assigning, renewing, and terminating them.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 7 of 11).

Regulation/Order	Title	Subject
43 CFR Part 3600	Mineral Materials Disposal	Procedures for the exploration, development, and disposal of mineral material resources on the public lands, and for the protection of the resources and the environment.
43 CFR Part 3620	Free Use of Petrified Wood	Terms and conditions for persons collecting limited quantities of petrified wood for noncommercial purposes consistent with the preservation of significant deposits as a public recreational resource.
47 CFR Part 17	Construction, Marking, and Lighting of Antenna Structures	Standards for construction, marking, lighting, maintenance, and inspection of antenna structures.
47 CFR Part 24	Personal Communications Services	Conditions under which portions of the radio spectrum are made available and licensed for personal communications.
49 CFR Part 40	Procedures for Transportation Workplace Drug and Alcohol Testing Programs	Procedures for conducting workplace drug and alcohol testing for the federally regulated transportation industry.
49 CFR Part 107	Hazardous Materials Program Procedures	Procedures and permits for the transportation of hazardous materials.
49 CFR Part 171	General Information, Regulations, and Definitions	General information, regulations, and definitions for the safe and secure transportation of hazardous materials in commerce.
49 CFR Part 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements	Listing and classification of materials that the Department of Transportation has designated as hazardous materials for purposes of transportation and prescribes the requirements for shipping papers, packaging, marking, labeling, and transport vehicle placarding applicable to the shipment and transportation of those materials.
49 CFR Part 173	Shippers-General Requirements for Shipments and Packaging	Requirements for preparing hazardous materials for shipment by air, highway, rail, or water, and inspection, testing, and retesting responsibilities for persons who retest, recondition, maintain, repair, and rebuild containers used or intended for use in the transportation of hazardous materials.
49 CFR Part 174	Carriage By Rail	Handling, loading, and operating requirements for transport of hazardous and radioactive materials by rail.
49 CFR Part 177	Carriage By Public Highway	Requirements for transportation of hazardous materials by private, common, or contract carriers by motor vehicle, including hazardous materials training.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 8 of 11).

Regulation/Order	Title	Subject
49 CFR Part 178	Specifications for Packaging	Manufacturing and testing specifications for packaging and containers used for the transportation of hazardous materials in commerce.
49 CFR Part 179	Specifications for Tank Cars	Specifications for tanks that are mounted on or form part of a tank car and which are to be marked with a Department of Transportation specification.
49 CFR Part 180	Continuing Qualification and Maintenance of Packaging	Requirements for the maintenance, reconditioning, repair, inspection, and testing of packaging, and any other function having an effect on the continuing qualification and use of a packaging.
49 CFR Part 210	Rail Noise Emission Compliance Regulations	Inspection and testing requirements for railcars for compliance with the Railroad Noise Emission Standards established by the Environmental Protection Agency in 40 CFR part 201.
49 CFR Part 213	Track Safety Standards	Minimum safety requirements for railroad track that is part of the general railroad system of transportation.
49 CFR Part 214	Railroad Workplace Safety	Minimum federal safety standards for railroad employees involved in railroad inspection, maintenance, and construction activities.
49 CFR Part 215	Railroad Freight Car Safety Standards	Minimum federal safety standards for railroad freight cars.
49 CFR Part 217	Railroad Operating Rules	Railroad operating rules and practices with respect to trains and other rolling equipment in the railroad industry, and each railroad is required to instruct its employees in operating practices.
49 CFR Part 218	Railroad Operating Practices	Minimum requirements for railroad operating rules and practices. Each railroad may prescribe additional or more stringent requirements in its operating rules, timetables, timetable special instructions, and other special instructions.
49 CFR Part 219	Control of Alcohol and Drug Use	Minimum federal safety standards for control of alcohol and drug use by rail line employees.
49 CFR Part 220	Railroad Communications	Wireless and radio communication procedures for trains and rail line workers.
49 CFR Part 221	Rear End Marking Device–Passenger, Commuter, and Freight Trains	Minimum requirements governing highly visible marking devices for the trailing end of the rear car of all passenger, commuter, and freight trains.
49 CFR Part 223	Safety Glazing Standards–Locomotives, Passenger Cars, and Cabooses	Minimum requirements for glazing materials in order to protect railroad employees and railroad passengers from injury as a result of objects striking the windows of locomotives, cabooses, and passenger cars.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 9 of 11).

Regulation/Order	Title	Subject
Regulation (continued)		
49 CFR Part 225	Railroad Accidents/Incidents: Reports, Classification, and Investigations	Reporting, classification, and investigation procedures for rail line accidents and incidents.
49 CFR Part 228	Hours of Service of Railroad Employees	Records and reporting requirements for railroad employees hours of service and construction of sleeping quarters.
49 CFR Part 229	Railroad Locomotive Safety Standards	Minimum safety requirements for locomotives.
49 CFR Part 231	Railroad Safety Appliance Standards	Safety standards for locomotives and railcars.
49 CFR Part 232	Brake System Safety Standards for Freight and Other Non-passenger Trains and Equipment	Requirements for railroad power brakes and drawbars for freight and other nonpassenger trains.
49 CFR Part 233	Signal Systems Reporting Requirements	Reporting requirements for railroad signal systems.
49 CFR Part 234	Grade Crossing Signal System Safety	Inspection, testing, and maintenance requirements for rail crossing signal systems.
49 CFR Part 235	Instructions Governing Applications for Approval of a Discontinuance or Material Modification of a Signal System or Relief from the Requirements of Part 236	Provides applications for approval to discontinue or materially modify block signal systems, interlockings, traffic control systems, automatic train stop, train control, or cab signal systems, or other similar appliances, devices, methods, or systems.
49 CFR Part 236	Rules, Standards and Instructions Governing the Installation, Inspection, Maintenance, and Repair of Signal and Train Control Systems, Devices, and Appliances	Rules, standards and instructions for the installation, inspection, maintenance, and repair of signal and train control systems, devices, and appliances.
49 CFR Part 240	Qualification and Certification of Locomotive Engineers	Qualification and certification requirements for locomotive engineers.
49 CFR Part 395	Hours of Service of Drivers	Hours of service requirements for drivers of commercial motor vehicles.
49 CFR Part 1005	Principles and Practices for the Investigation and Voluntary Disposition of Loss and Damage Claims and Processing Salvage	Principles and practices for the investigation and voluntary disposition of loss and damage claims and processing salvage.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 10 of 11).

Regulation/Order	Title	Subject
49 CFR Part 1035	Bills of Lading	Requirements for uniform bills of lading.
49 CFR Part 1104	Filing with the Board-Copies-Verification-Service-Pleadings	Requirements for filing of pleading and other documents with the Surface Transportation Board.
49 CFR Part 1105	Procedures for Implementation of Environmental Laws	Procedures for implementation of environmental laws by the Surface Transportation Board.
49 CFR Part 1150	Certificate to Construct, Acquire, or Operate Railroad Lines	Administrative practices and procedures to obtain certification for construction, acquisition, or operation of railroad lines.
50 CFR Part 15	Wild Bird Conservation Act	Standards for the protection of wild birds.
50 CFR Part 17	Endangered and Threatened Wildlife and Plants	Standards for the protection of endangered and threatened wildlife and plants.
50 CFR Part 402	Interagency Cooperation–Endangered Species Act of 1973, as Amended	Interprets and implements the Endangered Species Act of 1973, as amended.
Executive Orders		
Executive Order 11514	*Protection and Enhancement of Environmental Quality*	The federal government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Federal agencies shall initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals.
Executive Order 11593	*Protection and Enhancement of the Cultural Environment*	The federal government shall provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation and institute procedures to assure that federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historical, architectural or archaeological significance.
Executive Order 11988	*Floodplain Management*	Federal agencies shall provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing, and disposing of federal lands and facilities.
Executive Order 11990	*Protection of Wetlands*	Federal agencies shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for acquiring, managing, and disposing of federal lands and facilities.
Executive Order 12088	*Federal Compliance with Pollution Control Standards*	Federal agencies are responsible for compliance with applicable pollution control standards.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 11 of 11).

Regulation/Order	Title	Subject
Executive Order 12898	*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	Federal agencies shall make achieving ***environmental justice*** part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on ***minority populations*** and ***low-income populations***.
Executive Order 13007	*Indian Sacred Sites*	In managing federal lands, each executive branch agency with statutory or administrative responsibility for the management of federal lands shall accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.
Executive Order 13112	*Invasive Species*	Federal agencies shall prevent the introduction of invasive species and provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.
Executive Order 13132	*Federalism*	Establishes policy to guarantee the division of governmental responsibilities between the national government and the states, and to ensure that the principles of federalism guide the executive departments and agencies in the formulation and implementation of policies.
Executive Order 13175	*Consultation and Coordination with Indian Tribal Governments*	Federal agencies shall establish regular and meaningful consultation and collaboration with Indian tribal governments in the development of regulatory practices on federal matters that significantly or uniquely affect their communities; to reduce the imposition of unfunded mandates upon Indian tribal governments; and to streamline the application process for and increase the availability of waivers to Indian tribal governments.
Executive Order 13186	*Responsibilities of Federal Agencies to Protect Migratory Birds*	The United States recognizes that migratory birds are of great ecological and economic value to this country and to other countries. They contribute to biological diversity and bring tremendous enjoyment to millions of Americans who study, watch, feed, or hunt these birds throughout the United States and other countries. The United States has recognized the critical importance of this shared resource by ratifying international, bilateral conventions for the conservation of migratory birds.
Executive Order 13423	*Strengthening Federal Environmental, Energy, and Transportation Management*	Federal agencies must conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner.

a. CFR = Code of Federal Regulations.

Table 6-3 lists applicable State of Nevada codes and statutes. Sections 6.3.1 through 6.3.8 are organized by environmental topic and describe the laws, regulations, Executive Orders, State of Nevada codes and statutes, and regulatory actions potentially applicable to construction and operation of the proposed railroad facilities.

Table 6-3. Potentially applicable State of Nevada codes and statutes (page 1 of 3).

Code or statute[a]	Title	Subject
NAC 408	Highways and Roads Installation and Relocation of Facilities and Encroachments	Requirements for design and location, permits, etc.
NAC 444 - Sanitation		
NAC 444.550 through 444.566	Labor Camps	Standards for living and sleeping quarters; cooking and eating, sanitary, and laundry facilities; lighting; and operating permits
NAC 444.8618	Disposal of Hazardous Waste Hazardous Waste Generator Identification Number	Information concerning an application for EPA identification number
NAC 444.850 through 444.8746	Disposal of Hazardous Waste	Standards of practice, variances, and administrative penalties
NAC 445A	Water Controls	Permits, certification of laboratories to analyze substances in water, water pollution control, public water systems, and underground injection control
NAC 445A.226 through 445A.22755	Action Levels for Contaminated Sites	Remediation standards and monitoring requirements for soil, groundwater, and surface-water contamination
NAC 445A.228 through 445A.263	Discharge Permits	Requirements, establishment of effluent limitations, schedules of compliance, inspection, sampling, and monitoring
NAC 445A.266 through 445A.272	General Permits	Requirements for discharge and procedures for application for general permits
NAC 445A.305 through 445A.340	Diffuse Sources	Administration of controls by municipality, determination of new sources of water pollution, state and local handbooks of best management practices, and requirements for permits to construct or grade and forlogging
NAC 445A.345 through 445A.348	Notification of Release of Pollutant	Notice required and use of information in criminal prosecution
NAC 445A.591 through 445A.6731	Drinking Water Systems	Operation of ***community water system*** or nontransient water system; permits to operate privately owned systems; certification of operators; and design, construction, operation, and maintenance
NAC 445A.810 through 445A.925	Underground Injection Control Permits	Permits and construction, operation, monitoring, and abandonment
NAC 445B.001 through 455B.899	Air Pollution Control	Permits, air emissions control program, clean air mercury rule program, and emissions from engines
NAC 445C.010 through 445C.120	Environmental Requirements	Requirements to enter into and contents of an environmental audit agreement
NAC 459	Hazardous Materials	Hazardous materials

Table 6-3. Potentially applicable State of Nevada codes and statutes (page 2 of 3).

Code or statute[a]	Title	Subject
NAC 459.952 through 459.95528	Regulation of Highly Hazardous Substances and Explosives	Requirements, permits, hazard assessments, prevention programs, emergency response programs, and enforcement
NAC 459.975 through 459.991	Transportation of Hazardous Materials on Public Highways	Transportation of hazardous materials on public highways permits
NAC 459.9912 through 459.99184	Planning for and Responding to Discharge of Hazardous Materials	Emergency planning funding for local emergency planning committees, funding for state agencies, and payment of fees
NAC 459.9921 through 459.999	Storage Tanks	Storage tank requirements, registration, monitoring, and corrective action
NAC 472	State Forester Firewarden	Fire retardant roofing materials
NAC 477.010 and 477.290	State Fire Marshal – General Provisions	Definitions and severability
NAC 477.323	Permit to Store Hazardous Material	Permit required; issuance, expiration, renewal, suspension, reinstatement and revocation of permit; fees; criminal investigation; plan for termination
NAC 477.710	Use of Explosives in Blasting	Certificate required; qualifications; exemptions; renewal of certificate; fees
NAC 477.920	Miscellaneous Requirements	Fire suppression systems in buildings in rural areas
NAC 503	Hunting, Fishing, and Trapping Miscellaneous Protective Measures	Classification and taking of wildlife; possession, transportation, importation, exportation, and release of wildlife; hunting and trapping generally; raptors; fishing; depredation; and dredging permits
NAC 504.520	Alteration of a Stream System or Watershed	Approval of Department required to alter stream system or watershed to detriment of wildlife habitat; application for approval
NAC 527	Protection and Preservation of Timbered Lands, Trees, and Flora	Nevada Natural Heritage Program, permits, compliance with plan, revocation of permit, and protection of cacti and yucca
NAC 534	Underground Water and Wells	License to drill well; duties of well drillers; drilling, construction, and plugging of wells and boreholes; waivers; and enforcement
NAC 555	Control of Insects, Pests, and Noxious Weeds	Classification of weeds, weed control districts, regulation of nurseries and nursery stock, custom application of pesticides, certified applicators, and rodent control districts
NAC 586.018	Pesticides	Restricted-use pesticides: Application by or under supervision of certified applicator
NAC 703	Public Utilities Commission of Nevada	Application for privileges, rights, and authority and practice before the public utilities commission
NAC 705	Railroads	Standards and requirements for health and safety and transportation of hazardous materials by rail
NRS 408	Highways, Roads, and Transportation Facilities	Planning; financing highways and roads; improvement of county roads; state highway system; and construction, improvement, and maintenance of highways
NRS 444.130 through 444.200	Sanitation/Construction and Labor Camps	Requirements for conditions

Table 6-3. Potentially applicable State of Nevada codes and statutes (page 3 of 3).

Code or statute[a]	Title	Subject
NRS 444.440 through 444.620	Collection and Disposal of Solid Waste	Collection and disposal of solid waste
NRS 444.570 through 444.650	Disposal of Solid Waste	Disposal of solid waste and sewage
NRS 445A	Water Controls	Concentration of fluoride in water, water pollution control, and public water systems
NRS 445B	Air Pollution	State environmental commission, local hearing board, provisions for enforcement, program for control of air pollution, penalties, and control of emissions from engines
NRS 459.400 through 459.600	Disposal of Hazardous Waste	Disposal of hazardous waste
NRS 533.324 through 533.455	Appropriation of Public Waters: Applications, Permits and Certificates	Environmental permits and transfer of water from county of origin to another county
NRS 704	Regulation of Public Utilities Generally	Rates and schedules, general standards and practices, etc.
NRS 705	Railroads and Monorails	Railroads and monorails

a. NAC = Nevada Administrative Code; NRS = Nevada Revised Statutes.

6.3.1 NATIONAL ENVIRONMENTAL POLICY ACT, AS AMENDED (42 U.S.C. 4321 *et seq.*)

The National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 *et seq.*), requires federal agencies to integrate environmental values into their decision-making process by considering the environmental impacts of proposed federal actions and reasonable ***alternatives*** to those actions. The Act establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the policy. Section 102(2) contains action-forcing provisions to ensure that federal agencies follow the letter and spirit of the Act. For major federal actions significantly affecting the quality of the human ***environment***, Section 102(2)(C) of NEPA requires federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and other specified information. DOE promulgated regulations (10 CFR Part 1021) and issued DOE Order 451.1B, National Environmental Policy Act Compliance Program, to ensure compliance with Section 102(2) of NEPA.

DOE would construct and operate the proposed railroad in compliance with NEPA and promulgated DOE regulations.

6.3.2 HAZARDOUS MATERIALS PACKAGING, HANDLING, AND TRANSPORTATION (49 CFR PARTS 172 AND 173; 10 CFR PARTS 71 AND 73)

The ***shipment*** of ***nuclear waste*** is highly regulated and subject to the utmost scrutiny. DOE follows the strict U.S. Department of Transportation and U.S. Nuclear Regulatory Commission transportation rules, including the use of Commission-certified transportation casks, advance route approvals and notification, and shipment escorts. The Department also tracks its shipments by satellite 24 hours a day. DOE follows these precautions carefully now and will follow any others that might be required in the future, whether by the U.S. Congress, the Department of Transportation, or the Nuclear Regulatory Commission.

In addition, the Department would follow DOE Order 460.1B, which establishes safety requirements for the proper packaging and transportation of DOE/National Nuclear Security Administration offsite shipments and onsite transfers of hazardous materials and for modal transport.

The Department of Transportation is responsible for developing and implementing transportation-safety standards for hazardous materials, including radioactive materials. The Department of Transportation has established standards and requirements for packaging, transporting, and handling radioactive materials for all modes of transportation (49 CFR Parts 172 and 173). The regulations also specify safety requirements for vehicles and transportation operations, training for personnel who perform handling and transportation of hazardous materials, and liability insurance requirements for carriers. For all spent nuclear fuel and high-level radioactive waste shipments, DOE would comply with the requirements for identification, labeling, packaging, marking, placarding, and preparation of shipping papers set forth by the Department of Transportation in 49 CFR Parts 172 and 173.

The Nuclear Regulatory Commission regulates the packaging- and transportation-related operations of its licensees, including commercial shippers of radioactive materials. It sets design and performance standards for packaging (***shipping casks***) that contain materials with high levels of ***radioactivity***.

The Department of Transportation, by agreement with the Nuclear Regulatory Commission, accepts the Commission standards of 10 CFR Part 71 for packaging. The Commission also establishes safeguards and security regulations to minimize the possibility of theft, diversion, or attack on shipments of radioactive materials (10 CFR Part 73). Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local governments and American Indian tribes through whose jurisdictions DOE plans to transport spent nuclear fuel or high-level radioactive waste.

6.3.2.1 Hazardous Materials Transportation Act, as Amended (49 U.S.C. 1801)

The Hazardous Materials Transportation Act of 1975, as amended (49 U.S.C. 1801), gives the U.S. Department of Transportation authority to regulate the transport of hazardous materials, including radioactive materials. Under these regulations, the Department of Transportation regulates the interstate and intrastate shipment of hazardous materials, including spent nuclear fuel and high-level radioactive waste, by land, air, and navigable water. As outlined in a 1979 memorandum of understanding with the U.S. Nuclear Regulatory Commission (44 *FR* 38690, July 2, 1979), the Department of Transportation specifically regulates carriers of spent nuclear fuel and the conditions of transport such as routing, handling, storage, and vehicle and driver requirements. It also regulates the labeling, classification, and marking of transportation packages for radioactive materials.

Department of Transportation regulations include requirements for carriers, drivers, vehicles, routing, packaging, labeling, marking, placarding of vehicles, shipping papers, training, and emergency response. The requirements specify the maximum ***dose rate*** associated with radioactive material shipments and the maximum allowable levels of radioactive surface ***contamination*** on packages and vehicles. Department of Transportation regulations also include requirements to protect the health and safety of transportation workers.

6.3.2.2 Low-Level Radioactive Waste Policy Act, as Amended (42 U.S.C. 2021b *et seq.*)

In 1980 Congress passed the Low-Level Radioactive Waste Policy Act to establish federal policy on nuclear waste disposal, the foundation of which is the idea that the states are responsible for the disposal of ***low-level radioactive waste*** generated within their borders (except for certain federal waste). The desire to restrict access to disposal facilities was a driving force behind the adoption of the 1980 Act and the subsequent Low-Level Radioactive Waste Policy Act of 1985, as amended (42 U.S.C. 2021b *et seq.*).

The 1985 amendments clarified the right of Congressionally approved compacts to control access to their disposal facilities. This Act gives states the responsibility to dispose of low-level radioactive waste generated within their borders and allows them to form compacts to establish facilities to serve a group of states. The Act provides that the facilities will be regulated by the U.S. Nuclear Regulatory Commission or by states that have entered into agreements with the Commission under Section 274 of the Atomic Energy Act. The Act also requires the Commission to establish standards for determining when ***radionuclides*** are present in waste streams in sufficiently low concentrations or quantities as to be "below regulatory concern." Whereas Congress maintains authority over the disposal of high-level nuclear waste and ***transuranic waste***, states are responsible for low-level radioactive waste, which, unlike spent nuclear reactor fuel or high-level radioactive waste, emits a low level of radiation that decays fairly rapidly. Most low-level radioactive waste (97 percent) does not require special ***shielding*** during handling or transportation for the protection of workers or the surrounding community, and it can include such things as contaminated clothing, tools, or equipment.

6.3.2.3 U.S. Nuclear Regulatory Commission Radioactive Material Packaging and Transportation (10 CFR Parts 71 and 73)

Pursuant to 10 CFR Part 71, the U.S. Nuclear Regulatory Commission regulates the packaging and transport of spent nuclear fuel for its licensees, including commercial shippers of radioactive material and the DOE Office of Civilian Radioactive Waste Management. Under an agreement with the Department of Transportation, the Commission sets standards for packaging of radioactive materials, including spent nuclear fuel and high-level radioactive waste. These wastes must meet Type B packaging standards, which require that packages be designed and built to retain their radioactive contents in both normal and accident conditions.

The demonstration of compliance with these requirements applies a combination of calculation methods, computer modeling techniques, and physical testing to the design features of the package. DOE would present the results of the analyses and tests to the Nuclear Regulatory Commission in a safety analysis report for packaging. The Commission would review the safety analysis report, and if approved, would then issue a certificate of compliance to allow spent nuclear fuel or high-level radioactive waste to be shipped to the repository.

The regulations at 10 CFR Part 73 govern safeguards and physical security during the transit of shipments of spent nuclear fuel and specify requirements for carrier personnel, communications, notification of state governors, escorts, and route planning for such shipments. DOE carefully follows the Department of Transportation and the Nuclear Regulatory Commission transportation rules and will follow or exceed any others that may be established in the future, whether by the U.S. Congress, the Department of Transportation, or the Nuclear Regulatory Commission.

6.3.2.4 Emergency Planning and Community Right-to-Know Act (42 U.S.C. 1001 *et seq.*)

Under Subtitle A of the Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 1001 *et seq.*), which is also known as the Superfund Amendments and Reauthorization Act, Title III, federal agencies must provide information on hazardous and toxic chemicals to state emergency response commissions, local emergency planning committees, and the U.S. Environmental Protection Agency. The goal of providing this information about inventories of specific chemicals used or stored, and descriptions of releases that could occur at work sites, is to ensure that emergency plans are sufficient to respond to unplanned releases of hazardous substances. The Emergency Planning and Community Right-to-Know Act, codified at 40 CFR Parts 302 through 372, requires agencies to provide reports on material safety data sheets, emergency and ***hazardous chemical*** inventory, and toxic chemical releases to appropriate local, state, and federal agencies. These regulations also require facilities that store, dispense, use, or handle extremely hazardous materials in excess of specified thresholds, to report quantity data to specific agencies and organizations. Nevada Administrative Code, Chapters 459 and 477, establish the permitting requirements for highly hazardous substances and hazardous materials, respectively.

6.3.3 AIR QUALITY

6.3.3.1 Clean Air Act, as Amended (42 U.S.C. 7401 *et seq.*)

The Clean Air Act of 1970, as amended (42 U.S.C. 7401 *et seq.*), is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." The Act requires:

- Federal agencies with jurisdiction over any property or endeavor that might result in the discharge of air pollutants to comply with "all federal, state, interstate, and local requirements" related to the control and abatement of air pollution in accordance with 42 U.S.C. 7401, Section 118.
- The Environmental Protection Agency to establish national ***ambient air quality standards*** to protect public health from any known or anticipated adverse effects of a regulated pollutant (42 U.S.C. 7409).
- The Environmental Protection Agency to establish national standards of performance for new or modified stationary sources of atmospheric pollutants (42 U.S.C. 7411) and the evaluation of specific emission increases to prevent a significant deterioration in ***air quality*** (42 U.S.C. 7470).

6.3.3.2 National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50)

Under the Clean Air Act, the Environmental Protection Agency has established national ***ambient air*** quality standards at 40 CFR Part 50 to protect the public health and the environment. The national ambient air quality standards identify six pollutant types as criteria pollutants: ***nitrogen dioxide***, ***ozone***, lead, ***carbon monoxide***, ***particulate matter***, and ***sulfur dioxide***. The Environmental Protection Agency calls these "criteria" air pollutants because it regulates them from the development of human health-based and/or environmentally based criteria (science-based guidelines) in setting permissible levels.

The Clean Air Act specifically regulates emissions of hazardous air pollutants, including radionuclides, through the national emission standards for ***hazardous air pollutants*** program (40 CFR Parts 61 and 63).

6.3.3.3 Nevada Revised Statutes: Air Pollution (Title 40, Chapter 445B)

Nevada Revised Statutes, Chapter 445B, Air Pollution, and regulations in the Nevada Administrative Code implement state and federal Clean Air Act provisions, identify the requirements for permits for each air pollution source unless it is specifically exempted, and identify ongoing monitoring requirements. DOE would need operating permits from the Nevada Division of Environmental Protection, Bureau of Air Pollution Control, for the control of gaseous and particulate emissions from construction and operation of the proposed railroad.

6.3.4 WATER QUALITY

6.3.4.1 Clean Water Act, as Amended (33 U.S.C. 1251 *et seq.*)

The Clean Water Act regulates the discharge of pollutants into the Nation's surface waters, including lakes, rivers, streams, ***wetlands***, and coastal areas. Passed in 1972 and amended in 1977 and 1987, the Clean Water Act was originally known as the Federal Water Pollution Control Act. The Clean Water Act is administered by the U.S. Environmental Protection Agency, which sets water quality standards, handles enforcement, and helps state and local governments develop their own pollution control plans. The purpose of the Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) is to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." The U.S. Environmental Protection Agency delegated the State of Nevada the authority to implement and enforce most programs in the state under the Clean Water Act; exceptions include those addressed by Section 404 of the Act, which is administered by the U.S. Army Corps of Engineers, and described in this section.

This Act prohibits the "discharge of toxic pollutants in toxic amounts" to navigable ***waters of the United States***. Section 313 of the Act requires all departments and agencies of the Federal Government engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with federal, state, interstate, and local requirements. The Act applies to activities at and along the Caliente ***rail alignment*** and the Mina rail alignment that could affect waterways. Under the Clean Water Act, the State of Nevada sets water quality standards, and the U.S. Environmental Protection Agency and the State of Nevada regulate and issue permits for point-source discharges as part of the National Pollutant Discharge Elimination System permitting program. The Environmental Protection Agency regulations for this program are codified at 40 CFR Part 122, and Nevada rules for this program are codified at Nevada Administrative Code, Chapter 445A. If construction or operation of the proposed railroad in Nevada would result in point-source discharges, DOE would need to obtain a National Pollutant Discharge Elimination System permit from the Nevada Division of Environmental Protection, Bureau of Water Pollution Control.

Section 402(p) of the Clean Water Act requires the Environmental Protection Agency to establish regulations and requires individual states to issue permits for stormwater discharges associated with industrial activity, including construction activities that could disturb 20,000 or more square meters (5 or more acres) (40 CFR Part 122). Stormwater discharge permits are designed to control the degradation of surface water and ***groundwater*** primarily from erosion and sedimentation. Nevada rules for this program are codified at Nevada Administrative Code, Chapter 445A. Stormwater permits issued from the Nevada Bureau of Water Pollution Control regulate the discharge of stormwater from facilities. The Proposed Action includes rail line ***construction and operations support facilities*** that would have discharges of stormwater. DOE would need to obtain permits for these discharges. Additionally, construction and operation of septic and sanitary-sewage collection systems would require permits from the Nevada Bureau of Water Pollution Control.

Jurisdictional waters of the United States are subject to regulation by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. Jurisdictional waters of the United States include navigable and interstate waters, intrastate waters with a connection to interstate commerce and tributaries to such waters, and wetlands that are adjacent to waters of the United States. Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Construction activities, such as those for the proposed railroad, that would impact waters of the United States are regulated under this program.

The basic premise of the Section 404 permitting program is that no discharge of dredged or fill material into jurisdictional waters will be permitted if a practicable alternative exists that is less damaging to the aquatic environment, or the Nation's waters would be significantly degraded. In other words, it must be demonstrated that, to the extent practicable, steps have been taken to avoid impacts and that potential impacts on jurisdictional waters have been minimized and compensation is provided for any remaining unavoidable impacts (if required). Proposed activities are regulated through a permit review process.

An evaluation under Section 404(b)(1) of the Clean Water Act would analyze and describe the potential impacts from any proposed discharges of dredged or fill material into jurisdictional waters that would result from construction and operation of the proposed railroad. To complete the 404(b)(1) analysis, DOE would be required to identify the appropriate and applicable steps that would be taken during construction to minimize potential adverse impacts. These steps would include actions taken to reduce the potential for increased erosion and subsequent sedimentation and to ensure that any downstream water would not experience increases in sediment loading or turbidity that would threaten the beneficial use of that stream.

Section 404(r) of the Clean Water Act states that the discharge of dredged or fill material as part of the construction of a federal project specifically authorized by Congress is not prohibited or subject to regulation under Section 404 of the Clean Water Act so long as certain conditions are met. One of those conditions is to publish in an EIS information on the effects of such discharge, including an analysis of alternatives as required by Section 404(b)(1) of the Clean Water Act. If DOE determines that it will comply with Section 404(r), an alternatives analysis that meets the requirements of Sections 404(b)(1) and 404(r) will be published in the Final EIS. Otherwise, DOE would apply to the U.S. Army Corps of Engineers for a permit to fill jurisdictional waters of the United States.

Sections 401 and 405 of the Water Quality Act of 1987 and Public Law 100-4 added Section 402(p) to the Clean Water Act. Section 401 provides states with the opportunity to review and approve, condition, or deny all federal permits or licenses that might result in a discharge to state or tribal waters, including wetlands. The major federal permit subject to Section 401 review is a Section 404 permit. Every applicant for a Section 404 permit must request state certification that the proposed activity will not violate state or federal water quality standards. Construction of the proposed railroad would require the discharge of dredged or fill materials for bridges and culverts into United States waters via interstate streams and dry ***washes***. DOE would follow the requirements of Section 401 in requesting state certification. The proposed construction activities would not exceed State of Nevada water quality standards or otherwise violate a state requirement.

6.3.4.2 Safe Drinking Water Act, as Amended (42 U.S.C. 300 *et seq.*)

The Safe Drinking Water Act of 1974, as amended (42 U.S.C. 300(f) *et seq.*), gives the U.S. Environmental Protection Agency the responsibility and authority to regulate public drinking-water supplies by establishing drinking-water standards, delegating authority for enforcement of drinking-water standards to the states, and protecting ***aquifers*** from pollution hazards. The Nevada Division of Environmental Protection, Bureau of Safe Drinking Water, is the state agency responsible for enforcement. Environmental Protection Agency regulations for this program are codified at 40 CFR Part 141, and Nevada rules for this program are codified at Nevada Administrative Code, Chapter 445A. Operating permits are required for public water distribution systems, which are classified as a public water supply if each serves 15 connections or 25 people for more than 60 days per year. Because public water distribution systems would be located along the rail line at ***construction camps*** and railroad operations support facilities, DOE would have to obtain operating permits for these systems.

6.3.4.3 Nevada Revised Statutes: Water Controls (Title 40, Chapter 445A)

Nevada Revised Statutes, Chapter 445A, Water Controls, classifies the waters of the state, establishes standards for the quality of all waters in the state, and specifies permit and notification provisions for stormwater discharges and for other discharges to the waters of the state according to provisions of the Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) and the Safe Drinking Water Act of 1974 (42 U.S.C. 300 *et seq.*). These statutes and regulations in the Nevada Administrative Code set drinking water standards, specifications for certification, and conditions for issuance of variance and exemptions; set standards and requirements for the construction of wells and other water-supply systems; establish the different classes of wells and aquifer exemptions; and establish requirements for well operation and monitoring, plugging, and abandonment activities.

Additionally, the Nevada Division of Environmental Protection, Bureau of Water Pollution Control, requires a temporary permit to work in waterways of the state (that is, a rolling stock permit) before using equipment in waters of the state, including dry washes, that could directly discharge pollutants into waters of the state. Construction of the rail line would require installation of drainage ***culverts*** or bridges to cross some of the washes and streambeds and other construction activities in channels. DOE would have to obtain a permit for such work.

6.3.4.4 Nevada Revised Statutes: Adjudication of Vested Water Rights, Appropriation of Public Waters; Underground Water and Wells (Title 48, Chapters 533 and 534)

Nevada Revised Statutes, Chapters 533 and 534, and accompanying regulations in the Nevada Administrative Code, Chapters 533 and 534, establish permitting procedures for appropriating public waters of the state, including underground waters for beneficial use. The withdrawal of underground water in Nevada requires a permit from the Nevada State Engineer. DOE intends to meet water needs through construction of new wells and would need to apply for water rights with the Nevada State Engineer for construction of wells along the proposed rail alignment.

6.3.4.5 Floodplain Management and Protection of Wetlands (Executive Orders 11988 and 11990)

Executive Order 11988 requires federal agencies to ensure that the agency evaluates the potential effects of any proposed action on ***floodplains***; to ensure that planning programs and budget requests reflect consideration of flood hazards and floodplain management; and to prescribe procedures to implement the policies and requirements of the Order. Federal agencies are required to reduce risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains.

Executive Order 11990 requires that federal agencies "…take action to minimize the destruction, loss, or degradation of wetlands," and to consider wetland protection in decision making. It should be noted that exclusion of isolated (nonjurisdictional) wetlands is not indicated in the Executive Order.

DOE issued regulations that implement these Executive Orders (10 CFR Part 1022, Compliance with Floodplain/Wetlands Environmental Review Requirements). In accordance with this regulation, specifically 10 CFR 1022.11(d), DOE must prepare a floodplain assessment for proposed actions that would take place in floodplains and a wetlands assessment for proposed actions that would take place in wetlands. DOE must also avoid to the extent possible the long- and short-term adverse impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative.

To meet the requirements of 10 CFR Part 1022, Appendix F, Floodplain and Wetlands Assessment, includes a detailed analysis of floodplains and wetlands within the Caliente and Mina rail alignments regions of influence.

6.3.5 POLLUTION PREVENTION AND CONTROL

6.3.5.1 Pollution Prevention Act (42 U.S.C. 13101 *et seq.*)

The Pollution Prevention Act of 1990 (42 U.S.C. 13101 *et seq.*) establishes a national policy for waste management and pollution control that focuses first on source reduction, and then on environmentally safe waste recycling, treatment, and disposal. Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, directs federal agencies to implement sustainable practices for pollution and waste prevention and recycling.

6.3.5.2 Comprehensive Environmental Response, Compensation, and Liability Act, as Amended (42 U.S.C. 9601 *et seq.*)

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601 *et seq.*), authorizes the U.S. Environmental Protection Agency to require responsible site owners, operators, arrangers, and transporters to clean up releases of hazardous substances, including certain radioactive substances. Under this Act, the Environmental Protection Agency has the authority to regulate hazardous substances at rail line construction zones in the event of a release or a "substantial threat of a release." DOE would report any releases greater than reportable quantities of hazardous substances (as codified in 40 CFR Part 302 under the Comprehensive Environmental Response, Compensation, and Liability Act) to the National Response Center, extremely hazardous substances (as codified in 40 CFR Part 355 under the Emergency Planning and Community Right-to-Know Act) to the State Emergency Response Commission contacts for Nevada, and substances classified as both hazardous and extremely hazardous to both the National Response Center and the State Emergency Response Commission contacts for Nevada. Nevada Administrative Code, Sections 445A.226 through 445A.22755, provide action levels for contaminated sites, including levels for groundwater, surface water, and soil. In the event of a release of hazardous substances during construction and operation of the proposed railroad, DOE would clean up releases in a manner that complies with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended.

6.3.5.3 Resource Conservation and Recovery Act, as Amended (42 U.S.C. 6901 *et seq.*)

The treatment, storage, and disposal of hazardous and nonhazardous waste is regulated by the provisions of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 and the Hazardous and Solid Waste Amendments of 1984 (42 U.S.C. 6901 *et seq.*), and applicable state laws. Environmental Protection Agency regulations implementing the ***hazardous waste*** portions of the Resource Conservation and Recovery Act define hazardous wastes and specify requirements for their transportation, handling, treatment, storage, and disposal (40 CFR Parts 260 through 272). Immediate response actions and cleanup of spills are specified in 40 CFR Part 263.

Subtitle C of the Resource Conservation and Recovery Act requires that Resource Conservation and Recovery Act hazardous wastes be characterized and managed. DOE would track the amount of hazardous wastes that would be generated each month during proposed railroad construction and operations, including a log of materials and weight of all generated hazardous wastes. DOE would monitor waste-generator status and would comply in accordance with the applicable Subtitle C regulations. Nevada Administrative Code, Sections 444.850 to 444.8746, are the governing requirements for wastes generated under Subtitle C.

Subtitle D of the Resource Conservation and Recovery Act sets forth definitions, methods of disposal, and special requirements for solid-waste collection, transportation standards; and classification of landfills. Subtitle D focuses on state and local governments as the primary planning, regulating, and implementing entities for the management of nonhazardous solid waste, such as household garbage and nonhazardous industrial solid waste. The governing requirements for wastes generated in Nevada under Subtitle D are Nevada Revised Statutes, Sections 444.440 to 444.620, and Nevada Administrative Code, Sections 444.570 to 444.7499. DOE plans to dispose of solid waste from railroad construction and operations at commercial or municipal landfill facilities that meet Subtitle D requirements.

6.3.5.4 Federal Insecticide, Fungicide, and Rodenticide Act, as Amended (7 U.S.C. 136 *et seq.*)

The primary focus of the Federal Insecticide, Fungicide, and Rodenticide Act of 1948, as amended (7 U.S.C. 136 *et seq.*), and the Act's implementing regulations (40 CFR Parts 152 through 186), is to provide federal control of pesticide distribution, sale, and use. The Nevada Pesticides Act, Nevada Administrative Code, Chapter 586, and Nevada Revised Statutes, Sections 586.010 through 586.450, also regulate pesticide distribution and use, and require registration with the state. DOE would comply with federal and state laws in the application and storage of pesticides during construction and operation of the proposed railroad.

6.3.5.5 Noise Control Act, as Amended (42 U.S.C. 4901 *et seq.*)

Section 4 of the Noise Control Act of 1972, as amended (42 U.S.C. 4901 *et seq.*), directs federal agencies to carry out programs in their jurisdictions "to the fullest extent within their authority" and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare. This law provides requirements related to noise that would be generated by construction and operations activities associated with the proposed railroad. The STB, a cooperating agency on this Rail Alignment EIS, has environmental review regulations for noise analysis (49 CFR 1105.7e(6)) with the following criteria:

- An increase in noise exposure as measured by day-night average noise level of 3 ***A-weighted decibels*** or more.
- An increase to a noise level of 65 A-weighted decibels ***day-night average noise level*** or greater.

DOE used these environmental review regulations to analyze potential train noise for this Rail Alignment EIS.

6.3.5.6 Strengthening Federal Environmental, Energy, and Transportation Management (Executive Order 13423)

Executive Order 13423 sets goals for federal agencies in the areas of energy efficiency, acquisition, renewable energy, toxics reductions, recycling, renewable energy, sustainable buildings, electronics stewardship, fleets, and water conservation. In addition, this Order requires more widespread use of Environmental Management Systems as the framework in which to manager and continually improve these sustainable practices. DOE would comply with the provisions of this Order during construction and operation of the proposed railroad.

6.3.6 CULTURAL RESOURCES

To meet federal historic preservation laws and regulations and NEPA (40 CFR 1500 through 1508) mandates, DOE would identify and evaluate all cultural resources in the regions of influence along the Caliente rail alignment and the Mina rail alignment, including prehistoric, historic, and American Indian, and assess the potential for adverse impacts during construction and operation of the proposed railroad. The National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 *et seq.*), is the primary source of regulatory requirements for the protection of cultural resources (see Section 6.3.6.1). Sections 6.3.6.2 through 6.3.6.8 describe other sources of regulatory requirements.

6.3.6.1 National Historic Preservation, as Amended (16 U.S.C. 470 *et seq.*)

The National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 *et seq.*), provides for the placement of sites with significant national historic value on the *National Register of Historic Places*. It requires no permits or certifications. In this Rail Alignment EIS, DOE evaluated proposed railroad construction activities that could have a potential effect on historic resources pursuant to a programmatic agreement with the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, all). The programmatic agreement provides that, prior to commencement of any ground-disturbing construction activities, an appropriate level of field investigation including on-the-ground intensive surveys, evaluations of all recorded resources on the *National Register of Historic Places*, assessments of adverse effects, and applicable ***mitigation*** of identified impacts be completed. The BLM manages most of the land over which DOE would construct the proposed railroad; therefore, relevant provisions of the programmatic agreement would apply. Additionally, in cooperation with the BLM and the STB, the programmatic agreement requires DOE to make a good faith effort to consult with tribes and identify affected ethnic groups, to identify properties of traditional religious and cultural importance, inform the consulting parties of the eligibility of properties for listing on the *National Register of Historic Places*, and suggest appropriate treatment to avoid adverse impacts to historic properties. Appendix B of this Rail Alignment EIS describes the consultation process.

6.3.6.2 American Antiquities Act (16 U.S.C. 431 *et seq.*)

The American Antiquities Act of 1906 (16 U.S.C. 431 *et seq.*) protects historic and prehistoric ruins, monuments, and objects of antiquity including vertebrate paleontological resources, on federally owned or controlled lands. If historic or prehistoric ruins or objects were found during construction of the proposed railroad, DOE would follow provisions of this Act to minimize or mitigate adverse effects.

6.3.6.3 Archaeological Resources Protection Act, as Amended (16 U.S.C. 470aa *et seq.*)

The Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa *et seq.*), requires a permit for excavation or removal of archaeological resources from publicly held or American Indian lands. The Act requires that excavations further archaeological knowledge in the public interest, and that the resources removed remain the property of the United States. Requirements of this Act would apply to any proposed excavation activity that resulted in identification of archaeological resources.

6.3.6.4 Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq.*)

The Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 *et seq.*) directs the Secretary of the Interior to guide the repatriation of federal archaeological collections and collections that are culturally affiliated with American Indian tribes and held by museums that receive federal funding. Actions required by this law include establishing a review committee with monitoring and policy-making responsibilities, developing regulations for repatriation, including procedures for identifying lineal descent or cultural affiliation needed for claims, overseeing museum programs designed to meet the inventory requirements and deadlines of this law, and developing procedures to handle unexpected discoveries of graves or grave artifacts during activities on federal or tribal land. DOE would follow the provisions of this Act if any excavations associated with the proposed railroad construction led to unexpected discoveries of American Indian graves or grave artifacts.

6.3.6.5 American Indian Religious Freedom Act (42 U.S.C. 1996)

The American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996) reaffirms American Indian religious freedom under the First Amendment of the U.S. Constitution, and establishes policy to protect and preserve the inherent and Constitutional right of American Indians to believe, express, and exercise their traditional religions. This law ensures the protection of sacred locations and access of American Indians to those sacred locations and traditional resources that are integral to the practice of their religions. It also establishes requirements that would apply to American Indian sacred locations, traditional resources, or traditional religious practices potentially affected by construction and operation of the proposed railroad.

6.3.6.6 Protection and Enhancement of the Cultural Environment (Executive Order 11593)

Executive Order 11593 directs federal executive agencies to locate, catalog, and nominate properties under their jurisdiction or control to the *National Register of Historic Places*. DOE would follow the provisions of this Order during construction of the proposed railroad.

6.3.6.7 Indian Sacred Sites (Executive Order 13007)

Executive Order 13007 directs federal agencies, to the extent permitted by law and not inconsistent with agency missions, to avoid adverse effects to sacred sites and to provide access to those sites to American Indians for religious practices. The Order directs agencies to plan projects in a manner that allows protection of and access to sacred sites to the extent compatible with the project. DOE would follow the provisions of this Order during construction and operation of the proposed railroad.

6.3.6.8 Consultation and Coordination with Indian Tribal Governments (Executive Order 13175)

Executive Order 13175 directs federal agencies to establish regular and meaningful consultation and collaboration with tribal governments in developing federal policies that have tribal implications, to strengthen U.S. government-to-government relationships with American Indian tribes, and to reduce the imposition of unfunded mandates on tribal governments. DOE has and will continue to follow the provisions of this Order during construction and operation of the proposed railroad through regular consultation with the Consolidated Group of Tribes and Organizations, which consists of officially appointed tribal representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE.

6.3.7 BIOLOGICAL RESOURCES

6.3.7.1 Endangered Species Act, as Amended (16 U.S.C. 1531 *et seq.*)

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), provides for the conservation of ***threatened*** and ***endangered species*** and the ***ecosystems*** upon which those species rely. If construction or operation of the proposed railroad could affect threatened or endangered species, or their designated critical ***habitat***, DOE would be required to assess the potential impact and develop measures to minimize the impact. If there would be potential adverse impacts to a listed species or designated critical habitat, DOE would be required to consult formally with the U.S. Fish and Wildlife Service in compliance with Section 7 of the Act. As part of the Section 7 consultation, DOE would have to prepare a Biological Assessment and provide it to the Fish and Wildlife Service. The Fish and Wildlife Service would then prepare a Biological Opinion making a determination as to whether the Proposed Action would jeopardize the continued existence of the species under consideration. If the Fish and Wildlife Service rendered a non-jeopardy opinion, but a finding that some individuals could be killed or otherwise harmed incidentally by the Proposed Action, the Fish and Wildlife Service could determine that such losses are not prohibited, so long as measures outlined in a permit to incidentally take a listed species were followed. The permit would include limits on the taking of a listed species and its designated critical habitat and mandatory terms and conditions for minimizing the take. Regulations implementing the applicable interagency consultation process of the Endangered Species Act are codified at 50 CFR Part 402.

If the Fish and Wildlife Service determines that the proposed federal action jeopardizes a listed species or adversely modifies its designated critical habitat, the Secretary of the Interior suggests alternatives to the proposed action that would not violate the action. Then federal agencies must decide whether to modify the project as suggested, abandon it, or file an application for an exemption. Regulations that describe the exemption process are found in 50 CFR Parts 450 through 453.

6.3.7.2 Fish and Wildlife Coordination Act, as Amended (16 U.S.C. 661 *et seq.*)

The Fish and Wildlife Coordination Act of 1934, as amended (16 U.S.C. 661 *et seq.*), promotes effectual planning and cooperation between federal, state, public, and private agencies for the conservation and rehabilitation of the Nation's fish and wildlife, and authorizes the U.S. Department of the Interior to provide assistance. The Act requires that when a department or agency of the U.S. Government modifies the waters, or channel of a body of water, the department or agency must consult with the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and the state agency that administers wildlife resources in the affected state. DOE consultation with appropriate federal and State of Nevada agencies regarding construction and operation of the proposed railroad would be in compliance with the requirements of this Act.

6.3.7.3 Migratory Bird Treaty Act, as Amended (16 U.S.C. 703 seq.)

The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 *et seq.*), protects birds that have common migration patterns between the United States, Canada, Mexico, Japan, and Russia. It also regulates the take and harvest of migratory birds. All species of birds found along the proposed rail alignments are protected by the Migratory Bird Treaty Act with the exceptions of European starlings (*Sturnus vulgaris*), rock doves (pigeons; *Columba livia*), and house sparrows (*Passer domesticus*), and any game species having legal harvest seasons set by the Nevada Department of Wildlife. DOE would implement methods during proposed railroad construction and operation, including surveys for nesting birds and restrictions on the timing of construction, to prevent the take of migratory birds.

6.3.7.4 Bald and Golden Eagle Protection Act, as Amended (16 U.S.C. 668 through 668d)

The Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. 668 through 668d), makes it illegal to take, pursue, molest, or disturb bald eagles (American, *Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), their nests, or their eggs anywhere in the United States (Sections 668 and 668c). The U.S. Department of the Interior regulates activities that might adversely affect bald and golden eagles.

6.3.7.5 The Wild Free-Roaming Horses and Burros Act, as Amended (16 U.S.C. 1331 *et seq.*)

The Wild Free-Roaming Horses and Burros Act of 1971, as amended (16 U.S.C. 1331 *et seq.*), requires the protection, management, and control of wild free-roaming horses and burros on ***public lands***. The Act states that "wild free-roaming horses and burros shall be protected from capture, branding, harassment, or death; and to accomplish this they are to be considered in the area where presently found, as an integral part of the natural system of the public lands." DOE would construct and operate the railroad in compliance with the provisions of this Act.

6.3.7.6 National Wildlife Refuge System Administration Act, as Amended (16 U.S.C. 668dd)

The National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd), provides guidelines for the administration and management of lands, including "wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas." If use of lands for the proposed railroad could affect lands in the National Wildlife Refuge System, DOE would consult with the U.S. Fish and Wildlife Service. Regulations implementing the Act are codified at 50 CFR Parts 25 and 27 through 29.

6.3.7.7 Nevada Revised Statutes: Protection and Preservation of Timbered Lands, Trees, and Flora (Title 47, Chapter 527)

Nevada Revised Statutes, Chapter 527, specifies protection of the indigenous flora of the State of Nevada. If the state determines that a species or subspecies of native flora is threatened with extinction, that species or subspecies is to be placed on the state list of fully protected species. No member of the species or subspecies may be taken or destroyed unless an authorized state official issues a special permit.

6.3.7.8 Nevada Revised Statutes: Hunting, Fishing, and Trapping; Miscellaneous Protective Measures (Title 45, Chapter 503)

Nevada Revised Statutes, Chapter 503, Hunting, Fishing, and Trapping, Miscellaneous Protective Measures, and Nevada Administrative Code, Chapter 503, Sections 010 through 104, specify procedures for the classification and protection of wildlife. No member of a species classified as protected may be hunted, taken, or possessed without first obtaining a permit or written authorization from the Nevada Department of Wildlife. Nevada Revised Statute, Chapter 527, Protection and Preservation of Timbered

Lands, Trees, and Flora, also applies to the permit requirement. No protected species would be hunted, taken, or possessed during construction or operation of the proposed railroad.

6.3.7.9 Nevada Revised Statutes: Control of Insects, Pests, and Noxious Weeds (Title 49, Chapter 555)

Nevada Revised Statutes, Chapter 555, Control of Insects, Pests, and Noxious Weeds, specifies the laws by which the Nevada Department of Agriculture designates and regulates ***noxious weeds*** and pests. Clearing vegetation and disturbing the soil during construction would create habitat for colonization by noxious weeds present along the rail line. DOE would minimize such impacts, in compliance with the provisions in this Nevada Statute, by developing and implementing a weed management program, which could include reclamation of disturbed areas that would enhance the recovery of native vegetation and reduce colonization by exotic species.

6.3.7.10 Invasive Species (Executive Order 13112)

Executive Order 13112 directs federal agencies to act to prevent the introduction of, or to monitor and control, nonnative or invasive plant species, to provide for restoration of ***native plant species***, to conduct research, to promote educational activities, and to exercise care in taking actions that could promote the introduction or spread of ***invasive species***. DOE would minimize such impacts, in compliance with the provisions in this Executive Order, by developing and implementing a weed management program.

6.3.7.11 Responsibilities of Federal Agencies to Protect Migratory Birds (Executive Order 13186)

Executive Order 13186 requires federal agencies to avoid or minimize the negative impacts of their actions on migratory birds and to take active steps to protect birds and their habitats. The Order directs each federal agency whose action has, or is likely to have, a negative impact on migratory bird populations to develop an agreement with the U.S. Fish and Wildlife Service to conserve those birds. The Order directs agencies to avoid or minimize the impact on migratory bird populations, to take reasonable steps that include restoring and enhancing bird habitats, to prevent or abate pollution that would affect birds, and to incorporate migratory bird conservation into agency planning processes when possible. The Order also requires environmental analyses of federal actions to evaluate effects of those actions on migratory birds, to control the spread and establishment in the wild of exotic animals and plants that could harm migratory birds and their habitats, and either to provide advance notice of actions that could result in the taking of migratory birds or to report annually to the U.S. Fish and Wildlife Service on the numbers of each species taken during the conduct of agency actions. Section 4.12 of this Rail Alignment EIS, Biological Resources, discusses potential impacts to migratory birds. DOE would implement methods during proposed railroad construction and operation, including surveys for nesting birds and restrictions on the timing of construction, to prevent the take of migratory birds.

6.3.8 LAND USE

Land uses that could be affected by the proposed railroad are under the jurisdiction of federal, state, county, and municipal plans and policies. Lincoln, Nye, and Esmeralda Counties have land-use plans (*Lincoln County Master Plan* [DIRS 174520-State of Nevada 2001, all]; *Adoption of the Nye County Comprehensive Plan* [DIRS 147994-McRae 1994, all]; *Master Plan Esmeralda County, Nevada* [DIRS 176770-Duval et al. 1976, all]). Approximately 99 percent of the lands along the Caliente and Mina rail alignments are BLM-administered public lands. The BLM administers the uses of lands along the Caliente rail alignment through ***resource management plans*** including the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), the *Draft Ely Resource*

Management Plan (when it is finalized; DIRS 174518-BLM 2005, all), and the *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (DIRS 176043-BLM 1998, all). The BLM administers the uses of lands along the Mina rail alignment through the *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all), the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), and the *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (DIRS 176043-BLM 1998, all).

6.3.8.1 Federal Land Policy and Management Act (43 U.S.C. 1701 *et seq.*)

The Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq*.) established procedures for acquiring access to public lands. The regulations regarding withdrawals of public-domain land from public use, as codified in 43 CFR Part 2300, and the establishment of right-of-way reservations, as codified in 43 CFR Part 2800, primarily govern access to, and use of, BLM-administered lands. Section 6.6 describes this Act.

6.3.8.2 Materials Act (30 U.S.C. 601 *et seq.*)

The Materials Act of 1947 (30 U.S.C. 601 *et seq.*) authorizes land management agencies such as the BLM to make common varieties of sand, stone, and gravel from public lands available to federal and state agencies under a ***free-use permit***. Regulations implementing the Materials Act are codified at 43 CFR Part 3600. To use common varieties of sand, stone, and gravel from public lands during construction of the proposed railroad, DOE would obtain free-use permits from the BLM.

6.3.8.3 Taylor Grazing Act, as Amended (43 U.S.C. 315 *et seq.*)

The Taylor Grazing Act of 1943, as amended (43 U.S.C. 315 *et seq.*), establishes processes by which the BLM grants and administers grazing rights. Regulations implementing the Taylor Grazing Act are codified at 43 CFR Parts 2300 and 4100 and include provisions for the agency to consider in administering grazing rights.

6.3.8.4 Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*)

The Farmland Protection Policy Act of 1981 (7 U.S.C. 4201 *et seq.*) seeks to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion to nonagricultural uses of farmlands with soils that are identified as prime and unique or of statewide and local importance. To comply with this law, DOE has coordinated with the U.S. Department of Agriculture, Natural Resources Conservation Service, to identify ***prime farmlands*** that could be affected by the proposed action and to evaluate impacts to those lands. Regulations implementing the Farmland Protection Policy Act are codified at 7 CFR Part 658.

6.3.8.5 Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4651 *et seq.*)

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4651 *et seq.*) encourages and expedites the acquisition of real property by agreements with owners; avoids litigation, including condemnation actions where possible, and relieves congestion in the courts; provides for consistent treatment of owners; and promotes public confidence in federal land-acquisition practices. For those portions of the rail line that would cross private land, DOE could negotiate a long-term lease with the landowner or transfer the land to federal ownership in accordance with this Act.

6.3.8.6 General Mining Law, as Amended (30 U.S.C. 22 through 54)

The Mining Law of 1872, as amended (30 U.S.C. 29; 43 CFR 3860) (30 U.S.C. 22 through 54), was one of a number of public land laws passed by Congress in the late 1800s to encourage settlement, development, and private ownership of the public-domain lands in the western United States. The Mining Law of 1872 enables public citizens and the mining industry the right to claim, settle on, develop mineral resources, and acquire title to public lands administered by the BLM and the U.S. Forest Service (an agency of the U.S. Department of Agriculture).

The Mining Law Administration program managed by the BLM involves primarily the last three elements: recordation, maintenance (annual work/surface management), and mineral patents. Surface management on National Forest System lands is administered by the Forest Service.

6.3.9 CONSTRUCTION- AND OPERATIONS-RELATED STATUTES AND REGULATIONS

6.3.9.1 Communications Act, as Amended (47 U.S.C. 308 *et seq.*)

The Communications Act of 1934, as amended by the Telecommunications Act of 1996 (47 U.S.C. 308 *et seq.*), and regulations of the Federal Communications Commission require an agency to obtain Federal Communications Commission permission to construct a private broadcasting system. DOE would need to obtain permission to use an assigned frequency, and the Federal Communications Commission would have to approve the design and location of the system prior to construction. The communication system for the proposed railroad would consist of a fiber optic cable along the length of the line with broadcasting antenna located within the ***operations right-of-way*** at sufficient intervals to allow complete coverage of train-to-dispatch radio communications. DOE would obtain Federal Communications Commission approval to construct and operate this radio system and install a fiber optics line.

6.3.9.2 Construction Camp Permits (Title 40, Chapter 444.130; NAC 444.550 through 444.566)

The Nevada State Health Division specifies conditions and requires permits for construction and labor camps in Nevada (Nevada Revised Statutes, Chapter 444.130 *et seq.*, and Nevada Administration Code, Chapters 444.550 through 444.566). These statutes and regulations are designed to maintain sanitary and healthy conditions at construction and labor camps in Nevada. They would apply to the design and operation of construction camps that DOE would establish during construction of the proposed railroad.

6.3.9.3 Occupancy Permits to Cross State Highways

The Nevada Department of Transportation and the Nevada Public Utilities Commission regulate rail crossings of public highways. The Nevada Department of Transportation requires an occupancy permit to place a facility (including a railway) within a right-of-way of a state highway (Nevada Administrative Code, Section 408.427). The Public Utilities Commission must approve the placement of railroad tracks across public highways prior to construction of the tracks (Nevada Administrative Code, Section 703.455). DOE would have to obtain similar approvals for construction of access roads, water pipelines, and other ***infrastructure*** that would intersect highway rights-of-way.

The STB would regulate the proposed railroad if DOE implemented the Shared-Use Option. In this case, the Federal Railroad Safety Act of 1970, as amended (49 U.S.C. 20106 *et seq.*), could preempt Nevada regulations related to railroad safety. However, DOE would still design and construct highway crossings to address the concerns of Nevada regulatory agencies.

6.4 U.S. Department of Energy Orders

Under the authority of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 through 2259), DOE is responsible for establishing a comprehensive health, safety, and environmental program for its activities and facilities. DOE has established a framework for managing its facilities through the promulgation of regulations and the issuance of DOE Orders that set forth policies, programs, and procedures for implementing activities. DOE Orders are a component of DOE Directives that also include Policies, Notices, Manuals, and Guides, all of which are intended to direct, guide, inform, and instruct employees in the performance of their jobs, and enable them to work effectively within the Department and with agencies, contractors, and the public. Table 6-4 lists DOE Orders that could be relevant to construction and operation of the proposed railroad.

Table 6-4. Potentially applicable DOE Orders (page 1 of 2).

Order number and date of last revision	Subject	Description[a]
151.1C 11/02/05	Comprehensive Emergency Management System	Establishes requirements for emergency planning, preparedness, response, recovery, and readiness assurance activities and describes the approach for effectively integrating these activities under a comprehensive, all-emergency concept.
231.1A 06/03/04	Environment, Safety, and Health Reporting	Establishes the requirements procedures for information with environmental protection, safety, or protection significance for DOE operations.
252.1 11/19/99	Technical Standards	Requires that appropriate voluntary consensus standards (codes and standards) be selected, used, and adhered to for the design, testing, etc., of the proposed railroad.
413.3 07/28/06	Project Management	Demonstrates that DOE will support the development of documentation for the critical-decision process.
414.1C 06/17/05	Quality Assurance	Establishes an effective quality assurance management system using the performance requirements of this Order, coupled with technical standards, where appropriate.
420.1B 12/22/05	Facility Safety	Where no specific requirements are specified concerning natural phenomena hazard mitigation, requires model building codes or national consensus industry standards to be used in the design of the proposed railroad facilities.
430.1B 09/24/03	Life-Cycle Asset Management, Building Codes, and Value Engineering	Establishes procedures to follow in all phases of the management of DOE facilities.
430.2A 04/15/02	Energy Management	Requires design for the proposed railroad to be in compliance with the energy management plan, sustainable design, and water efficiency required by this Order.
440.1A 03/27/98	Worker Protection Management for DOE, Federal and Contractor Employees, and Fire Protection	Establishes a comprehensive worker protection program that ensures that DOE and its contractor employees have an effective worker protection program to reduce or prevent injuries, illnesses, and accidental losses by providing DOE, federal, and contractor workers with a safe and healthful workplace.
450.1 01/03/07	Environmental Protection Program	Establishes DOE policy to conduct its operations in an environmentally safe and sound manner and to conduct its activities in compliance with applicable laws and regulations through implementation of environmental management systems at DOE sites.

Table 6-4. Potentially applicable DOE Orders (page 2 of 2).

Order number and date of last revision	Subject	Description[a]
451.1B[b] 09/28/01	NEPA Compliance Program	Establishes DOE requirements and responsibilities for complying with NEPA.
460.1B 4/4/03	Packaging and Transportation Safety	Establishes requirements and assigns responsibilities for the safe transport of hazardous materials, hazardous substances, hazardous wastes, and radioactive materials.
460.2A 12/22/04	Transportation and Packaging Management	Establishes DOE polices and requirements to supplement applicable laws, rules, regulations, and other DOE Orders for materials, transportation and packaging operations.
470.2B 10/31/02	Independent Oversight and Performance Assurance Program	Prescribes the requirements and responsibilities to enhance safeguards and security; cyber security; emergency management; environment, safety, and health programs; and other critical functions by providing an independent evaluation of the adequacy of DOE policy and the effectiveness of line management performance.
470.4 08/26/05	Safeguards and Security System Design	Requires the design of the proposed railroad facilities to provide site-specific safeguards and security protection or to tailor the physical protection elements in a number of areas, as described in the Order.
5400.5 01/07/93	Protection of Public from Radiation Risks	Establishes standards and requirements for operations of DOE and DOE contractors for protection of members of the public and the environment against undue risk from radiation.
5480.19 10/23/01	Conduct of Operations Requirements for DOE Facilities	Provides requirements and guidelines for departments to use in developing directives, plans, and procedures for conducting operations at DOE facilities that should result in improved quality and uniformity of operations.

a. DOE = U.S. Department of Energy; NEPA = National Environmental Policy Act.
b. DOE Order 451.1B was modified by a DOE Notice (DOE N 451.1, 10/6/06).

6.5 Bureau of Indian Affairs Requirements

The regulations at 25 CFR Part 169 prescribe the procedures, terms, and conditions under which the U.S. Department of the Interior, Bureau of Indian Affairs, may grand rights-of-way over and across tribal land, individually owned land, and Federal Government-owned land; subsection 169.23 outlines that rights-of-way for railroads shall not exceed 50 feet in width on each side of the centerline of the railroad, except where there are heavy ***cuts*** and ***fills***, when they shall not exceed 100 feet in width. The regulations at 25 CFR Part 162 identify the conditions and authorities under which the Bureau of Indian Affairs may lease certain interests in Indian land and Federal Government land.

6.6 Bureau of Land Management Requirements

As a cooperating agency, the BLM may adopt this Rail Alignment EIS for the disclosure and analysis of potential environmental impacts, as required by NEPA.

The Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq*.) established procedures for acquiring access to public lands. The regulations regarding ***withdrawals*** of public-domain land from public use, as codified at 43 CFR Part 2300, and the establishment of right-of-way reservations, as codified at 43 CFR Part 2800, primarily govern access to, and use of, BLM-administered lands. Construction and operation of a proposed railroad along either the Caliente rail alignment or the Mina rail alignment would require access to BLM-administered lands through application to the BLM for a

right-of-way grant. A right-of-way grant is an instrument issued pursuant to Title V of the Federal Land Policy and Management Act authorizing the use of a right-of-way over, upon, under, or through public lands for construction, operation, maintenance, and termination of a project.

The BLM-authorized officer considers whether the application is in compliance with the purpose for which the public lands are managed and the public interest. The Federal Land Policy and Management Act requires the authorized officer, prior to issuing a right-of-way grant or temporary-use permit, to perform the following tasks:

- Complete an environmental analysis in accordance with NEPA using the Council on Environmental Quality regulatory provisions for implementing NEPA (40 CFR Parts 1500 through 1508) as the review guidelines.
- Determine compliance of the applicant's proposed plan with applicable federal and state laws.
- Consult with all other federal, state, and local agencies having an interest.
- Take any other action necessary to fully evaluate and make a decision to approve or deny the application and prescribe suitable terms and conditions for the grant (reservation) or permit.

The BLM-authorized officer may hold public meetings on an application for a right-of-way grant if it is determined that such meetings are appropriate and that sufficient public interest exists to warrant the time and expense for such meetings.

Requirements of the application for a right-of-way grant are outlined at 43 CFR 2802.3. Requirements include a description of the proposal and a map (aerial photo or equivalent) showing the approximate location of the proposed right-of-way and facilities on public lands and existing improvements adjacent to the proposal. The BLM-authorized officer may require the applicant to submit additional information such as a description of the ***common segments*** and ***alternative segments*** considered; a statement of need and economic feasibility of the proposal; and a statement of the environmental, social, and economic effects of the proposal.

The regulations specify that all right-of-way grants assigned under 43 CFR Part 2800 contain terms, conditions, and stipulations as required by the authorized officer regarding extent, duration, survey, location, construction, operation, maintenance, use, and termination. Stipulations typically include the following requirements:

- Restoration, revegetation, and curtailment of erosion of the surface of the land, or any other rehabilitation measure determined necessary
- Assurance that activities in connection with the grant or permit do not violate applicable air- and water-quality standards or related facility siting standards established by or pursuant to applicable federal or state law
- Controls or prevention of damage to scenic, aesthetic, cultural, and environmental values including damage to fish and wildlife habitat, damage to federal property, and hazards to public health and safety
- Compliance with state standards for public health and safety, environmental protection and siting, construction, operation, and maintenance, when those standards are more stringent than federal standards

The Federal Land Policy and Management Act, by which the government accomplishes most federal land withdrawals, contains a detailed procedure for application, review, and study by the BLM of the withdrawal of public domain land. The BLM submits the application to the Secretary of the Interior for approval of the terms and conditions of withdrawal. Withdrawals accomplished through the Act remain valid for no longer than 20 years unless extended after further review and approval by the Secretary of the Interior.

On December 19, 2003, DOE submitted *Application for Administrative Land Withdrawal for Potential Rail Corridor* (DIRS 177745-Arthur 2003, all) to the BLM, pursuant to Section 204 of the Federal Land Policy and Management Act. The purpose of the application was to withdraw 124.9 square kilometers (308,600 acres) of public land encompassing the Caliente rail corridor from ***surface entry*** and new ***mining claims*** for 20 years to evaluate the land for potential construction and operation of the proposed railroad. On December 29, 2003, the BLM issued a notice in the *Federal Register* of the proposed land withdrawal (*Notice of Proposed Withdrawal and Opportunity for Public Meeting*; *Nevada*, 68 *FR* 74965).

The notice segregated the land from surface entry and mining for a period of up to 2 years to allow a ***case file*** containing various studies and analyses to be prepared to support a final decision on the withdrawal application. The action would not transfer the land to DOE control. The BLM would continue to manage the withdrawal area in compliance with BLM resource management plans. In a May 21, 2004, Notice of Public Meetings, the BLM invited the public to submit written comments and gave notice of two public scoping meetings on the proposed land withdrawal and possible land-use plan amendments (*Notice of Public Meetings; Notice of Intent to Amend the Caliente Management Framework Plan, Schell Management Framework Plan, Tonopah Resource Management Plan, and the Las Vegas Resource Management Plan; Nevada*; 69 *FR* 29323). Separately from this Rail Alignment EIS, DOE prepared and released an environmental assessment in December 2005, *Environmental Assessment for the Proposed Withdrawal of Public Lands Within and Surrounding the Caliente Rail Corridor, Nevada* (DIRS 176452-DOE 2005, all), proposing the continued segregated effect of the land by withdrawing the land for a preferred period of 10 years. On December 28, 2005, the BLM withdrew the requested lands, subject to valid existing rights, from settlement, sale, location, or entry under general land laws, including the United States mining laws (30 U.S.C. Chapter 2), but not from leasing under the mineral leasing laws (for example, the Mineral Leasing Act of 1920, as amended [30 U.S.C. 181 *et seq.*]), for a period of 10 years (70 *FR* 76854).

DOE initiated a further application for land withdrawal and requested that the Secretary of the Interior withdraw a total of 84.19 square kilometers (208,037 acres) of public lands from surface entry and mining through December 27, 2015. Thereby the BLM issued a notice on January 10, 2007 in the *Federal Register* of this application by DOE (*Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada*; 72 *FR* 1235). This notice included an additional 27.78 square kilometers (68,646 acres) of public lands for evaluation along the Caliente rail corridor, and 56.41 square kilometers (139,391 acres) of public lands for the purpose of evaluating the potential construction, operation, and maintenance of a rail line along a suite of alternative segments and common segments referred to by the DOE as the “Mina Route.” The expiration date for this proposed withdrawal is the same (December 27, 2015) as in the earlier December 28, 2005 BLM land withdrawal.

Implementation of the Proposed Action along the Caliente rail alignment or the Mina rail alignment would require a BLM right-of-way grant for use and access to BLM-administered lands that would be disturbed for rail line construction and operation. The BLM may issue a right-of-way grant for temporary or long-term use of land, and before issuing a right-of-way grant, must complete an environmental analysis in accordance with the National Environmental Policy Act of 1969. As a cooperating agency in the preparation of this Rail Alignment EIS, the BLM may adopt this document as authorized by 40 CFR 1501 to satisfy the NEPA requirements for the right-of-way application.

6.7 U.S. Army Requirements

The U.S. Army is a consulting agency to DOE in the preparation of this Rail Alignment EIS. Under the Mina Implementing Alternative (the nonpreferred alternative), DOE would need to construct and operate the ***Staging Yard*** on the Hawthorne Army Depot in Mineral County. DOE would do so in conformance with existing permits issued to the Hawthorne Army Depot by the State of Nevada, Division of Environmental Protection. Table 6-5 lists the permits for the main site at the Hawthorne Army Depot.

Table 6-5. Permits for the Hawthorne Army Depot main site at Hawthorne, Nevada, issued by the State of Nevada, Division of Environmental Protection.[a]

Permit	Type	Permit number
Class I, Title V, Main Base	Air	AP9711-0863.01
Class I Construction, hazardous waste generator	Air	AP9711-1145
Class I Construction, Bulk Energetics Demilitarization System	Air	AP9711-1489
Wastewater, Plasma Ordnance Demilitarization System	Groundwater	NEV2003516
Wastewater, Western Area Demilitarization Facility	National Pollutant Discharge Elimination System	NV0021946
Stormwater	Clean Water Act	NVR050000
Treatment storage and disposal system, storage open burn, incineration	Resource Conservation and Recovery Act, C	HW0017
Solid-waste and fill	Resource Conservation and Recovery Act, D	Waiver No. SWMI-09-68
Solid-waste landfill	Resource Conservation and Recovery Act, D	SW-1209702
Drinking water	Solid Waste Disposal Act	MI-0357-12C
Water Treatment Facility	Groundwater	NEV2004524

a. Source: DIRS 181385-Millsap 2007, all.

CHAPTER 7. BEST MANAGEMENT PRACTICES AND MITIGATION

This chapter describes the best management practices DOE would implement to help avoid impacts to environmental resources and the measures the Department would consider to mitigate adverse impacts from constructing and operating the proposed railroad under the Caliente Implementing Alternative or the Mina Implementing Alternative, as appropriate. Mitigation measures include only those actions that would be above and beyond compliance with statutory and regulatory requirements and implementation of best management practices DOE has incorporated into the Proposed Action.

Glossary terms are shown in ***bold italics***.

During planning and design of the proposed railroad, the U.S. Department of Energy (DOE or the Department) used various engineering and site evaluation and planning measures to avoid, minimize, or otherwise reduce environmental ***impacts***. These measures included the elimination of certain ***alternative segments*** as unreasonable and moving the location of specific segments. The Department took many of these actions in response to comments received during the scoping periods for this Rail Alignment EIS. As the environmental analyses have progressed, DOE has refined the Caliente ***rail alignment*** and the Mina rail alignment to avoid certain sensitive environmental features and reduce potential impacts to sensitive areas by limiting the project's ***footprint*** in such areas. Chapter 2 and Appendix C describe this process.

As described in Chapter 2 and shown in Figure 7-1, engineering and site evaluation and planning represent the initial step toward avoiding, minimizing, or otherwise reducing the environmental impacts of the Proposed Action.

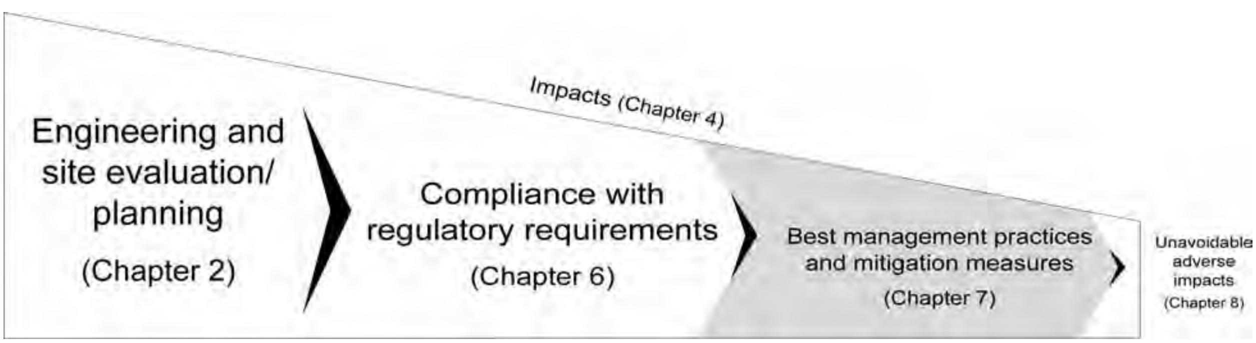

Figure 7-1. Multi-step approach to avoid, minimize, or reduce environmental impacts.

In addition to engineering and site evaluation and planning practices, DOE must also comply with all applicable environmental requirements (see Chapter 6). DOE incorporated a variety of best management practices into the ***Proposed Action*** that relate to these requirements and would further reduce the environmental impacts of constructing and operating the proposed ***railroad***.

After consideration of engineering and site evaluation and planning measures, compliance with environmental requirements, and application of best management practices, DOE would also consider various ***mitigation*** measures to further avoid, minimize, rectify, reduce, or compensate for any remaining adverse environmental impacts. DOE regards mitigation measures as activities or actions that would be above and beyond compliance with statutory and regulatory requirements and the application of the best management practices DOE has incorporated into the Proposed Action.

7.1 Representative Best Management Practices

Best Management Practices

Practices, techniques, methods, processes, and activities commonly accepted and used throughout the construction and railroad industries that DOE would implement as part of the Proposed Action to facilitate compliance with applicable requirements and that provide an effective and practicable means of preventing or minimizing the adverse impacts of an action on human health and the environment.

As part of the Proposed Action, DOE would implement appropriate best management practices to prevent or minimize environmental impacts. Table 7-1 lists, but does not limit, such practices. Some of the representative best management practices listed in Table 7-1 could change depending on the requirements included in permits and ***right-of-way grants*** applicable to construction and operation of the proposed railroad. The table identifies the affected resource area(s) for each best management practice, the requirement(s) the practice would support (see Chapter 6), and the purpose of the practice.

7.2 Mitigation

As the agency responsible for administering the federal lands over which the proposed railroad would cross, the Bureau of Land Management (BLM), an agency of the U.S. Department of the Interior, would have a substantial role in development of any necessary mitigation measures and monitoring requirements on the affected lands.

7.2.1 MITIGATION ACTION PLAN

Mitigation (40 CFR 1508.20) includes:

Avoiding the impact altogether by not taking a certain action or parts of an action.

Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

Compensating for the impact by replacing or providing substitute resources or environments.

DOE regulations at 10 Code of Federal Regulations (CFR) 1021.331 requires the preparation of a mitigation action plan when DOE identifies mitigation commitments in the ***Record of Decision*** for this Rail Alignment EIS. If a mitigation action plan is necessary, it would follow the Record of Decision and would provide details about mitigation commitments and provisions provided in the Record of Decision, if any. DOE must prepare the mitigation action plan before it could take any action authorized by the Record of Decision that would be subject to a mitigation measure or commitment. The Plan would contain:

- An introduction describing the basis, function, and organization of the Plan
- A summary of the impacts to be mitigated
- A description of specific mitigation measures

- A description of the Mitigation Action Plan monitoring and reporting system that DOE would implement to ensure that elements of the Plan were met and were effective

- A schedule for actions and identification of the responsible parties

7.2.2 MONITORING

If DOE implemented the Proposed Action along the Caliente rail alignment or the Mina rail alignment, the Department would implement any mitigation measures and commitments specified in the Record of Decision. As needed, DOE would adapt mitigation measures to accomplish their intended objectives. As required by 40 CFR 1505.2(c), DOE would adopt and summarize a monitoring and enforcement program where applicable for any mitigation.

7.2.3 MITIGATION MEASURES

Table 7-2 summarizes potential mitigation measures for potential impacts along the proposed railroad. Each mitigation measure is linked to an identified potential impact, and is either location specific or global (applicable to the entire appropriate ***region of influence***), depending on the level of knowledge and degree of certainty regarding the extent, duration, and location of the potential impact. Mitigation measures would continue to evolve with project development and could change or become more specific and refined in a mitigation action plan following a Record of Decision for this Rail Alignment EIS (see Section 7.2.1). Consistent with the definition of mitigation described above, the mitigation measures identified in Table 7-2 include only those actions that would be above and beyond compliance with statutory and regulatory requirements and implementation of best management practices DOE has incorporated into the Proposed Action.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 1 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Prior to ground-disturbing activities, collect data to plan for the restoration of disturbed areas and minimize impacts to sensitive ***habitats***. This could include collecting satellite data to identify previously disturbed land, surveying vegetation, and looking for special status species habitat.	Physical Setting Aesthetic Resources Biological Resources	50 CFR Part 402 – Interagency Cooperation Endangered Species Act Of 1973, as Amended	Minimize impacts to sensitive habitats and species. Promote effective restoration efforts.
General employee training for construction personnel would include a desert tortoise education program. Surveys would be conducted prior to clearing vegetation at previously undisturbed sites within the range of the desert tortoise. For areas within the desert tortoise range, a desert tortoise biologist or environmental monitor would be available during construction activities to help ensure that desert tortoises are not inadvertently harmed. Project activities that may endanger desert tortoises would cease if a tortoise is found on a project site and activities would resume only after a biologist or environmental monitor ensures that the tortoise is not in danger or after the tortoise has been moved to a safe area. The worker education program would also include training to prevent the intentional or unintentional take of sensitive or protected plant and animal species, State of Nevada game species, or wild horses and burros.	Biological Resources	Endangered Species Act Of 1973, as Amended	Minimize impacts to desert tortoises.
Minimize groundbreaking or land clearing activities during the critical nesting period for migratory birds, which the BLM defines as May 1 through July 15. If groundbreaking or land-clearing activities must be conducted during the bird nesting season, DOE would conduct surveys for migratory bird nests prior to any of those activities. All activities that would harm nesting birds or result in nest abandonment would be prohibited.	Biological Resources	Migratory Bird Treaty Act	Avoid harm to migratory birds, their nests, and their young.
Coordinate with local Floodplain Administrators to ensure that new project-related stream and ***floodplain*** crossings are appropriately designed to minimize impacts. DOE would incorporate hydraulic modeling into the engineering design process to ensure that all crossings would be designed to limit adverse impacts.	Surface-Water Resources	10 CFR Part 1022 – Compliance with Floodplain/Wetlands Environmental Review Requirements	Minimize risks to streams and floodplains.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 2 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Position temporary pipelines to prevent obstructing or redirecting surface runoff and to prevent obstructing natural drainage channels.	Surface-Water Resources	Clean Water Act of 1977 33 CFR Part 323 NAC 445A – Water Controls	Prevent flooding or surface-water ponding.
Require construction contractors to prepare and submit a stormwater pollution prevention plan. This plan would be prepared consistent with state and federal standards for construction activities and would detail practices that would be employed to minimize soil loss and degradation to nearby water resources. Such practices could include those listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all), and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all).	Surface-Water Resources	40 CFR Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*)	Control site runoff and minimize erosion.
Continue to solicit input from American Indians to identify the potential for impacts to American Indian cultural resources, discuss potential solutions, and avoid adverse impacts. Comply with all regulatory requirements that protect American Indian interests.	Cultural Resources American Indian Interests	Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*	Minimize impacts to American Indian cultural resources.
Conduct final field surveys (an intensive BLM ***Class III inventory***) of the ***construction right-of-way***, as described in the Programmatic Agreement (see Appendix C) between DOE, the BLM, the Surface Transportation Board, and the Nevada State Historic Preservation Office.	Cultural Resources	National Historic Preservation Act, 36 CFR Part 800 – Protection of Historic Properties	Minimize impacts to cultural resources.
Consult with American Indian tribes and protect their access to ***public lands*** that contain American Indian cultural resources.	Cultural Resources American Indian Interests	American Indian Religious Freedom Act of 1978 Executive Order 13007, *Indian Sacred Sites*	Minimize impacts and allow access to sacred American Indian sites.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 3 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Notify all potentially affected utility owners prior to project-related construction activities and coordinate with the owners to minimize impacts to utilities. Consult with utility owners to design the ***rail line*** so that utilities are protected during project-related construction activities. Contact Nevada Underground Service Alert so they can locate and mark underground facilities to prevent possible damage to underground utility lines, injury, property damage, and service outages.	Land Use and Ownership Utilities, Energy, and Materials Occupational and Public Health and Safety	NAC 455 – Excavations and Demolitions	Prevent damage to utilities, avoid and/or minimize disturbances to utility service, and avoid injuries to workers.
Prior to initiation of construction activities in the area, provide appropriate information regarding construction plans and schedules for the proposed rail line to fire departments and other local emergency planning agencies within the project area. Communicate updates and changes in the construction plans to appropriate parties as needed.	Occupational and Public Health and Safety	40 CFR Part 355 – Emergency Planning and Notification	Facilitate local emergency response planning and community awareness.
Prior to initiating any project-related construction activities, develop a spill prevention plan for petroleum products and other hazardous materials during construction activities. Ensure that equipment is available to respond to spills and identify the location of such equipment. In the event of a reportable spill, comply with the spill prevention plan and applicable federal, state, and local regulations pertaining to spill containment and appropriate cleanup. Make the required notifications to the appropriate federal and state environmental agencies in the event of a reportable hazardous materials release.	Hazardous Materials and Waste Occupational and Public Health and Safety Biological Resources Surface-Water Resources Groundwater Resources	40 CFR Part 112 – Oil Pollution Prevention 40 CFR Part 263 – Standards Applicable to Transporters of Hazardous Waste 40 CFR Part 302 – Designation, Reportable Quantities and Notification	Prevent release of oil and chemicals during construction. Establish effective spill response procedures. Minimize adverse environmental effects of a spill. Ensure appropriate cleanup of spilled material.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 4 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Develop internal emergency response plans for use during proposed rail line construction and operations to ensure that appropriate agencies and individuals are notified in case of an emergency. Provide the emergency response plans to appropriate state and local entities prior to any rail construction activities. Ensure such plans fully delineate the roles and responsibilities of all parties.	Hazardous Materials and Waste Occupational and Public Health and Safety	The Nuclear Waste Policy Act of 1982	Facilitate emergency response planning and enhance emergency response capabilities.
Provide fire departments and local emergency response agencies with a toll-free number for the DOE contact, who will be available to answer questions or attend meetings for the purpose of informing emergency-service providers about the project construction and operations. Revise this information, including changes in construction schedule, as appropriate. Before the start of operations, contact any local emergency response agencies to provide them with information concerning the proposed operations to allow them to incorporate the information into local response plans.	Hazardous Materials and Waste Occupational and Public Health and Safety	40 CFR Part 355 – Emergency Planning and Notification 49 CFR Part 172 – Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements NAC 705 – Railroads	Facilitate communication to ensure state and local emergency response efforts are up to date. Ensure local response plans are up to date before the start of operations.
Develop and implement an Ordnance and Explosives Safety Construction Support Program applicable to construction activities. Include ordnance and explosives training for all construction personnel working in the areas designated by the U.S. Department of Defense (DoD) as being at risk of containing unexploded ordnance. DOE may employ a full-time unexploded-ordnance technician to oversee construction activities in areas near the Nevada Test and Training Range.	Hazardous Materials and Waste Occupational and Public Health and Safety	DoD Directive 4715.11 – Environmental and Explosives Safety Management on DoD Active and Inactive Ranges Within the U.S. 29 CFR 1910.120 and 1926.65 – Hazardous Waste Operations and Emergency Response Standard	Identify, evaluate, and control safety and health hazards related to unexploded ordnance on DoD property.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 5 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Adopt a rigorous safety program that would enable workers to avoid the most common accidents.	Occupational and Public Health and Safety	DOE Order O 440.1A, Worker Protection Management for DOE Federal and Contractor Employees 29 CFR Part 1926, *S*afety and Health Regulations for Construction 29 CFR Part 1960, Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters	Ensure health and safety of construction workers during construction.
As appropriate, remove and stockpile topsoil that will be needed later for application during reclamation of disturbed areas. Stabilize topsoil stockpiles to prevent erosion. If the topsoil would remain in a stockpile for more than one year, seed with ***native plant species***. Periodically monitor and maintain the topsoil reserve to keep it stable and minimize erosion until it is used during reclamation efforts.	Physical Setting Biological Resources Surface-Water Resources	43 CFR Part 2800 – Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act and the Mineral Leasing Act 40 CFR Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System	Re-establish the stability and productivity of land subjected to surface disturbances through proper soils management. Preserve native seed stock contained in topsoil. Minimize erosion and control stormwater runoff to maintain water quality.
Construction best management practices			
Phase construction to the extent practicable. Limit grading activities to the phase immediately under construction and limit ground disturbance to areas necessary for project-related construction activities. Identify limits of disturbance on maps and in the field, and convey to construction personnel. Implement erosion and sediment control measures prior to and during construction.	Physical Setting Surface-Water Resources Groundwater Resources Biological Resources	40 CFR Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System 10 CFR Part 1022 – Compliance with Floodplain/Wetlands Environmental Review Requirements Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*)	Minimize and control stormwater runoff to maintain water quality. Minimize ground disturbance and disturbance to vegetation, wetlands, streams, floodplains, and other sensitive environments.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 6 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Establish staging and laydown areas for project-related construction material and equipment away from streams and wetlands and in areas that are not environmentally sensitive. Avoid clearing vegetation between the staging area and the waterway or wetlands. When project-related construction activities, such as ***culvert*** and bridge work, require work in streambeds, conduct these activities, to the extent practicable, during minimum-flow conditions. Maintain current drainage patterns to the greatest extent practicable. Prohibit project-related construction vehicles from driving in or crossing streams and/or ***washes*** at locations other than established crossing points. Place heavy equipment on mats when working in wetlands or use other methods to minimize soil disturbance in wetlands.	Physical Setting Surface-Water Resources Biological Resources	10 CFR Part 1022 – Compliance with Floodplain/Wetlands Environmental Review Requirements Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) NAC 445A – Water Controls Fish and Wildlife Coordination Act	Protect surface-water quality and floodplains. Minimize project-related increases in turbidity and impacts to ***waters of the United States***.
During construction, use temporary barricades, fencing, and/or flagging to demarcate sensitive habitats; contain project-related impacts to the area within the construction right-of-way. When practicable, locate staging areas in previously disturbed sites or in construction right-of-way, and avoid sensitive habitat areas. Fence off areas of habitat for sensitive species or other special resources, such as wetlands, prior to ground-disturbing activities. Inform project workers of all resource protection goals.	Physical Setting Surface-Water Resources Biological Resources	Frequently a Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) permit condition or a result of Section 7 consultation under the Endangered Species Act Of 1973, as Amended	Minimize impacts to sensitive habitats and species.
Use a minimum-width rail line footprint when practicable. DOE would limit disturbance within the construction right-of-way in the areas where it could not completely avoid wetlands.	Surface-Water Resources Biological Resources	10 CFR Part 1022 – Compliance with Floodplain/Wetlands Environmental Review Requirements Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*)	Minimize impacts to wetlands.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 7 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Require periodic inspections of equipment for any fuel, lube oil, hydraulic, or antifreeze leaks. If leaks are found, repair the leak or replace the equipment.	Hazardous Materials and Waste Occupational and Public Health and Safety Surface-Water Resources Groundwater Resources Biological Resources	Pollution Prevention Act of 1990 (42 U.S.C. 133)	Avoid accidental discharge of pollutants.
Use storage tanks, ponds (temporary holding reservoirs), or inflatable bladders along the rail alignment to help manage water ***demand***, such as to control ***groundwater*** withdrawal rates and pumping timetables.	Surface-Water Resources Groundwater Resources	NRS 533.324 through 533.435 – Water Appropriation Permit	Maximize water-use efficiency during construction activities.
Use treated wastewater effluent (***gray water***) produced at the camps for dust suppression and soil compaction to reduce the demands placed on groundwater wells.	Groundwater Resources	NAC 534 – Underground Water and Wells NRS 533.324 through 533.435 – Water Appropriation Permit	Reduce ***aquifer*** drawdown.
If determined through impacts analysis to be possibly or likely required to preclude impacts on an existing well or spring, limit pumping rates or eliminate pumping at a proposed new groundwater withdrawal well, obtain (purchase) additional water from existing water-rights holder(s), relocate a proposed new well to an alternative location, or implement one or more other best management practices as necessary. Alternatively, DOE would negotiate with the existing water-rights holder or domestic water-well owner to access and monitor water levels in the existing well or monitor discharge rates to the spring, where appropriate, to verify the effects, if any, of the proposed groundwater withdrawal on those wells or springs.	Groundwater Resources	NAC 534 – Underground Water and Wells NRS 533.324 through 533.435 – Water Appropriation Permit	To preclude a reduction in flow rate to an existing well or a reduction in discharge rate to a spring.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 8 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Provide alternate sources of water or relocate wells if DOE action prevents access to groundwater. Any action to change the location of an existing water diversion would require the approval of the well owner and/or the holder of the water rights associated with that diversion point and would require a permit from the State of Nevada under Nevada Revised Statutes (NRS) 533.325.	Groundwater Resources	NRS 533.325 – Application to State Engineer for Permit	To ensure continued access to wells and groundwater.
Keep disturbance around known areas of underground utilities to a minimum. Ensure that work crossing any buried utility line would not be started until all material and equipment was available for immediate use. Complete work as quickly as possible; keep exposure of existing utilities to a minimum. Install underground utility crossings within protective casings buried in trenches beneath the rail and surround the utility line with appropriate backfill material.	Utilities, Energy, and Materials Occupational and Public Health and Safety Land Use and Ownership	NAC 455 – Excavations and Demolitions NAC 704A – Facilities Placed Underground	Prevent inadvertent disruption to utilities, destruction of property, and injury to DOE contractors. Ensure future functionality and safety of underground utilities.
Implement ***fugitive dust*** suppression per applicable permits, such as spraying water, the use of crusting agents, or other approved measures to minimize fugitive dust emissions created during project-related construction activities, including activities on haul roads and at quarries.	Aesthetic Resources Air Quality Occupational and Public Health and Safety	40 CFR Part 50 – National Primary and Secondary ***Ambient Air Quality Standards*** 29 CFR 1910-1000 – Occupational Health and Safety Standards	Meet ***ambient air*** quality standards during construction.
Maintain construction equipment to ensure that exhaust and muffler systems and other required pollution-control and noise-control devices are in good working condition. Administer a continuing, effective hearing conservation program in accordance with the Occupational Safety and Health Administration standards.	Air Quality Noise and Vibration Occupational and Public Health and Safety	40 CFR Parts 61 and 63 – National Emission Standards for Hazardous Air Pollutants and Noise Control Act of 1972 Federal Railroad Administration Regulation 49 CFR 229.121 Mine Safety and Health Administration Regulation 30 CFR 62	Minimize exhaust, emissions, and noise during construction and operations.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 9 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Implement construction activities with the goal of minimizing, to the extent practicable, construction-related noise disturbances near any residential areas; coordinate and communicate these goals to construction contractors.	Noise and Vibration Occupational and Public Health and Safety	Noise Control Act of 1972 49 CFR Part 210, Rail Noise Emission Compliance Regulations	Minimize rail line construction noise.
Conduct routine monitoring for occupational dust exposure during quarry construction and operations and during rail alignment construction activities that would potentially expose workers, such as ***ballast*** placement. Apply engineering controls such as the application of water for dust suppression and washing the ballast before placement. An industrial hygienist would take mineral dust measurements to identify potential exposure. Implement the use of personal protective equipment, such as respirators, and other measures to reduce occupational exposure to silica in the event aforementioned activities are not effective in reducing such exposure.	Occupational and Public Health and Safety	29 CFR 1910 – Occupational Safety and Health Standards	To prevent exposure to crystalline silica, ***erionite***, or cristobalite.
Reduce packaging wastes by purchasing supplies in bulk; purchase recycled or recyclable goods; and reuse waste paper and Styrofoam™ as packaging materials and fillers (DIRS 182385-Burns 2007, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Eliminate excessive resource use and trash generation.
Dispose of drill cuttings through land application.	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Prevent overburdening local landfill facilities with waste.
Promote the use of environmentally preferable products such as recovered materials (recycled-content products) and ***bio-based products*** (energy, industrial, and consumer products made from renewable biological resources such as wood, agricultural residues, and fiber crops). Purchase materials and equipment designated as long life, energy efficient, and sustainable if they are reasonably cost-effective and available (DIRS 182385-Burns 2007, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Eliminate excessive resource use and trash generation.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 11 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Practice preventive maintenance, use recycled oil, and use oil additives that improve engine and oil performance.	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Increase the number of lubricating-oil changes to reduce leaks and drips and poor engine performance.
Where practicable, use biodegradable water-based solvents, substitute nonhazardous surfactants for hazardous surfactants for equipment cleaning, and reuse spent solvents. Paint only when necessary and use less-toxic, less-volatile paints.	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Reduce the production of ***hazardous wastes***.
Inspect and replace worn or damaged components. Use sealed components (DIRS 155558-Hoganson 2001, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Reduce the production of hazardous wastes.
Establish and implement a centralized procurement and distribution program to purchase, track, distribute, and manage hazardous and toxic materials. Implement a Hazardous Material Management Program to review hazardous and toxic material requisitions and purchases; and to recommend feasible nonhazardous, biodegradable, or less-toxic substitutes, such as nonhazardous solvents, paints, and cleaning materials (DIRS 182385-Burns 2007, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Reduce the production of wastes.
Implement an Environmental Management System and a Pollution Prevention/Waste Minimization Program, which would include an evaluation of alternatives to eliminate, reduce, or minimize the amounts of hazardous materials used and hazardous wastes generated. As part of the Environmental Management System, regularly perform Pollution Prevention Opportunity Assessments (DIRS 182385-Burns 2007, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Reduce the production of wastes.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 12 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Salvage extra materials not used as ballast for the rail alignment and use for other construction activities or for regrading during quarry reclamation activities (DIRS 176172-Nevada Rail Partners 2006, Section 3.1).	Hazardous Materials and Waste	Executive Order 13101 – Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions	Reduce the generation of wastes and ***contamination*** of environmental media.
Store and dispose of biosolids (sludge), allowing them to dry according to applicable requirements. DOE would dispose of biosolids at a licensed facility in accordance with all applicable requirements (DIRS 176172-Nevada Rail Partners 2006, p. 4-6).	Hazardous Materials and Waste	40 CFR Part 503 – Standard for the Use or Disposal of Sewage Sludge	Ensure proper treatment and disposal of wastes.
Post-construction, operations, and maintenance best management practices			
Control ***noxious weeds***/***invasive species*** using approved herbicides and other pest-management techniques. Select herbicide products that would minimize impacts to water; apply the smallest effective amount of herbicide to reduce the risk of contamination from runoff and leaching. Adhere to herbicide labeling requirements. Plan to treat between weather fronts (calms) and at the appropriate time of day to avoid high winds and to avoid potential stormwater runoff. Establish buffer widths based on herbicide- and site-specific criteria to minimize impacts to water bodies.	Surface-Water Resources Groundwater Resources Biological Resources Occupational and Public Health and Safety	NAC 555 – Control of Insects, Pests, and Noxious Weeds Executive Order 13112, Invasive Species Federal Insecticide, Fungicide, and Rodenticide Act of 1948 (40 CFR Parts 152 through 186)	Prevent introduction of, or minimize impacts from, insects, pests, and noxious weeds. Minimize the risk of adverse effects to non-target species. Minimize the potential for adverse effects on water quality. Protect occupational and public health and safety.
Once construction is complete, revegetate disturbed areas within the right-of-way not required for operation of the rail line with native species or cover with angular rock fragments to prevent erosion. Use weed-free straw and mulch for revegetation and restoration activities. To the extent practicable, return all stream/wash crossing points to their preconstruction contours and reseed or replant the crossing banks with native species immediately following project-related construction. If weather or season precludes the prompt reestablishment of vegetation, employ measures such as mulching or erosion control blankets to prevent erosion until reseeding can be completed.	Physical Setting Aesthetic Resources Biological Resources Surface-Water Resources	43 CFR Part 2800 – Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act and the Mineral Leasing Act The Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661 *et seq.*) NAC 555 – Control of Insects, Pests, and Noxious Weeds Executive Order 13112, *Invasive Species*	Reduce the visual scope of disturbed areas. Prevent loss of and damage to wildlife resources. Prevent introduction of invasive or exotic species.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 13 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Post-construction, operations, and maintenance best management practices			
Once construction is complete, eliminate new quarry access roads by removing pavement and regrading road to original contours. Restore quarry walls to a 3-to-1 grade for public safety. Revegetate around quarry.	Physical Setting Biological Resources Surface-Water Resources	NAC 445 – Water Controls NAC 519A – Reclamation of Land Subject to Mining	Restoration of quarry sites. Minimize erosion. Protect public health.
Monitor reclaimed sites to determine whether reclamation success standards are being met.	Physical Setting Biological Resources	43 CFR Part 2800 – Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act and the Mineral Leasing Act	Ensure success of site restoration.
When practical, use proven technologies to reduce idling time of trains.	Air Quality Utilities, Energy, and Materials	40 CFR Parts 61 and 63 – National Emission Standards for Hazardous Air Pollutants	Minimize exhaust emissions during construction and operations and minimize energy required for operations.
Provide training to emergency response units in the vicinity of the proposed rail line on how to respond to incidents potentially involving ***radioactive*** materials.	Hazardous Materials and Waste Occupational and Public Health and Safety	The Nuclear Waste Policy Act Of 1982	Facilitate emergency response planning and enhance emergency response capabilities.

a. Best management practices are the practices, techniques, methods, processes, and activities commonly accepted and used throughout the construction and railroad industries that DOE would implement as part of the Proposed Action to facilitate compliance with applicable requirements and that provide an effective and practicable means of preventing or minimizing the adverse impacts of an action on human health and the environment.

b. Requirements include laws, statutes, codes, regulations, and orders. DOE commits to appropriate best management practices that support implementation of such requirements and specific compliance requirements in project-related activities and approvals.

c. CFR = Code of Federal Regulations; DoD = U.S. Department of Defense; EPA = U.S. Environmental Protection Agency; NAC = Nevada Administrative Code; NRS = Nevada Revised Statutes; U.S.C. = United States Code.

Table 7-2. Potential measures to mitigate potential environmental impacts of constructing and operating the proposed railroad (page 1 of 3).

Environmental resource/project phase	Nature of potential impact	Mitigation measure	Agency jurisdiction	Location
Physical Setting (see Sections 4.2.1 and 4.3.1)				
Construction and operations	Human health risks attributed to ***seismic*** activities	During the construction and operations phases, adopt Railway Engineering and Maintenance-of-Way Association guidelines and implement monitoring procedures to reduce the potential for structural damage and human exposure to seismic hazards. DOE would make use of seismic monitoring with regional networks; early warning systems to identify track disruption; and track inspections immediately before transit of the trains.	DOE[a]	Site-specific as determined through seismic and geotechnical investigations.
Land Use and Ownership (see Sections 4.2.2 and 4.3.2)				
Construction	Land-use conflict	Notify nearby mining lessees/claimants and consult with owners of active local mines and ***mining claims*** to ensure that impacts to mine-related operations are minimized during construction activities.	DOE and BLM[a]	Site-specific dependent upon the locations of mining claims and active mines.
Construction and operations	Segmenting wildlife habitat	Limit fencing on public lands to those areas where safety is a concern, or where it is required for the safety of livestock.	DOE and BLM	Site-specific as determined through coordination with permittees and the BLM.
Construction	Construction schedule	To the extent practicable, minimize the number of road closures due to construction, and limit detours to one mile or less. DOE would inform the public of road closures through various media outlets.	DOE and BLM	Site-specific dependent upon the locations of road closures.
Air Quality and Climate (see Sections 4.2.4 and 4.3.4)				
Operations	Air quality impacts associated with quarries	Acquire additional land and move the public access (fence line) farther away from the quarries.	DOE	Site-specific quarry locations.

Table 7-2. Potential measures to mitigate potential environmental impacts of constructing and operating the proposed railroad (page 2 of 3).

Environmental resource/project phase	Nature of potential impact	Mitigation measure	Agency jurisdiction	Location
Biological Resources (see Sections 4.2.7 and 4.3.7)				
	Growth and/or spreading of noxious weeds and invasive species	Minimize watering of land surfaces for soil stabilization, ballast cleaning, vehicle washing, and dust suppression to the extent possible.	DOE	Various locations as warranted.
	Conifer mortality	Salvage and restore damaged conifers.	DOE	Specific locations as warranted.
	Attract wildlife to areas of active construction	Install a fence around any storage reservoirs. Install removable covers over storage reservoirs or basins as needed.	DOE	Applies to overall project.
Noise and Vibration (see Sections 4.2.8 and 4.3.8)				
	Elevated noise levels resulting from construction activities	Limit major noise producing activities, such as blasting and pile driving, near ***sensitive receptors***.	DOE	Specific locations as warranted.
	Elevated noise levels from operations such as locomotive warning horns	Apply for a Quiet Zone. Install quad gates, or other supplementary safety measures, to provide the level of warning necessary to allow the communities to request a waiver from the Federal Railroad Administration of the requirement to sound the horn at ***at-grade crossings***.	FRA[a]	Specific locations as warranted.
Socioeconomics (see Sections 4.2.9 and 4.3.9)				
	Overextend local law enforcement capacity	Staff ***construction camps*** with security personnel.	DOE	Construction camp sites.
Occupational and Public Health and Safety (see Sections 4.2.10 and 4.3.10)				
	Hantavirus infection of workers	Implement procedures for decontamination of any rodent excreta encountered by construction workers during construction activities.	DOE	Applies to overall project.
	Equipment and property damage and injury	Assign people, a source of water, and a water-tank trailer that would be used to respond to fire emergencies at the camps and construction areas.	DOE	Construction camp sites.

Table 7-2. Potential measures to mitigate potential environmental impacts of constructing and operating the proposed railroad (page 3 of 3).

Environmental resource/project phase	Nature of potential impact	Mitigation measure	Agency jurisdiction	Location
Hazardous Materials and Waste (see Sections 4.2.12 and 4.3.12)				
	Overburdening local landfill facilities with waste	Determine which landfills solid and ***industrial and special wastes*** would be sent to during the construction phase and balance the distribution. Send manageable quantities of ***solid waste*** to local landfills or send the waste to the larger Apex Landfill.	DOE	Applies to construction.
Cultural Resources (see Sections 4.2.13 and 4.3.13)				
	Adverse impacts or disturbances to cultural resources sites	Provide cultural resources training to workers.	DOE and SHPO[a]	Applies to construction and various locations along the rail alignments.
Paleontological Resources (see Sections 4.2.14 and 4.3.14)				
	Disturbance and/or destruction of paleontological resources	Perform pre-disturbance testing of physical resources within the rail line construction right-of-way where there could be a potential for important paleontological resources. Consult with the BLM to develop appropriate measures to minimize damage to paleontological resources during the construction phase if fossils were found.	DOE and BLM	Specific locations along the rail alignments.

a. BLM = Bureau of Land Management; DOE = Department of Energy; FRA = Federal Railroad Administration; SHPO = State Historic Preservation Office.

8. UNAVOIDABLE ADVERSE IMPACTS; SHORT-TERM USES AND LONG-TERM PRODUCTIVITY; IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

In accordance with the National Environmental Policy Act (NEPA), Section 102 (42 U.S.C. 4332), and the Council on Environmental Quality (CEQ) NEPA implementing regulations (40 CFR 1502.16), this chapter addresses:

- Any adverse environmental impacts DOE would not be able to avoid if the Department implemented the Proposed Action along the Caliente rail alignment or the Mina rail alignment.
- The relationship between local short-term uses of the environment within the Caliente rail alignment or Mina rail alignment region of influence and the maintenance and enhancement of long-term productivity.
- Any irreversible and irretrievable commitments of resources if DOE implemented the Proposed Action along the Caliente rail alignment or the Mina rail alignment.

Glossary terms are shown in ***bold italics***.

8.1 Caliente Rail Alignment

During the engineering and site evaluation and planning phase for the proposed ***railroad***, DOE considered many factors to avoid or minimize potential environmental ***impacts*** (see Chapter 2), and would continue to consider these factors during the final design phase. DOE would meet all applicable regulatory requirements during proposed railroad construction and operations along the Caliente ***rail alignment***, and would implement an array of best management practices to ensure compliance with requirements (see Chapter 7, Best Management Practices and Mitigation). Also as described in Chapter 7, DOE could implement measures to mitigate any impacts remaining after final design and compliance with regulatory requirements and implementation of best management practices.

An **irreversible commitment** of resources represents a loss of future options. It applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity.

An **irretrievable commitment** of resources represents opportunities that are foregone for the period of the proposed action. Examples include the loss of production, harvest, or use of renewable resources. The decision to commit the resources is reversible, but the utilization opportunities foregone are irretrievable.

However, there could be unavoidable adverse impacts (adverse impacts are impacts that could be viewed as having disproportionately negative effects); impacts to short-term uses and long-term productivity resources; and/or irreversible and irretrievable commitment of resources, for example:

- DOE could mitigate most potential impacts described in Chapter 4, but there would be some unavoidable impacts, for example, on the use of grazing land.
- Railroad construction would involve ground-disturbing activities that would result in localized ***short-term impacts***

to soil, water use, and ***habitat***. These resources would recover over time, and long-term productivity would not be affected.

- An irreversible commitment of resources such as consumption of fossil fuel, and an irretrievable commitment such as a loss of habitat.

This chapter summarizes and consolidates information from Chapter 4, Environmental Impacts, and Chapter 7, Best Management Practices and Mitigation.

8.1.1 UNAVOIDABLE ADVERSE IMPACTS

Engineering and site evaluation and planning are the first steps in undertaking a ***proposed action***. Next follows compliance with all laws, regulatory requirements, and stipulations and conditions of associated permits to minimize environmental and health-related impacts. Best management practices are implemented to maintain compliance with these requirements. Where analyses identify potential environmental impacts, ***mitigation*** measures are implemented to avoid, minimize, rectify, reduce, or compensate for those impacts. Finally, unavoidable adverse impacts may arise where there are no reasonably practicable mitigation measures to entirely eliminate impacts, and there are no reasonably practicable ***alternatives*** to the proposed project that would meet the purpose and need of the action, eliminate the impact, and not cause other or similar significant adverse impacts. Figure 8-1 illustrates how unavoidable adverse impacts may arise and identifies the chapters of this Rail Alignment ***Environmental Impact Statement*** (EIS) where the topic areas shown are discussed.

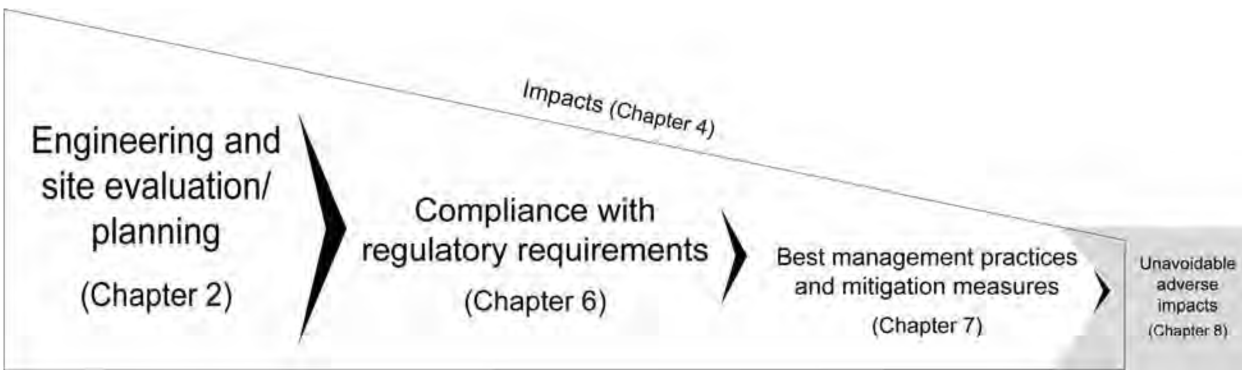

Figure 8-1. How unavoidable adverse impacts might arise.

Unavoidable adverse impacts would not vary substantially among alternative segments along the Caliente rail alignment, or by implementation of the ***Shared-Use Option***. Sections 8.1.1.1 to 8.1.1.15 describe unavoidable adverse impacts, if any, for each environmental resource area evaluated in this Rail Alignment EIS.

8.1.1.1 Physical Setting

Construction of the proposed railroad along the Caliente rail alignment would lead to permanent alterations in topography in the ***rail line construction right-of-way*** as a result of ***cuts*** and ***fills,*** and in the locations of potential quarry sites. Cuts and fills would also alter local drainage patterns, and would remain after a possible future abandonment of the railroad. Cuts and fills associated with construction of any of the ***alternative segments*** could result in the loss of topsoil, and an increased potential for erosion. No mineral deposits would be removed; nevertheless, a rail line could unavoidably restrict access to such deposits. The Goldfield alternative segments would cross ***mining areas*** and could displace minerals or limit the boundaries for mining if mineral resources extended under the rail alignment. There would be potential impacts to isolated pockets of unused land classified as ***prime farmland*** along the Caliente or

Eccles alternative segment and Caliente ***common segment*** 1. As required under the Farmland Protection Policy Act (7 United States Code [U.S.C.] 4201 *et seq.*), which directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands, DOE has coordinated with the Natural Resources Conservation Service to minimize any potential conversion of land classified as prime farmland to nonagricultural uses. The 0.22 square kilometer (54 acres) of prime farmland soils along Caliente common segment 1 is in a relatively isolated area in Nye County (see DIRS 182843-Coogan and Bethoney 2007, Part A, plates 107 to 109), and at present is not being farmed. Construction of the proposed railroad along the Caliente rail alignment would result in the loss of a total of 0.43 square kilometer (110 acres) of prime farmland soils. Lincoln and Nye Counties contain approximately 1,500 square kilometers (370,000 acres) of prime farmland soils; thus, the proposed railroad would remove less than 0.1 percent of the prime farmland soils from productive use. Construction activities within the construction right-of-way would result in local soil compaction, which could impact the natural revegetation rate and vegetation types over time.

Any permanent alterations in topography that could not be mitigated could be viewed as unavoidable adverse impacts. As described in Section 4.2.1.2.1, topographic impacts due to major cut and fill and other earthwork processes would primarily occur along the Goldfield alternative segments and common segment 6, and around Bennett Pass, Goldfield Hills, Beatty, and Yucca Mountain. Tables 4-2 to 4-9 in Section 4.2.1 list specific amounts of disturbed surface areas for the Caliente rail alignment alternative segments, common segments, and ***construction and operations support facilities***. Any impacts to physical setting, although unavoidable, would be small.

8.1.1.2 Land Use and Ownership

Use of land along the Caliente rail alignment for construction and operation of the proposed railroad and railroad construction and operations support facilities would involve some long-term changes in land use. The land DOE would use for this project would be managed as a ***right-of-way grant*** obtained from the U.S. Department of the Interior, Bureau of Land Management (BLM). This would not pose a land-use conflict because the rights-of-way would not be in right-of-way avoidance areas. The BLM could establish land management requirements that provide for multiple use, but land used for the proposed railroad and railroad construction and operations support facilities could limit certain other land uses. The multiple-use mandate set forth in the Federal Land Policy and Management Act would continue to apply to the ***public lands*** within the right-of-way, but railroad construction and operations could limit certain future land uses that pose a conflict.

DOE would need to gain access to some private lands. Assuming a ***nominal*** 61-meter (200-foot) right-of-way on either side of the centerline of the rail line, this could result in a loss of about 1 percent of private land compared to the total amount of land that would be required for the project. The parking lot and access road to the Hot Springs Hotel would lie within the Caliente alternative segment construction right-of-way, and the loss of some parking area and the impact of noise during construction and operation of the rail line may cause the hotel to no longer remain viable. If the Caliente alternative segment is selected, DOE would negotiate with the hotel owner to gain access to the land. The Staging Yard at either of the Caliente options (Upland or Indian Cove) would be on private land.

Construction and operation of the proposed railroad along the Caliente rail alignment would directly impact ***grazing allotments*** by transecting parcels and potentially hindering access to forage and water resources. Other potential impacts include allotments being reduced in size and a reduced ability of livestock, wild horses, and burros to range freely across grazing areas. The Eccles-North Staging Yard would be on public land within an active grazing allotment. Even with mitigation, some adverse impacts to the use of grazing land would be unavoidable. Tables 4-23 to 4-30 in Section 4.2.2 summarize potential impacts to land use and ownership for each alternative segment, common segment, and railroad construction and operations support facility.

Construction and operation of the proposed railroad along the Caliente rail alignment would not displace existing or planned land uses over a large area or conflict with land-use plans or goals. Therefore, any impacts to land use and ownership, although unavoidable, would be small.

8.1.1.3 Aesthetic Resources

The ***region of influence*** for aesthetic resources is the ***viewshed*** around all Caliente rail alignment alternative segments, common segments, and railroad construction and operations support facilities, and any additional ***sidings*** that would be added under the Shared-Use Option. Operation of the proposed railroad along the Caliente rail alignment would remain consistent with BLM visual resource management objectives, under which areas of high visual value (Classes I and II) are managed to minimize contrast levels, and areas of lower visual value (Classes III and IV) are allowed higher contrast levels. There would be unavoidable visual changes associated with the proposed rail alignment. Contrast levels that were rated by DOE as none, weak, or moderate would be such that BLM visual resource management objectives would be met. In specific locations such as Garden Valley, which is classified as a more visually sensitive Class II area in the *Draft Ely Resource Management Plan* (DIRS 174518-BLM 2005), BLM visual resource management objectives also would be met.

8.1.1.4 Air Quality

Construction and operation of the proposed railroad along the Caliente rail alignment would cause unavoidable emissions of some ***criteria air pollutants***. Air pollutant concentrations would not exceed the National ***Ambient Air Quality Standards*** during construction and operation of the proposed railroad, with the possible exception of the 24-hour standard for ***particulate matter*** with an aerodynamic diameter less than or equal to 10 micrometers (***PM_{10}***) that DOE modeled as exceeded during quarry operations in South Reveille Valley during rail line construction. However, DOE will be required to obtain a Surface Area Disturbance Permit Dust Control Plan, issued by the State of Nevada, Department of Environmental Protection, prior to quarry development. DOE anticipates that compliance with the requirements of this plan to reduce ***fugitive dust*** emissions would decrease the possibility of exceedance of the ***air quality*** standard—for example, the requirement for cessation of all operations when winds make control of fugitive dust difficult (this was a mitigating attribute not accounted for in the modeling that DOE undertook). DOE could further reduce the possibility of exceeding the 24-hour standards for PM_{10} at a public boundary during quarry operations by acquiring additional land and moving public access farther away.

The highest increase in air pollutant emissions would occur during the construction phase. During the operations phase, the highest increase would occur in the vicinity of the railroad operations support facilities. Fugitive dust emissions from construction-vehicle traffic on unpaved roads, surface disturbance (such as grading, scraping, bulldozing, wind erosion, and quarry excavation activities), and operation of concrete batch plants could cause unavoidable temporary impacts to air quality that, although within permissible limits, could not be completely mitigated. Table 4-53 in Section 4.2.4 summarizes impacts to air quality, which are projected to be small during both construction and operation, with the possible exception in the vicinity of the South Reveille Valley quarry.

Therefore, any impacts to air quality, although unavoidable, would be small.

8.1.1.5 Surface-Water Resources

Regrading, cut and fill activities, and structures such as box ***culverts*** would cause localized changes in drainage patterns throughout the rail line construction right-of-way. Construction of the proposed ***Staging Yard*** and ***Interchange Yard***, whether along the Caliente or Eccles alternative segment, would require channelization of natural drainage surface waters to keep water out of railroad operations support facility sites. Changes in drainage patterns could result in changes in erosion and sedimentation rates or locations. Construction in ***washes*** or other flood-prone areas could reduce the area through which floodwaters naturally flow, resulting in water buildup or ponding on the upstream side of crossings during floods that would slowly drain through the culverts or bridges.

DOE evaluated potential impacts to surface waters by identifying areas where there are drainage channels or water resources. While some changes would be unavoidable, DOE would take steps to ensure the alterations to natural drainage, sedimentation, and erosion would not increase future flood damage, increase the impact of floods on human health and safety, or cause identifiable harm to the functions and values of ***floodplains***. Because hydraulic structures and conveyance systems would be designed to safely convey 50-year or 100-year design storms and minimize concentration of flow, impacts associated with drainage conveyance would be small. The Department would minimize impacts to surface-water resources through the implementation of engineering design standards and best management practices that include erosion control measures. The Caliente alternative segment is adjacent to ***wetlands*** and some wetland fill would be unavoidable. Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the potential quarry siding. Construction of the Staging Yard in Indian Cove would require filling an area of wetlands and in the loss of approximately 0.19 square kilometer (47 acres) of wetland habitat. The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. The total area to be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres). DOE would minimize adverse impacts to wetlands (and the functions served by wetlands) and other surface-water resources.

8.1.1.6 Groundwater Resources

Withdrawal of ***groundwater*** from multiple wells for construction of the proposed railroad could cause a short-term decrease in groundwater resources resulting from increased ***demand*** on the host ***aquifer*** at each new well location. Groundwater withdrawal could decrease the amount of water available to a nearby existing well or spring discharge, and/or, in theory, decrease the amount of water available for underflow to a downgradient basin. The impacts of groundwater withdrawals from the proposed water-supply wells at the range of production rates that would be required for the railroad would be localized in nature, small in magnitude compared to existing groundwater inventories, and primarily temporary. Impacts analysis results indicate that short-term withdrawal of water from new water wells at the proposed withdrawal rates could, in some instances, if unmitigated, have some unavoidable impact on existing wells or springs. In those instances, mitigation measures are proposed, such as use of a staggered pumping schedule for the new well, or pumping the new well at a reduced rate over a longer time period, in order to minimize or prevent such impacts on existing groundwater users and uses. Over time, because the amount of groundwater withdrawn represents a fractionally small percentage of the available groundwater in storage, and the withdrawals would be limited primarily to the construction phase, DOE anticipated that this water would be replenished through the natural water cycle following the construction phase. Some of the water used for compaction would return to groundwater aquifers. For these reasons, DOE expects that there would be no adverse ***long-term impacts*** to existing groundwater resources.

8.1.1.7 Biological Resources

There could be unavoidable, short-term, adverse impacts to wildlife, special status species, protected game species, and wild horses and burros. There would be the potential for unavoidable impacts to ***threatened or endangered species*** during rail line construction. Potential impacts to desert tortoise would be moderate because of fragmentation of habitat. There could be localized and minor loss of roosting and foraging habitat for the southwestern willow flycatcher and western yellow-billed cuckoo.

DOE determined that there would be unavoidable impacts to wetlands and ***riparian*** habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove and Upland), and the Eccles alternative segment. Unavoidable impacts to wildlife and wild horses and burros from the operation of the rail line could result from collisions of wildlife with trains and short-term disruption of activities (such as foraging, nesting, and resting). Although such impacts would be unavoidable, long-term impacts would be small. Other unavoidable impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

There could be some unavoidable impacts to special status wildlife or plant species. For example, project activities could result in small but unavoidable adverse impacts to:

- Non-critical habitat for the federally threatened Mojave population of the desert tortoise (*Gopherus agassizii*)
- Habitat for the BLM-designated sensitive southwestern toad (*Bufo microscaphus*) near Caliente and Meadow Valley Wash
- Individual BLM-designated sensitive plants and their habitats, including the Schlesser pincushion (*Sclerocactus schlesseri*) and the White River catseye (*Cryptantha welshii*) along Caliente common segment 1; Eastwood milkweed (*Asclepias eastwoodiana*) near Caliente common segment 3; and the Nevada dune beardtongue (*Penstemon arenarius*) along common segment 5
- Habit for the Chuckwalla lizard (*Sauromalus ater*) documented in the southeastern foothills of Yucca Mountain, adjacent to common segment 6

Nevertheless, DOE has concluded that there would be a small loss of habitats, and potential loss of wildlife from trains and construction traffic would be low. Although such impacts would be unavoidable, long-term impacts would be small.

8.1.1.8 Noise and Vibration

Railroad operations along the Caliente rail alignment would lead to an unavoidable increase in ***ambient noise*** from passing trains in areas of Nevada that are mostly uninhabited. Noise from trains might be noticeable as new noise in residential areas near the rail line in Caliente and Goldfield. Because there is already a substantial amount of train activity in Caliente, additional train noise would be less noticeable there than in other areas where there is no train activity and no train noise at present. DOE estimated noise levels during the operations phase at all sensitive receptor locations along the Caliente rail alignment and found they would be below Surface Transportation Board environmental review criteria for noise analysis. Therefore, DOE has determined that no long-term adverse noise impacts would be expected during railroad operations along the Caliente rail alignment. However, during rail line construction, DOE estimated that noise levels at certain receptor locations near the City of Caliente would be higher than Federal Transit Administration construction noise guidelines. This unavoidable impact would be temporary.

8.1.1.9 Socioeconomics

Construction and operation of the proposed railroad along the Caliente rail alignment would unavoidably impact population, housing, employment, and public services in Lincoln, Nye, Esmeralda, and Clark Counties; traffic; and, to a small extent, local current agriculture, ranching, and mining activities.

Socioeconomic changes during the construction phase would include a brief elevation in project-related employment, temporary population increases, and immediate impact on existing levels of public services (health care, transportation, fire protection, and law enforcement) where construction activities were concentrated near communities. DOE determined that the greatest impacts would be economic, and although unavoidable, would be viewed as beneficial and not adverse. As outlined in Section 4.2.9, Socioeconomics, construction-related impacts in Lincoln, Esmeralda, and Nye Counties would result in small increases in peak employment, increases in ***real disposable income***, and increases in ***gross regional product***. The project would generate vehicle trips during facilities construction, both from the movement of materials and from workers traveling to and from the work sites. DOE analyzed highway ***level of service*** by looking at traffic volume in terms of design hour and peak hour flow during a 4- to 10-year construction phase, and determined that there would be some unavoidable impacts from construction of the ***Rail Equipment Maintenance Yard*** at Yucca Mountain to traffic on U.S. Highway 95 near the entrances to the ***Yucca Mountain Site***. This effect would degrade the level of service during peak traffic hours. However, this level would represent high density but stable traffic flow and constitute a small, but unavoidable, impact. This unavoidable impact would be temporary, lasting only as long as the construction phase (4 to 10 years, with the peak period limited to 2 years).

Impacts to traffic during railroad operations would be considerably lower than construction-related impacts. DOE determined that Rail Equipment Maintenance Yard operations would affect traffic on U.S. Highway 95 near the entrances to the Yucca Mountain Site. However, this level would represent high density but stable traffic flow, and constitute a small, but unavoidable, impact. Elsewhere, there would be no impacts or changes to highway levels of service during the railroad operations phase.

Socioeconomic changes during railroad operations would include increases in project-related employment (particularly associated with railroad operations support facilities); slight long-term population increases; moderate pressure on available housing, and fire-protection and health services in southern Nye County; and continued small impacts on mining, ranching, and agriculture. DOE determined that the greatest economic gains would arise in Lincoln County.

8.1.1.10 Occupational and Public Health and Safety

The possibility of nonradiological industrial hazards (such as exposure to physical hazards, chemicals, dust, and pathogens) causing injury or illness to workers during construction and operations would not be completely unavoidable. However, the potential for such impacts would be very small. DOE has estimated that there could be approximately two fatalities associated with all such hazards during construction and 50 years of railroad operations.

There could be radiological impacts to workers and the public from ***incident-free transportation*** and facility operations. While the impact would be very small, radiological impacts would not be completely unavoidable. DOE estimated that approximately 0.34 ***latent cancer fatality*** would result to workers from incident-free transportation and facility operations, and that approximately 1.4×10^{-4} latent ***cancer*** fatality would result to the public from incident-free transportation and facility operations.

There could be radiological impacts from rail ***accidents*** involving casks. Radiological impacts from accidents are estimated to result in less than one latent cancer fatality.

There could be radiological impacts from sabotage events involving casks. If a sabotage event occurred in a suburban area, the collective ***radiation dose*** to the population is estimated to be 1,800 ***person-rem***. The total latent cancer fatalities for people exposed during a sabotage event is estimated to be one.

By their very nature, roadway accidents are considered unavoidable; however, the projected number of roadway accidents that could be attributed to construction and operation of the proposed railroad would be very small. DOE assessed the potential transportation safety impacts of vehicle traffic on roadways associated with constructing and operating the rail line and facilities. DOE determined that there could be up to six fatalities on roadways for the 335 million vehicle-kilometers (200 million vehicle-miles) traveled over the construction phase, and up to eight fatalities on roadways for the 460 million vehicle-kilometers (288 million vehicle-miles) traveled during the 50-year operations phase.

Also by their nature, rail line accidents are considered unavoidable; however, the projected number of rail accidents that could be attributed to construction and operation of the railroad would be very small. DOE determined that there could be approximately one fatality associated with the construction and operations phases. DOE also assessed the potential transportation safety impacts of rail traffic on the rail line and at ***at-grade crossings*** during the construction and operations phases. The Department estimated that over the construction phase and 50-year operations phase, approximately 16 rail-related accidents could be expected to occur for the entire set of estimated train movements.

8.1.1.11 Utilities, Energy, and Materials

Some interfacing with existing utility rights-of-way, in particular electric utility lines, would be unavoidable. Temporary unavoidable impacts to utilities during the construction phase could include possible short-term service interruptions as service was switched from existing electric-power lines, telecommunication lines, and water pipelines to new lines crossing the proposed railroad, or to lines that were relocated to avoid railroad construction activities.

The two principal electric providers in the project region, Nevada Power Company and Sierra Pacific Power Company, can currently meet peak load demands of 5,800 megawatts and 1,900 megawatts, respectively, through generating capacity or power-purchase capabilities. In 2005, their electricity sales were estimated to be 19 million megawatt-hours and 8.8 million megawatts-hours, respectively. In addition, the smaller Valley Electric Association, Inc. and Lincoln County Power District No. 1 are local area power purchasers and resellers. Over the 4- to 10-year construction phase, the electrical power providers in the project region would have adequate generating capacity or power-purchase capabilities (see Section 3.2.11) to supply the project during peak demand without disrupting service to the providers' respective coverage areas. Therefore, although energy use would be unavoidable, anticipated electricity demand to meet construction and operations needs would be modest and would not adversely impact other regional needs for electric power.

As described in Section 4.2.11.2.1.3, DOE estimated that annual consumption of diesel fuel during the railroad construction phase would be 117 million liters (31 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5b), which would represent 6.5 percent of diesel fuel used annually in Nevada. As described in Section 4.2.11.2.2.2, DOE estimated that over an anticipated 50-year operations lifecycle, 119 million liters (31.5 million gallons) of diesel fuel would be consumed and the annual consumption rate would peak at 4.3 million liters (1.1 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5a), a rate which is less than 0.25 percent of the current annual vehicular diesel fuel usage in Nevada. Although the use of fuel would be unavoidable, its use during either construction or operations would not adversely affect the capacity of national and regional fuel producers and distributors.

The need for construction materials, primarily steel, concrete, and aggregate, would be unavoidable, but would represent a small fraction of available materials (see Table 4-135). The regional and national impacts of meeting such needs would be small. Materials needed during the operations phase would be much less than during the construction phase, remaining considerably below available capacity.

8.1.1.12 Hazardous Materials and Waste

The generation of some general ***solid wastes***, special wastes (construction debris, used tires, and other materials with specific management requirements), and hazardous materials would be unavoidable, primarily during the construction phase. DOE would handle all wastes in accordance with applicable regulations, and would implement best management practices and pollution prevention/waste minimization programs. As described in Section 4.2.12, DOE estimated that 2,300 metric tons (2,500 tons) per year of nonhazardous solid waste (for example, general household waste) would be generated during the construction phase, for a daily rate of about 6.3 metric tons (6.9 tons). Nonrecyclable wastes would be disposed of, which would raise the total amount disposed of in the four-county area of Lincoln, Nye, Esmeralda, and Clark by up to approximately 0.077 percent. In addition, DOE estimated that construction activities would generate approximately 4,020 metric tons (4,380 tons) of ***industrial and special wastes*** per year, for an approximate daily rate of 11 metric tons (12 tons), which would result in an increase of approximately 0.13 percent in waste receipt at local landfills.

DOE estimated that 190 metric tons (210 tons) per year or 0.51 metric ton (0.56 ton) per day of nonhazardous solid waste would be generated at railroad operations support facilities, which would raise the total amount disposed of in the four-county area by less than 0.01 percent. There would be ample disposal capacities to accept the small amounts of ***low-level radioactive wastes*** generated from the ***Cask Maintenance Facility*** of 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) over the 30- to 50-year lifetime of this project (DIRS 181425-MTS 2007, all).

Although the use of disposal facilities would be unavoidable, existing disposal facilities have ample capacity to handle all additional wastes.

8.1.1.13 Cultural Resources

Because of the length of the Caliente rail alignment and the complexity associated with engineering a feasible alignment, DOE used a phased cultural resource identification and evaluation approach, as described in 36 Code of Federal Regulations (CFR) 800.4(b)2, to identify specific cultural resources as is fully described in Section 4.2.13. DOE has surveyed approximately 20 percent of the area for cultural resources. Based on cultural resources already identified, it is reasonable to conclude that there may be undiscovered cultural resources in the Caliente region of influence. The number and extent of identified cultural resource sites throughout the Caliente rail alignment region of influence will continue to increase as more surveys and inventories of potentially disturbed land are completed.

Nevertheless, railroad construction could cause unavoidable disturbance or destruction of cultural resources. Disturbance or destruction could occur during ground-disturbing activities along the rail alignment, at quarries, along temporary access roads, at ***borrow sites***, at temporary ***construction camps***, and at railroad operations support facilities. During construction, larger numbers of workers in the vicinity of the construction camps could increase the potential for impacts to nearby cultural resources. Excavation and other construction-related ground-disturbing activities could unearth additional cultural materials that were either thought, based on previous archaeological surveys, to occur only at ground surface, or were previously undetected because they were completely underground.

Railroad construction and operation could also lead to unavoidable changes in cultural landscapes, such as changes to ***ethnographic***, rural historic, and historic viewscapes. Cultural landscapes include historic-period Western Shoshone villages and surrounding use areas in the Oasis Valley, the Goldfield area, and Stone Cabin and Reveille Valleys; early ranching operations in the Stone Cabin and Reveille Valleys, and the Mormon settlement of Meadow Wash Valley; and the Goldfield, Clifford, and Reveille Mining Districts.

DOE would further modify the rail alignment, as necessary, to avoid discovered cultural resources. Based on preliminary information and sample surveys, any impacts would likely range from small to moderate because of an extensive effort to avoid or mitigate them.

8.1.1.14 Paleontological Resources

As described in Section 4.2.14, there is a paleontological resource site approximately 4.8 to 8 kilometers (3 to 5 miles) south of where Caliente common segment 1 would cross Bennett Pass, but because of its distance from the rail line, there would be no impacts to the site. There are no other known paleontological resources at or near the remaining portions of the Caliente rail alignment, nor do these areas have a strong potential to contain important paleontological resources. While there could be a potential to uncover previously unknown ***fossils*** during railroad construction, DOE would consult with the BLM to develop appropriate measures to minimize damage to paleontological resources during project-related construction if fossils were found. DOE has not identified any unavoidable adverse impacts.

8.1.1.15 Environmental Justice

DOE determined that constructing and operating the proposed railroad along the Caliente rail alignment would not result in disproportionately high and adverse human health, environmental, ecological, or cultural impacts on ***minority populations***, low-income communities, or American Indian tribes from construction and operation of a railroad along the Caliente rail alignment. DOE has not identified impacts, unavoidable or otherwise, in the context of ***environmental justice***.

8.1.2 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Council on Environmental Quality regulations that implement the procedural requirements of the National Environmental Policy Act (NEPA) require consideration of "the relationship between short-term uses of man's ***environment*** and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). This includes using " … all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generation of Americans" (NEPA, Section 101, 42 U.S.C. 4331).

This section discusses the short-term use of the environment and the maintenance of its long-term productivity. Chapter 4 provides more detailed discussions of the impacts and resource utilization associated with the Proposed Action and the Shared-Use Option. Construction and operation of the proposed railroad would require short-term uses of land and other resources. Any long-term loss of productivity in disturbed areas would be small. The land-cover types along the proposed rail alignment are widely distributed throughout the region of influence and any loss of vegetation in the disturbed area along the rail alignment would have little impact on the regional productivity of plants and animals. Future long-term land uses such as grazing or mining would not be precluded by the short-term use of the land for the proposed rail line. The relationships between short-term uses and long-term productivity would not be meaningfully altered if either the Proposed Action or Shared-Use Option were implemented, or by the selection of alternative segments within the Caliente rail alignment ***implementing alternative***.

Wetlands or waters that would be filled would not recover in the short term and long-term productivity would be lost permanently. To the extent practicable, DOE would minimize such fill by optimizing final engineering and design and use a minimum-width construction right-of-way whenever possible. Construction of the Staging Yard in Indian Cove would require filling an area of wetlands and in the resultant loss of approximately 0.19 square kilometer (47 acres) of wetland habitat. There would be a long-term loss of productivity to riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove and Upland), and the Eccles alternative segment. The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of a floodplain. The total area to be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres).

Productivity loss for soils should be limited to the disturbed areas affected by land clearing, grading, and construction. Most disturbed areas not permanently maintained for railroad operations would recover over time, although recovery and a return to natural productivity could be slow for disturbed biological communities in an ***arid*** environment. DOE would revegetate disturbed areas with appropriate native species. Potentially productive soils characterized as prime farmland along Caliente common segment 1 and the Caliente and Eccles alternative segments are found only in isolated pockets and cannot support farming. Therefore, the minimal loss of these soils would not impact long-term productivity.

The areas used for temporary construction camps would likely recover in the short term because they would be unused after construction activities ceased. DOE would implement restoration activities to encourage natural vegetation to grow on these sites. The Department might eventually abandon the proposed railroad and its operations support facilities, although it is unlikely that the rail ***roadbed*** would ever be completely dismantled. The proposed railroad and these facilities could be turned over to commercial carriers, especially if the Shared-Use Option were selected, and could continue to aid economic productivity in the region. Under the Shared-Use Option, the proposed railroad could increase transportation opportunities and lower transportation costs in the region.

The short-term withdrawal of water from the temporary construction wells could have a small impact on groundwater availability. However, DOE has projected that drawdowns would be sufficiently small to preclude impacts on flow rates or discharge rates at existing productive water-supply wells or springs. There would be no long-term impacts to groundwater resource productivity because the construction wells would only be used for a short time.

8.1.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA Section 102 (42 U.S.C. 4332) and Council on Environmental Quality regulations that implement the procedural requirements of NEPA (40 CFR 1502.16) require that environmental analyses include identification of: "… any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." An irreversible commitment of resources represents a loss of future options. It applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity, whereas an irretrievable commitment of resources represents opportunities that are foregone for the period of the proposed action. Examples include the loss of production, harvest, or use of renewable resources. The decision to commit the resources is reversible, but the utilization opportunities foregone are irretrievable.

This section describes irreversible and irretrievable commitments of resources associated with implementation of the Proposed Action along the Caliente rail alignment. Sections 8.1.3.1 to 8.1.3.15 discuss resource commitments that could be irreversible and irretrievable. Irreversible and irretrievable commitments of resources would not meaningfully vary among alternative segments along the Caliente rail alignment, or by implementation of the Shared-Use Option.

8.1.3.1 Physical Setting

Construction of the rail line and construction and operations support facilities along the Caliente rail alignment could displace mineral deposits. Perlite is a locally important mineral that occurs in the area of the Caliente and Eccles alternative segments. Although no minerals would be removed, placement of the rail line could displace perlite and reduce its availability for mining, if there was perlite within the construction right-of-way. The Goldfield alternative segments would cross mining areas and could displace minerals or limit the boundaries for mining if mineral resources extend under the rail alignment. If these circumstances occurred and options for future use of minerals were limited, there would be an irreversible commitment of resources.

8.1.3.2 Land Use and Ownership

Construction and operation of the proposed railroad would require the commitment of land for placement of the rail line, construction and operations support facilities, and access roads. If at a future date DOE were to abandon the railroad, although much of the construction material might be removed, it is not likely that all of the natural landscape would be restored, and some of the land commitment would remain irreversible. Following abandonment of the rail line, lands along the Caliente rail alignment would be relinquished back to the BLM. If DOE had to acquire private lands for the Staging Yard at either of the Caliente options (Upland or Indian Cove), the Department would dispose of purchased land pursuant to DOE Order O 430.1B, *Real Property Asset Management*, or would return leased land to the lessee.

8.1.3.3 Aesthetic Resources

DOE determined that the visual impacts of operating trains would range from no visual contrast to strong visual contrast, and that the long-term visual impacts of marks on rock, soil, and vegetated landscape from cuts, fills, well pads, and access roads would range from weak to strong (with mitigation in Garden Valley) (see Section 4.2.3). The railroad would remain consistent with BLM visual resource management objectives where areas of high visual value are managed to minimize contrast levels, and areas of lower visual value are allowed higher contrast levels. Where land commitment was irreversible, aesthetic impacts would sometimes remain irreversible.

8.1.3.4 Air Quality

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment.

8.1.3.5 Surface-Water Resources

The Caliente alternative segment is adjacent to wetlands and some wetland fill would be unavoidable. This could result in an irretrievable commitment of resources along the Caliente rail alignment. Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the potential quarry siding. Construction of the Staging Yard in Indian Cove would require filling an area of wetlands and in the resultant loss of approximately 0.19 square kilometer (47 acres) of wetland habitat. The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. The total area to be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres).

8.1.3.6 Groundwater Resources

DOE estimated that a total of 7.52 billion cubic meters (6,100 ***acre-feet***) of water would be required for railroad construction (DIRS 180875-Nevada Rail Partners 2007, Section 4.4.2, pp. 4 to 10), most of which would be obtained through the construction of new water wells. Over time, because the amount of groundwater withdrawn represents a fractionally small percentage of the available groundwater in storage, and the withdrawals would be limited primarily to the railroad construction period, it is anticipated that this water would be replenished through the natural water cycle following the railroad construction phase. The use of groundwater could be considered as an irretrievable commitment of resources during the construction phase.

8.1.3.7 Biological Resources

The areas that would be occupied by the rail line, railroad construction and operations support facilities, and access roads would be irreversibly removed from natural habitat for the life of the proposed railroad. In addition, the disturbances of the desert soil surfaces in areas of temporary construction activity could result in changes that would be irreversible over the long term. The permanent conversion of vegetation resources and wildlife habitat along the rail line and at construction and operations support facilities could represent an irreversible commitment of biological resources for the life of the proposed railroad and beyond if, following abandonment, DOE did not restore these resources, or if former vegetation cover and composition did not recover. Losses of wildlife during railroad construction and operations would represent an irretrievable commitment of biological resources.

Impacts to wetlands and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove and Upland), the Eccles alternative segment, and the Interchange Yard could represent an irreversible rather than irretrievable commitment of resources if, following abandonment, DOE did not restore these resources. However, during rail line final design, DOE would make adjustments to minimize such impacts.

8.1.3.8 Noise and Vibration

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment.

8.1.3.9 Socioeconomics

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment.

8.1.3.10 Occupational and Public Health and Safety

As discussed in Section 8.1.1.10, nonradiological industrial hazards (such as exposure to chemicals, dust, and pathogens) could cause injury or illness to workers during railroad construction and operations; however, DOE estimated the ***risk*** as approximately two fatalities. Radiological impacts to workers (0.34 latent cancer fatality) and the general public (1.4×10^{-4} latent cancer fatality) could occur from incident-free transportation, and DOE assessed the potential transportation safety impacts of movement on roadways, the rail line, at railroad operations support facilities, and at grade crossings associated with railroad construction and operation. DOE estimated there could be six vehicular-related fatalities during construction and approximately seven during operations. DOE estimated there could be approximately one rail-related fatality during construction and operations.

8.1.3.11 Utilities, Energy, and Materials

As described in Section 4.2.11, DOE estimated that annual consumption of diesel fuel during the construction phase would be 117 million liters (31 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5b). Over an anticipated 50-year operations lifecycle, 119 million liters (31.5 million gallons) of diesel fuel would be consumed, and if the Shared-Use Option was implemented during the operations period, a total of 392 million liters (103.5 million gallons) would be consumed (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5a). Fossil fuel consumed would be irreversible, and any portion of fuel consumed that was bio-fuel would be considered irretrievable. DOE has established an 8-megawatt power requirement (which includes a 30-percent reserve) for the Rail Equipment Maintenance Yard and Cask Maintenance Facility (DIRS 181033-Hamilton-Ray 2007, all). Fossil fuel or nuclear resources that generated that electricity would be irreversible.

As described in Section 4.2.11, construction of the railroad would require an estimated 82,000 metric tons (90,000 tons) of steel and 450,000 metric tons (496,000 tons) of concrete. Approximately 1,020,000 concrete railroad ties would be required for track construction. The estimated requirement for railroad ***ballast*** would be approximately 3.2 million metric tons (3.5 million tons), and approximately 2.7 million metric tons (3 million tons) for ***subballast*** (DIRS 180875-Nevada Rail Partners, Section 3.1.1, p. 3-1). Use of these materials would not be considered an irretrievable commitment of resources, because they could be recovered and recycled if DOE eventually abandoned the rail line.

8.1.3.12 Hazardous Materials and Waste

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment, other than the irreversible loss of land used for landfills.

8.1.3.13 Cultural Resources

Cultural resources (archeological, historical, and ethnographic) are nonrenewable resources and any loss would be irreversible. At this time DOE cannot fully characterize potential effects on cultural resources along the Caliente rail alignment or the magnitude of these effects.

8.1.3.14 Paleontological Resources

At this time DOE has not identified any impacts to paleontological resources along the Caliente rail alignment, but any impact that could occur would be irreversible.

8.1.3.15 Environmental Justice

DOE determined that constructing and operating the proposed railroad along the Caliente rail alignment would not cause high or adverse impacts to or fall disproportionately on minority or ***low-income populations***. Thus, DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment that would present an environmental justice concern.

8.2 Mina Rail Alignment

During the engineering and site evaluation and planning phase for the proposed railroad, DOE considered many factors to avoid or minimize potential environmental impacts (see Chapter 2), and would continue to consider these factors during the final design phase. DOE would meet all applicable regulatory requirements during proposed railroad construction and operations along the Mina rail alignment, and would implement an array of best management practices to ensure compliance with requirements (see Chapter 7, Best Management Practices and Mitigation). Also as described in Chapter 7, DOE could implement measures to mitigate any impacts remaining after final design and compliance with regulatory requirements and implementation of best management practices.

However, there could be unavoidable adverse impacts; impacts to short-term uses and long-term productivity resources; and/or irreversible and irretrievable commitment of resources, for example:

- DOE could mitigate most potential impacts described in Chapter 4, but there would be some unavoidable impacts, for example, on the use of grazing land.
- Railroad construction would involve ground-disturbing activities that would result in localized short-term impacts to soil, water use, and habitat. These resources would recover over time, and long-term productivity would not be affected.
- An irreversible commitment of resources such as consumption of fossil fuel, and an irretrievable commitment such as a loss of habitat.

This chapter summarizes and consolidates information from Chapter 4, Environmental Impacts, and Chapter 7, Best Management Practices and Mitigation.

8.2.1 UNAVOIDABLE ADVERSE IMPACTS

Engineering and site evaluation and planning are the first steps in undertaking a proposed action. Next follows compliance with all laws, regulatory requirements, and stipulations and conditions of associated permits to minimize environmental and health-related impacts. Best management practices are implemented to maintain compliance with these requirements. Where analyses identify potential environmental impacts, mitigation measures are implemented to avoid, minimize, rectify, reduce, or compensate for those impacts. Finally, unavoidable adverse impacts may arise where there are no reasonably practicable mitigation measures to entirely eliminate impacts, and there are no reasonably practicable alternatives to the proposed project that would meet the purpose and need of the action, eliminate the impact, and not cause other or similar significant adverse impacts.

Unavoidable adverse impacts would not vary substantially among alternative segments along the Mina rail alignment, or by implementation of the Shared-Use Option. Sections 8.2.1.1 to 8.2.1.15 describe unavoidable adverse impacts, if any, for each environmental resource area evaluated in this Rail Alignment EIS.

8.2.1.1 Physical Setting

Construction of the proposed railroad along the Mina rail alignment would lead to permanent alterations in topography in the rail alignment construction right-of-way as a result of cuts and fills, and in the locations of potential quarry sites. Cuts and fills would also alter local drainage patterns, and would remain after a possible future abandonment of the rail line. Cuts and fills associated with construction of any of the alternative segments could result in the loss of topsoil, and an increased potential for erosion. No mineral deposits would be removed; nevertheless, a rail line could unavoidably restrict access to such deposits. Less than 1 percent of soils along the Mina alignment are classified as prime farmland. As required under the Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*), which directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands, DOE has coordinated with the Natural Resources Conservation Service to minimize any potential conversion of land classified as prime farmland to nonagricultural uses. Less than 0.1 percent of soils along the Mina rail alignment are classified as prime farmlands, all of which occur on the Walker River Paiute Reservation. There are 0.011 square kilometer (2.7 acres) of prime farmland along Schurz alternative segment 1, 0.012 square kilometer (3 acres) along Schurz alternative segment 4, and 0.014 square kilometer (3.5 acres) along each of Schurz alternative segments 5 and 6; at present these soils are not farmed. The Walker River Paiute Reservation contains approximately 5.5 square kilometers (1,400 acres) of prime farmland soils, thus, construction of the Mina rail alignment would remove less than 0.1 percent of prime farmland soils on the Reservation from possible future productive use. Construction activities within the construction right-of-way would result in local soil compaction, which could impact the natural revegetation rate and vegetation types over time.

Any permanent alterations in topography that could not be mitigated could be viewed as unavoidable adverse impacts. As described in Section 4.3.1.2.1, topographic impacts due to major cut-and-fill and other earthwork processes would occur primarily along the Montezuma alternative segments, specifically along Montezuma alternative segment 1. In addition, impacts from major cut-and-fill and other earthwork processes also would occur around the Calico Hills and Terrill Mountains, the Goldfield Hills, Beatty, and Yucca Mountain. As described in Section 4.3.1.2.1.1, the total area that would be disturbed during construction of the proposed rail line and construction and operations support facilities would range from approximately 40 to 48 square kilometers (9,900 to 12,000 acres). Tables 4-145 to 4-150 in Section 4.3.1 list specific amounts of disturbed surface areas for the Mina rail alignment alternative segments, common segments, and construction and operations support facilities. Any impacts to physical setting, although unavoidable, would be small.

8.2.1.2 Land Use and Ownership

Use of land along the Mina rail alignment for construction and operation of the proposed railroad would involve some long-term changes in land use. The land DOE would use for this project would be managed as a right-of-way grant obtained from the BLM. This would not pose a land-use conflict because the rights-of-way would not be in right-of-way avoidance areas. The BLM could establish land management requirements that provide for multiple use, but land used for the proposed rail line and construction and operations support facilities could limit certain other land uses. The multiple-use mandate set forth in the Federal Land Policy and Management Act would continue to apply to the public lands within the right-of-way, but railroad construction and operations could limit certain future land uses that pose a conflict.

Construction and operation of the proposed railroad along the Mina rail alignment would directly impact grazing allotments by transecting parcels and potentially hindering access to forage and water resources. Other potential impacts include allotments being reduced in size and a reduced ability of livestock, wild horses, and burros to range freely across grazing areas. Even with mitigation, some adverse impacts to the use of grazing land would be unavoidable. Tables 4-161 to 4-166 in Section 4.3.2 summarize potential impacts to land use and ownership for each alternative segment, common segment, and railroad construction and operations support facility.

Construction and operation of the proposed railroad would not displace existing or planned land uses over a large area or conflict with land-use plans or goals. Therefore, any impacts to land use and ownership, although unavoidable, would be small.

8.2.1.3 Aesthetic Resources

The region of influence for aesthetic resources is the viewshed around all Mina rail alignment alternative segments, common segments, and railroad construction and operations support facilities, and any additional sidings that would be added under the Shared-Use Option. Operation of the proposed railroad along the Mina rail alignment would remain consistent with BLM visual resource management objectives, under which areas of high visual value (Classes I and II) are managed to minimize contrast levels, and areas of lower visual value (Classes III and IV) are allowed higher contrast levels. There would be unavoidable visual changes associated with the proposed railroad. Contrast levels that were rated by DOE as none, weak, or moderate would be such that BLM visual resource management objectives would be met for BLM-administered lands and impacts would be comparable on non-BLM-administered land.

8.2.1.4 Air Quality

Construction and operation of the proposed rail line and operations support facilities along the Mina rail alignment would cause unavoidable emissions of some criteria air pollutants. However, air pollutant concentrations would not exceed National Ambient Air Quality Standards for construction or operation of the railroad and associated facilities, with the exception of the 24-hour standards for both particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}) and an aerodynamic diameter of 2.5 micrometers or less (***$PM_{2.5}$***) that DOE modeled as exceeded near the construction right-of-way at Mina and Schurz during the short (less than 6 months) construction period, and at the Staging Yard at Hawthorne and the potential Garfield Hills quarry. However, DOE will be required to obtain a Surface Area Disturbance Permit Dust Control Plan, issued by the State of Nevada, Department of Environmental Protection, prior to development of the quarry and construction of the Staging Yard. DOE anticipates that compliance with the requirements of this plan to reduce fugitive dust emissions would decrease the possibility of ***ambient air*** quality standards exceedances—for example, the requirement for cessation of all operations when winds make control of fugitive dust difficult (this was a mitigating attribute not accounted for in the modeling that DOE undertook). DOE could further reduce the possibility of exceeding the 24-hour standard for PM_{10} at a public boundary by acquiring additional land and moving public access farther away.

The highest increase in air pollutant emissions would occur during the construction phase, and the highest increase in air emissions from railroad operations would occur in the vicinity of the operations support facilities. The highest increase in criteria air pollutant emissions would be for ***nitrogen oxides*** in Esmeralda County during the construction phase, where emissions could be 3,570 metric tons (3,940 tons) per year higher than the 2002 county-wide emissions of nitrogen oxides. However, these emissions would be distributed over the entire length of the rail alignment in the county and no air quality standard would be exceeded. Fugitive dust emissions from construction-vehicle traffic on unpaved roads, surface disturbance (such as grading, scraping, bulldozing, wind erosion, and quarry excavation activities), and operation of concrete batch plants could cause unavoidable temporary impacts to air quality that, although within permissible limits, could not be completely mitigated. Table 4-198 in Section 4.3.4 summarizes impacts to air quality, which are projected to be small during both construction and operation, except temporarily during construction near the construction right-of-way at Mina and Schurz, the Staging Yard at Hawthorne, and the Garfield Hills quarry.

Therefore, any impacts to air quality, although unavoidable, would be small.

8.2.1.5 Surface-Water Resources

Regrading, cut and fill activities, and structures such as box culverts would cause localized changes in drainage patterns throughout the rail line construction right-of-way. Construction of the proposed Staging

Yard and Interchange Yard would require channelization of natural drainage surface waters to keep water out of railroad operations support facility sites. Changes in drainage patterns could result in changes in erosion and sedimentation rates or locations. Construction in washes or other flood-prone areas could reduce the area through which floodwaters naturally flow, resulting in water buildup or ponding on the upstream side of crossings during floods that would slowly drain through the culverts or bridges.

Temporary unavoidable impacts could occur from disturbance of about 0.002 square kilometer (0.55 acre) of wetlands along Schurz alternative segments 1 and 4, and 0.003 square kilometer (0.73 acre) of wetlands along Schurz alternative segments 5 and 6 during construction of a bridge at the Walker River crossing. Permanent fill or loss of wetlands would total about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6.

DOE evaluated potential impacts to surface waters by identifying areas where there are drainage channels or other water resources. While some changes would be unavoidable, DOE would take steps to ensure the alterations to natural drainage, sedimentation, and erosion would not increase future flood damage, increase the impact of floods on human health and safety, or cause identifiable harm to the functions and values of floodplains. Because hydraulic structures and conveyance systems would be designed to safely convey 50-year or 100-year design storms and minimize concentration of flow, impacts associated with drainage conveyance would be small. The Department would minimize impacts to surface-water resources through the implementation of engineering design standards and best management practices that include erosion control measures.

Therefore, any impacts to surface-water resources, although unavoidable, would be small.

8.2.1.6 Groundwater Resources

Withdrawal of groundwater from multiple wells for construction of the proposed railroad could cause a short-term decrease in groundwater resources resulting from increased demand on the host aquifer at each new well location. Groundwater withdrawal could decrease the amount of water available to a nearby existing well or spring discharge, and/or, in theory, decrease the amount of water available for underflow to a downgradient basin. The impacts of groundwater withdrawals from the proposed water-supply wells at the range of production rates that would be required for the rail line would be localized in nature, small in magnitude compared to existing groundwater inventories, and primarily temporary. Impacts analysis results indicate that short-term withdrawal of water from new water wells at the proposed withdrawal rates could, in some instances, if unmitigated, have some unavoidable impact on existing wells or springs. In those instances, mitigation measures are proposed, such as use of a staggered pumping schedule for the new well, or pumping the new well at a reduced rate over a longer time period, in order to minimize or prevent such impacts on existing groundwater users and uses. Over time, because the amount of groundwater withdrawn represents a fractionally small percentage of the available groundwater in storage, and the withdrawals would be limited primarily to the construction phase, DOE anticipated that this water would be replenished through the natural water cycle following the construction phase. Some of the water used for compaction would return to groundwater aquifers. For these reasons, DOE expects that there would be no adverse long-term impacts to existing groundwater resources.

8.2.1.7 Biological Resources

There could be unavoidable, short-term, adverse impacts to wildlife, special status species, protected game species, and wild horses and burros. There would be the potential for unavoidable impacts to threatened or endangered species during the construction phase. Potential impacts to desert tortoise would be moderate because of fragmentation of habitat. There would be the potential for impacts to threatened or endangered species during construction. Unavoidable impacts to wildlife and wild horses and burros from railroad operations would consist of potential collisions of wildlife with trains and short-term disruption of activities (such as foraging, nesting, and resting). Other unavoidable impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

There could be some unavoidable impacts to special status wildlife or plant species. For example, project activities could result in small to moderate but unavoidable adverse impacts to:

- Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), as a result of construction of a bridge crossing the Walker River
- Non-critical habitat for the federally threatened Mojave population of the desert tortoise (*Gopherus agassizii*)
- Western snowy plover (*Charadrius alexandrinus nivosus)* along Mina common segment 1
- Northern goshawk (*Accipiter gentilis*) and Ferruginous hawk (*Buteo regalis*) along Montezuma 1, 2, and 3 and the potential North Clayton quarry

Nevertheless, DOE has concluded that there would be a small loss of habitats, and potential deaths of wildlife from trains and construction traffic would be low. Although such impacts would be unavoidable, long-term impacts would be small.

Construction of additional access roads would make ***herd management areas*** more accessible, which would then indirectly, but unavoidably, increase the loss of wild horses, burros, and desert tortoises from human interaction. However, DOE has determined that such impacts would be small and would have a small impact on management strategies within herd management areas. The overall ***indirect impact*** would be small.

8.2.1.8 Noise and Vibration

Railroad operations along the Mina rail alignment would lead to an unavoidable increase in ambient noise from passing trains in areas of Nevada that are mostly uninhabited. Noise from trains might be noticeable as new noise in residential areas near the rail line in Silver Springs, Silver Peak, Mina, and Goldfield. Because there is already some train activity in Silver Springs, additional train noise would be less noticeable there than in other areas where there is no train activity and no train noise at present. DOE estimated noise levels during the operations phase at all sensitive receptor locations along the Mina rail alignment, and found they would be below Surface Transportation Board noise impact criterion. Therefore, DOE has determined that no long-term adverse noise impacts would be expected during railroad operations along the Mina rail alignment. However, during the construction phase, DOE estimated that noise levels at certain receptor locations would be higher than Federal Transit Administration construction noise guidelines. This unavoidable impact would be temporary.

8.2.1.9 Socioeconomics

Construction and operation of the proposed railroad along the Mina rail alignment would unavoidably impact population, housing, employment, and public services in Lyon, Mineral, Esmeralda, Nye, and Clark Counties; traffic; and, to a small extent, local current agriculture, ranching, and mining activities.

Socioeconomic changes during the construction phase would include a brief elevation in project-related employment, temporary population increases, and immediate impact on existing levels of public services (health care, transportation, fire protection, and law enforcement) where construction activities were concentrated near communities. DOE determined that the greatest impacts would be economic, and although unavoidable, would be viewed as beneficial and not adverse. As outlined in Section 4.3.9, DOE demonstrated that construction-related impacts in Lyon, Mineral, Esmeralda, and Nye Counties would result in small increases in peak employment, increases in real disposable income, and increases in gross regional product. The project would generate vehicle trips during facilities construction, both from the movement of materials and from workers traveling to and from the work sites. DOE analyzed highway level of service by looking at traffic volume in terms of the peak hour flow during a 4- to 10- year construction period. DOE determined that there would be some unavoidable impacts from construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility at Yucca Mountain to traffic on U.S. Highway 95 near the entrances to the Yucca Mountain Site. This effect would degrade the level of service during peak traffic hours. However, this level would represent high density but stable traffic flow and constitute a small, but unavoidable, impact. This unavoidable impact would be temporary, lasting only as long as the construction phase (4 to 10 years, with the peak period limited to 2 years).

Impacts to traffic during railroad operations would be considerably lower than construction-related impacts. DOE determined that Rail Equipment Maintenance Yard operations would affect traffic on U.S. Highway 95 near the entrances to the Nevada Test Site; however, this level would represent high density but stable traffic flow, and constitute a small, but unavoidable, impact. Elsewhere, there would be no impacts or changes to highway levels of service during the operations phase.

Socioeconomic changes during the operations phase would include increases in project-related employment (particularly associated with railroad operations support facilities); slight long-term population increases; moderate pressure on available housing, and fire-protection and health services in southern Nye County; and continued small impacts on mining, ranching and agriculture. DOE determined that the greatest economic gains would arise in Mineral, Esmeralda, and Nye Counties.

8.2.1.10 Occupational and Public Health and Safety

The possibility of nonradiological industrial hazards (such as exposure to physical hazards, chemicals, dust, and pathogens) causing injury or illness to workers during construction and operations would not be completely unavoidable. However, the potential for such impacts would be very small. DOE has estimated that there could be approximately two fatalities associated with all such hazards during rail line and facility construction and 50 years of railroad operations.

There could be radiological impacts to workers and the public from incident-free transportation and facility operations. While the impact would be very small, radiological impacts would not be completely unavoidable. DOE estimated that approximately 0.35 latent cancer fatality could result to workers from incident-free transportation and facility operations, and that approximately 8.5×10^{-4} latent cancer fatality could result to the public from incident-free transportation and facility operations.

There could be radiological impacts from rail accidents involving casks. Radiological impacts from accidents are estimated to result in less than one latent cancer fatality.

There could be radiological impacts from sabotage events involving casks. If a sabotage event occurred in a suburban area, the collective radiation dose to the population is estimated to be 4,700 person-rem. The total latent cancer fatalities for people exposed during a sabotage event is estimated to be three.

By their nature, roadway accidents are considered unavoidable; however, the projected number of roadway accidents that could be attributed to construction and operation of the proposed rail line and facilities would be very small. DOE assessed the potential transportation safety impacts of vehicle traffic on roadways associated with constructing and operating the rail line and facilities. DOE determined that there could be six fatalities on roadways for the 315 million vehicle-kilometers (190 million vehicle-miles) traveled over the construction period, and seven fatalities on roadways for the 420 million vehicle-kilometers (263 million vehicle-miles) traveled during the 50-year operations phase.

Also by their nature, railway accidents are considered unavoidable; however, the projected number of rail accidents that could be attributed to construction and operation of the rail line and facilities would be very small. DOE determined that there could be approximately one fatality associated with the construction and operations phases. DOE also assessed the potential transportation safety impacts of rail traffic on the rail line and at at-grade crossings during the operations phase. The Department estimated that over the 50-year operations phase, 16 rail-related accidents could be expected to occur for the entire set of estimated train movements.

8.2.1.11 Utilities, Energy, and Materials

Some interfacing with existing utility rights-of-way, in particular electric utility lines, would be unavoidable. Temporary unavoidable impacts to utilities during the construction phase could include possible short-term service interruptions as service was switched from existing electric-power lines, telecommunication lines, and water pipelines to new lines crossing the rail line, or to lines that were relocated to avoid railroad construction activities.

The two principal electric providers in the project region, Nevada Power Company and Sierra Pacific Power Company, can currently meet peak load demands of 5,800 megawatts and 1,900 megawatts, respectively, through generating capacity or power-purchase capabilities. In 2005, their electricity sales were estimated to be 19 million megawatt-hours and 8.8 million megawatts, respectively. In addition, the smaller Valley Electric Association, Inc., is a local area power purchaser and reseller. Over the 4- to 10-year construction phase, the electrical power providers in the project region would have adequate generating capacity or power-purchase capabilities (see Section 3.3.11) to supply the project during peak demand without disrupting service to the providers' respective coverage areas. Therefore, although energy use would be unavoidable, anticipated electricity demand to meet construction and operations needs would be modest and would not adversely impact other regional needs for electric power.

As described in Section 4.3.11.2.1.3, DOE estimated that annual consumption of diesel fuel during the construction phase would be 109 million liters (28.8 million gallons), which would represent 6 percent of diesel fuel used annually in Nevada (DIRS 180874- Nevada Rail Partners 2007, Appendix D, Table D-5b). As described in Section 4.3.11.2.2.2, DOE estimated that over an anticipated 50-year operations lifecycle, 119 million liters (31.5 million gallons) of diesel fuel would be consumed, and the annual consumption rate would peak at 4.3 million liters (1.1 million gallons), a rate which is less than 0.25 percent of the current annual vehicular diesel fuel usage in Nevada. Although the use of fuel would be unavoidable, its use during either construction or operations would not adversely affect the capacity of national and regional fuel producers and distributors.

The need for construction materials, primarily steel, concrete, and aggregate, would be unavoidable, but would represent a small fraction of available materials (see Table 4-284). The regional and national impacts of meeting such needs would be small. Materials needed during the operations phase would be much less than during the construction phase, remaining considerably below available capacity, and impacts would not be adverse.

8.2.1.12 Hazardous Materials and Waste

The generation of some general solid wastes, special wastes (construction debris, used tires, and other materials with specific management requirements), and hazardous materials would be unavoidable, primarily during railroad construction. DOE would handle all wastes in accordance with applicable regulations, and would implement best management practices and pollution prevention/waste minimization programs. As described in Section 4.3.12, DOE estimated that 2,300 metric tons (2,500 tons) per year of nonhazardous solid waste (such as general household waste) would be generated during the construction phase, for a daily rate of about 6.3 metric tons (6.9 tons). Nonrecyclable wastes would be disposed of, which would raise the total amount disposed of in the four-county area of Mineral, Nye, Esmeralda, and Clark Counties by approximately 0.077 percent. In addition, DOE estimated that construction activities would generate approximately 12,000 metric tons (13,100 tons) of industrial and special wastes per year, for an approximate daily rate of 33 metric tons (36 tons), which would result in an increase of approximately 0.41 percent in waste receipt to local landfills.

DOE estimated that 170 metric tons (190 tons) per year or 0.45 metric tons (0.5 tons) per day of nonhazardous solid waste would be generated at railroad operations support facilities, which would raise the total amount disposed of in the four-county area by less than 0.01 percent. There would be ample disposal capacities to accept the small amounts generated of low-level radioactive wastes from the Cask Maintenance Facility of 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) over the 30- to 50-year lifetime of this project (DIRS 181425-MTS 2007, Table 2).

Although the use of disposal facilities would be unavoidable, existing disposal facilities have ample capacity to handle all additional wastes.

8.2.1.13 Cultural Resources

Because of the length of the Mina rail alignment and the complexity associated with engineering a feasible alignment, DOE used a phased cultural resource identification and evaluation approach, as described in 36 CFR 800.4(b)2, to identify specific cultural resources as is fully described in Section 4.3.13. DOE has surveyed approximately 20 percent of the area for cultural resources. Based on cultural resources already identified, it is reasonable to conclude that there may be undiscovered cultural resources in the Mina region of influence. The number and extent of identified cultural resource sites throughout the Mina rail alignment region of influence will continue to increase as more surveys and inventories of potentially disturbed land are completed.

Nevertheless, construction activities could cause unavoidable disturbance or destruction of cultural resources. Disturbance or destruction could occur during ground-disturbing activities along the Mina rail alignment, at quarries, along temporary access roads, at borrow sites, at temporary construction camps, and at railroad operations support facilities. During construction, larger numbers of workers in the vicinity of the construction camps could increase the potential for impacts to nearby cultural resources. Excavation and other construction-related ground-disturbing activities could unearth additional cultural materials that were either thought, based on previous archaeological surveys, to occur only at ground surface, or were previously undetected because they were completely underground.

Railroad construction and operation could also lead to unavoidable changes in cultural landscapes, such as changes to ethnographic, rural historic, and historic viewscapes. Cultural landscapes include historic-period Northern Paiute use of the Walker River and Walker Lake areas; historic-period Western Shoshone villages and surrounding use areas in the Oasis Valley and Goldfield areas; and historic mining in the Luning, Mina, and Goldfield districts.

DOE would further modify the rail alignment, as necessary, to avoid discovered cultural resources. Based on preliminary information and sample surveys, any impacts would likely range from small to moderate because of an extensive effort to avoid or mitigate them.

8.2.1.14 Paleontological Resources

DOE has not identified paleontological resources at or close to the Mina rail alignment, nor do these areas have a strong potential to contain important paleontological resources. While there could be a potential to uncover previously unknown fossils during railroad construction, DOE would consult with the BLM to develop appropriate measures to minimize damage to paleontological resources during project-related construction if fossils were found. DOE has not identified any unavoidable adverse impacts.

8.2.1.15 Environmental Justice

DOE determined that constructing and operating the proposed railroad along the Mina rail alignment would not result in disproportionately high and adverse human health, environmental, ecological, or cultural impacts on minority populations, low-income communities, or American Indian tribes from construction and operation of a rail line along the Mina rail alignment. DOE has not identified impacts, unavoidable or otherwise, in the context of environmental justice.

8.2.2 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Council on Environmental Quality regulations that implement the procedural requirements of NEPA require consideration of “the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). This includes using “ … all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generation of Americans” (NEPA, Section 101, 42 U.S.C. 4331).

This section discusses the short-term use of the environment and the maintenance of its long-term productivity. Chapter 4 provides more detailed discussions of the impacts and resource utilization associated with the Proposed Action and the Shared-Use Option. Construction and operation of the proposed railroad would require short-term uses of land and other resources. Any long-term loss of productivity in disturbed areas would be small. The land-cover types along the proposed rail alignment are widely distributed throughout the region of influence and any loss of vegetation in the disturbed area along the rail alignment would have little impact on the regional productivity of plants and animals. Future long-term land uses such as grazing or mining would not be precluded by the short-term use of the land for the proposed rail line. The relationships between short-term uses and long-term productivity would not be meaningfully altered if either the Proposed Action or Shared-Use Option were implemented, or by the selection of alternative segments within the Mina corridor.

DOE anticipates temporary short-term disturbances of about 0.002 square kilometer (0.55 acre) of wetlands along Schurz alternative segments 1 and 4, and 0.003 square kilometer (0.73 acre) of wetlands along Schurz alternative segments 5 and 6 during construction of a bridge at the Walker River crossing. Permanent fill or loss of wetlands would total about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6.

Productivity loss for soils should be limited to the disturbed areas impacted by land clearing, grading, and construction. Most disturbed areas not permanently maintained for railroad operations would recover over time, although recovery and a return to natural productivity could be slow for disturbed biological communities in an arid environment. DOE would revegetate disturbed areas with appropriate native species. DOE estimated a maximum of 14,000 square meters (3.5 acres) of potentially disturbed soils are characterized as prime farmland along the Schurz alternative segments and the minimal loss of these unfarmed soils would not impact long-term productivity.

The areas used for temporary construction camps would likely recover in the short-term because they would be unused after construction activities ceased. DOE would implement restoration activities to encourage natural vegetation to grow on these sites. The Department might eventually abandon the proposed rail line and its operations support facilities, although it is unlikely that the rail roadbed would ever be completely dismantled. The proposed rail line and these facilities could be turned over to commercial carriers, especially if the Shared-Use Option were selected, and could continue to aid economic productivity in the region. Under the Shared-Use Option, the proposed rail line could increase transportation opportunities and lower transportation costs in the region.

The short-term withdrawal of water from the temporary construction wells could have a small impact on groundwater availability. However, DOE has projected that drawdowns would be sufficiently small to preclude impacts on flow rates or discharge rates at existing productive water-supply wells or springs. There would be no long-term impacts to groundwater resource productivity because the construction wells would only be used for a short time.

8.2.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA Section 102 (42 U.S.C. 4332) and Council on Environmental Quality regulations that implement the procedural requirements of NEPA (40 CFR 1502.16) require that environmental analyses include identification of "… any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." An irreversible commitment of resources represents a loss of future options. It applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity, whereas an irretrievable commitment of resources represents opportunities that are foregone for the period of the proposed action. Examples include the loss of production, harvest, or use of renewable resources. The decision to commit the resources is reversible, but the utilization opportunities foregone are irretrievable.

This section describes irreversible and irretrievable commitments of resources associated with implementation of the Proposed Action along the Mina rail alignment. Sections 8.2.3.1 to 8.2.3.15 discuss resource commitments that could be irreversible and irretrievable. Irreversible and irretrievable commitments of resources would not meaningfully vary among alternative segments along the Mina rail alignment, or by implementation of the Shared-Use Option.

8.2.3.1 Physical Setting

Construction of the rail line and railroad construction and operations support facilities along the Mina rail alignment could displace mineral deposits. Although no minerals would be removed, placement of the rail line could displace mineral deposits and reduce their availability for mining, if any were found within the construction right-of-way. If these circumstances occurred and options for future use of minerals were limited, there would be an irreversible commitment of resources.

8.2.3.2 Land Use and Ownership

Construction and operation of the proposed railroad would require the commitment of land for placement of the rail line, construction and operations support facilities, and access roads. If at a future date DOE were to abandon the railroad, although much of the construction material might be removed, it is not likely that all of the natural landscape would be restored, and some of the land commitment would remain irreversible. Following abandonment of the railroad, the appropriate lands along the Mina rail alignment would be relinquished back to the BLM, the Walker River Paiute Tribe, and Department of Defense at the Hawthorne Army Depot.

8.2.3.3 Aesthetic Resources

DOE determined that the visual impacts of operating trains would range from no visual contrast to strong visual contrast, and that the long-term visual impacts of marks on rock, soil, and vegetated landscape from cuts, fills, well pads, and access roads would range from weak to strong (see Section 4.3.3). The rail alignment would remain consistent with BLM visual resource management objectives where areas of high visual value are managed to minimize contrast levels, and areas of lower visual value are allowed higher contrast levels. Where land commitment was irreversible, aesthetic impacts would sometimes remain irreversible.

8.2.3.4 Air Quality

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment.

8.2.3.5 Surface-Water Resources

Permanent fill or loss of wetlands would total about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6. This could result in an irreversible commitment of resources.

8.2.3.6 Groundwater Resources

DOE estimated that a total of 7.3 billion cubic meters (5,900 acre-feet) of water would be required for railroad construction and operations, all of which DOE assumed would be obtained through the construction of new water wells. Although this water would be consumed, this would not be an irretrievable commitment. Over time, because the amount of groundwater withdrawn represents a fractionally small percentage of the available groundwater in storage, and the withdrawals would be limited primarily to the railroad construction period, it is anticipated that this water would be replenished through the natural water cycle following the railroad construction phase. Some of the water used for compaction would return to groundwater aquifers. For these reasons, it is expected that there would be no adverse long-term impacts to existing groundwater resources.

8.2.3.7 Biological Resources

The areas that would be occupied by the rail line, railroad construction and operations support facilities, and access roads would be irreversibly removed from natural habitat for the life of the proposed railroad. In addition, the disturbances of the desert soil surfaces in areas of temporary construction activity could result in changes that would be irreversible over the long term. The permanent conversion of vegetation resources and wildlife habitat along the rail line and at construction and operations support facilities could represent an irreversible commitment of biological resources for the life of the railroad and beyond if, following abandonment, DOE did not restore these resources, or if former vegetation cover and composition did not recover. Losses of wildlife during railroad construction and operations would represent an irretrievable commitment of biological resources.

8.2.3.8 Noise and Vibration

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment.

8.2.3.9 Socioeconomics

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment.

8.2.3.10 Occupational and Public Health and Safety

As discussed in Section 8.2.1.10, nonradiological industrial hazards (such as exposure to chemicals, dust, and pathogens) could cause injury or illness to workers during railroad construction and operations; however, DOE estimated the risk as approximately two fatalities. Radiological impacts to workers (0.35 latent cancer fatality) and the general public (8.5×10^{-4} latent cancer fatality) could occur from incident-free transportation, and DOE estimated the risk to be each less than one. DOE assessed the potential transportation safety impacts of movement on roadways, the rail line, at operations support facilities, and at grade crossings associated with railroad construction and operation. DOE estimated that there could be six vehicular-related fatalities during construction, seven vehicular-related fatalities during operations, and approximately one rail-related fatality during construction and operations.

8.2.3.11 Utilities, Energy, and Materials

As described in Section 4.3.11, DOE estimated that annual consumption of diesel fuel during the railroad construction phase would be 109 million liters (28.8 million gallons). Over an anticipated 50-year operations lifecycle, 119 million liters (31.5 million gallons) of diesel fuel would be consumed, and if the Shared-Use Option was implemented during the operations period, a total of 390 million liters (103.5 million gallons) would be consumed (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table D-5a). Fossil fuel consumed would be irreversible, and any portion of fuel consumed that was bio-fuel would be considered irretrievable. DOE has established an 8 megawatt power requirement (which includes a 30-percent reserve) for the Rail Equipment Maintenance Yard and Cask Maintenance Facility (DIRS 181033-Hamilton-Ray 2007, all). Fossil fuel or nuclear resources that generated that electricity would be irreversible.

As described in Section 4.3.11, railroad construction would require an estimated 63,000 metric tons (69,000 tons) of steel and 373,000 metric tons (411,000 tons) of concrete. Approximately 776,000 concrete railroad ties would be required for track construction. The estimated requirement for rail line ballast would be approximately 2.5 million metric tons (2.8 million tons), approximately 2.2 million metric tons (2.4 million tons) for subballast (DIRS 180874-Nevada Rail Partners 2007, Section 3.1.1, p. 3-1). Use of these materials would not be considered an irretrievable commitment of resources because they could be recovered and recycled if DOE eventually abandoned the rail line.

8.2.3.12 Hazardous Materials and Waste

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment, other than the irreversible loss of land used for landfills.

8.2.3.13 Cultural Resources

Cultural resources (archeological, historical, and ethnographic) are nonrenewable resources and any loss would be irreversible. At this time, DOE cannot fully characterize potential effects on cultural resources along the Mina rail alignment or the magnitude of these effects.

8.2.3.14 Paleontological Resources

At this time DOE has not identified any impacts to paleontological resources along the Mina rail alignment, but any impact that could occur would be irreversible.

8.2.3.15 Environmental Justice

DOE determined that constructing and operating the proposed railroad along the Mina rail alignment would not cause high or adverse impacts to fall disproportionately on minority or low-income populations. Thus, DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment that would present an environmental justice concern.

PREPARERS, CONTRIBUTORS, AND REVIEWERS

This chapter identifies the individuals who had key responsibilities in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS, and summarizes their education and professional experience.

Preparers and Contributors

The U.S. Department of Energy (DOE or the Department) provided direction to the NEPA analysis team, which was responsible for developing the analytical methodology and alternatives, coordinating the work tasks, performing the impact analyses, and producing the documents. DOE is responsible for data quality, scope, content, issue resolution, and direction.

In addition, Bechtel SAIC Company, LLC, and its subcontractors prepared engineering-based documentation and information that was independently evaluated and incorporated into the Nevada Rail Corridor SEIS and the Rail Alignment EIS. DOE retained the responsibility for determining the appropriateness and adequacy of incorporating any data, analyses, and results of other work performed by these organizations into the SEIS and the EIS; the NEPA analysis team integrated this work in the documents.

The table below lists the names, education, experience summaries, and responsibilities of key personnel who managed, prepared, contributed to, and reviewed the Rail Corridor SEIS and the Rail Alignment EIS.

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 1 of 9).

Name	Education	Experience	Responsibilities
U.S. Department of Energy/Office of National Transportation			
M. Lee Bishop	B.S., Biology, 1987	16 years – NEPA; environmental permitting and protection; health physics; radioactive waste management	SEIS/EIS Document Manager
Robert Black	M.P.A., Public Administration, 1984 M.N.S., Biological Sciences, 1977 B.S., Zoology, 1969	32 years – NEPA compliance; environmental studies; resource management	Technical reviewer
Robert Clark	B.S., Marine Engineering, 1981	24 years – nuclear design; construction; quality assurance; radioactive waste management	Rail line conceptual design; mitigation; technical reviewer
Ned B. Larson	M.S., Geotechnical Engineering, 1982 B.S., Civil Engineering, 1978	25 years – engineering and design of numerous civil structures; soil and rock mechanics investigations; design of facilities to dispose of hazardous and nuclear wastes; project management	Nevada Rail Federal Project Director

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 2 of 9).

Name	Education	Experience	Responsibilities
U.S. Department of Energy/Office of National Transportation (continued)			
Narendra Mathur	M.S., Environmental Engineering, 1972	30 years – NEPA compliance and documentation; environmental, safety, and health compliance; environmental audits; environmental program management; environmental regulatory compliance	National transportation
Robin L. Sweeney	Ph.D., Environmental Science and Public Policy, 2006 M.S., Geosciences, 1987 B.S., Biological Sciences, 1980	22 years – hazardous and nuclear waste field, waste management, RCRA/ CERCLA facility assessments, sampling and monitoring, project and program management, laboratory research	Technical Advisor, Nevada Transportation Project Manager
Mark Vandeberg	B.S., Geology, 1984	22 years – geotechnical/ environmental projects; CERCLA site restoration; DOE FUSRAP program management; environmental compliance and permitting	Technical reviewer
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Management Team			
Michael West Potomac-Hudson Engineering, Inc.	M.S., Environmental Engineering, 2001 B.S., Environmental Engineering, 1993	14 years – NEPA analysis; environmental studies; regulatory analysis; program management	Project Manager Project Controls Officer Deputy Quality Assurance Manager
A. Brook Crossan, P.E. Potomac-Hudson Engineering, Inc.	Ph.D., Geophysical Fluid Dynamics, 1974 M.S., Mechanical Engineering, 1971 B.S., Mechanical Engineering, 1969	35 years – NEPA analysis and mitigation design; environmental permitting; project management	Project Manager Technical reviewer
Jeffrey McCann Potomac-Hudson Engineering, Inc.	B.G.S., Geology, 1980	26 years – geological analysis; NEPA specialist; program management	Deputy Project Manager Engineering interface and project integration
Elizabeth Kavanagh Potomac-Hudson Engineering, Inc.	B.S., Environmental Science, 2000	6 years – NEPA review and supporting studies; environmental management systems; regulatory compliance	Deputy Project Manager Project integration
Robert Peel URS Corporation	B.S., Geography, 1976	30 years – DOE and commercial nuclear projects; NEPA document management; environmental impact analysis; regulatory compliance	Deputy Project Manager

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 3 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Management Team (continued)			
Neil Sullivan ICF International	M.S., Integrated Environmental Management, 1999 B.S., Human and Physical Geography, 1994	11 years – NEPA documentation for rail and other nonlinear projects; environmental program management; technical and policy analysis	Deputy Project Manager Lead, Rail Alignment EIS Chapter 1
Judith Shipman Potomac-Hudson Engineering, Inc.	A.A., General Studies, 1991	31 years – NEPA documentation; document production coordination; editing; quality assurance	Document Manager Editorial lead
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team			
Jeff Ang-Olson ICF International	Master of City Planning, 1997 M.S., Transportation Engineering, 1997	11 years – passenger and freight transportation planning and analysis	Analyst, Shared-Use Option
Matthew Barkley ICF International	M.A., Organizational Management, 2006 Certificate of Environmental Management, 2002 B.S., Environmental Resource Management, 1997	8 years – NEPA and environmental consulting, including cumulative impact assessments, wetland delineations, and hazardous materials surveys	Analyst, mitigation, cumulative impacts
Stephanie Barrett ICF International	M.P.A., Environmental Policy, 1998 B.S., Geology, 1994	11 years – environmental policy analysis, including hazardous waste, land revitalization programs, and land use impact for NEPA projects; 2.5 years – RCRA and groundwater contamination sampling and reporting	Analyst, land-use impacts and Rail Alignment EIS Chapter 2
Anthony Becker Potomac-Hudson Engineering, Inc.	B.S., Biology, 2003	4 years – NEPA analysis	Lead analyst, waste and hazardous materials
Mark Bethoney ICF International		16 years – GIS and computer-aided mapping	GIS, CAD, map atlas creation/production, graphics
Fred Carey, P.E. Potomac-Hudson Engineering, Inc.	M.S., Environmental Engineering, 1997 B.S., Civil Engineering, 1992	15 years – NEPA management and impact analysis; civil engineering	Senior Technical Reviewer
Edward Carr ICF International	M.S., Atmospheric Science, 1983 B.S., Meteorology, 1979	19 years – air quality impact assessments; air quality modeling; emission inventory development; meteorological data collection and assessment	Lead analyst, air quality and climate

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 4 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
Austina Casey Potomac-Hudson Engineering, Inc.	M.S., Environmental Sciences, 2001 B.S., Chemistry, 1990	16 years – environmental compliance; air permits and air quality impact assessments preparation; emissions inventory development; RCRA investigations	Analyst, air quality and climate
Nancy Clark Potomac-Hudson Engineering, Inc.	J.D., 2004 M.S.E.L., Environmental Law, 2004 B.S., Chemical Engineering, 2001	7 years – NEPA analysis; nuclear waste engineering; environmental law	Analyst, statutory requirements Engineering interface
David Coate ICF International	M.S., Energy Technology, 1980 B.A., Mathematics, 1978 B.A., Physics, 1978 B.A., Chemistry, 1978	28 years – acoustics and vibrations analysis	Lead analyst, noise and vibration
Brian Colson URS Corporation	B.S., Geography, 2004	2 years – NEPA projects; various FEMA projects; energy projects, and transportation projects for public and private sectors	Cartographer GIS analyst for biological, cultural, and groundwater resources
Anna Compton URS Corporation	M.S., Geography, pending (coursework, examinations, and research completed) B.S., Logistics & Transportation, 2003	5 years – GIS analysis; cartography	Analyst, water resources
Charina Contreras		10 years – administrative and records support	Administrative record and references support
Theodore Coogan ICF International	B.S., Environmental Earth Science, 1986	23 years – marine geochemistry and geospatial sciences	GIS and mapping
Mary Jo Crance URS Corporation	M.S., pending B.S., Environmental Science, 1991 B.A., Environmental Studies, 1991 A.A.S., Laboratory Technology, 1985	18 years – radiological, chemical, and biological characterizations and mitigations through habitat investigations; surface-water sampling; groundwater sampling; NEPA analysis	Analyst, water resources
Maria de la Paz Aviles Potomac-Hudson Engineering, Inc.	M.S., Environmental Management and Planning, 2004 B.S., Biological Resources Engineering, 2002	5 years – NEPA support; field studies	GIS, CAD, graphics creation and production

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 5 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
James Dendy URS Corporation	B.S., Geology, 1999 (emphasis in hydrogeology)	8 years – senior environmental consultant/hydrogeologist for DoD and DOE	Analyst, groundwater resources
Steve Diem URS Corporation	M.S., Biology, 1999 B.S., Engineering Geology, 1994	9 years – geological consulting and paleontology	Technical reviewer, paleontological resources
Michelle Moser ICF International	M.S., Biological Sciences, 2005 B.S., Environmental Sciences, 2002	4 years- environmental and biological studies; NEPA analysis; regulatory analysis	Quality assurance support; SEIS editorial support
Frank Gallivan ICF International	Master of City Planning, 2006 B.A., Economics / Classical Archaeology, 2001	3 years – transportation studies, master planning, and land use studies	Analyst, Shared-Use Option
Lynne Gilman Potomac-Hudson Engineering, Inc.		35 years – document management; quality control	Project and quality controls; reference traceability
Elizabeth Gormsen ICF International	M.P.P., Public Policy, 2002 B.A., Economics, 1998	6 years – policy analysis; economic and regulatory analysis; socioeconomic impact analysis	Analyst, socioeconomics
Joe Grieshaber Potomac-Hudson Engineering, Inc.	M.B.A., Finance, 1984 M.S., Biology, 1974 B.S., Biology, 1972	30 years – NEPA analysis; project management; environmental compliance	Technical reviewer; project controls
Mark Hale URS Corporation	M.A., pending (coursework, examinations, and research completed) B.A., Anthropology,1983	25 years – federal experience, including DOE and BLM; NEPA document preparation for variety of federal projects, including rail construction; NEPA review and evaluations; Section 106 Compliance	Analyst, cultural resources
Brian Harper URS Corporation	M.S., Nuclear Engineering, 2006 B.S., Chemical Engineering, 1997	3 years – radiological monitoring/analysis; investigation of nuclear fuel cycle impacts; groundwater and contaminant transport modeling	Analyst, water resources

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 6 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
Seth Hartley ICF International	M.S., Atmospheric Sciences, 2000 B.S., Physics, 1996	7 years – air pollution and air quality, particularly as related to transportation, as well as general numerical modeling, engineering, and data handling and analysis issues	Analyst, air quality and climate
Jennifer Kelly URS Corporation	B.S., Earth Science, 2004 B.A., Anthropology, 1993	3 years – environmental investigation projects; environmental remediation; groundwater and soil investigations; sampling and analysis reports	Analyst, groundwater resources
Michael Kelly URS Corporation	M.A., Anthropology, 1986 B.A., Anthropology, 1978	26 years – cultural resources management; Great Basin archaeology	Lead Analyst, cultural resources and American Indian interests
Kavi Koleini URS Corporation	B.S., Environmental Science, 1999	7 years – natural resource inventory, analysis, and reporting; preparation of NEPA documents for long-term land-use plans	Biological surveys of potential quarry sites
Tanvi Lal ICF International	M.S.E.S., Environmental Conservation and Management, 2006 M.P.A., Environmental Economics and Policy, 2006 B.S., Life Sciences, 2001	1 year – NEPA analysis, environmental science, natural resource conservation, and environmental economics	Project controls; quality assurance
David Lawrence URS Corporation		12 years – visual simulation and analysis; experience with the BLM Visual Resource Management system and the U.S. Forest Service Visual Management System	Analyst, aesthetics
Robert Lanza ICF International	M. Eng., Chemical Engineering, 1982 B.S., Chemical Engineering, 1980	25 years – NEPA document preparation and review, including NEPA documentation for proposed radioactive and hazardous waste management units and radioactive and hazardous materials transportation projects	Lead analyst, occupational and public health and safety
Alistair Leslie ICF International	Ph.D., Chemistry, 1975 B.A., Physics and Chemistry, 1966	30 years – NEPA analysis, environmental regulation and compliance; electric-power generation and transmission; energy analysis; air pollution analysis; air quality legislation; atmospheric chemistry research	Lead analyst, utilities, energy, and materials; unavoidable impacts Lead, Summary and Rail Alignment EIS Chapter 6

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 7 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
Jon Luellen URS Corporation	B.S., Geology, 1979 B.S., Physics, 1977	19 years – hydrogeologic investigations; site characterization; monitoring system design and implementation; site remediation; water resource assessments; nuclear disposal facility design and licensing	Lead analyst, groundwater resources
Jamie Martin-McNaughton Potomac-Hudson Engineering, Inc.	B.S., Geology-Biology, 2003	4 years – NEPA analysis, geology and soils science	Lead analyst, physical setting, geology, soils
Kristine Mayer URS Corporation	B.S., Geography, 2004	2 years – NEPA projects; various FEMA projects; energy projects	Cartographer GIS analyst
David McIntyre Potomac-Hudson Engineering, Inc.	M.S., Environmental Management, 1997 M.A., Geography, 2000 B.S., History 1990	16 years – NEPA analysis; environmental studies; program management	Lead, Nevada Rail Corridor SEIS
Aaron McKinnon Potomac-Hudson Engineering, Inc.		10 years – document production, graphics	Lead desktop publisher; graphics coordinator
Evelyn Mayfield		30 years – writing, editing, document production	Editorial support
Michelle Moser ICF International	M.S., Biological Sciences, 2005 B.S., Environmental Science, 2002	5 years – NEPA analysis, rulemaking support, and ecological risk assessments	Analyst, mitigation and best management practices
Elena Nilsson URS Corporation	M.A., Anthropology, 1985 B.A., English, 1978	28 years – cultural resources management; NEPA document preparation for variety of federal projects, including rail construction; NEPA review and evaluations; Section 106 Compliance	Analyst, cultural resources
Becky Oldham Potomac-Hudson Engineering, Inc.	B.S., English, 1991	15 years – NEPA analysis; document management	Lead analyst, environmental justice
Cynthia Ong Potomac-Hudson Engineering, Inc.	M.S., Environmental Science, 2003 B.S., Civil Engineering, 1994	5 years – land development; stormwater design; NEPA analysis	Analyst, transportation; surface water; utilities, energy, and materials
Marek Ostrowski URS Corporation	M.S., Water Resources and Hydraulics, 1999 B.S., Civil Engineering, 1989	17 years – hydrogeology, hydrology and hydraulics; groundwater flow and contaminant transport modeling; design of drainage and remediation systems; water supply evaluations	Analyst, water resources

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 8 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
Dautis Pearson URS Corporation	B.S., Biology, 1994	22 years – land management planning; interdisciplinary and interagency team leading and facilitation; NEPA document preparation	Analyst, biological resources
Stephanie Pesek URS Corporation	B.S., Animal Science, 1997	7 years – threatened and endangered species surveys; NEPA document preparation; Section 404 permitting	Analyst, biological resources
Polly Quick ICF International	Ph.D., Anthropology, 1976 M.A., Anthropology, 1970 B.A., Anthropology, 1968	31 years – NEPA analysis; public participation	Lead analyst, aesthetics and socioeconomics
Jean Reynolds URS Corporation	M.S., Meteorology, 1967 B.S., Meteorology, 1965	18 years – meteorological research; 6 years – air quality permitting, NEPA analysis; program management, regulatory compliance and waste management	Lead analyst, paleontological resources
Danny Rakestraw URS Corporation	M.S., Wildlife Ecology, 1995 B.S., Wildlife Ecology, 1986	16 years – endangered species compliance; environmental impact monitoring; biological resource studies	Analyst, biological resources and water resources
Mike Rivera Potomac-Hudson Engineering, Inc.	B.S., Environmental Planning and Analysis, 1993 B.S., Earth Science, 1992	13 years – NEPA analysis; wetland specialist	Analyst, water resources
Rachel Spangenberg Potomac-Hudson Engineering, Inc.	B.S., Biology, 1987	19 years – NEPA analysis; hazardous wastes; solid wastes	Analyst, physical setting
Mike Stanwood ICF International	M.S., Mineral Economics, 1979 B.A., Psychology, 1975	23 years – NEPA project management and process management; socioeconomics; land use; cultural resources; environmental justice; visual resources	Lead analyst, cumulative impacts and mitigation
Michelle Stegner URS Corporation	M.A., Anthropology, 2007 (pending) B.A., Geography-Anthropology, 1999	11 years – cultural resources management, Great Basin archaeology, NEPA document preparation; Section 106 compliance	Analyst, cultural resources
Adam Teepe ICF International	M.S., Environmental Science and Management, 2004 B.S., Environmental Geology, 2001	3 years – environmental impact analysis	Lead, Rail Alignment EIS Chapter 2 Engineering interface

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 9 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS Rail Alignment EIS Preparation Team (continued)			
Nathan Wagoner ICF International	M.S., Human Dimensions of Ecosystem Science and Management, 2006 B.S., Natural Resources Integrated Policy and Planning, 2003	4 years – parks and recreation and visitor use characteristics	Analyst, aesthetics and land use
Toni Washington Potomac-Hudson Engineering, Inc.		17 years – federal records management	Administrative record and technical reference coordination; records management
Jen Wennerlund URS Corporation	B.S., Geography, Cartography, Remote Sensing, Land Use Planning, 1987	18 years – geosciences, GIS analyst, manager; NEPA analysis for federal, state, and private projects	GIS Manager
Marcy Westover URS Corporation	B.S., Biology, 2000	6 years – natural resources; ecology; threatened and endangered species surveys; NEPA document preparation	Analyst, biological resources
Brian Whipple, P.E. Potomac-Hudson Engineering, Inc.	M.S., Information Science, 2003 B.S., Environmental Engineering, 1993	14 years – NEPA analysis; environmental remediation; engineering studies; regulatory compliance	Lead analyst, surface-water resources
Hovalin Woods ICF International	M.P.A., Environmental Policy and Management, 2001 B.S., Finance, 1999	7 years – NEPA analysis for rail projects and other linear projects, environmental management systems	Analyst, cumulative impacts
Audra Ziolkowski Potomac-Hudson Engineering, Inc.	B.A, Journalism/Mass Communications English, 1995	12 years – Editing, writing, proofreading, fact checking	Editor
Zintars Zadins URS Corporation	Ph.D., Geology, 1989 M.S., Geology, 1983 B.S., Geology, 1979	19 years – geologic and environmental remediation investigations in the academic, federal, and private sectors	Peer reviewer, groundwater resources

a. BLM = Bureau of Land Management; CAD = computer-aided design; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; DoD = U.S. Department of Defense; DOE = U.S. Department of Energy; FEMA = Federal Emergency Management Agency; FUSRAP = Formerly Utilized Sites Remedial Action Program; GIS = geographic information system; NEPA = National Environmental Policy Act; RCRA = Resource Conservation and Recovery Act.

Reviewers

The DOE Yucca Mountain Project Office incorporated input into the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS from a number of other DOE offices that reviewed the document while it was under development. These offices included:

- The Office of Naval Reactors, Nuclear Energy
- The Office of Repository Development
- National Nuclear Security Administration, Nevada Operations Office

Cooperating and Consulting Agencies

Cooperating and consulting agencies in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS, who provided appropriate input or participated in document review and comment resolution processes, are as follows:

- Cooperating agencies
  - U.S. Bureau of Land Management
  - Surface Transportation Board
  - U.S. Air Force
- Consulting agencies
  - U.S. Bureau of Indian Affairs
  - Walker River Paiute Tribe
  - U.S. Army

Disclosure Statements

As required by federal regulations (40 Code of Federal Regulations 1506.5c), Potomac-Hudson Engineering, Inc., and its subcontractors have signed National Environmental Policy Act of 1969 (42 United States Code 4321) disclosure statements in relation to the work they performed on the Nevada Rail Corridor SEIS and the Rail Alignment EIS. These statements appear on the following pages.

Disclosure Statement

Environmental Impact Statement
Rail Alignment for the Nevada Transportation Project
DE-RP28-05RW12351

DEAR 952.209-8 ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE requires an offeror to provide a statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. The offeror is to provide a statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certify as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a) X Has no past, present, or currently planned financial interest in the outcome of the project.

(b) Has the following financial interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Contractual Interest.

(a) X Has no past, present, or currently planned contractual interest in the outcome of the project.

(b) Has the following contractual interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Organizational Interest:

(a) X Has no past, present, or currently planned organizational interest in the outcome of the project.

(b) Has the following organizational interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Other Interest:

(a) X Has no past, present, or currently planned other interest in the outcome of the project.

(b) Has the following other interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Unfair Competitive Advantage:

To the best of my knowledge and belief, no unfair competitive advantage exists with regard to Potomac-Hudson Engineering, Inc.'s participation on the instant contract.

Certified by:

08/12/05

Signature Date

Fred Carey, Vice President

Name & Title (Printed)

Potomac-Hudson Engineering, Inc.

Company

Disclosure Statement

Environmental Impact Statement
Rail Alignment for the Nevada Transportation Project
DE-RP28-05RW12351

DEAR 952.209-8 ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE requires an offeror to provide a statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. The offeror is to provide a statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certifies as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a) X Has no past, present, or currently planned financial interest in the outcome of the project.

(b) Has the following financial interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Contractual Interest:

(a) X Has no past, present, or currently planned contractual interest in the outcome of the project.

(b) Has the following contractual interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

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3.

Organizational Interest:

(a) X Has no past, present, or currently planned organizational interest in the outcome of the project.

(b) Has the following organizational interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

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Other Interest:

(a) X Has no past, present, or currently planned other interest in the outcome of the project.

(b) Has the following other interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

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3.

Unfair Competitive Advantage:

To the best of my knowledge and belief, no unfair competitive advantage exists with regard to ICF Incorporated's participation on the instant contract.

Certified by:

Michael Berg 8/10/05

Signature Date

Michael Berg, Senior Vice President

Name & Title (Printed)

ICF Incorporated, LLC

Company

Disclosure Statement

Environmental Impact Statement
Rail Alignment for the Nevada Transportation Project
DE-RP28-05RW12351

DEAR 952.209-8 ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE requires an offeror to provide a statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. The offeror is to provide a statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certify as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a)	X	Has no past, present, or currently planned financial interest in the outcome of the project.
(b)		Has the following financial interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

Contractual Interest:

(a)		Has no past, present, or currently planned contractual interest in the outcome of the project.
(b)	X	Has the following contractual interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

California Institute of Technology
200 E. California Blvd., Pasadena CA 91125-0600
Nathan Niemy, PhD, (626) 395-6166
URS is completing development of Environmental Assessments of potential impacts of new geodetic monitoring stations to be installed by CalTech in southern Nevada and southeastern California. The stations will be used to monitor minute movements in the tectonic plates in the region so that the Department of Energy can evaluate potential performance of the Yucca Mountain repository. CalTech is installing the stations as a subcontract to the University of Nevada System on a grant from the DOE. URS' interest in the project will be completed in by the end of September, if not earlier.
URS POC: Danny Rakestraw
Client Contract Number: 26698733
Wilbur Smith Associates
201 Mission Street, Suite 1450, San Francisco CA, 94105
Justin Fox, Chief of Rail Studies, 415-495-6201 (Fax) 415-495-5305
As a subcontractor to Wilbur Smith Associates, URS evaluated potential economic benefits to the counties of Nye, Lincoln and Esmeralda from a new freight rail line to serve the federal geologic waste repository at Yucca Mountain, Nevada. This preliminary assessment involved quantifying the freight traffic that would be generated by the new rail line, or diverted from shipment via truck, and translating transportation cost savings into local economic benefit. Shippers and potential shippers throughout the rail corridor were interviewed regarding their interest in rail shipment, and the savings it would represent. In addition, URS assessed the potential benefits the three counties might gain via involvement in the planning, construction, ownership and operation of the railroad.

URS POC: D. Sanford Stodtfeld
Client Contract Number: None Assigned
Bechtel SAIC
1180 Town Center Drive, Las Vegas, NV 889144
Richard Pernisi, (702) 821-7720
Development of preclosure seismic design and posclosure performance assessment ground motions for the repository and surface facilities. Activities include geotechnical and geological site characterization and numerical modeling of earthquake ground motions.
URS POC Ivan Wong
Subcontract #QA-HC4-00443

Organizational Interest:

(a) X Has no past, present, or currently planned organizational interest in the outcome of the project.

(b) Has the following organizational interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract.

Other Interest:

(a) X Has no past, present, or currently planned other interest in the outcome of the project.

Unfair Competitive Advantage:

To the best of my knowledge and belief, no unfair competitive advantage exists with regard to URS Group Inc.'s participation on the instant contract.

Certified by:

Signature [signature] August 11, 2005
Date

Edward Jennrich, Vice President
Name & Title (Printed)

URS Group, Inc
Company

Disclosure Statement

Environmental Impact Statement
Rail Alignment for the Nevada Transportation Project
DE-RP28-05RW12351

DEAR 952.209-8 ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE requires an offeror to provide a statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. The offeror is to provide a statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certify as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a) X Has no past, present, or currently planned financial interest in the outcome of the project.

(b) Has the following financial interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

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3.

Contractual Interest:

(a) X Has no past, present, or currently planned contractual interest in the outcome of the project.

(b) Has the following contractual interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

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Organizational Interest:

(a) X Has no past, present, or currently planned organizational interest in the outcome of the project.

(b) Has the following organizational interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

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Other Interest:

(a) X Has no past, present, or currently planned other interest in the outcome of the project.

(b) Has the following other interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

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3.

Unfair Competitive Advantage:

To the best of my knowledge and belief, no unfair competitive advantage exists with regard to Image Associates, LLC participation on the instant contract.

Certified by:

Signature — Date: 8/11/05

Diane L. Gunter, President

Name & Title (Printed)

Image Associates, LLC

Company

GLOSSARY

DOE prepared this glossary to help readers understand information in the Supplemental Yucca Mountain Nevada Rail Corridor EIS and Rail Alignment EIS. This glossary includes definitions of technical and regulatory terms common to DOE NEPA documents and explains these terms with their most likely meanings in the context of DOE NEPA documents, and in particular this document. To better aid the reader, a number of terms in this glossary emphasize their specific relationship to the proposed railroad project and to the Yucca Mountain Repository. DOE obtained each definition from an authoritative source (for example, a statute, regulation, DOE directive, dictionary, or technical reference book).

Words in ***bold italics*** refer to other words in the glossary.

100-year flood	A flood event of such magnitude that it occurs, on average, every 100 years; this equates to a 1-percent chance of its occurring in a given year. A base flood may also be referred to as a 100-year storm. The area inundated during the base flood is sometimes called the 100-year ***floodplain***.
136 RE rail	This term denotes rail with a nominal weight of 136 pounds per yard specified in English units, and is also specified as 132 metric tons per kilometer (234 tons per mile) for two-rail track.
500-year flood	A flood event of such magnitude that it occurs, on average, every 500 years; this equates to a 0.2-percent chance of its occurring in a given year.
50-year flood	A flood event of such magnitude that it occurs, on average, every 50 years; this equates to a 2-percent chance of its occurring in a given year.
accessible environment	For this ***environmental impact statement*** (EIS), all points on Earth outside the surface and subsurface area controlled over the long term for the ***repository***, including the atmosphere above the controlled area.
accident	An unplanned sequence of events that results in undesirable consequences. Examples in this Rail Alignment EIS include an inadvertent release of ***radiation*** from the ***casks*** or hazardous materials from their containers; train derailments; vehicular accidents; and construction-related accidents that could affect workers.
acre-foot	A unit commonly used to measure water volume. It is the quantity of water required to cover 4,047 square meters (1 acre) to a depth of 0.3048 meter (1 foot), and is equal to 1,233.5 cubic meters (325,851 gallons).

AERMOD (**A**MS/**E**PA **R**egulatory **Mod**el)	A short-range steady-state ***air quality*** dispersion model. The model incorporates air dispersion concepts based on the state-of-the-science understanding of planetary boundary layer turbulence structure and scaling concepts. On December 9, 2005, AERMOD became the U.S. Environmental Protection Agency (EPA) preferred air dispersion model in place of ISC3.
AERMET (**AER**MOD **Met**eorological Preprocessor)	The meteorological preprocessor component of ***AERMOD***. Surface meteorological observations, hourly cloud-cover observations, and twice-a-day upper air sounds are "preprocessed" by AERMET into data used by AERMOD.
AERMAP (**AER**MOD **Map**s terrain Preprocessor)	The terrain preprocessor that uses data from the Digital Elevation Model Database and creates a file suitable for use within ***AERMOD***. This file contains elevation and hill-height scaling factors for each receptor for use by AERMOD.
aerosol	A suspension of tine, ***colloid***-size particles or liquid droplets in air. Fog and smoke are common examples of aerosols.
affected environment	For an EIS, a description of the existing ***environment*** (site description) covering information that relates directly to the scope of the ***Proposed Action***, the ***No-Action Alternative***, and the ***implementing alternatives*** being analyzed; that is, the information necessary to assess or understand the ***impacts***. This description must contain enough detail to support the impact analysis. The information must highlight "environmentally sensitive resources," if present; these include ***floodplains*** and ***wetlands***, ***threatened*** and ***endangered species***, prime and unique agricultural lands, and property of historic, archaeological, or architectural significance.
Agreement State	A state that reaches an agreement with the U.S. Nuclear Regulatory Commission (NRC) to assume regulatory authority to license and regulate ***radioactive*** materials.
air quality	A measure of the concentrations of pollutants, measured individually, in the air.
alien species	With respect to a particular ***ecosystem***, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.
alkalinity	Acid-neutralizing capacity of a substance. High alkalinity conditions can promote metal ***corrosion***.
alluvial fan	A low, outspread, relatively flat-to-gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream where it issues from a narrow mountain valley on a plain or break valley.
alluvium	A general term for the sedimentary material deposited by flowing water.

alpha particle	A positively charged particle ejected spontaneously from the nuclei of some ***radioactive*** elements. It is identical to a helium ***nucleus*** and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See ***ionizing radiation.***
alternative	One of two or more actions, processes, or propositions, from which a decisionmaker will determine the course to be followed. The National Environmental Policy Act, as amended, states that in preparing an EIS, an agency "shall … (s)tudy, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" [42 U.S.C. 4321, Title I, Section 102(E)]. The regulations of the Council on Environmental Quality that implement the National Environmental Policy Act indicate that the alternatives section is "the heart of the ***environmental impact statement*** (40 CFR 1502.14), and include rules for presentation of the ***alternatives***, including no action, and their estimated impacts. The Nevada Rail Corridor SEIS analyzes one alternative to the ***Proposed Action***, the ***No-Action Alternative***. Under the Nevada Rail Corridor SEIS No-Action Alternative, the U.S. Department of Energy (DOE or the Department) would not select a ***rail alignment*** within the Mina ***rail corridor*** for the construction and operation of a ***railroad***. As such, the No-Action Alternative provides a basis for comparison to the Proposed Action. The Rail Alignment EIS analyzes one alternative to the Proposed Action – the No-Action Alternative – and two implementing alternatives under the Proposed Action – the Caliente Implementing Alternative and the Mina Implementing Alternative – for constructing, operating, and possibly abandoning a ***railroad*** for the shipment of ***spent nuclear fuel*** and ***high-level radioactive waste*** for long-term ***disposal*** in a ***geologic repository*** at Yucca Mountain. Under the No-Action Alternative, DOE would not construct the proposed railroad along the Caliente rail alignment or the Mina rail alignment.
alternative segments	Geographic region of the ***rail alignment*** for which multiple routes for the ***rail line*** have been identified. In this Rail Alignment EIS, there are different alignments identified within the Caliente ***rail corridor*** and the Mina ***rail corridor*** that could minimize or avoid environmental ***impacts*** and reduce construction complexities.
ambient	(1) Undisturbed, natural conditions such as ambient temperature caused by climate or natural subsurface thermal gradients. (2) Surrounding conditions.
ambient air	The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It is not the air in the immediate proximity to emission sources.

ambient air quality standards	Standards established on a federal or state level that define the limits for airborne concentrations of designated ***criteria pollutants*** [***nitrogen dioxide***, ***sulfur dioxide***, ***carbon monoxide***, ***particulate matter*** with aerodynamic diameters less than 10 microns (PM_{10}), particulate matter with aerodynamic diameters less than 2.5 microns ($PM_{2.5}$), ***ozone***, and lead] to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).
ambient noise	The sum of all sounds (noise is unwanted sound) at a specific location over a specific time.
animal unit month	(1) A standardized unit of measurement of the amount of forage necessary for the complete sustenance of one animal for 1 month. (2) A unit of measurement of grazing privileges that represents the privilege of grazing one animal for 1 month.
aquifer	A subsurface saturated rock unit (formation, group of formations, or part of a formation) of sufficient ***permeability*** to transmit ***groundwater*** and yield usable quantities of water to wells and springs.
aquitard	A rock unit or layer that stores water and allows it to move only at a very slow rate.
Areas of Critical Environmental Concern	Places within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, and other natural systems, or processes or to protect life and safety from natural hazards.
arid	(1) Areas in which mean annual evaporation exceeds mean annual precipitation; (2) having insufficient rainfall to support agriculture; (3) the hyper-arid zone (arid index 0.03) comprising dry land areas without vegetation with the exception of a few scattered shrubs. Annual rainfall is low, rarely exceeding 100 millimeters (4 inches). In the arid zone (arid index 0.03-0.20), the native vegetation is sparse, being comprised of annual and perennial grasses and other herbaceous vegetation, and shrubs and small trees. There is high rainfall variability, with annual amounts ranging between 100 and 300 millimeters (4 and 12 inches).
at-grade crossing	Occurs when a roadway and a ***rail line*** cross paths at the same elevation.
atomic mass	The mass of a neutral atom, based on a relative scale, usually expressed in atomic mass units. See ***atomic weight.***
atomic nucleus	See ***nucleus***.
atomic number	The number of ***protons*** in an atom's ***nucleus***.

atomic weight	The relative mass of an atom based on a scale in which a specific carbon atom (carbon-12) is assigned a mass value of 12. Also known as relative ***atomic mass***.
A-weighted decibel scale	See ***decibel, A-weighted***.
Back Country Byway	A vehicle route that traverses scenic corridors utilizing secondary or back country road systems
background radiation	***Radiation*** from cosmic sources, naturally occurring ***radioactive*** materials such as granite, and global fallout from nuclear testing.
ballast	The coarse rock that is placed under the ***railroad*** tracks to support the railroad ties and improve drainage along the ***rail line***.
barrier	Any material, structure, or condition (as a thermal barrier) that prevents or substantially delays the movement of water or ***radionuclides***.
basalt	A dark gray to black, dense to fine-grained, ***igneous*** rock.
baseline	The existing environmental conditions against which impacts of a ***proposed action*** and its alternatives can be compared.
berm	A mound or wall of earth.
beta particle	A negatively charged ***electron*** or positively charged positron emitted from a ***nucleus*** during ***decay***. Beta decay usually refers to a ***radioactive*** transformation of a ***nuclide*** by electron emission, in which the ***atomic number*** increases by 1 and the mass number remains unchanged. In positron emission, the atomic number decreases by 1 and the mass number remains unchanged. See ***ionizing radiation.***
bio-based products	Energy, industrial, and consumer products made from renewable biological resources such as wood, agricultural residues, and fiber crops.
BLM-designated sensitive species	Species not already conferred U.S. Bureau of Land Management (BLM) special status by virtue of being (1) a federally listed, proposed, or ***candidate species***, or (2) a State of Nevada listed species. BLM policy is to provide these species with the same level of protection that is provided for candidate species in BLM Manual 6840.06 C.
block-bounding fault	A high-angle, ***normal fault*** with relatively large displacement that bounds one or both sides of the fault-block mountains typical of the Basin and Range province.
blowing soil	A soil characteristic based on the soil survey classification of susceptibility of a given soil to wind erosion. The blowing soils characteristic identifies areas where fine-textured, sandy materials predominate and where uncontrolled soil disturbance could result in increased wind erosion.

boiling-water reactor (BWR)	A ***nuclear reactor*** that uses boiling water to produce steam to drive a turbine.
borehole	For this Rail Alignment EIS, a hole drilled for purposes of collecting geotechnical information.
borosilicate glass	***High-level radioactive waste matrix*** material in which boron takes the place of the lime used in ordinary glass mixtures. See ***vitrification***.
borrow sites	Areas outside the ***nominal*** width of the ***rail-line construction right-of-way*** where construction personnel could obtain materials to be used in the establishment of a stable platform (subgrade) for the rail track. Aggregate crushing operations could occur in these areas.
buffer car	A flatbed railcar that would be placed at the front of a ***cask*** train between the locomotive and the first ***cask car*** and at the back of the train between the last cask car and the ***escort car***. Federal regulations require the separation of a railcar carrying ***spent nuclear fuel*** and ***high-level radioactive waste*** from a locomotive, occupied caboose, carload of undeveloped film, or railcar carrying another class of hazardous material by at least one ***buffer car***. These could be DOE railcars or, in the case of general freight service, commercial railcars.
caldera	An enlarged volcanic crater formed by explosion or collapse of the original crater.
cancer	A malignant tumor of potentially unlimited growth, capable of invading surrounding tissue or spreading to other parts of the body.
candidate species	Species for which the U.S. Fish and Wildlife Service has enough substantive information on biological status and threats to support proposals to list them as threatened or endangered under the Endangered Species Act. Listing is anticipated but has been precluded temporarily by other listing activities. See ***threatened species***, ***endangered species***.
canister	An unshielded metal container used as: (1) a pour mold in which molten vitrified ***high-level radioactive waste*** can solidify and cool; (2) the container in which DOE and electric utilities place intact ***spent nuclear fuel***, loose rods, or nonfuel components for shipping or ***storage***; or (3) in general, a container used to provide ***radionuclide confinement***. ***Canisters*** are used in combination with specialized overpacks that provide structural support, ***shielding*** or confinement for storage, transportation, and ***emplacement***. Overpacks used for transportation are usually referred to as transportation ***casks***; those used for emplacement in a ***repository*** are referred to as ***waste packages***.
carbon monoxide (CO)	A colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion; one of the six pollutants for which there is a national ***ambient air quality standard***.
carcinogen	An agent capable of producing or inducing ***cancer***.

carcinogenic	Capable of producing or inducing ***cancer***.
case file, BLM	A file typically including the following information: a report identifying the present users of the lands and how they would be affected; a report specifying water use for the project and how water would be obtained; an Environmental Assessment or ***EIS***; and floodplain and wetland impact statements. 43 CFR 2310.3-2 describes the required contents of a case file.
cask	A heavily shielded container that meets applicable regulatory requirements used to ship ***spent nuclear fuel*** or ***high-level radioactive waste***.
cask car	A railcar that would be used to transport ***casks*** of ***spent nuclear fuel*** or ***high-level radioactive waste***.
Cask Maintenance Facility	Processing location for empty transportation casks used to transport canistered fuel, including testing, inspection, maintenance, and decontamination
casual use	Activities ordinarily resulting in no or negligible disturbance of the public lands, resources, or improvements, including surveying, marking routes, and collecting data to use to prepare grant applications.
Census County Division	A statistical subdivision of a county, established and delineated cooperatively by the U.S. Census Bureau and state, local, and tribal officials for data presentation purposes. Census County Divisions have been established in states that do not have minor civil divisions suitable for data presentation. In these cases, minor civil divisions have not been legally established, do not have governmental or administrative purposes, have boundaries that are ambiguous or change frequently, or generally are not well known to the public.
Class 1 Area (related to air quality)	A specifically designated area in which the degradation of ***air quality*** is stringently restricted (for example, many national parks, wilderness areas).
Class 1 commercial railroad	The Surface Transportation Board defines a Class 1 commercial railroad as one with an annual operating revenue exceeding $277.7 million.
Class 3 road	A light-duty, paved or improved road.
Class 4 road	An unimproved, unsurfaced road (includes track roads in back country).
Class I inventory (related to cultural resources)	A study of published and unpublished documents, records, files, registers, and other sources, resulting in analysis and synthesis of all reasonably available data.

Class II inventory (related to cultural resources)	A sample-oriented field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a portion of a defined area to make possible an objective estimate of the nature and distribution of cultural resources in the entire defined area.
Class III inventory (cultural resources)	An intensive field survey designed to locate and record all cultural resource sites within a specified area. Upon completion of such an inventory, no further cultural resource inventory work is normally needed in the area.
clastic	Describing a rock or sediment composed mainly of broken fragments of preexisting minerals or rocks that have been transported from their places of origin.
cloudshine	***Irradiation*** of the human body by ***neutrons*** and ***gamma rays*** emitted by the passing plume of ***radioactive*** material.
collective dose	See ***population dose***.
colloid	Small particles in the size range of 10^{-9} to 10^{-6} meters that are suspended in a solvent. Naturally occurring colloids in ***groundwater*** arise from clay minerals.
colluvium	Loose earth material that has accumulated at the base of a hill through the action of gravity.
commercial spent nuclear fuel	Commercial nuclear fuel rods that have been removed from ***reactor*** use at civilian nuclear power plants that generate electricity. See ***spent nuclear fuel*** and ***DOE spent nuclear fuel***.
committed groundwater resource	Within a given hydrographic area, the total volume of permitted, certificated, and vested groundwater rights that are recognized by the State Engineer and have been approved for withdrawal in a ***hydrographic area*** in any given year.
common segment	Geographic region of the ***rail alignments*** for which a single route for the ***rail line*** has been identified.
community water system	A public water system that serves year-round residents of a community, subdivision, or mobile home park that has more than 15 service connections or an average of more than 25 residents for more than 60 days of the year.
Condition 1, 2, 3	BLM ranking of areas for their potential to contain paleontological resources: ***Condition 1 -*** Areas that are known to contain vertebrate ***fossils*** or noteworthy occurrences of invertebrate or plant fossils. ***Condition 2 -*** Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. ***Condition 3 -*** Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

cone of depression	The lowering of the ***water table*** in a cone-shaped depression around a pumped well.
confinement	As it pertains to ***radioactivity***, the retention of ***radioactive*** material within some specified bounds. Confinement differs from containment in that there is no absolute physical ***barrier*** in the former.
construction and operations support facilities	Construction support facilities are the temporary facilities that would be used during the ***railroad*** construction phase (***construction camps***, quarries, some access roads, and some water wells). Operations support facilities are the permanent structures that would be used during the railroad operations phase (***Staging Yard***, ***Interchange Yard***, ***Maintenance-of-Way Facilities***, ***Rail Equipment Maintenance Yard***, ***Cask Maintenance Facility***, some access roads, and some water wells).
construction camps	Areas along the ***rail alignment*** that could be used as temporary residences for construction crews, material and equipment storage areas, and concrete production areas. Such camps would be used during rail-line construction activities far from population centers.
construction right-of-way	Property obtained for construction of the proposed railroad. This right-of-way would have a ***nominal*** width of 150 meters (500 feet) on either side of the centerline of the ***rail line***, but would vary at specific locations to accommodate, for example, certain deep ***cuts*** and ***fills***, and construction of drainage controls. In addition, some facilities (such as quarries) would be outside the nominal width of the ***construction right-of-way***, but DOE would also obtain rights-of-way in these areas. See ***operations right-of-way***.
contaminant	A substance that contaminates (pollutes) air, soil, or water. It could also be a hazardous substance that does not occur naturally or that occurs at levels greater than those occurring naturally in the surrounding ***environment***.
contamination	The intrusion of undesirable elements (unwanted physical, chemical, biological, or radiological substances, or matter that has an adverse effect) to air, water, or land.
convection	(1) Thermally driven ***groundwater*** flow or a heat-transfer mechanism for a gas phase. The bulk motion of a flowing fluid (gas or liquid) in the presence of a gravitational field, caused by temperature differences that, in turn, cause different areas of the fluid to have different densities (for example, warmer is less dense). (2) One of the processes that moves solutes in groundwater.
corrosion	The process of dissolving or wearing away gradually, especially by chemical action.
cosmic radiation	A variety of high-energy particles including ***protons*** that bombard the Earth from outer space. They are more intense at higher altitudes than at sea level, where the Earth's atmosphere is most dense and provides the greatest protection.

cosmogenic radionuclides	***Radioactive*** nuclides generated when the upper atmosphere interacts with many of the ***cosmic radiations***. Common cosmogenic ***radionuclides*** include carbon-14, tritium, and beryllium-7.
criteria air pollutants	Six common pollutants (***ozone***, ***carbon monoxide***, ***particulate matters***, ***sulfur dioxide***, lead, and ***nitrogen dioxide***) known to be hazardous to human health and the ***environment***, and for which the U.S. Environmental Protection Agency sets National ***Ambient Air Quality Standards*** under the Clean Air Act. See ***toxic air pollutants***.
crustal extension	Descriptive of the slow movement off ***tectonic plates*** stretching Earth's outer layer of rocks.
culvert	A conduit for conveying surface water through an embankment.
cumulative impact	The ***impact*** on the ***environment*** that results from the incremental impact(s) of an action when added to other past, present, or reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
cut	Cutting away from the top of a slope to fill in at the bottom, thereby providing a suitable grade for the rail ***roadbed***. See ***fill***.
day-night average noise level	The energy average of ***A-weighted decibel*** sound levels over 24 hours, which includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the daytime.
decay (radioactive)	The process in which one ***radionuclide*** spontaneously transforms into one or more different radionuclides called ***decay products***.
decay product	A ***nuclide*** resulting from the radioactive decay of a parent isotope or precursor nuclide.
decay series	The ***radioactive decay*** of different discrete radioactive decay products as a chained series of transformations. Most ***radioactive*** elements do not decay directly to a stable state, but rather undergo a series of ***decays*** until eventually a stable isotope is reached.
decibel (dB)	A standard unit for measuring sound pressure levels based on a reference sound pressure of 0.0002 dyne per square centimeter. This is the smallest sound a human can hear.

decibel, A-weighted (dBA)	A frequency-weighted ***noise*** unit that corresponds approximately to the frequency response of the human ear and thus correlates well with loudness. It is widely used for traffic and industrial noise measurements.
dedicated train	A train that handles only one commodity. For the proposed ***railroad***, this separate train with its own crew would limit switching between trains of the railcars carrying ***spent nuclear fuel*** and ***high-level radioactive waste***.
demand (related to groundwater)	The amount (volume) of water needed to complete a specified action.
desert	***Arid***, barren land incapable of supporting any considerable population without an artificial water supply.
designated groundwater basin	A ***hydrographic area*** identified by the State of Nevada when permitted water rights approach or exceed the estimated ***perennial yield*** and the water resources are being depleted or require additional administration.
dip-slip fault	A ***fault*** in which the relative displacement is along the direction of dip of the fault plane. If the block above the fault has moved downward, it is a ***normal fault***; upward movement indicates a ***reverse fault***.
direct impact	Effect that results solely from the construction or operation of a ***proposed action*** without intermediate steps or processes. Examples include ***habitat*** destruction, soil disturbance, air emissions, and water use.
disposal (of spent nuclear fuel and high-level radioactive waste)	The ***emplacement*** in a ***repository*** of ***spent nuclear fuel***, ***high-level radioactive waste***, or other highly ***radioactive*** material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste, and the ***isolation*** of such waste from the ***accessible environment***.
disproportionately high and adverse environmental impacts	An environmental ***impact*** that is unacceptable or above generally accepted norms; these would include economic impacts of the ***Proposed Action***. A disproportionately high impact is one (or the ***risk*** of one) to a ***low-income population*** or ***minority population*** that significantly exceeds the impact to the general population. In assessing cultural and aesthetic impacts, agencies consider impacts that would have unique effects on geographically dislocated or dispersed low-income or minority populations.
distance zones	Landscape divisions based on their relative location to common viewpoints: foreground to middleground, background, and seldom seen. The foreground-middleground zone includes areas less than 5 to 8 kilometers (3 to 5 miles) away. The background zone includes areas visible beyond the foreground-middleground zone but usually less than 24 kilometers (15 miles) away. Areas not seen as foreground-middleground or background are in the seldom-seen zone.

DOE spent nuclear fuel	***Radioactive*** waste created by defense activities that consists of more than 250 different ***waste forms***. The major contributor to this waste form is the N-Reactor fuel currently stored at the Hanford Site. This waste form also includes 65 ***metric tons of heavy metal*** of ***naval spent nuclear fuel***.
dose (radioactive)	The amount of ***radioactive*** energy taken into (absorbed by) living tissues. See ***effective dose equivalent***.
dose equivalent	(1) The number (corrected for background) zero and above that is recorded as representing an individual's ***dose*** from external ***radiation*** sources or internally deposited ***radioactive*** materials; (2) the product of the absorbed dose in ***rads*** and a quality factor; (3) the product of the absorbed dose, the quality factor, and any other modifying factor. The ***dose equivalent*** quantity is used for comparing the biological effectiveness of different kinds of radiation (based on the quality of radiation and its spatial distribution in the body) on a common scale; it is expressed in ***rem***.
dose rate	The ***dose*** per unit time.
dose risk	The product of a ***radiation dose*** and the ***probability*** of its occurrence.
duty (related to groundwater)	The amount of water either appropriated or under consideration for appropriation by the Nevada State Engineer to a water rights holder in the State of Nevada. Duty is typically specified in terms of a total annual duty or total duty granted over a specified seasonal period to a water rights holder. A ***pending annual duty*** value represents an annual duty for which an appropriation application has been submitted to the State Engineer for consideration and that the State Engineer has classified as a pending annual duty value within a specified ***groundwater*** basin (***hydrographic area***), in accordance with Nevada Revised Statutes contained in Chapter 533 and pursuant to the application review process contained in Nevada Revised Statutes 533.370.
earthquake	A series of elastic waves in the crust of the Earth caused by abrupt movement easing strains built up along ***geologic faults*** or by volcanic action and resulting in movement of the Earth's surface.
ecoregion	A relatively discrete set of ***ecosystems*** characterized by certain plant communities or assemblages.
ecosystem	A community of organisms and their physical environment interacting as an ecological unit.
effective dose equivalent	Often referred to simply as ***dose***, it is an expression of the ***radiation*** dose received by an individual from external radiation and from ***radionuclides*** internally deposited in the body.
EIS	See ***environmental impact statement***.
electron	A stable elementary particle that is the negatively charged constituent of ordinary matter.

emplacement — The placement and positioning of ***waste packages*** in the ***repository***.

endangered species — A species that is in danger of extinction throughout all or a significant part of its range; a formal listing of the U.S. Fish and Wildlife Service under the Endangered Species Act.

endemic — Being native to one location only.

environment — (1) Includes water, air, and land and all plants and humans and other animals living therein, and the interrelationship existing among these. (2) The sum of all external conditions affecting the life, development, and survival of an organism.

environmental impact statement (EIS) — A detailed written statement that describes:

"...the environmental impact of the ***proposed action***; any adverse environmental effects which cannot be avoided should the proposal be implemented; ***alternatives*** to the proposed action; the relationship between local short-term uses of man's ***environment*** and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."

Preparation of an EIS requires a public process that includes public meetings, reviews, and comments, as well as agency responses to the public comments.

environmental justice — The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Executive Order 12898, *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to make achieving environmental justice part of their missions by identifying and addressing ***disproportionately high and adverse effects*** of agency programs, policies, and activities on ***minority populations*** and ***low-income populations***.

environmental resource areas — Areas examined for potential environmental impacts as part of the National Environmental Policy Act analysis process. Examples include ***air quality***, ***hydrology***, and biological resources.

ephemeral (creek, stream, wash, river, drainage) — A channel with a bed above the normal water table and only flows in direct response to precipitation or snowmelt within its drainage basin.

equivalent sound levels (L_{eq})	A single value of sound level for any desired duration (such as 1 hour), which includes all of the time-varying sound energy in the measurement period. L_{eq} correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their times of occurrence (day or night), are relevant.
erionite	A natural fibrous zeolite in the rocks in and around Yucca Mountain that is listed as a known human ***carcinogen*** by recognized international agencies such as the International Agency for Research on Cancer.
erodes easily (soil characteristic)	A measure of the susceptibility of bare soil to be detached and moved by water. These soils, which tend to contain relatively high amounts of silts and ***loams***, have fair to poor erosion characteristics when disturbed.
escort cars	Railcars in which escort personnel would travel on trains carrying ***spent nuclear fuel*** or ***high-level radioactive waste***.
ethnographic	Describing the study and systematic recording of human cultures.
ethnographic landscape (ethnographic cultural landscape)	(1) A landscape containing a variety of natural or cultural resources that contemporary cultural groups define as meaningful because they are inextricably and traditionally linked to their own local or regional histories, cultural identities, beliefs, and behaviors. (2) A landscape that helps inform what it means to be a member of a particular culture, especially a culture (such as the American Indian culture) that is tied religiously to that landscape.
evapotranspiration	The combined processes of evaporation and plant ***transpiration*** that remove water from the soil and return it to the air.
exposure (to radiation)	The condition of being subject to the effects of or potentially acquiring a ***dose*** of ***radiation***. The incidence of radiation on living or inanimate material by ***accident*** or intent. Background exposure is the exposure to natural ionizing radiation. Occupational exposure is the exposure to ***ionizing radiation*** that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.
exposure pathway	The course a chemical or physical agent takes from the source to the exposed organism; describes a unique mechanism by which an individual or population can become exposed to chemical or physical agents at or originating from a release site. Each exposure pathway includes a source or a release from a source, an exposure point, and an exposure route.
fan piedmont	The area along the base of a mountain slope within a large ***alluvial fan***.
fan remnants	Parts of an older ***alluvial fan*** that remain after erosion has removed most of the fan.
fan skirt	The area along the base of the ***alluvial fan*** in a valley.

fault	A ***fracture*** or a fracture zone in crustal rocks along which there has been movement of the fracture's two sides relative to one another, separating one continuous rock stratum or vein into parts.
faulting	The movement of the Earth's crust that produces relative displacement of adjacent rock masses along a ***fracture***.
fill	The material used to fill the bottom of a slope with material cut away from the top of a slope, thereby providing a suitable grade for the rail ***roadbed***. (See ***cut***.)
Fiscal Year	A 12-month period to which a jurisdiction's annual budget applies and at the end of which its financial position and the results of its operations are determined. For example, the Fiscal Year for Clark and Nye Counties, the Cities of Las Vegas and North Las Vegas, the Towns of Tonopah and Pahrump, and the Clark County and Nye County School Districts is from July 1 through the following June 30; the federal fiscal year runs from October 1 through the following September 30.
fission	The splitting of a ***nucleus*** into at least two other nuclei, resulting in the release of two or three ***neutrons*** and a relatively large amount of energy.
fission products	***Radioactive*** or nonradioactive atoms produced by the ***fission*** of heavy atoms, such as uranium.
floodplain	The lowlands adjoining inland and coastal waters, and relatively flat areas and flood-prone areas of offshore islands, including, at a minimum, that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0-percent) floodplain. The critical action floodplain is defined as the 500-year (0.2-percent) floodplain. (See ***100-year flood***, ***50-year flood***, ***500-year flood***.)
fluvial	Of or pertaining to rivers or produced by the action of a stream or river.
footprint	The area that would be covered by the ***rail line*** or ***rail-line construction and operations support facilities***. For certain of these facilities (for example, quarry sites), this would be the area inside the site fence line.
fossil	Fossils include the body remains, traces, and imprints of plants or animals that have been preserved in the Earth's crust since some past geologic or prehistoric time. Generally, to be considered a fossil, the remains must be older than recent in age (older than 10,000 years). Fossils are found in ***sedimentary rock***.
fracture	A general term for any break in a rock, or the act of breaking, whether or not it causes displacement, caused by mechanical failure from stress. Fractures include cracks, ***joints***, and ***faults***. Fractures can act as pathways for rapid ***groundwater*** movement.
free-use permit	An authorization to extract mineral materials from public lands at no charge. The BLM issues free-use permits to a federal or state agency when the materials are for use in a public project.

fuel assembly	A number of fuel elements held together by structural materials, used in a ***nuclear reactor***; sometimes called a fuel bundle.
fugitive dust	***Particulate matter*** composed of soil; can include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is removed or redistributed.
fugitive emissions	(1) Emissions that do not pass through a stack, vent, chimney, or similar opening where they could be captured by a control device. (2) Any air pollutant emitted to the atmosphere other than from a stack. Sources of fugitive emissions include pumps; valves; flanges; seals; area sources such as ponds, lagoons, landfills, piles of stored material (such as coal); and road construction areas or other areas where earthwork occurs.
gamma ray	The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. See ***ionizing radiation.***
geologic repository	A system for the ***disposal*** of ***radioactive*** waste in excavated geologic media, including surface and subsurface areas of operation, and the adjacent part of the geologic setting that provides ***isolation*** of the radioactive waste in a controlled area.
geotextiles	Fabrics manufactured from synthetic fiber that are used for soil reinforcement, to allow for drainage, and to control erosion.
graben	An elongated block of rock down-dropped along roughly parallel normal faults.
grade (related to a rail line)	The ratio of elevation change to the distance traveled by a train, expressed as a percent. For example, a 1-meter (3.28-foot)-change in elevation over 100 meters (328 feet) of track is a 1-percent grade.
grade-separated crossing	Occurs when a roadway and a ***rail line*** cross paths and one passes over the other via an overpass or under the other via an underpass.
grazing allotment	An area where one or more livestock operators graze their livestock. An allotment generally consists of federal land but may include parcels of private or state-owned land.
grant	Any authorization or instrument (for example, easement, lease, license, or permit) the BLM issues under Title V of the Federal Land Policy and Management Act (43 U.S.C. 1761 *et seq.*).
gray water	Non-industrial wastewater generated from domestic processes such as washing dishes, laundry, and bathing. Gray water gets its name from its cloudy appearance and from its status as being neither fresh nor heavily polluted.
groundshine	The ***radiation dose*** received from an area on the ground where ***radioactivity*** has been deposited by a ***radioactive*** plume or cloud.

gross regional product	The dollar value of all final goods and services produced in a given year in a specific region (such as the ***region of influence***).
ground vibration	The rapid linear motion of a compression wave in the ground caused by a single or repeated force or impact to the ground, as in the action of a pile driver, or a tire hitting a bump or pothole in a road.
groundwater	Water contained in pores or fractures in either the ***unsaturated*** zone or ***saturated zone*** below ground level.
habitat	Area in which a plant or animal lives and reproduces.
half-life	The time in which half the atoms of a ***radioactive*** substance ***decay*** to another nuclear form. Half-lives range from millionths of a second to billions of years depending on the stability of the nuclei.
hardpan	A layer of hard subsoil that prevents the ***infiltration*** of water or roots.
hazardous air pollutant	An air pollutant not covered by ***ambient air quality standards*** but which may present a threat of adverse human health effects or adverse environmental effects, and is specifically listed on the federal list of 189 hazardous air pollutants in 40 CFR 61.01.
hazardous chemical	As defined under the Occupational Safety and Health Act (Public Law 91-956) and the Emergency Planning and Community Right-to-Know Act (42 U.S.C. 116), a chemical that is a physical or health hazard.
hazardous pollutant	A ***hazardous chemical*** that can cause serious health and environmental hazards; listed on the federal list of hazardous air pollutants (Clean Air Act; 42 U.S.C. 7412). See ***toxic air pollutants***.
hazardous waste	Waste that appears on the list of hazardous materials prepared by the U.S. Environmental Protection Agency or a state or local regulatory agency, or if it has characteristics defined as hazardous by such agency. If the Environmental Protection Agency does not list a material as hazardous,, it can be considered a hazardous waste if it exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C: ignitability, corrosivity, reactivity, or toxicity.
herd management area (HMA)	Areas where wild horses and burros were found on public lands when the Wild and Free-Roaming Horses and Burros Act passed in 1971. The BLM evaluates each area to determine if there is adequate food, water, cover, and space to sustain healthy and diverse wild horse and burro populations over the long term. The areas that meet these criteria are then designated herd management areas in BLM land-use plans.
heritage tourism	Heritage tourism is "the business and practice of attracting and accommodating visitors to a place or area based especially on the unique or special aspects of that locale's history, landscape (including trail systems), and culture." (Section 7 of Executive Order 13287).

hertz	A unit of frequency equal to one cycle per second.
high-level radioactive waste	(1) The highly ***radioactive*** material that resulted from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains ***fission products*** in sufficient concentrations.
hi-rail truck	A vehicle that is capable of traveling on roads or on railroad tracks.
historic tourism	Traveling to experience the places, artifacts, and activities that authentically represent the stories and people of the past and present.
hydric soil	Soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Hydric soils are used to characterize ***wetland*** conditions.
hydrogeology	A study that encompasses the interrelationships of geologic materials and processes involving water.
hydrographic area	In reference to Nevada ***groundwater***, divisions of the state into groundwater basins and sub-basins based primarily on topographic features such as mountains and valleys. The state uses the map of hydrographic areas as the basis for water planning, management, and administration. (Because they are based heavily on topographic features, hydrographic area boundaries sometimes differ from groundwater basin designations developed from studies of inferred or measured groundwater flow patterns.)
hydrology	(1) The study of water characteristics, especially the movement of water. (2) The study of water, involving aspects of geology, oceanography, and meteorology.
igneous	(1) A type of rock formed from a molten, or partially molten, material. (2) An activity related to the formation and movement of molten rock either in the subsurface (plutonic) or on the surface (***volcanic***).
impact	For an EIS, the positive or negative effect of an action (past, present, or future) on the natural ***environment*** (land use, ***air quality***, water resources, geological resources, ecological resources, aesthetic and scenic resources) and the human environment (***infrastructure***, economics, social, and cultural).
impact limiters	Devices attached to rail and truck ***shipping casks*** that would help absorb impact energy in the event of a collision.

implementing alternative	An action or proposition by DOE necessary to implement the ***Proposed Action*** and to enable the estimation of the range of reasonably foreseeable ***impacts*** of that action or proposition. In this Rail Alignment EIS, there are two implementing alternatives under the Proposed Action: 1. The Caliente Implementing Alternative, under which DOE would construct and operate the proposed ***railroad*** from in or near the City of Caliente, Nevada, westward and then southward to ***Yucca Mountain***. 2. The Mina Implementing Alternative (the non-preferred alternative), under which DOE would construct and operate the proposed railroad from Hazen, Nevada, southeastward to Yucca Mountain. Under this implementing alternative, DOE would use the existing Union Pacific Railroad Hazen Branchline from Hazen to Wabuska, Nevada, and would not perform any construction activities along this portion of the rail alignment.
in attainment	The U.S. Environmental Protection Agency designates an area as being in attainment for a particular pollutant if ***ambient*** concentrations of that pollutant are below the National ***Ambient Air Quality Standards***.
in situ	In its natural position or place. The phrase distinguishes in-place experiments, conducted in the field or underground facility, from those conducted in the laboratory.
incident-free transportation	Routine transportation in which cargo travels from origin to destination without being involved in an ***accident***.
indirect impact	An effect that is related to but removed from a ***proposed action*** by an intermediate step or process. Examples include surface-water quality changes resulting from soil erosion at construction sites, and reductions in productivity resulting from changes in soil temperature.
industrial and special wastes	Construction debris and other ***solid waste***, such as tires, that have specific management requirements for permitted landfill disposal.
industry track	A ***siding*** used by a single shipper.
infiltration	The process of water entering the soil at the ground surface and the ensuing movement downward. Infiltration becomes percolation when water has moved below the depth at which it can return to the atmosphere by evaporation or ***evapotranspiration***.
infrastructure	Basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communication systems.
Interchange Yard	The ***sidings*** where railcars containing other materials (such as materials needed for construction and operation of the proposed ***railroad*** and the ***repository***) would be decoupled from Union Pacific Railroad trains.
intermittent stream/ intermittent	A channel bed that fluctuates above or below the normal water table along its length, and may or may not have flow within it during any particular time or at

drainage	any particular location. The presence of flow within the channel is determined by its channel elevation relative to the water table, precipitation events, or snowmelt within its drainage basin.
invasive plant species	An alien species the introduction of which does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).
ionizing radiation	(1) ***Alpha particles***, ***beta particles***, ***gamma rays***, ***X-rays***, ***neutrons***, high-speed ***electrons***, high-speed ***protons***, and other particles capable of producing ions. (2) Any ***radiation*** capable of displacing electrons from an atom or molecule, thereby producing ions.
irradiation	***Exposure*** to ***radiation***.
Isolate (related to cultural resources)	An isolated artifact occurrence that does not meet the minimum threshold to be designated a "site." Isolates are generally considered ineligible for the *National Register of Historic Places*.
isolation	Inhibiting the transport of ***radioactive*** material so that the amounts and concentrations of this material entering the ***accessible environment*** stay within prescribed limits.
isotropic	Identical in all directions.
joint	A non-tectonic fracture in the surface or linear opening in a rock.
latent	Present and capable of becoming, though not now visible, obvious, or active.
latent cancer fatality	A death that results from ***cancer*** that exposure to ***ionizing radiation*** caused. There typically is a ***latent period*** between the time of the radiation exposure and the time the cancer cells become active.
latent period	(1) The incubation period of a disease. (2) The interval between stimulation and response. (3) The interval between ***radiation exposure*** and the time a cancer becomes active.
level of service (roadway)	A qualitative measure describing operational conditions within a traffic stream, generally described in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.
lithic scatters	Concentrations of waste flakes resulting from the manufacture of stone tools.
lithology	The study and description of the general, gross physical characteristics of a rock, especially sedimentary ***clastics***, including color, grain size, and composition.
loam	A soil composed of a mixture of clay, silt, sand, and organic matter.
locomotive sanding	Area where a locomotive's sand box is filled. Trains use sand for traction.

area

long-term impact	In the Rail Alignment ***EIS***, ***impacts*** that could occur throughout and beyond the life of the ***railroad*** operations phase (up to 50 years).
lost workday cases	Incidents that result in injuries that cause the loss of work time.
low-income population	Defined in terms of U.S. Census Bureau annual statistical poverty levels, may consist of groups or individuals who live in geographic proximity to one another or who are geographically dispersed or transient (such as migrant workers or American Indians), where either type of group experiences common conditions of environmental exposure or effect.
low-level radioactive waste	***Radioactive*** waste that is not classified as ***high-level radioactive waste***, ***transuranic waste***, or byproduct tailings containing uranium or thorium from processed ore. Usually generated by hospitals, research laboratories, and certain industries.
maintenance-of-way activities	Activities to maintain the track, bridges, culverts, grade crossings, signal equipment, and communications equipment along a ***rail line***.
matrix (geology)	The solid, but porous, portion of rock.
maximally exposed individual	A hypothetical individual whose location and habits result in the highest total radiological or chemical ***exposure*** (and thus ***dose***) from a particular source for all exposure routes pathways (for example, inhalation, ingestion, direct exposure).
maximum contaminant level	Under the Safe Drinking Water Act (Public Law 93-523), the maximum permissible concentrations of specific constituents in drinking water that is delivered to any user of a public water system that serves 15 or more connections and 25 or more people; the standards established as maximum contaminant levels consider the feasibility and cost of attaining the standard.
maximum reasonably foreseeable accident	An ***accident*** characterized by extremes of mechanical (impact) forces, heat (fire), and other conditions that would lead to the highest foreseeable consequences. In general, accidents with conditions that have a chance of occurring more often than 1 in 10 million in a year are considered to be reasonably foreseeable.
mesosphere	Belt of atmosphere, just above the stratosphere, from 50 to 80 kilometers (30 to 50 miles) above the Earth's surface.
metamorphic rocks	Rocks that have undergone chemical or structural changes produced by an increase in heat and temperature or by replacement of elements by hot, chemically active fluids.
metric tons of heavy metal	Quantities of ***spent nuclear fuel*** without the inclusion of other materials such as cladding (the tubes containing the fuel) and structural materials. A metric ton is 1,000 kilograms (1.1 tons or 2,200 pounds). Uranium and other metals in spent

	nuclear fuel (such as thorium and plutonium) are called heavy metals because they are extremely dense; that is, they have high weights per unit volume.
mining area	Places where prospecting or mining is known to have occurred, or where concentrations of specific types of minerals are known to exist, but which were never included within an organized mining district. Many of these areas, with continued use, have come to be called ***mining districts***.
mining claim	The description by boundaries of real property in which metal ore and/or minerals may be located. A claim on public land must be filed with the BLM or other federal agency, and the claim must be "worked" by being mined or prepared for mining within a specific period of time. All mining claims are initially ***unpatented claims***, which give the right only for those activities necessary to exploration and mining, and last only as long as the claim is worked every year. The original mining law gave miners the opportunity to obtain patents (deeds from the government), much as farmers could obtain title under the Homestead Act. The owner of a patented claim can put it to any legal use.
mining district	An area usually designated by name with described or understood boundaries where minerals are found and mined under rules prescribed by the miners, consistent with the General Mining Law of 1872.
minority population	A community in which the percent of the population of a racial or ethnic minority is 10 points higher than the percent found in the population as a whole.
mitigation	Actions and decisions that (1) avoid ***impacts*** altogether by not taking a certain action or parts of an action, (2) minimize impacts by limiting the degree or magnitude of an action, (3) rectify the impact by repairing, rehabilitating, or restoring the ***affected environment***, (4) reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action, or (5) compensate for an impact by replacing or providing substitute resources or environments.
mixed low-level waste	***Low-level radioactive waste*** mixed with ***hazardous wastes***; it must satisfy treatment, storage, and disposal regulations both as low-level radioactive waste and as hazardous waste.
movement corridor	A patch of wildlife habitat, generally vegetated, that joins two or more larger areas of wildlife habitat.
native plant species	With respect to a particular ***ecosystem***, a species that, other than as a result of an introduction, historically occurred, or currently occurs in that ecosystem.
naval spent nuclear fuel	***Spent nuclear fuel*** discharged from reactors in surface ships, submarines, and training ***reactors*** operated by the U.S. Navy.
neutron	An atomic particle with no charge and an ***atomic mass*** of 1; a component of all atoms except hydrogen; frequently released as ***radiation***.

nitrogen dioxide	See ***nitrogen oxides***.
nitrogen oxides (oxides of nitrogen; NO_x)	Gases formed in great part from atmospheric nitrogen and oxygen when combustion occurs under conditions of high temperature and high pressure; a major air pollutant. Two primary nitrogen oxides, nitric oxide (NO) and ***nitrogen dioxide*** (NO_2), are noteworthy airborne ***contaminants***. Nitric oxide combines with atmospheric oxygen to produce nitrogen dioxide. Both nitric oxide and ***nitrogen dioxide*** can, in high concentration, cause lung ***cancer***. ***Nitrogen dioxide*** is a ***criteria pollutant***.
No-Action Alternative	Under the No-Action Alternative in the Nevada Rail Corridor SEIS, DOE would not construct and operate a railroad within the Mina ***rail corridor*** from Wabuska to ***Yucca Mountain***. Under the No-Action Alternative the Rail Alignment ***EIS***, DOE would not implement the ***Proposed Action*** in the Caliente or the Mina rail corridor.
nominal	(1) Of, being, or relating to a designated or theoretical size that may vary from the actual. (2) According to plan.
nonattainment area	An area that does not meet the ***ambient air quality standard*** for one or more ***criteria pollutants***. Further designations (for example, serious, moderate) describe the magnitude of the nonattainment.
non-transient, non-community public water system	A public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.
non-native plant species	A species found in an area where it has not historically been found.
nonpoint source pollution	Pollution does not come from a single source but from many unidentifiable sources. An example of nonpoint source pollution would be urban runoff of items like oil, fertilizers, and lawn chemicals. As rainfall or snowmelt moves over and through the ground, it picks up and carries away natural and human-made pollutants. These pollutants are eventually deposited into natural bodies of water, such as lakes, rivers, wetlands, coastal waters, and underground sources of drinking water.
normal fault	A ***fault*** in which the relative displacement is along the direction of dip of the fault plane (***dip-slip fault***) where the block above the fault has moved downward in relation to the block below the fault. See ***reverse fault***.
nuclear radiation	***Radiation*** that emanates from an unstable ***atomic nucleus***.
notable drainage channels	In the Rail Alignment ***EIS***, channels with a stream order of 2 or greater based on Strahler's ordering system, with the National Hydrography Dataset as a base map.

noxious weeds	Any species of plant that is, or is likely to be, detrimental or destructive and difficult to control or eradicate.
nuclear reactor	A device in which a nuclear fission chain reaction can be initiated, sustained, and controlled to generate heat or to produce useful ***radiation***.
nuclear waste	Unusable by-products of nuclear power generation, nuclear weapons production, and research, including ***spent nuclear fuel*** and ***high-level radioactive waste***.
Nuclear Waste Technical Review Board	An independent body established within the Federal Government executive branch, created by the Nuclear Waste Policy Amendments Act of 1987 to evaluate the technical and scientific validity of activities undertaken by DOE, including site characterization activities and activities relating to the packaging or transportation of ***spent nuclear fuel*** or ***high-level radioactive waste***. Members of this Board are appointed by the President from a list prepared by the National Academy of Sciences.
nucleus	The central, positively charged, dense portion of an atom. Also known as ***atomic nucleus***.
nuclide	An atomic ***nucleus*** specified by its ***atomic weight***, ***atomic number***, and energy state; a ***radionuclide*** is a ***radioactive*** nuclide.
operations right-of-way	Property that would be obtained for operation of the proposed ***railroad***. This right-of-way would be a ***nominal*** width of 61 meters (200 feet) on either side of the centerline of the ***rail line***, but could vary at specific locations to accommodate, for example, access and maintenance roads, and drainage structures. In addition, some facilities (such as the ***Staging Yard***) would be outside the nominal width of the operations right-of-way, but DOE would also obtain rights-of-way in these areas. See ***construction right-of-way***.
ordinary high water mark	That line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (33 CFR 328.3e).
other material	In the Rail Alignment EIS, material related to the construction (for example, reinforcing steel and cement) and operation (for example, ***waste packages*** and fuel oil) of the ***repository***.
outcrop	The part of a rock formation that appears at the surface of the ground.
overburden	***Geologic*** material of any nature, consolidated or unconsolidated, that overlies a deposit of useful materials.
ozone (O_3)	The triatomic (three atoms in the molecule) form of oxygen; in the ***stratosphere***, ozone protects the Earth from the sun's ***ultraviolet radiation***, but in lower levels of the atmosphere, it is an air pollutant.

package plant	Modular ***wastewater treatment*** units that can be designed to be portable. Most package plants use some type of biological treatment, which can be based on aerobic, anaerobic, or anoxic conditions and use attached or suspended organisms. Other processes incorporated into package plants can include membrane filtration and disinfection by chlorine, ultraviolet light, or ***ozone***.
particulate matter	Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions. See PM_{10}.
peak particle velocity	The maximum instantaneous positive or negative peak of the vibration signal, measured as a distance per time (such as millimeters or inches per second). This measurement has been used historically to evaluate shock-wave type vibrations from actions like blasting, pile driving, and mining activities, and their relationship to building damage.
pending annual duty	See ***duty***.
perceived risk and stigma	DOE uses the term risk perception to mean how an individual perceives the amount of risk from a certain activity. Studies show that perceived risk varies with certain factors, such as whether the exposure to the activity is voluntary, the individual's degree of control over the activity, the severity of the exposure, and the timing of the consequences of the exposure. DOE uses stigma to mean an undesirable attribute that blemishes or taints an area or locale.
perennial stream	A stream that receives ***groundwater*** into its channel and its streambed is normally below the water table. During years with normal precipitation, a perennial stream will have constant flow.
perennial yield	The estimated quantity of ***groundwater*** that can be withdrawn annually from a ***hydrographic area*** without depleting the ***aquifer***. The Nevada State Engineer uses the perennial yield estimate as a guideline by which to limit groundwater allocations.
permeability	In general terms, the capacity of such mediums as rock, sediment, and soil to transmit liquid or gas. Permeability depends on the substance transmitted (oil, air, water, etc.) and on the size and shape of the pores, ***joints***, and ***fractures*** in the medium and the manner in which they interconnect. "Hydraulic conductivity" is equivalent to "permeability" in technical discussions relating to ***groundwater***.
permeable	Pervious; a permeable rock is a rock, either porous or cracked, that allows water to soak into and pass through it freely.
person-rem	A unit used to measure the ***radiation exposure*** to an entire group and to compare the effects of different amounts of radiation on groups of people; it is the product of the average ***dose equivalent*** (in ***rem***) to a given organ or tissue multiplied by the number of persons in the population of interest.
petroglyph	A carving or inscription on a rock; rock art.

pH	A measure of the relative acidity or ***alkalinity*** of a solution, expressed on scale from 0 to 14, with the neutral point at 7.0. Acid solutions have pH values lower than 7.0, and basic (that is, alkaline) solutions have pH values higher than 7.0.
plate girder bridge	A typical bridge constructed across short spans. It usually looks like a u-shape in cross section, with two steel plates supporting each side of the bridge.
playa	A nearly level area at the bottom of a ***desert*** basin that does not drain to a river and is temporarily covered with water from heavy rains or snowmelts. Normally a dry lakebed that may contain water in response to seasonally high runoff.
pluvial lakes	Lakes that increase in size and depth as a result of increased precipitation and decreased evaporation, characteristic of past environmental conditions that were cooler and wetter than today.
PM_{10}	All ***particulate matter*** with an aerodynamic diameter less than or equal to a nominal 10 micrometers. Particles less than this diameter are small enough to be breathable and could be deposited in lungs.
$PM_{2.5}$	All ***particulate matter*** with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.
population dose	A summation of the ***radiation doses*** received by individuals in an exposed population; equivalent to ***collective dose***; expressed in ***person-rem***.
pressurized-water reactor (PWR)	A ***nuclear*** power ***reactor*** that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.
prime farmland	Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or ***alkalinity***, an acceptable content of salt and sodium, and few or no rocks. Its soils are ***permeable*** to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding.
primordial radionuclides	***Radionuclides*** that originate mainly from the interiors of stars and are still present because their ***half-lives*** are so long that they have not yet completely ***decayed***.

probability	The relative frequency at which an event can occur in a defined period. Statistical probability is what happens in the real world and can be verified by observation or sampling. Knowing the exact probability of an event is usually limited by the inability to know, or compile the complete set of, all possible outcomes over time or space. Probability is measured on a scale of 0 (event will not occur) to 1 (event will occur).
Proposed Action	The activity proposed to accomplish a federal agency's purpose and need. An ***EIS*** analyzes the environmental ***impacts*** of a proposed action, which includes the project and its related support activities. The Proposed Action in the Nevada Rail Corridor SEIS is to construct and operate a railroad to connect the Yucca Mountain repository to an existing ***rail line*** near Wabuska, Nevada (the Mina ***rail corridor***). The Proposed Action in the Rail Alignment EIS, is to determine an alignment (within a corridor) and construct and operate a railroad in Nevada to transport ***spent nuclear fuel***, ***high-level radioactive waste***, and other ***Yucca Mountain*** project materials to a repository at Yucca Mountain.
proton	An elementary particle that is the positively charged component of ordinary matter and, together with the ***neutron***, is a building block of all ***atomic*** nuclei.
public lands	As defined in Public Law 94-79, public lands are any land and interest in land outside of Alaska owned by the United States and administered by the Secretary of the Interior through the BLM. In common usage, public lands may refer to all federal land no matter what agency has responsibility for its management.
public land order	An order affecting, modifying, or canceling a withdrawal or reservation that has been issued by the Secretary of the Interior pursuant to powers of the President delegated to the Secretary by Executive Order 9146 of April 24, 1942, or 9337 of April 24, 1943.
public water system	A water system that provides water for human consumption for an average of at least 25 persons per day (or 15 or more service connections) and in use for at least 60 days each year.
pyroclastic	Of or relating to individual particles or fragments of ***clastic*** rock material of any size formed by volcanic explosion or ejected from a volcanic vent.
qualitative	With regard to a variable, a parameter, or data, an expression or description of an aspect in terms of non-numeric qualities or attributes. See ***quantitative***.
quantitative	A numeric expression of a variable. See ***qualitative***.
rad	A unit of absorbed radiation dose in terms of energy. One rad equals 100 ergs of energy absorbed per gram of tissue.

radiation	The emitted particles or ***photons*** from the nuclei of radioactive atoms. Some elements are naturally ***radioactive***; others are induced to become radioactive by ***irradiation*** in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.
radioactive	Emitting ***radioactivity***.
radioactivity	The property possessed by some elements (for example, uranium) of spontaneously emitting ***alpha, beta***, or ***gamma rays*** by the disintegration of ***atomic*** nuclei.
radionuclide	See ***nuclide***.
radiotoxicity	Of, relating to, or being a ***radioactive*** substance that is toxic to living cells or tissues.
radius of influence	The distance from the well where the drawdown becomes insignificant and can be neglected.
rail alignment	An engineered refinement of a ***rail corridor*** in which DOE would identify the location of a ***rail line***. A rail alignment is comprised of ***common segments*** and ***alternative segments***.
rail corridor	As used in this Rail Alignment EIS, a strip of land, 400 meters (0.25 mile) wide through which DOE would identify an alignment (***rail alignment***) for the construction of a ***rail line*** in Nevada to a ***geologic repository*** at ***Yucca Mountain***.
Rail Equipment Maintenance Yard	The rail yard that would be near the ***geologic repository*** and would temporarily store, service, and maintain railcars and locomotives in preparation for the return trip to the ***Staging Yard***.
rail line	An engineered feature incorporating the track, ties, ***ballast***, and ***subballast*** at a specific location.
rail route	Route from point of origin to the ***repository***.
railroad	A transportation system incorporating the ***rail line***, operations support facilities, railcars, locomotives, and other related property and infrastructure.
Nevada Railroad Control Center	A facility that would control all train movements, rail operations, and emergency response operations along the proposed ***railroad*** in Nevada to ***Yucca Mountain***.
rain shadow	Effect that occurs when moist air is blown toward a mountain and the air rises, cools, and releases its moisture as rain or snow. When the air passes to the other side of the mountain, it is dry and does not release moisture. If the wind always blows the same way, the area on the dry side of the mountain is said to be in a rain shadow.

reactor	See ***nuclear reactor***.
real disposable income	The value of total income received after taxes; it is the income available for spending or saving; also referred to as ***real disposable personal income***.
real disposable personal income	See ***real disposable income***.
recharge	The movement of water from an ***unsaturated zone*** to a ***saturated zone***.
Record of Decision	A document that provides a concise public record of a decision made by a government agency.
recordable cases	Occupational injuries or occupation-related illnesses that result in (1) a fatality, regardless of the time between the injury or the onset of the illness and death, (2) ***lost workday cases*** (nonfatal), and (3) the transfer of a worker to another job, termination of employment, medical treatment, loss of consciousness, or restriction of motion during work activities.
region of influence	The physical area that bounds the environmental, sociologic, economic, or cultural features of interest for the purpose of analysis.
rem	A unit of ***dose equivalent***. The dose equivalent in rems equals the absorbed dose in ***rads*** in tissue multiplied by the appropriate quality factor and possibly other modifying factors. Derived from roentgen equivalent man, referring to the dosage of ionizing ***radiation*** that will cause the same biological effect as one roentgen of ***X-ray*** or ***gamma ray*** exposure. One rem equals 0.01 sievert.
remediation	Action taken to permanently remedy a release or threatened release of a hazardous substance to the ***environment***, instead of or in addition to removal.
repository	See ***geologic repository***.
resource management plan	A land-use plan for public lands as described by the Federal Land Management and Policy Act. Among other things, it establishes land areas for limited, restricted, or exclusive use; allowable resource uses; resource condition goals and objectives; general management practices to achieve the goals; the need for more specific management plans for certain areas; general implementation sequences; and monitoring intervals and standards.
reverse fault	A ***fault*** in which the relative displacement is along the direction of the dip of the fault plane (***dip-slip fault***), and in which the block above the fault has moved upward in relation to the block below the fault.
right-of-way grant	Authorization from the BLM to use a specific portion of public land for construction and operation of the proposed ***railroad***. The land covered by the right-of-way grant would include the area of construction, known as the ***construction right-of-way*** and the area of operations known as the ***operations right-of-way***.

riparian	Of, on, or pertaining to, the bank of a river or stream, or of a pond or small lake.
riprap	Broken rocks or chunks of concrete used as foundation material or to protect embankments and gullies to control water flow or prevent erosion.
risk	The product of the ***probability*** that an undesirable event will occur multiplied by the consequences of the undesirable event.
roadbed	The earthwork foundation upon which the track, ties, ***ballast***, and ***subballast*** of a ***rail line*** are lain.
root mean-square velocity	An average or smoothed vibration amplitude, commonly measured over 1-second intervals. It is expressed on a log scale in ***decibels (VdB)*** referenced to 0.000001 (10^{-6}) inch per second and is not to be confused with noise ***decibels***.
sand sheets	Large, irregularly shaped, commonly thin, surficial mantles of windblown sand that lack the discernible slip faces that are common on dunes.
sanitary and industrial solid waste	***Solid waste*** that is neither ***hazardous*** nor ***radioactive.*** Sanitary waste streams include paper, glass, and discarded office material. State of Nevada waste regulations identify this waste stream as household waste.
sanitary waste	Domestic wastewater from toilets, sinks, showers, kitchens, and floor drains from restrooms, change rooms, and food preparation and storage areas.
saturated zone	The area below the ***water table*** where all spaces (***fractures*** and rock pores) are completely filled with water.
scenic quality	A measure of the visual appeal of a tract of land. Areas are rated from A to C based on key factors including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. An A rating is assigned to areas that combine the most outstanding characteristics of each category, whereas a C rating is assigned to areas common to the region.
screened (related to water wells)	The portion of a well that is screened is the interval in the well where the casing contains slots to let in the water from the primary (most productive) water-bearing zone or zones.
sedimentary rocks	Rock formed by the accumulation of sediment in water or land. Sandstone, chert, limestone, dolomite, shale, siltstone, and mudstone are types of sedimentary rocks that are found in the Great Basin. They are differentiated by chemistry, deposition, and texture.
seismic	Pertaining to, characteristic of, or produced by, earthquakes or earth vibrations.
seismicity	A ***seismic*** event or activity such as an ***earthquake*** or earth tremor; seismic action.
semi-desert	An ***arid*** area that has some of the characteristics of a ***desert*** but has greater annual precipitation.

sensitive receptors	As used in this Rail Alignment EIS, any specific resource (population or facility) that would be more susceptible to the effects of the ***impact*** of implementing the ***Proposed Action*** than would otherwise be.
sensitive structures	Buildings or structures, usually old and of cultural value, or facilities that house vibration-sensitive equipment, that could be susceptible to ***ground vibrations,*** activities, or conditions causing ***ground vibrations***.
sensitivity levels	A measure of public concern for ***scenic quality***. Areas are ranked high, medium, or low based on types of users, amount of use, public interest, adjacent land uses, and whether they are special areas.
Shared-Use Option	An option under the ***Proposed Action***. DOE would allow commercial and other shippers to use the ***rail line*** for general freight shipments. General freight would include stone and other nonmetallic minerals, petrochemicals, waste materials (nonradioactive), or other commodities that private companies would ship or receive.
short-term impact	In the Rail Alignment EIS, impacts limited to the construction phase (4 to 10 years).
shielding	Any material that provides ***radiation*** protection.
shipment	The movement of a properly prepared (loaded, unloaded, or empty) ***cask*** from one site to another and associated activities to ensure compliance with applicable regulations.
shipping cask	A heavily shielded, massive container that meets regulatory requirements for shipping ***spent nuclear fuel*** and ***high-level radioactive waste***. See ***cask***.
siding	A track that runs parallel to the main line for a short distance and is used for passing and overtaking trains to prevent backups and keep traffic flowing.
signal blocks	A ***rail line*** bounded on one end by an entry signal and on the other end by an exit signal. The proposed ***railroad*** would be divided into a number of signal blocks, which would allow for easier control of trains along the railroad.
site characterization	Activities associated with the determination of the suitability of the ***Yucca Mountain Site*** for a ***geologic repository***.
soft soils	Soils with saline conditions that limit the chemical and physical potentials of the soil and that could have negative effects on the vegetation-bearing capacity of the soil. These soils would have a higher potential for erosion until revegetation was complete.
soil recovery	The return of disturbed land to a relatively stable condition with a form and productivity similar to that which existed before any disturbance.
solid waste	For purposes of this analysis, defined as nonhazardous general household waste.

source term — Types and amounts of ***radionuclides*** that are the source of a potential release of ***radioactivity***.

Special Areas — Defined in BLM Visual Resource Inventory Manual 8410 as lands where measures must be taken to protect visual values. Special Areas often include designated natural areas, ***Wilderness Study Areas***, scenic rivers, and scenic roads. Special Areas are not necessarily unique or picturesque, but the management objective for a Special Area is to preserve its natural characteristics.

spent nuclear fuel —

1. ***Nuclear reactor*** fuel that has been used to the extent that it can no longer effectively sustain a chain reaction.

2. Fuel that has been withdrawn from a nuclear reactor after ***irradiation***, the component elements of which have not been separated by reprocessing. For this project, this refers to:

   a. Intact, nondefective ***fuel assemblies***
   b. Failed fuel assemblies in ***canisters***
   c. Fuel assemblies in canisters
   d. Consolidated fuel rods in canisters
   e. Nonfuel assembly hardware inserted in ***pressurized-water reactor*** fuel assemblies
   f. Fuel channels attached to ***boiling-water reactor*** fuel assemblies
   g. Nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in canisters

splay faults — Minor faults that branch off of a primary fault, or interconnect to form a fault zone.

spoils areas — Areas outside the ***rail corridor*** for the deposition of excavated materials from ***rail line*** development.

Staging Yard — The rail yard that would temporarily store, service, and maintain railcars and locomotives in preparation for a trip to the ***Rail Equipment Maintenance Yard*** inside the ***Yucca Mountain Site boundary*** near the ***repository*** operations area, or in preparation for return to the Union Pacific Railroad. Railcars containing ***casks*** would be decoupled from Union Pacific Railroad trains in preparation for the trip to the repository.

stakeholder — A person or organization with an interest in, or affected by, DOE actions (for example, representatives from federal, state, tribal, or local agencies; members of Congress or state legislatures; unions, educational groups, environmental groups, industrial groups; and members of the general public).

State protected species	Animals classified under Nevada Administrative Code, Section 503.103, as meeting the Endangered Species Act definition or the State population being in danger of extinction. Under Nevada Administrative Code 527.020, a plant species is classified as being in danger of extinction if its survival requires assistance because of overexploitation, disease, or other factors or because its habitat is threatened with destruction, drastic modification, or severe curtailment.
stigma	See ***perceived risk and stigma***.
storage	The collection and containment of waste or ***spent nuclear fuel*** in a way that does not constitute ***disposal*** of the waste or spent nuclear fuel for the purposes of awaiting treatment or disposal capacity.
stratigraphy	The branch of geology that deals with the definition and interpretation of rock strata, the conditions of their formation, character, arrangement, sequence, age, distribution, and especially their correlation, by the use of ***fossils*** and other means of identification.
stratosphere	The atmospheric shell above the ***troposphere*** and below the ***mesosphere***. It extends from 10 to 20 kilometers (6 to 12 miles) to about 53 kilometers (33 miles) above the Earth's surface.
stratum	A sheet like mass of ***sedimentary rock*** or earth of one kind lying between beds of other kinds.
subballast	A layer of crushed gravel that is used to separate the ***ballast*** and ***roadbed*** for the purpose of load distribution and drainage.
subgrade elevation	The elevation of the top of the ***subballast*** in the ***rail line***.
substrate	Basic surface on which a material adheres.
sulfur dioxide (SO_2)	A pungent, colorless gas produced during the burning of sulfur-containing fossil fuels. It is the main pollutant involved in the formation of acid rain. Coal- and oil-burning electric utilities are the major source of sulfur dioxide in the United States. Inhaled sulfur dioxide can damage the human respiratory tract and can severely damage vegetation. See ***criteria pollutants***, ***ambient air quality standards***.
sulfur oxides	A mixture of ***sulfur dioxide***, sulfur trioxide, and inorganic sulfites and sulfates. Sulfur dioxide combines with oxygen in the air to form sulfur trioxide and microscopic aerosol sulfite and sulfate particles, all of which are lung irritants. See ***criteria pollutants***, ***ambient air quality standards***.

surface entry	The appropriation of any non-federal interests or claims (other than mining claims), land sales, BLM land exchanges, state selections, Desert Land Entries, Indian Allotments, Carey Act selections, or any other like public land disposal actions. Surface entry does not include ***rights-of-way***, granted pursuant to Title V of the Federal Land Policy and Management Act, and other easements, leases, licenses, and/or use permits.
sustained yield	The amount of water that may be pumped from a ***hydrographic area*** during a specific period of time without affecting future yields. Equal to ***recharge***, and independent of economic feasibility and management objectives.
team track	A track on which rail cars would be placed for public use to load or unload freight.
tectonic plate	A piece of Earth's outer shell that moves across the mantle.
thermal desorption	The use of heat to remove an absorbed substance from a liquid or gas environment, including soil.
threatened species	A species that is likely to become an ***endangered species*** within the foreseeable future throughout all or a significant part of its range.
thrust fault	A ***fault*** that occurs when squeezing forces push the block above an inclined fault up in relation to the other block.
total employment	The sum of direct and indirect employment resulting from initiation of an activity. Direct employment consists of jobs performing the activity. Indirect employment consists of jobs in other activities supporting the direct employees. Also defined as composite employment.
total population	The sum of all people associated with direct and indirect employees and their families resulting from initiation of an activity.
toxic air pollutant	A ***hazardous chemical*** that can cause serious health and environmental hazards; listed on the federal list of ***hazardous air pollutants*** (Clean Air Act; 42 U.S.C. 7412).
traditional cultural property	A property that is eligible for inclusion in the *National Register of Historic Places* because of its association with cultural practices or beliefs of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community. Culture includes the traditions, beliefs, practices, lifeways, arts, crafts, and social institutions of any community, whether an American Indian tribe, a local ethnic group, or the people of the Nation as a whole. Properties can include buildings, structures, and sites; groups of buildings, structures, or sites forming historic districts; and individual objects.
transpiration	The process by which water enters a plant through its root system, passes through its vascular system, and is released into the atmosphere through openings in its outer covering. It is an important process for removal of water

	that has infiltrated below the zone where it could be removed by evaporation.
transuranic waste	Waste materials (excluding ***high-level radioactive waste*** and certain other waste types) contaminated with alpha-emitting ***radionuclides*** that are heavier than uranium with half-lives greater than 20 years and that occur in concentrations greater than 100 nanocuries per gram. Transuranic waste results primarily from treating and fabricating plutonium, and research activities at DOE defense installations.
troposphere	The lowest layer of the atmosphere; it contains about 95 percent of the mass of air in the Earth's atmosphere. The troposphere extends from the Earth's surface up to about 10 to 15 kilometers (7 to 9 miles).
tuff	***Igneous*** rock formed from compacted volcanic fragments from ***pyroclastic*** (explosively ejected) flows with particles generally smaller than 4 millimeters (about 0.16 inch) in diameter. Nonwelded tuff results when volcanic ash cools in the air sufficiently that it does not melt together, yet later becomes rock through compression.
ultraviolet radiation	Electromagnetic ***radiation*** with wavelengths from 4 to 400 nanometers. This range begins at the short wavelength limit of visible light and overlaps the wavelengths of long ***X-rays*** (some scientists place the lower limit at higher values, up to 40 nanometers). Also known as ultraviolet light.
uncertainty	A measure of how much a calculated or estimated value that is used as a reasonable guess or prediction might vary from the unknown true value.
unique farmland	Land other than ***prime farmland*** that is used for the production of specific high-value food and fiber crops such as citrus, tree nuts, olives, cranberries, fruits, and vegetables.
unpatented mining claim	See ***mining claim***.
unsaturated zone	The zone of soil or rock below the ground surface and above the ***water table***.
viewshed	A total field of vision or a vista. In particular, an area with visual boundaries seen from various points within the area.
vitrification	A waste treatment process that uses glass (for example, ***borosilicate glass***) to encapsulate or immobilize ***radioactive*** wastes.
volatile organic compound (VOC)	Organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.
volcanic rock	Rocks that have been ejected at or near the Earth's surface. ***Tuffs***, lava flows, volcanic breccias, basalt, andesite, and rhyolite are types of volcanic rocks that are found in the Great Basin. They are differentiated by chemistry and texture.

wash	The dry streambed of an ***intermittent*** or ***ephemeral stream***. In the Nevada Rail Corridor SEIS and the Rail Alignment EIS, wash is used interchangeably with intermittent and ***ephemeral streams***.
waste form	A generic term that refers to the different types of ***radioactive*** wastes.
waste package	A container that consists of the barrier materials and internal components into which DOE would place the ***canisters*** that contained ***spent nuclear fuel*** and ***high-level radioactive waste*** at the ***repository***.
waste packages	Two thick metal cylinders, one nested within the other. The inner cylinder would be made of stainless steel to provide structural strength. The outer cylinder would be made of a nickel alloy that is highly resistant to corrosion.
wastewater treatment	A process that typically involves three stages (called primary, secondary, and tertiary treatment). First, the solids are separated from the wastewater. Next, dissolved biological matter is progressively converted into a solid mass using indigenous water-borne bacteria. Finally, the biological solids are neutralized and then disposed of or re-used, and the treated water can be disinfected chemically or physically (such as by lagooning and micro-filtration). The final effluent can be discharged into a natural surface-water body or other environment.
water table	(1) The upper limit of the ***saturated zone*** (the portion of the ground wholly saturated with water). (2) The upper surface of a zone of saturation above which most pore spaces and ***fractures*** are less than 100-percent saturated with water most of the time (***unsaturated zone***) and below which the opposite is true (saturated zone).
waters of the United States	Streams, drainages, or washes under the jurisdiction of the U.S. Army Corps of Engineers under the Clean Water Act as defined at 33 CFR 328.3a. The U.S. Army Corps of Engineers and U.S. Environmental Protection Agency regulate the placement of dredged or fill material into these waters. The definition incorporates channels with ***ephemeral*** and intermittent flow that exhibit specific physical features, including channel shape and surrounding vegetation that would provide indications of an ***ordinary high water mark***.
wayside signal	Any signal of fixed location outside the train alongside the track.
welded tuff	A ***tuff*** deposited under conditions in which the particles making up the rock were heated sufficiently to cohere. In contrast to nonwelded tuff, welded tuff is denser, less porous, and more likely to be ***fractured*** (which increases ***permeability***).
wetland	Areas inundated or saturated by surface- or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wilderness Study Area	Areas of public lands the BLM has formally identified as having wilderness characteristics. These areas are protected by Congress, until Congress either designates them as an official Wilderness Area or removes them from any wilderness designation.
wildlife guzzler	A water development for wildlife that relies on rainfall or snowmelt to recharge it, rather than springs or streams. Usually used where there are no other sources of water for wildlife.
withdrawal	Related to land use: Withholding an area of federal land from settlement, sale, location, or surface entry, under some or all of the general land laws, for the purpose of limiting activities under those laws to maintain other public values in the area or reserving the area for a particular public purpose or program. Related to water resources: Water diverted from the ground or diverted from a surface-water source for use.
worker year	Two-thousand hours of paid labor; a project requiring 1.5 worker years would take 3,000 hours to complete.
wye track	A triangular shaped arrangement of tracks with a switch at each corner. With a sufficiently long track leading away from each corner, a train of any length can be turned.
X-rays	Penetrating electromagnetic ***radiation*** having a wavelength much shorter than that of visible light. X-rays are identical to ***gamma rays*** but originate outside the ***nucleus***, either when the inner orbital ***electrons*** of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.
Yucca Mountain Site	The area inside the site boundary over which DOE has control.
Yucca Mountain Site boundary	The outer limit of the 600-square-kilometer (150,000-acre) area shown on figures in this Rail Alignment EIS, assumed, for purposes of analysis, to be the area of federal property set aside for the exclusive use of DOE for the repository project.

DOE used the Document Input Reference System (DIRS) to manage references for the document. The unique number assigned by this system has been used in text and in this Reference List to aid the reader in identifying source documents.

Reference	Author/Date	Document Title
		CITED DOCUMENTS
155658	AAR 2000	AAR (Association of American Railroads) 2000. Recommended Railroad Operating Practices for Transportation of Hazardous Materials. Circular No. OT-55-C. Washington, D.C.: Association of American Railroads. TIC: 250387.
166338	AAR 2003	AAR S-2043. 2003. Performance Specification for Trains Used to Carry High-Level Radioactive Material. [Washington, D.C.]: Association of American Railroads. TIC: 257585.
175727	AAR 2005	AAR (Association of American Railroads) 2005. Field Manual of the Interchange Rules. Change No. 05-1. Washington, D.C.: Association of American Railroads. TIC: 257725; 257789.
174548	Abaris Group 2004	Abaris Group 2004. Pahrump Valley Fire & Rescue Service Study, Final Report February 2004. Walnut Creek, California: Abaris Group. TIC: 257693.
174690	Abbey and Baldrica 2005	Abbey, R.V. and Baldrica, A.M. 2005. State Protocol Agreement (as Amended through January 2005) between the Bureau of Land Management, Nevada and the Nevada State Historic Preservation Office. The Protocol Defines How the Nevada State Historic Preservation Office (SHPO) and the Nevada Bureau of Land Management (BLM) will Interact and Cooperate under the BLM National Programmatic Agreement (NPA) for Implementing the National Historic Preservation Act (NHPA). ACC: MOL.20060216.0173.
182014	Adkins et al. 2006	Adkins, H.E., Jr.; Cuta, J.M.; Koeppel, B.J.; Guzman, A.D.; and Bajwa, C.S. 2006. Spent Fuel Transportation Package Response to the Baltimore Tunnel Fire Scenario. NUREG/CR-6886, Rev. 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20070724.0369.
181841	Adkins et al. 2007	Adkins, H.E., Jr.; Koeppel, B.J.; Cuta, J.M.; Guzman, A.D.; and Bajwa, C.S. 2007. Spent Fuel Transportation Package Response to the Caldecott Tunnel Fire Scenario. NUREG/CR-6894, Rev. 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20070724.0370.
174688	AGEISS 2005	AGEISS Environmental 2005. Cultural Resources Historic Context Report for the U.S. Department of Energy Caliente-Yucca Mountain Railroad Environmental Impact Statement. Las Vegas, Nevada: AGEISS Environmental. ACC: MOL.20050928.0003.
102043	AIWS 1998	AIWS (American Indian Writers Subgroup) 1998. American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement. Las Vegas, Nevada: Consolidated Group of Tribes and Organizations. ACC: MOL.19980420.0041.

Reference	Author/Date	Document Title
180760	Albers and Steward 1981	Albers, J.P. and Stewart, J.H. 1981. Geology and Mineral Deposits of Esmeralda County, Nevada. 1st Edition, 2nd Printing. Bulletin 78. Reno, Nevada: Nevada Bureau of Mines and Geology, University of Nevada, Reno. ACC: HQS.19880517.1904; JQS.19880517.1904.
173918	American Ecology Corportation 2005	American Ecology Corportation 2005. "Beatty, NV - Hazardous Waste Treatment & Disposal Facility." [Boise, Idaho]: American Ecology Corportation. Accessed May 24, 2005. TIC: 257527. URL: http://www.americanecology.com/locations/beatty/INDEX.ASP
180694	Ang-Olson and Gallivan 2007	Ang-Olson, J. and Gallivan, F. 2007. Shared Use Option: Commercial Traffic Estimates. [Fairfax, Virginia]: ICF International. ACC: MOL.20070511.0006.
176756	Ang-Olson and Khan 2005	Ang-Olson, J. and Khan, S. 2005. RA EIS Shared Use Alternative, Summary of AGEISS Team Interview Findings. [Las Vegas, Nevada: AGEISS Environmental]. ACC: MOL.20060410.0237.
177524	Anning and Konieczki 2005	Anning, D.W. and Konieczki, A.D. 2005. Classification of Hydrogeologic Areas and Hydrogeologic Flow Systems in the Basin and Range Physiographic Province, Southwestern United States. Professional Paper 1702. Reston, Virginia: U. S. Geological Survey. ACC: MOL.20060925.0025.
174545	Arcaya 2005	Arcaya, M. 2005. "Discuss Population Served by Grover C. Dils Medical Center, High School Closest to Caliente, and Plans for Development in Lincoln County." Record of conversation from M. Arcaya to K. Dickson (Lincoln County), June 13, 2005. ACC: MOL.20050810.0035.
174731	Arcaya 2005	Arcaya, M. 2005. "Nye County Fire Protection." Record of conversation from M. Arcaya to B. Jones (Nye County), March 22, 2005. ACC: MOL.20050810.0030.
174732	Arcaya 2005	Arcaya, M. 2005. "Services Provided by the Nye Regional Medical Center." Record of conversation from M. Arcaya to J. McMillan (Nye County), March 22, 2005. ACC: MOL.20050810.0026.
174735	Arcaya 2005	Arcaya, M. 2005. "Education in Lincoln County." Record of conversation from M. Arcaya to R. Hardy (Lincoln County School District), March 1, 2005. ACC: MOL.20050810.0024.
174736	Arcaya 2005	Arcaya, M. 2005. "Medical Services Provided by Community Health Nurses." Record of conversation from M. Arcaya to S. Himrick (State Community Health Nurse), June 14, 2005. ACC: MOL.20050810.0038.
174737	Arcaya 2005	Arcaya, M. 2005. "Obtain Education Data for Nye County." Record of conversation from M. Arcaya to G. Olson (Nye County), March 8, 2005 and June 13, 2005. ACC: MOL.20050810.0027.
174751	Arcaya 2005	Arcaya, M. 2005. "Obtain Data on Esmeralda County and Goldfield Water Supply and Sewer System." Record of conversation from M. Arcaya to M. Anderson (Esmeralda County Public Works), June 14, 2005. ACC: MOL.20050810.0036.
174753	Arcaya 2005	Arcaya, M. 2005. "Obtain Information on Fire Protection and Law Enforcement." Record of conversation from M. Arcaya to K. Elgan (Esmeralda County) March 22, 2005. ACC: MOL.20050810.0029.
174970	Arcaya 2005	Arcaya, M. 2005. "Education in Esmeralda County, Especially Goldfield." Record of conversation from M. Arcaya to C. Jordan (Esmeralda County School District), March 22, 2005. ACC: MOL.20050915.0303.

Reference	Author/Date	Document Title
174971	Arcaya 2005	Arcaya, M. 2005. “Fire Protection and Emergency Response in Lincoln County.” Record of conversation from M. Arcaya to T. Rowe (Lincoln County Board of Commissioners), March 4, 2005. ACC: MOL.20050915.0301.
174972	Arcaya 2005	Arcaya, M. 2005. “Health Care in Nye County.” Record of conversation from M. Arcaya to S. Trummel (Nye County), March 11, 2005. ACC: MOL.20050915.0302.
174973	Arcaya 2005	Arcaya, M. 2005. “Emergency Management in Lincoln County.” Record of conversation from M. Arcaya to M. Gunn (Lincoln County), March 4, 2005. ACC: MOL.20050915.0300.
174974	Arcaya 2005	Arcaya, M. 2005. “Verify Number of Nye County Sheriff’s Office Employees.” Record of conversation from M. Arcaya to G. Barnwell (Nye County Sheriff’s Office), June 1, 2005. ACC: MOL.20050810.0033.
175508	Arcaya 2005	Arcaya, M. 2005. “Health Care in Lincoln County.” Record of conversation from M. Arcaya to R. Mangum (Grover C Dils Medical Center), March 8, 2005. ACC: MOL.20051013.0011.
175973	Arcaya 2006	Arcaya, M. 2006. “Lincoln County High School in Panaca.” Record of conversation from M. Arcaya to R.D. Kelley (Lincoln County High School), January 3, 2006, with attachment. ACC: MOL.20060116.0022.
178094	Arcaya 2006	Arcaya, M. 2006. “Obtain Information on Level of State and Federal Support for Esmeralda County Sheriff’s.” Record of conversation from M. Arcaya to M. Knight (Esmeralda County Sheriff’s Office), October 5, 2006. ACC: MOL.20061031.0153.
178099	Arcaya 2006	Arcaya, M. 2006. “Determine Extent of Federal and State Support of County Sheriff’s Office.” Record of conversation from M. Arcaya to P. Robistow (Lincoln County Grants Coordinator), October 13, 2006. ACC: MOL.20061031.0154.
181388	Arcaya 2007	Arcaya, M. 2007. “Farmland Protection Policy Action Information.” Record of conversation from M. Arcaya to P.A. Hughes (Natural Resources Conservation Service), April 27, 2007, with attachment. ACC: MOL.20070622.0006.
106860	AREA 1997	AREA (American Railway Engineering Association) 1997. Track. Volume 1 of Manual for Railway Engineering. Washington, D.C.: American Railway Engineering Association. TIC: 233847.
162040	AREMA 2001	AREMA (American Railway Engineering and Maintenance-of-Way Association) 2001. 2001 Manual for Railway Engineering. Four volumes. Landover, Maryland: American Railway Engineering and Maintenance-of-Way Association. TIC: 250280.
177745	Arthur 2003	Arthur, J.W., III. 2003. “Application for Administrative Land Withdrawal for Potential Rail Corridor.” Letter from J.W. Arthur, III (DOE/ORD) to R.V. Abbey (BLM), December 19, 2003, OSPD:RLS-0481, with enclosure. ACC: MOL.20041111.0055.
181843	Axtell 2007	Westover, M. 2007. “AML’s for Garfield, Horse Mountain and Pilot HMAs.” Record of conversation from M. Westover (DOE) to J. Axtell (Carson City BLM), May 23, 2007. ACC: MOL.20070721.0002.

Reference	Author/Date	Document Title
175021	Barnato, Sanders, and Owens 2001	Barnato, A.E.; Sanders, G.D.; and Owens, D.K. 2001. "Cost-Effectiveness of a Potential Vaccine for Coccidioides Immitis." Emerging Infectious Diseases. 7, (5). [Atlanta, Georgia]: Center for Disease Control and Prevention. Accessed September 15, 2005. ACC: MOL.20050915.0304. URL: http://www.cdc.gov/incidod/eid/vol7no5/barnato.htm
178728	Bartoldus, Garbisch, and Kraus 1994	Bartoldus, C.C.; Garbisch, E.W.; and Kraus, M.L. 1994. Evaluation for Planned Wetlands (EPW). St. Michaels, Maryland: Environmental Concern. TIC: 259078.
173546	BEA 2004	BEA (Bureau of Economic Analysis) 2004. "CAO5N - CAO5N - Personal Income by Major Source and Earnings by Industry--Esmeralda, NV (Thousands of Dollars." Bureau of Economic Analysis: Regional Economic Accounts. [Washington, D.C.]: Bureau of Economic Analysis. Accessed April 7, 2005. ACC: MOL.20050505.0106. URL: http://www.bea.gov/bea/regional/reis/action.cfm?catable=CA05N&areatype=32000&years=2002,2001&fips=32009format=htm
173548	BEA 2005	BEA (Bureau of Economic Analysis) 2005. "CAO5N - Personal Income by Major Source and Earnings by Industry--Nye County, NV (Thousands of Dollars)." Bureau of Economic Analysis, Regional Economic Accounts. [Washington, D.C.]: Bureau of Economic Analysis. Accessed April 7, 2005. ACC: MOL.20050505.0108. URL: http://www.bea.gov/bea/regional/reis/action.cfm?catable=CAO5N&areatype=32000&years=2002,2001&fips=32023&format=htm
105038	Bear 1979	Bear, J. 1979. Hydraulics of Groundwater. New York, New York: McGraw-Hill. TIC: 217574.
173179	Belcher 2004	Belcher, W.R. 2004. Death Valley Regional Ground-Water Flow System, Nevada and California - Hydrogeologic Framework and Transient Ground-Water Flow Model. Scientific Investigations Report 2004-5205. Reston, Virginia: U.S. Geological Survey. ACC: MOL.20050323.0070.
181390	Bell et al. 2002	Bell, J.W.; Amelung, F.; Ramelli, A.R.; and Blewitt, G. 2002. "Land Subsidence in Las Vegas, Nevada, 1935-2000: New Geodetic Data Show Evolution, Revised Spatial Patterns, and Reduced Rates." Environmental & Engineering Geoscience, VIII, (3), 155-174. [College Station, Texas]: Geological Society of America. TIC: 259542.
181866	Belnap 2006	Belnap, J. 2006. "The Potential Roles of Biological Soil Crusts in Dryland Hydrologic Cycles." Hydrological Processes, 20, 3159-3178. [New York, New York]: Wiley InterScience. ACC: MOL.20070721.0100.
180220	Bendixen and Facanha 2007	Bendixen, L. and Facanha, C. 2007. "Rail Accident Rate Calculation Methodology." Technical memo from L. Bendixen (ICF International) and C. Facanha (ICF International), to M. West (Potomac-Hudson Engineering), March 30, 2007. ACC: MOL.20070412.0014.
174046	Bennet 2005	Bennett, T. 2005. "Wild Horse and Burro Populations on HMA's Administered by the Tonopah BLM Office." Record of conversation from T. Bennett to A. Dumas (BLM/Tonopah), January 19, 2005. ACC: MOL.20050614.0142.
174047	Bennet 2005	Bennett, T. 2005. "Wild Horse and Burro Populations on HMA's Administered by the Ely BLM Office." Record of conversation from T. Bennett to J. Bybee (BLM/Ely), January 19, 2005. ACC: MOL.20050614.0143.

Reference	Author/Date	Document Title
174048	Bennet and Thebeau 2005	Bennett, T. and Thebeau, L. 2005. “Received Maps and Discussed Locations and Ranges of Sensitive Wildlife Species.” Record of conversation from T. Bennett and L.Thebeau to B. Hardenbrook (Nevada Department of Wildlife), May 20, 2005. ACC: MOL.20050614.0144.
174519	Bennett 2005	Bennett, T. 2005. “GIS Information Transmittal.” Record of conversation from T. Bennett to B. Hardenbrook (NDOW), July 13, 2005, with attachment. ACC: MOL.20051013.0015.
172904	Berris et al. 2003	Berris, S.N.; Crompton, J.; Joyner, J.D.; and Ryan, R. 2003. “Water Resources Data, Nevada, Water Year 2002.” Water-Data Report NV-02-1. Carson City, Nevada: U.S. Geological Survey. Accessed March 1, 2005. ACC: MOL.20050404.0253. URL: http://water.usgs.gov/pubs/wdr/WDR-NV-02-1
181896	Bhark, Ruskauff, and Kelley 2005	Bhark, E.; Ruskauff, G.; and Kelley, V. 2005. Analysis of Hydraulic Responses from the ER-6-1 Multiple-Well Aquifer Test, Yucca Flat FY 2004 Testing Program, Nevada Test Site, Nye County, Nevada. S-N/99205--051, Rev. 0. Las Vegas, Nevada: Stoller-Navarro Joint Venture. ACC: MOL.20070721.0099.
176685	BHPS 2004	BHPS (Bureau of Health Protection Services) 2004. “Map of Nevada Public Water Systems.” Nevada Source Water Assessment Program (SWAP). Carson City, Nevada: Bureau of Health Protection Services. Accessed March 29, 2006. ACC: MOL.20060330.0157. URL: http://health2k.state.nv.us/BHPS/phe/swa.htm
176686	BHPS 2004	BHPS (Bureau of Health Protection Services) 2004. “A List Sorted by County of Nevada’s Public Water Systems that Have Had a Source Water Assessment.” Nevada Source Water Assessment Program (SWAP). Carson City, Nevada: Nevada State Health Division, Bureau of Health Protection Services. Accessed March 29, 2006. ACC: MOL.20060330.0156.
174501	Birnbaum 1994	Birnbaum, C.A. 1994. “Protecting Cultural Landscapes, Planning, Treatment and Management of Historic Landscapes.” 36 Preservation Briefs. Washington, D.C.: National Park Service. Accessed July 14, 2005. ACC: MOL.20050815.0191. URL: http://www.cr.nps.gov/hps/tps/briefs/brief36.htm
176750	Bishop 2006	Bishop, L. 2006. “Hazardous Material Table.” E-mail from L. Bishop to M. West, March 20, 2006, with attachment. ACC: MOL.20060410.0236.
182761	Bishop 2007	Larson, N.B. 2007. “Draft Final Integrated Natural Resources Management Plan, Prepared for the Hawthorne Army Ammunition Depot (Depot), July 2004.” Letter from N.B Larson (DOE/OCRWM) to LTC H. Green (Hawthorne Army Depot), May 23, 2007. ACC: MOL.20070831.0091.
102060	Biwer et al. 1997	Biwer, B.M.; Arnish, J.J.; Kamboj, S.; and Chen, S.Y. 1997. RISKIND Verification and Benchmark Comparisons. ANL/EAD/TM-74. Argonne, Illinois: Argonne National Laboratory. TIC: 243692.
178610	Bland 2007	Bland, J. 2007. “Baseline: REMI Policy Insight Version 9, Last History Year 2004.” E-mail from J. Bland to E. Gorsem, January 10, 2007, with attachment. ACC: MOL.20070119.0084.
179558	Bland 2007	Bland, J. 2007. “Caliente RR REMI Changes to 2067.” E-mail from J. Bland to P. Quick and E. Gormsen, March 1, 2007, with attachment. ACC: MOL.20070320.0418.

Reference	Author/Date	Document Title
180485	Bland 2007	Bland, J. 2007. "Delivery of Revised REMI Runs for Caliente Corridor Rail Spur." E-mail from J. Bland to E. Gormsen and P. Quick, April 18, 2007, with attachment. ACC: MOL.20070427.0078.
180689	Bland 2007	Bland, J. 2007. "REMI Outputs: TCC/NTOC in Mineral County." E-mail from J. Bland to E. Gormsen and P. Quick, April 29, 2007, with attachment. ACC: MOL.20070511.0002.
180690	Bland 2007	Bland, J. 2007. "REMI Outputs - Mina Route - Primary Run." E-mail from J. Bland to E. Gormsen and P. Quick, April 29, 2007, with attachment. ACC: MOL.20070511.0003.
180691	Bland 2007	Bland, J. 2007. "Single Construction Camp in Mineral County." E-mail from J. Bland to E. Gormsen and P. Quick, April 29, 2007, with attachment. ACC: MOL.20070511.0004.
181590	Bland 2007	Bland, J. 2007. "RE: Timing of Analysis." E-mail from J. Bland to P. Quick, June 8, 2007, with attachment. ACC: MOL.20070705.0082.
151227	Blasing et al. 1998	Blasing, T.J.; Cada, G.F.; Easterly, C.E.; McCold, L.N.; and Zimmerman, G.P. 1998. Environmental Assessment Renewal of Materials Licenses for ALARON Corp. Northeast Regional Service Facility, Wampum, Pennsylvania. NUREG/CR-5549. Washington, D.C.: U.S. Nuclear Regulatory Commission. TIC: 248520.
173057	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Miller Flat and Little Mountain Herd Management Areas, Lincoln County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0042. URL: http:www.blm.gov/hma/caliente/miller%20flat2.pdf
173059	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Highland Peak Herd Management Area, Lincoln County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0043. URL: http://www.nv.blm.gov/hma/caliente/highland_peak.pdf
173060	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Reveille Herd Management Area, Nye County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0044. URL: http://www.nv.blm.gov/hma/battle_mountain/reveille.pdf
173061	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Montezuma Peak Herd Management Area, Esmeralda County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0045. URL: http://www.nv.blm.gov/hma/battle_mountain/montezuma%20%20peak.pdf
173062	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Goldfield Herd Management Area, Nye and Esmeralda Counties, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0046. URL: http://www.nv.blm.gov/hma/battle_mountain/goldfield.pdf
173063	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Stonewall Herd Management Area, Nye County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0047. URL: http://www.nv.blm.gov/hma/battle_mountain/stonewall.pdf

Reference	Author/Date	Document Title
174329	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Saulsbury Herd Management Area, Nye County, Nevada. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050808.0384.
174330	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Stone Cabin Herd Management Area Nye County, Nevada. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050808.0385.
174332	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Rattlesnake Herd Management Area Lincoln County, Nevada. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050808.0386.
174333	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Seaman Herd Management Area Nye and Lincoln Counties, Nevada. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050808.0387.
176795	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Amargosa Toad. BLM/BM/GI-01/015+9212. Tonopah, Nevada: Bureau of Land Management, Tonopah Field Station. ACC: MOL.20060417.0021.
180122	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Collecting on Public Lands." Carson City, Nevada: Bureau of Land Management, Carson City Field Office. Accessed April 2, 2007. ACC: MOL.20070412.0017. URL: http://www.nv.blm.gov/carson/Minerals/Geology/collecting.htm
181599	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "How do I Apply?" What is a Special Recreation Permit? Permits. [Sacramento, California]: Bureau of Land Management. Accessed June 15, 2007. ACC: MOL.20070705.0085. URL: http://www.nv.blm.gov/recreation/recperm-how.html
182069	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Dry Lake Herd Management Area, Lincoln County, Nevada." Herd Management Areas in Nevada. Reno, Nevada: Bureau of Land Management, Nevada State Office. Accessed July 17, 2007. ACC: MOL.20070806.0004. URL: http://www.nv.blm.gov/hma/alpha_hmas.htm
101504	BLM 1979	BLM (Bureau of Land Management) 1979. Final Environmental Statement, Proposed Domestic Livestock Grazing Management Program for the Caliente Area. INT FES 79-44. Las Vegas, Nevada: Bureau of Land Management. ACC: MOL.20010730.0394.
173052	BLM 1984	BLM (Bureau of Land Management) 1984. 8400 - Visual Resource Management, BLM Manual. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050406.0039.
101505	BLM 1986	BLM (Bureau of Land Management) 1986. Visual Resource Inventory. BLM Manual Handbook 8410-1. Washington, D.C.: U.S. Bureau of Land Management. ACC: MOL.20010730.0378.
173053	BLM 1986	BLM (Bureau of Land Management) 1986. Visual Resource Contrast Rating, BLM Manual Handbook 8431-1. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050406.0040.
102218	BLM 1988	BLM (Bureau of Land Management) 1988. Right-Of-Way Reservation. N-47748. Reno, Nevada: Bureau of Land Management. ACC: NNA.19880113.0002.
182299	BLM 1988	BLM (Bureau of Land Management) 1988. National Environmental Policy Act Handbook. BLM Handbook H-1790-1, Rel. 1-1547. [Washington, D.C.]: U.S. Bureau of Land Management. ACC: MOL.20070815.0062.

Reference	Author/Date	Document Title
174691	BLM 1990	BLM (Bureau of Land Management) 1990. "Cultural Resource Inventory General Guidelines." 4th Edition (Revised). [Washington, D.C.]: Bureau of Land Management. Accessed October 13, 2004. ACC: MOL.20050810.0041. URL: http://www.nv.blm.gov/permits/GUIDE.WPF.htm
101523	BLM 1994	BLM (Bureau of Land Management) 1994. Proposed Tonopah Resource Management Plan and Final Environmental Impact Statement. Tonopah, Nevada: Bureau of Land Management. ACC: MOL.20010730.0385.
173224	BLM 1997	BLM (Bureau of Land Management) 1997. Tonopah Resource Management Plan and Record of Decision. Tonopah, Nevada: U.S. Department of the Interior, Bureau of Land Management. ACC: MOL.20050418.0038.
103079	BLM 1998	BLM (Bureau of Land Management) 1998. Proposed Las Vegas Resource Management Plan and Final Environmental Impact Statement. Three volumes. Las Vegas, Nevada: Bureau of Land Management. ACC: MOL.20010724.0319.
176043	BLM 1998	BLM (Bureau of Land Management) 1998. Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement. Las Vegas, Nevada: Bureau of Land Management, Las Vegas Field Office. ACC: MOL.20060313.0209.
176084	BLM 1998	BLM (Bureau of Land Management) 1998. H-8270-1 - General Procedural Guidance for Paleontological Resource Management. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. ACC: MOL.20060123.0281.
176085	BLM 1998	BLM (Bureau of Land Management) 1998. 8270 - Paleontological Resource Management. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. ACC: MOL.20060123.0282.
174200	BLM 2000	BLM (Bureau of Land Management) 2000. Approved Caliente Management Framework Plan Amendment for the Management of Desert Tortoise Habitat and Record of Decision. 1.10.61. Ely, Nevada: Bureau of Land Management , Ely Field Office. ACC: MOL.20050714.0437.
172901	BLM 2001	BLM (Bureau of Land Management) 2001. "United States Department of the Interior Bureau of Land Management Special Status." 6840-Special Status Species Management. [Washington, D.C.]: Bureau of Land Management. Accessed February 22, 2005. ACC: MOL.20050516.0553. URL: http://www.blm.gov/nhp/efoia/wo/manual/6840.pdf
179560	BLM 2001	BLM (Bureau of Land Management) 2001. Carson City Field Office Consolidated Resource Management Plan. Carson City, Nevada: U.S. Department of the Interior, Bureau of Land Management. ACC: MOL.20070320.0414.
181386	BLM 2001	BLM (Bureau of Land Management) 2001. The Federal Land Policy and Management Act of 1976, as Amended. Index # BLM/WO/GI-01-002. Washington, D.C.: U.S. Department of Interior, Bureau of Land Management. ACC: MOL.20070622.0005.
172900	BLM 2003	BLM (Bureau of Land Management) 2003. Nevada BLM Sensitive Species. Las Vegas, Nevada: Bureau of Land Management. ACC: MOL.20050516.0552.

Reference	Author/Date	Document Title
174208	BLM 2003	BLM (Bureau of Land Management) 2003. Proposed Toquop Land Disposal Amendment to the Caliente Management Framework Plan and Final Environmental Impact Statement for the Toquop Energy Project. FES 03-13. [Reno], Nevada: Bureau of Land Management, Nevada State Office. ACC: MOL.20050714.0441.
174479	BLM 2003	BLM (Bureau of Land Management) 2003. Lentic Water Sources: Functionality Data by Allotment Bureau of Land Management - Ely District. [RAIL-ARREF 75228]. [Las Vegas, Nevada]: Bureau of Land Management. ACC: MOL.20050928.0008.
178103	BLM 2003	BLM (Bureau of Land Management) 2003. Proposed Nevada Test & Training Range Resource Management Plan and Final Environmental Impact Statement. Las Vegas, Nevada: U.S. Department of the Interior, Bureau of Land Management, Las Vegas Field Office. ACC: MOL.20060814.0350.
178102	BLM 2004	BLM (Bureau of Land Management) 2004. Record of Decision for the Approved Nevada Test & Training Range Resource Management Plan and Final Environmental Impact Statement. Las Vegas, Nevada: U.S. Department of the Interior, Bureau of Land Management. ACC: MOL.20061031.0155.
174478	BLM 2005	BLM (Bureau of Land Management) 2005. [Special Instruction Sheet for File Transmittal from BLM-Battle Mountain to AGEISS on June 29, 2005]. [RAIL-ARREF 75227]. [Las Vegas, Nevada]: Bureau of Land Management. ACC: MOL.20050928.0007.
174518	BLM 2005	BLM (Bureau of Land Management) 2005. Draft - Resource Management Plan/Environmental Impact Statement for the Ely District. Volume 1 (Chapters 1, 2, and 3) and Map Volume. Ely, Nevada: Bureau of Land Management, Ely Field Office. ACC: MOL.20060222.0131; MOL.20060222.0132.
181600	BLM 2005	BLM (Bureau of Land Management) 2005. “Battle Mountain Field Office, Tonopah Field Station.” Planning. Battle Mountain, Nevada: Bureau of Land Management. Accessed June 15, 2007. ACC: MOL.20070705.0086. URL: http://www.nv.blm.gov/bmountain/project_planning/content_front_page_05.htm
182762	BLM 2005	BLM (Bureau of Land Management) 2005. Mineral Potential Report for the DOE Land Withdrawal for Caliente Rail Corridor. Case File No.: NVN77880. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. ACC: ENG.20070625.0003.
180461	BLM 2006	BLM (Bureau of Land Management) 2006. “Back Country Byways.” Carson City, Nevada: U.S. Department of the Interior, Bureau of Land Management. Accessed April 20, 2007. ACC: MOL.20070426.0079. URL: http://www.blm.gov/nv/st/en/prog/recreation.print.html
173064	BLM 2007	BLM (Bureau of Land Management) [n.d.]. “Bullfrog Herd Management Area, Nye County, Nevada.” [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0048. URL: http://wwww.nv.blm.gov/hma/battle_mountain/bullfrog.pdf
180123	BLM 2007	BLM (U.S. Bureau of Land Management) 2007. “Fossils on America’s Public Lands.” Adventures in the Past, Media Room. Washington, D.C.: U.S. Bureau of Land Management. Accessed April 5, 2007. ACC: MOL.20070412.0016. URL: http://www.blm.gov/heritage/adventures/media.html

Reference	Author/Date	Document Title
180699	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV03536 Gillis Mountain." Legacy Rehost. LR2000. Washington, D.C.: U.S. Department of the Interior, Bureau of Land Management. Accessed May 7, 2007. ACC: MOL.20070523.0043. URL: http://www.blm.gov/lr2000/
181020	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV03572 Parker Butte." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. Accessed May 14, 2007. ACC: MOL.20070529.0111. URL: http://www.blm.gov/lr2000/
181021	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV00099 Magruder Mtn." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. Accessed May 16, 2007. ACC: MOL.20070529.0112. URL: http://www.blm.gov/lr2000/
181023	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV03017 Desert Mountain." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Mangement. Accessed May 16, 2007. ACC: MOL.20070529.0113. URL: http://www.blm.gov/lr2000/
181024	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV03535 Garfield Flat." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. Accessed May 16, 2007. ACC: MOL.20070529.0114. URL: http://www.blm.gov/lr2000/
181025	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV03574 Pilot-Table Mountain." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. Accessed May 16, 2007. ACC: MOL.20070529.0115. URL: http://www.blm.gov/lr2000/
181026	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV03511 Belleville." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. Accessed May 16, 2007. ACC: MOL.20070529.0116. URL: http://www.blm.gov/lr2000/
181027	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV00097 Silver Peak." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. Accessed May 16, 2007. ACC: MOL.20070529.0117. URL: http://www.blm.gov/lr2000/
181029	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV20101 Yellow Hills." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. Accessed May 16, 2007. ACC: MOL.20070529.0118. URL: http://www.blm.gov/lr2000/
181152	BLM 2007	BLM (Bureau of Land Management) 2007. "Allotment Master Report NV00100 Sheep Mountain." Legacy Rehost. LR2000. [Washington, D.C.]: U.S. Department of the Interior, Bureau of Land Management. Accessed May 25, 2007. ACC: MOL.20070530.0244. URL: http://www.blm.gov/lr2000/

Reference	Author/Date	Document Title
177755	BLS [n.d.]	BLS (Bureau of Labor Statistics) [n.d.]. Labor Force Data by County, 2005 Annual Averages. [Washington, D.C.]: U.S. Department of Labor, Bureau of Labor Statistics. ACC: MOL.20061026.0274.
179131	BLS 2006	BLS (Bureau of Labor Statistics) 2006. "Table 1. Incidence Rates of Nonfatal Occupational Injuries and Illnesses by Industry and by Case Types, 2005." Occupational Injuries and Illnesses (Annual). Washington, D.C.: U.S. Department of Labor, Bureau of Labor Statistics. Accessed February 13, 2007. ACC: MOL.20070220.0267. URL: http://stats.bls.gov/news.release/osh.toc.htm
179129	BLS 2007	BLS (Bureau of Labor Statistics) 2007. "All Charts, Census of Fatal Occupational Injuries, 2005." Census of Fatal Occupational Injuries (CFOI) - Current and Revised Data. Washington, D.C.: U.S. Department of Labor, Bureau of Labor Statistics. Accessed February 12, 2007. ACC: MOL.20070220.0266. URL: http://stats.bls.gov/iif/oshcfoi1.htm
176975	BMI 2006	BMI (Battelle Memorial Institute) 2006. ICRP-60 and ICRP-72 RADTRAN 5 and RISKIND Dose Conversion Factors. Calculation Report Number: BCO-003. [Columbus, Ohio]: Battelle Memorial Institute. ACC: MOL.20060515.0089.
176994	Bodman 2006	Bodman, S.W. 2006. "DOE American Indian and Alaska Natives Tribal Government Policy." Memorandum from S.W. Bodman (DOE) to Heads of Departmental Elements, January 20, 2006, with attachment. ACC: HQO.20060215.0020; HQO.20060215.0021.
182895	Boise State University 2007	Boise State University 2007. "Common Loons Threats and Migration." Raptor Research Center Projects. Boise, Idaho: Boise State University, Raptor Research Center. Accessed August 31, 2007. TIC: 259715. URL: http://rrc.boisestate.edu/Current%20projects/Loon/Loon.htm
156091	Borup and Bagley 1976	Borup, H.J. and Bagley, D.G. 1976. Soil Survey of Meadow Valley Area, Nevada - Utah, Parts of Lincoln County, Nevada, and Iron County, Utah. [Washington, D.C.]: U.S. Department of Agriculture. TIC: 242941.
176316	Bostic et al. 2004	Bostic, R.E.; Crompton, E.J.; Garcia, K.T.; and Vasquez, S.L. 2004. Water Resources Data - Nevada, 2004. Water Data Report NV-01-1. [Carson City, Nevada]: U.S. Geological Survey, Nevada Water Science Center. ACC: MOL.20060206.0353.
181865	Bradley et al. 2006	Bradley, P.V.; O'Farrell, M.J.; Williams, J.A.; and Newmark, J.E. 2006. The Revised Nevada Bat Conservation Plan. Reno, Nevada: Nevada Bat Working Group. ACC: MOL.20070721.0098.
102224	Brattstrom and Bondello 1983	Brattstrom, B.H. and Bondello, M.C. 1983. "Effects of Off Road Vehicle Noise on Desert Vertebrate." Environmental Effects of Off-Road Vehicles: Impact and Management in Arid Regions, 167-206. New York, New York: Springer-Verlag. TIC: 221245.
176851	Brothers, Bugo, and Tracy 1993	Brothers, K.; Buqo, T.S.; and Tracy, J.V. 1993. Hydrology and Steady State Ground-Water Model of Coal and Garden Valleys, Lincoln and Nye Counties, Nevada. Water for Nevada's Future Report No. 8. Hydrographic Basins 171 & 172. Las Vegas, Nevada: Las Vegas Valley Water District, Cooperative Water Project. TIC: 255003.

Reference	Author/Date	Document Title
176883	Brothers, Katzer, and Johnson 1996	Brothers, K.; Katzer, T.; and Johnson, M. 1996. Hydrology and Steady State Ground-Water Model of Dry Lake and Delamar Valleys, Lincoln County, Nevada. Water for Nevada's Future Report No. 16. Hydrographic Basins 181 & 182. [Las Vegas, Nevada]: Las Vegas Valley Water District, Cooperative Water Project. TIC: 255049.
102475	Brussard et al. 1994	Brussard, P.F.; Berry, K.H.; Gilpin, M.E.; Jacobson, E.R.; Morafka, D.J.; Schwalbe, C.R.; Tracy, C.R.; and Vasek, F.C. 1994. Desert Tortoise (Mojave Population) Recovery Plan. Portland, Oregon: U.S. Fish and Wildlife Service. TIC: 241399.
164364	BSC 2003	BSC (Bechtel SAIC Company) 2003. BWR Source Term Generation and Evaluation. 000-00C-MGR0-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20030723.0001; ENG.20050815.0024.
169061	BSC 2004	BSC (Bechtel SAIC Company) 2004. PWR Source Term Generation and Evaluation. 000-00C-MGR0-00100-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20040524.0007; ENG.20050815.0020; ENG.20050822.0006.
169734	BSC 2004	BSC (Bechtel SAIC Company) 2004. Yucca Mountain Site Description. TDR-CRW-GS-000001 REV 02 ICN 01. Two volumes. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20040504.0008.
174942	BSC 2005	BSC (Bechtel SAIC Company) 2005. Project Design Criteria Document. 000-3DR-MGR0-00100-000 REV 005. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20050826.0001.
175036	BSC 2005	BSC (Bechtel SAIC Company) 2005. Nevada Transportation Requirements Document. TER-NVT-RQ-000001 REV 00. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20050621.0004.
178416	BSC 2006	BSC (Bechtel SAIC Company) 2006. Initial Handling Facility Mechanical Handling System Block Flow Diagram-Level 3, Sheet 1 of 11. 51A-MH0-H000-00201-000 REV 00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20061205.0001; ENG.20070207.0002; ENG.20070514.0018.
180222	BSC 2006	BSC (Bechtel SAIC Company) 2006. Mina Rail Route Feasibility Study. Rev. 01. Las Vegas, Nevada: Bechtel SAIC Company. ACC: MOL.20070108.0027.
180471	BSC 2007	BSC (Bechtel SAIC Company) 2007. Recommended Values for HLW Glass for Consistent Usage on the Yucca Mountain Project. 000-00A-MGR0-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20070330.0013.
181377	BSC 2007	BSC (Bechtel SAIC Company) 2007. Calculation of Transportation Data for SEIS Analyses. 000-00C-G000-01300-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20070523.0036.
182778	BSC 2007	Bechtel SAIC, LLC 2007. Comparative Cost Estimate Summary Report, Mina, Rev.01, 07/23/07. Las Vegas, Nevada: Bechtel SAIC, LLC. ACC: ENG.20070725.0020.
179132	Bureau of Census [n.d.]	Bureau of Census [n.d.]. "DP-1. General Population and Housing Characteristics: 1990 Data Set: 1990 Summary Tape File 1 (STF 1) - 100-Percent Data." Quick Tables - American FactFinder. Washington, D.C.: Bureau of Census. Accessed February 6, 2007. ACC: MOL.20070220.0268. URL: http://factfinder.census.gov/servlet/QTTable?

Reference	Author/Date	Document Title
173531	Bureau of Census 2000	Bureau of Census [2000]. “1990 Summary Tape File 3 (STF 3) - Sample Data.” Detailed Tables - American FactFinder. [Washington, D.C.]: Bureau of Census. Accessed April 7, 2005. ACC: MOL.20050505.0096. URL: http://factfinder.census.gov/servlet/DTTable?
173535	Bureau of Census 2000	Bureau of Census 2000. “Census 2000 Summary File 3 (SF 3) - Sample Data.” Profile of Selected Housing Characteristics: 2000, Goldfield CCD, Esmeralda County, Nevada. [Washington, D.C.]: Bureau of Census. Accessed April 7, 2005. ACC: MOL.20050505.0100. URL: http://factfinder.census.gov/servlet/QTTable?
175921	Bureau of Census 2000	Bureau of Census 2000. “PCT12. Sex by Age [209] - Universe: Total Population Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data.” Lincoln County, Nevada. [Washington, D.C.]: Bureau of Census. Accessed December 14, 2005. ACC: MOL.20060111.0284. URL: http://factfinder.census.gov/servlet/DTTable?
175922	Bureau of Census 2000	Bureau of Census 2000. “PCT12. Sex by Age [209] - Universe: Total Population Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data.” Esmeralda County, Nevada. [Washington, D.C.]: Bureau of Census. Accessed December 14, 2005. ACC: MOL.20060111.0285. URL: http://factfinder.census.gov/servlet/DTTable?_bm=y&-context=dt&-ds_name=DEC_2000_SF1_U
173530	Bureau of Census 2005	Bureau of Census 2005. “Nevada QuickFacts, Lincoln County, Nevada.” [Washington, D.C.]: Bureau of Census. Accessed April 7, 2005. ACC: MOL.20050505.0095. URL: http://quickfacts.census.gov/qfd/states/32/32017.html
173533	Bureau of Census 2005	Bureau of Census 2005. “Nevada QuickFacts, Clark County, Nevada.” [Washington, D.C.]: Bureau of Census. Accessed April 7, 2005. ACC: MOL.20050505.0098. URL: http://quickfacts.census.gov/qfd/states/32/32003.html
173534	Bureau of Census 2005	Bureau of Census 2005. “Nevada QuickFacts, Esmeralda County, Nevada.” [Washington, D.C.]: Bureau of Census. Accessed April 7, 2005. ACC: MOL.20050505.0099. URL: http://quickfacts.census.gov/qfd/states/32/32009.html
174625	Bureau of Census 2005	Bureau of Census 2005. “Poverty Thresholds 2000.” [Washington, D.C.]: Bureau of Census. Accessed [n.d.]. ACC: MOL.20050810.0040. URL: http://www.census.gov/hhes/www/poverty/threshld/thresh00.html
182302	Bureau of Indian Affairs 2005	Miller Ecological Consultants 2005. Final Environmental Impact Statement, Weber Dam Repair and Modification Project. Two volumes. Fort Collins, Colorado: Miller Ecological Consultants. ACC: MOL.20070815.0063.
171297	Bureau of the Census 2004	Bureau of the Census 2004. “PCT12. Sex by Age [209]-Universe: Total Population, Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data.” American FactFinder [Washington, D.C.]: Bureau of the Census. Accessed July 22, 2004. ACC: MOL.20040812.0271. URL: http://factfinder.census.gov/servlet/DTTable?_bm-y&geo?id=05000US32003&ds_name=DEC_...
171298	Bureau of the Census 2004	Bureau of the Census 2004. “PCT12. Sex by Age [209]-Universe: Total Population Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data.” [Washington, D.C.]: Bureau of the Census. Accessed July 22, 2004. ACC: MOL.20040812.0272. URL: ://factfinder.census.gov/servlet/DTTable?_bm=y&-geoid=05000US32023&-ds_name-DEC_...

Reference	Author/Date	Document Title
182385	Burns 2007	Burns, L. 2007. "Tech Memo." E-mail from L. Burns to L. Burns and T. Washington, June 1, 2007, with attachment. ACC: MOL.20070703.0114.
101830	Bury et al. 1994	Bury, R.B.; Esque, T.C.; DeFalco, L.A.; and Medica, P.A. 1994. Distribution, Habitat Use, and Protection of the Desert Tortoise in the Eastern Mojave Desert. Biology of North American Tortoises. Bury, R.B. and Germano, D.J., eds. Fish and Wildlife Research Report 13, Pages 57-72. Washington, D.C.: U.S. Department of the Interior, National Biological Survey. TIC: 225209.
180857	California Department of Finance 2007	California Department of Finance 2007. State Adds Almost 470,000 in 2006; 2007 Population Nears 37.7 Million. Sacramento, California: State of California Department of Finance, Demographic Research Unit. ACC: MOL.20070521.0095.
173568	California Environmental Protection Agency 2004	California Environmental Protection Agency 2004. Public Hearing to Consider Proposed Regulatory Amendments Extending the California Standards for Motor Vehicle Diesel Fuel to Diesel Fuel Used in Harborcraft and Intrastate Locomotives. Sacramento, California: State of California, California Environmental Protection Agency. TIC: 257531.
182283	Callan 2007	Callan, A. 2007. "Re: Yucca Mountain Special Recreation Permit Information." E-mail from A. Callan (BLM) to N. Wagoner (ICF International), June 26, 2007. ACC: MOL.20070815.0007.
174674	Carpenter and Murray [n.d.]	Carpenter, A.T. and Murray, T.A. [n.d.]. Element Stewardship Abstract for Bromus Tectorum L (Anisantha Tectorum (L.) Nevski). Arlington, Virginia: The Nature Conservancy. TIC: 257692.
178806	CBER 2006	CBER (Center for Business and Economic Research) 2006. Population Forecasts: Long-Term Projections for Clark County, Nevada, 2006-2035. Las Vegas, Nevada: University of Nevada, Las Vegas, Center for Business and Economic Research. TIC: 259006.
181391	CDC 2007	CDC (Centers for Disease Control and Prevention) 2007. "Hantavirus Pulmonary Syndrome Cases, by State of Residence, United States - March 26, 2007." All About Hantaviruses. [Atlanta, Georgia]: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Accessed June 18, 2007. ACC: MOL.20070622.0007. URL: http://www.cdc.gov/ncidod/diseases/hanta/hps/noframes/casemap pdf.pdf
179137	CEMP 2006	CEMP (Community Environmental Monitoring Program) 2006. "Amargosa Valley Nevada, Ave. Gamma Radiation." Station Graph - Amargosa Valley Nevada. Las Vegas, Nevada: Desert Research Institute, Community Environmental Monitoring Program. Accessed November 22, 2006. ACC: MOL.20070220.0242. URL: http://www.cemp.dri.edu/cgi-bin/wea_graph2
179138	CEMP 2006	CEMP (Community Environmental Monitoring Program) 2006. "Caliente Nevada Ave. Gamma Radiation." Station Graph - Caliente Nevada. Las Vegas, Nevada: Desert Research Institute, Community Environmental Monitoring Program. Accessed November 22, 2006. ACC: MOL.20070220.0243. URL: http://www.cemp.dri.edu//cgi-bin/wea_graph2

Reference	Author/Date	Document Title
179139	CEMP 2006	CEMP (Community Environmental Monitoring Program) 2006. “Tonopah Nevada Ave. Gamma Radiation.” Station Graph- Tonopah Nevada. Las Vegas, Nevada: Desert Research Institute, Community Environmental Monitoring Program. Accessed November 22, 2006. ACC: MOL.20070220.0244. URL: http://www.cemp.dri.edu/cgi-bin/wea_graph2
179140	CEMP 2006	CEMP (Community Environmental Monitoring Program) 2006. “Beatty Nevada Ave. Gamma Radiation.” Station Graph - Beatty Nevada. Las Vegas, Nevada: Desert Research Institute, Community Environmental Monitoring Program. Accessed November 22, 2006. ACC: MOL.20070220.0245. URL: http://www.cemp.dri.edu/cgi-bin/wea_graph2
179141	CEMP 2006	CEMP (Community Environmental Monitoring Program) 2006. “Goldfield Nevada Ave. Gamma Radiation.” Station Graph - Goldfield Nevada. Las Vegas, Nevada: Desert Research Institute, Community Environmental Monitoring Program. Accessed November 22, 2006. ACC: MOL.20070220.0246. URL: http://www.cemp.dri.edu/cgi-bin/wea_graph2
179142	CEMP 2006	CEMP (Community Environmental Monitoring Program) 2006. “Las Vegas Nevada Ave. Gamma Radiation.” Station Graph- Las Vegas Nevada. Las Vegas, Nevada: Desert Research Institute, Community Environmental Monitoring Program. Accessed November 22, 2006. ACC: MOL.20070220.0247. URL: http://www.cemp.dri.edu/cgi-bin/wea_graph2
182284	Center for Chemical Process Safety 1995	CCPS (Center for Chemical Process Safety) 1995. Guidelines for Chemical Transportation Risk Analysis. New York, New York: American Institute of Chemical Engineers. TIC: 259663.
152083	Chanin and Murfin 1996	Chanin, D.I. and Murfin, W.B. 1996. Site Restoration: Estimation of Attributable Costs From Plutonium-Dispersal Accidents. SAND96-0957. Albuquerque, New Mexico: Sandia National Laboratories. TIC: 248778.
180482	Churchill County Planning Department 2007	Churchill County Planning Department 2007. “Churchill County Master Plan (2005 Update).” Churchill County, Planning - Zoning - GIS - Code Enforcement - Business Licensing. Fallon, Nevada: Churchill County Planning Department. Accessed April 20, 2007. ACC: MOL.20070721.0101. URL: http://www.churchillcounty.org/planning/
181900	Coffin and Cowan 1995	Coffin, P.D. and Cowan, W.F. 1995. Lahontan Cutthroat Trout (Oncorhynchus Clarki Henshawi) Recovery Plan. Portland, Oregon: U.S. Fish and Wildlife Service. ACC: MOL.20070719.0379.
173390	Colliers International Partnership 2004	Colliers International Partnership 2004. Industrial Market Report. Q1. Las Vegas, Nevada: Colliers International Partnership. TIC: 257546.
173391	Colliers International Partnership 2004	Colliers International Partnership 2004. Office Market Report. Q1. Las Vegas, Nevada: Colliers International Partnership. TIC: 257547.
182776	Collins 1991	Collins, A. 1991. The Walker River Paiute Tribe Will Not Allow Nuclear Waste to be Transported Across Any Portion of the Walker River indian Reservation. Letter from A. Collins (Walker River Paiute Tribe) to Adm. J.D. Watkins, December 6, 1991. ACC: HQX.19911216.0009.

Reference	Author/Date	Document Title
173051	Comer et al. 2003	Comer, P.; Faber-Langendoen, D.; Evans, R.; Gawler, S.; Josse, C.; Kittel, G.; Menard, S.; Pyne, M.; Reid, M.; Schulz, K.; Snow, K.; and Teague, J. 2003. Ecological Systems of the United States, A Working Class Classification of the U.S. Terrestrial Systems. Arlington, Virginia: NatureServe. TIC: 257146.
176600	Converse Consultants 2005	Converse Consultants 2005. Water Resources Assessment Report, Caliente Rail Corridor, Yucca Mountain Project, Nevada, Task 3.4, Rev. 0. Converse Consultants Project No. 04-33110-01. Las Vegas, Nevada: Converse Consultants. ACC: ENG.20060315.0001.
176189	Converse Consultants 2006	Converse Consultants 2006. Hydrogeologic DEIS Analysis Report, REV. 0, April 10, 2006. Converse Project No. 04-33110-03. Las Vegas, Nevada: Converse Consultants. ACC: ENG.20060426.0001.
180887	Converse Consultants 2007	Converse Consultants 2007. Water Resources Assessment, Mina Rail Corridor, Task 3.5a: Phase 1 Water Resources Assessment, REV. 0. 04-33110-04. [Las Vegas, Nevada]: Converse Consultants. ACC: ENG.20070507.0003.
180888	Converse Consultants 2007	Converse Consultants 2007. Hydrogeologic DEIS Analysis Report Mina Rail Corridor, Task 3.6a: Identification of Water Resources, Rev. 0. Converse Consultants Project No. 04-33110-04. [Las Vegas, Nevada]: Converse Consultants. ACC: ENG.20070516.0009.
182759	Converse Consultants 2007	Converse Consultants 2007. NDWR Data Update - Technical Memorandum, Mina Rail Corridor. Las Vegas, Nevada: Parsons Brinckerhoff Quade & Douglas. ACC: ENG.20070724.0021.
182843	Coogan and Bethoney 2007	Coogan,T. and Bethoney, M. 2007. EIS for the Alignment, Construction and Operation of a Rail Line to a Geological Repository at Yucca Mountain,Nye county, Nevada, Yucca Mountain Railroad, Caliente Alignment Map Atlas. Lexington, MA: ICF International.
182844	Coogan and Bethoney 2007	Coogan, T. and Bethoney, M. 2007. EIS for the Alignment, Construction and Operation of a Rail Line to a Geological Repository at Yucca Mountain,Nye county, Nevada, Yucca Mountain Railroad, Mina Alignment Map Atlas. Lexington, MA: ICF International.
103162	Council on Environmental Quality 1997	Council on Environmental Quality 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Washington, D.C.: Council on Environmental Quality. TIC: 243482.
174081	Countess Environmental 2004	Countess Environmental 2004. WRAP Fugitive Dust Handbook. Westlake Village, California: Countess Environmental. TIC: 257525.
178724	Cowardin et al. 1979	Cowardin, L.M.; Carter, V.; Golet, F.C.; and LaRoe, E.T. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. Washington, D.C.: U.S. Government Printing Office. ACC: MOL.20070201.0265.
103676	Cowher, Muleski, and Kinsey 1988	Cowherd, C.; Muleski, G.E.; and Kinsey, J.S. 1988. Control of Open Fugitive Dust Sources, Final Report. EPA-450/3-88-008. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency. ACC: MOL.20010730.0381.
176463	Craig, Lechel, and Morton 2004	Craig, W.; Lechel, D.; and Morton, L. 2004. Summary of Public Scoping Comments, Related to the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV. Revision 00. Augusta, Georgia: Dade Moeller & Associates. ACC: MOL.20041011.0344.

Reference	Author/Date	Document Title
104795	CRWMS M&O 1995	CRWMS M&O 1995. Nevada Potential Repository Preliminary Transportation Strategy Study 1. B00000000-01717-4600-00023 REV 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19960729.0195.
101214	CRWMS M&O 1996	CRWMS M&O 1996. Nevada Potential Repository Preliminary Transportation Strategy Study 2. B00000000-01717-4600-00050 REV 01. Two volumes. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19960724.0199; MOL.19960724.0200.
147771	CRWMS M&O 1996	CRWMS M&O 1996. Meteorological Monitoring Program, Particulate Matter Ambient Air Quality Monitoring Report, January 1992 through December 1995. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19960329.0171.
102876	CRWMS M&O 1997	CRWMS M&O 1997. Meteorological Monitoring Program Particulate Matter Ambient Air Quality Monitoring Report January through December 1996. BA0000000-01717-5705-00001 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980416.0733.
132219	CRWMS M&O 1997	CRWMS M&O 1997. Nevada Potential Repository Preliminary Assessment of the Caliente-Chalk Mountain Rail Corridor, Working Draft. B00000000-01717-4600-00077 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19970507.0136.
102877	CRWMS M&O 1999	CRWMS M&O 1999. Environmental Baseline File for Meteorology and Air Quality. B00000000-01717-5705-00126 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990302.0186.
104508	CRWMS M&O 1999	CRWMS M&O 1999. Repository Surface Design Engineering Files Report. BCB000000-01717-5705-00009 REV 03. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990615.0238.
104593	CRWMS M&O 1999	CRWMS M&O 1999. Environmental Baseline File for Biological Resources. B00000000-01717-5700-00009 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990302.0181; MOL.19990330.0560.
104800	CRWMS M&O 1999	CRWMS M&O 1999. Environmental Baseline File for National Transportation. B00000000-01717-5705-00116 REV 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990608.0033.
175725	CVSA 2005	CVSA (Commercial Vehicle Safety Alliance) 2005. North American Standard Out-of-Service Criteria. Handbook and Out-of-Service Pictorial Edition. Washington, D.C.: Commercial Vehicle Safety Alliance. TIC: 257711.
178129	DataKustik [n.d.]	DataKustik [n.d.]. Cadna A, Software for Environmental Noise, Computer Aided Noise Abatement. Greifenberg, Germany: DataKustik. TIC: 258792.
180121	DC West [n.d.]	DC West (Design Concepts West) [n.d.]. City of Caliente, Nevada Zoning Map. Carson City, Nevada: Design Concepts West. ACC: MOL.20070703.0119.
176903	De Leuw, Cather & Company 1992	De Leuw, Cather & Company 1992. Final, Yucca Mountain Rail Access Study Caliente Route, Conceptual Design Report. San Francisco, California: De Leuw, Cather & Company. ACC: MOL.20010612.0435.
176730	DeLorme 1996	DeLorme 1996. Nevada Atlas & Gazetteer. 1st Edition. Freeport, Maine: DeLorme. TIC: 231818.

Reference	Author/Date	Document Title
176364	Department of Conservation & Natural Resources [n.d.]	Department of Conservation & Natural Resources. [n.d.]. "Wild Horses and Burros." Nevada Natural Resources Status Report. [Carson City], Nevada: State of Nevada, Department of Conservation & Natural Resources. Accessed February 7, 2006. ACC: MOL.20060306.0190. URL: http://dcnr.nv.gov/nrp01/bio10.htm
182891	Department of the Navy, BLM 2007	USN (U.S. Department of the Navy) and BLM (Bureau of Land Management) 2000. Final Environmental Impact Statement, Proposed Fallon Range Training Complex Requirements Naval Air Station Fallon, Nevada. BLM/CC/PL-00/005+1791. Carson City, Nevada: U.S. Bureau of Land Management. ACC: MOL.20070907.0045.
182290	Desert Research Institute 2007	Desert Research Institute 2007. Class I Archaeological Site Records Search of the Proposed Mina Rail Route, Yucca Mountain Project, Nevada. Las Vegas, Nevada: Nevada System of Higher Education, Desert Research Institute. ACC: MOL.20070815.0011.
182291	Desert Research Institute 2007	Desert Research Institute 2007. Class I Archaeological Site Records Search for the Proposed Caliente Rail Route, Yucca Mountain Project, Nevada. Las Vegas, Nevada: Nevada System of Higher Education, Desert Research Institute. ACC: MOL.20070815.0012.
181897	Desert View Regional Medical Center [n.d.]	Desert View Regional Medical Center [n.d.]. "Desert View Regional Medical Center." Pahrump, Nevada: Desert View Regional Medical Center. Accessed July 10, 2007. ACC: MOL.20070806.0002. URL: http://www.ruralhealthmgmt.com/desert%20View.htm
180740	DETR [n.d.]	DETR (Department of Employment, Training and Rehabilitation) [n.d.]. Nevada Empoyment and Payrolls 2003. Carson City, Nevada: State of Nevada, Department of Employment, Training and Rehabilitation. ACC: MOL.20070303.0008.
180742	DETR [n.d.]	DETR (Department of Employment, Training and Rehabilitation) [n.d.]. Nevada Employment and Payrolls 2005. Carson City, Nevada: State of Nevada Department of Employment, Training and Rehabilitation. ACC: MOL.20070303.0012.
181907	DETR [n.d.]	DETR (Nevada Department of Employment, Training and Rehabilitation) [n.d.]. "Nevada Employer Directory." Nevada Workforce Informer, Nevada's Largest Employers 4th Quarter 2006. [Carson City], Nevada: Nevada Department of Employment, Training and Rehabilitation. Accessed July 11, 2007. ACC: MOL.20070719.0382. URL: http://www.nevadaworkforce.com/cgi/dataAnalysis/stFirmsReport.asp
181908	DETR [n.d.]	DETR (Nevada Department of Employment, Training and Rehabilitation [n.d.]. "Nevada Employer Directory." Nevada Workforce Informer, Nevada's Largest Employers 4th Quarter 2006. [Carson City], Nevada: Nevada Department of Employment, Training and Rehabilitation. Accessed July 11, 2007. ACC: MOL.20070719.0383. URL: http://www.nevadaworkforce.com/cgi/dataAnalysis/stFirmsReport.asp
180741	DETR 2005	DETR (Department of Employment,Training and Rehabilitation) 2005. Nevada Employment and Payrolls 2004. Carson City, Nevada: State of Nevada, Department of Employment,Training and Rehabilitation. ACC: MOL.20070303.0010.

Reference	Author/Date	Document Title
182271	DHS 2003	DHS (U.S. Department of Homeland Security) 2003. “Management of Domestic Incidents.” Homeland Security Presidential Directive/HSPD-5. [Washington, D.C.]: U.S. Department of Homeland Security. Accessed August 2, 2007. ACC: MOL.20070809.0003. URL: http://www.dhs.gov/xnews/releases/press_release_0105.shtm
176455	Dickinson, ed. 1999	Dickinson, M.B., ed. 1999. Field Guide to the Birds of North America. 3rd Edition. Washington, D.C.: National Geographic Society. TIC: 258124.
181032	Dillingham 2007	Dillingham, D. 2007. “FW: HA/RA of Rail Operations through Schurz (UNCLASSIED).” E-mail from D. Dillingham to R. Lanza, April 4, 2007. ACC: MOL.20070529.0119.
172280	DLA 2003	DLA (Defense Logistics Agency) 2003. Environmental Assessment, Disposition of Thorium Nitrate. Fort Belvoir, Virginia: Defense Logistic Agency, Defense National Stockpile Center. ACC: MOL.20041122.0200.
172281	DOD 2003	DOD (U.S. Department of Defense) 2003. Finding of No Significant Impact, Defense National Stockpile Center, Disposition of Thorium Nitrate, Enivronmental Assessment. Fort Belvoir, Virginia: U.S. Department of Defense, Defense Logistics Agency. ACC: MOL.20041122.0201.
104558	DOE 1988	DOE (U.S. Department of Energy) 1988. Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation for the Nuclear Waste Deep Geologic Repository Program Yucca Mountain, Nevada. Washington, D.C.: U.S. Department of Energy. ACC: HQX.19890426.0057.
104837	DOE 1989	DOE (U.S. Department of Energy) 1989. Draft Reclamation Program Plan For Site Characterization. DOE/RW-0244. Washington, D.C.: U.S. Department of Energy. ACC: HQO.19890803.0001.
104958	DOE 1989	DOE (U.S. Department of Energy) 1989. Native American Interpretation of Cultural Resources in the Area of Yucca Mountain, Nevada. DOE/NV-10576-17. [Las Vegas], Nevada: U.S. Department of Energy, Nevada Operations Office. ACC: NNA.19890406.0052.
104959	DOE 1990	DOE (U.S. Department of Energy) 1990. Literature Review and Ethnohistory of Native American Occupancy and Use of the Yucca Mountain Area. DOE/NV-10576-21. [Las Vegas], Nevada: U.S. Department of Energy, Nevada Operations Office. ACC: NNA.19900516.0216.
101811	DOE 1996	DOE (U.S. Department of Energy) 1996. Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada. DOE/EIS-0243. Las Vegas, Nevada: U.S. Department of Energy, Nevada Operations Office. ACC: MOL.20010727.0190; MOL.20010727.0191.
101816	DOE 1997	DOE (U.S. Department of Energy) 1997. Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste. DOE/EIS-0200-F. Summary and five volumes. Washington, D.C.: U.S. Department of Energy, Office of Environmental Management. ACC: MOL.20010727.0150; MOL.20010727.0151; MOL.20010727.0152.

Reference	Author/Date	Document Title
155789	DOE 1999	DOE (U.S. Department of Energy) 1999. Report to Congress on the Price-Anderson Act. Washington, D.C.: U.S. Department of Energy. ACC: MOL.20011009.0012.
155970	DOE 2002	DOE (U.S. Department of Energy) 2002. Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. DOE/EIS-0250. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314; MOL.20020524.0315; MOL.20020524.0316; MOL.20020524.0317; MOL.20020524.0318; MOL.20020524.0319; MOL.20020524.0320.
162638	DOE 2002	DOE (U.S. Department of Energy) 2002. Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada. DOE/EIS-0243-SA-01. Las Vegas, Nevada: U.S. Department of Energy, National Nuclear Security Administration, Nevada Operations Office. ACC: MOL.20030409.0001.
162639	DOE 2002	DOE (U.S. Department of Energy) 2002. Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory. DOE/EIS-0319. Volume 1. Washington, D.C.: U.S. Department of Energy, National Nuclear Security Administration. ACC: MOL.20030409.0002.
171934	DOE 2002	DOE M 460.2-1. 2002. Radioactive Material Transportation Practices. Washington, D.C.: U.S. Department of Energy. ACC: MOL.20050517.0204.
173738	DOE 2002	DOE (U.S. Department of Energy) 2002. Site Environmental Report for Calendar Year 2001, Yucca Mountain Site, Nye County, Nevada. PGM-MGR-EC-000002 REV 00. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20040223.0077.
168842	DOE 2003	DOE (U.S. Department of Energy) 2003. Site Environmental Report for the Yucca Mountain Project Calendar Year 2002. PGM-MGR-EC-000004 REV 00. Las Vegas, Nevada: U.S. Department of Energy, Office of Repository Development. ACC: MOL.20040413.0145.
172433	DOE 2003	DOE (U.S. Department of Energy) 2003. Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions. [Las Vegas, Nevada]: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20041206.0113.
182923	DOE 2003	Miller, W.B. 2003. "Proposed New Cooperative Agreement Number DE-FC28-03RW12223 for Yucca Mountain Transportation Issues and Concerns Unique to the Destination County." Letter from W.B. Miller (DOE/ORD) to L.W. Bradshaw (Nye County), OPS:SRP-1588, July 25, 2003, with enclosures. ACC: MOL.20030922.0177.
169354	DOE 2004	DOE (U.S. Department of Energy) 2004. Source Term Estimates for DOE Spent Nuclear Fuels. DOE/SNF/REP-078, Rev. 1. Three volumes. Idaho Falls, Idaho: U.S. Department of Energy, Idaho Operations Office. ACC: MOL.20040524.0451.

Reference	Author/Date	Document Title
171271	DOE 2004	DOE (U.S. Department of Energy) 2004. General Description of Database Information Version 5.0.1. DOE/SNF/REP-094, Rev. 0. Idaho Falls, Idaho: U.S. Department of Energy, Idaho Operations Office. ACC: MOL.20040812.0117.
173740	DOE 2004	DOE (U.S. Department of Energy) 2004. Site Environmental Report for the Yucca Mountain Project Calendar Year 2003. PGM-MGR-EC-000005 REV 00. Las Vegas, Nevada: U.S. Department of Energy, Office of Repository Development. ACC: MOL.20050226.0059.
178579	DOE 2004	DOE (U.S. Department of Energy) 2004. Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements. Second Edition. Washington, D.C.: U.S. Department of Energy, Office of NEPA Policy and Compliance. ACC: MOL.20070111.0019.
176452	DOE 2005	DOE (Department of Energy) 2005. Environmental Assessment for the Proposed Withdrawal of Public Lands Within and Surrounding the Caliente Rail Corridor, Nevada. DOE/EA 1545, Rev. 0. Las Vegas, Nevada: Department of Energy, Office of Civilian Radioactive Waste Management. ACC: HQO.20060227.0001.
176996	DOE 2005	DOE (U.S. Department of Energy) 2005. Site Environmental Report for the Yucca Mountain Project Calendar Year 2004. PGM-MGR-EC-000006, Rev. 00. Las Vegas, Nevada: U.S. Department of Energy, Office of Repository Development. ACC: MOL.20051206.0012.
182346	DOE 2005	DOE (U.S. Department of Energy) 2005. Annual Report - FY 2004, Radioactive Waste Shipments to and from the Nevada Test Site (NTS). DOE/NV--1032. Las Vegas, Nevada: U.S. Department of Energy, National Nuclear Security Administration. ACC: MOL.20070810.0043.
179948	DOE 2006	DOE (U.S. Department of Energy) 2006. Site Environmental Report for the Yucca Mountain Project Calendar Year 2005. PGM-MGR-EC-000007, Rev. 00. Las Vegas, Nevada: U.S. Department of Energy, Office of Repository Development. ACC: MOL.20070330.0050.
181379	DOE 2007	DOE (U.S. Department of Energy) 2007. Summary of Public Scoping Comments, Expanded Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, Nevada, The Mina Corridor and Alternative Rail Alignments Within this Corridor. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20070524.0073.
156703	DOT 1998	DOT (U.S. Department of Transportation) 1998. Safety Compliance Oversight Plan for Rail Transportation of High-Level Radioactive Waste and Spent Nuclear Fuel, Ensuring the Safe, Routine Rail Transportation of Foreign Research Reactor Spent Nuclear Fuel. [Washington, D.C.]: U.S. Department of Transportation, Federal Railroad Administration. ACC: MOL.20011212.0115.
174551	DOT 1999	DOT (U.S. Department of Transportation) 1999. Proposed Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings. Washington, D.C.: U.S. Department of Transportation, Office of Railroad Development. ACC: MOL.20050824.0327.
180695	DOT 2002	DOT (U.S. Department of Transportation) 2002. Guidance on Traffic Control Devices at Highway-Rail Grade Crossings. [Washington, D.C.]: U.S. Department of Transportation, Federal Highway Administration. ACC: MOL.20070511.0007.

Reference	Author/Date	Document Title
175728	DOT 2004	DOT (U.S. Department of Transportation) 2004. 2004 Emergency Response Guidebook. [Washington, D.C.]: U.S. Department of Transportation. ACC: MOL.20051020.0131.
178016	DOT 2005	DOT (U.S. Department of Transportation) 2005. Railroad Safety Statistics 2004 Annual Report. Washington, D.C.: U.S. Department of Transportation, Federal Railroad Administration. ACC: MOL.20061031.0151.
176852	Drici, Garey, and Buqo 1993	Drici, O.; Garey, C.; and Buqo, T.S. 1993. Hydrology and Steady State Ground-Water Model of Pahroc Valley, Lincoln and Nye Counties, Nevada. Water for Nevada's Future Report No. 10. Hydrographic Basin 208. Las Vegas, Nevada: Las Vegas Valley Water District, Cooperative Water Project. TIC: 255004.
169127	Driesner and Coyner 2003	Driesner, D. and Coyner, A. 2003. Major Mines of Nevada 2002, Mineral Industries in Nevada's Economy. Nevada Bureau of Mines and Geology Special Publication P-14. Reno, Nevada: University of Nevada, Reno, Mackay School of Mines. ACC: MOL.20040429.0081.
116801	Driscoll 1986	Driscoll, F.G. 1986. Groundwater and Wells. 2nd Edition. St. Paul, Minnesota: Johnson Filtration Systems. TIC: 217555.
176770	Duval et al. 1976	Duval, R.; Bruinsma, P.; Davis, R.; Gemmell, J.; Howison, H.; Humphrey, H.; and Shrider, D. 1976. Master Plan Esmeralda County, Nevada. Goldfield, Nevada: Esmeralda County Commissionsers. ACC: MOL.20070111.0022.
182310	Dwyer 2007	Dwyer, M. 2007. "Couple BLM Comments." E-mail from M. Dwyer to raeiscomments, July 2, 2007, with attachments. ACC: MOL.20070815.0065.
176818	Eakin 1962	Eakin, T.E. 1962. Ground-Water Appraisal of Ralston and Stonecabin Valleys, Nye County, Nevada. Ground-Water Resources - Reconnaissance Series Report 12. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. ACC: MOL.20060417.0024.
178588	EIA 1999	EIA (Energy Information Administration) 1999. Fuel Oil and Kerosene Sales 1998. DOE/EIA-0535(98). Washington, D.C.: U.S. Department of Energy, Energy Information Administration. ACC: MOL.20070111.0020.
178609	EIA 2001	EIA (Energy Information Administration) 2001. Fuel Oil and Kerosene Sales 2000. DOE/EIA-0535(00). Washington, D.C.: U.S. Department of Energy, Energy Information Administration. ACC: MOL.20070119.0083.
173384	EIA 2003	EIA (Energy Information Administration) 2003. Fuel Oil and Kerosene Sales 2002. DOE/EIA-0535(02). Washington, D.C.: U.S. Department of Energy, Energy Information Administration. ACC: MOL.20050420.0228.
176397	EIA 2005	EIA (Energy Information Administration) 2005. Fuel Oil and Kerosene Sales 2004. DOE/EIA-0535(04). Washington, D.C.: U.S. Department of Energy, Energy Information Administration. ACC: MOL.20060216.0167.
180447	Emm, Lewis, and Breazeale [n.d.]	Emm, S.; Lewis, S.; and Breazeale, D. [n.d.]. Walker River Paiute Indian Reservation Agriculture and Natural Resource Focus Group Session Results. Fact Sheet: 02-46. Reno, Nevada: University of Nevada, Reno. TIC: 259582.

Reference	Author/Date	Document Title
101821	EPA 1974	EPA (U.S. Environmental Protection Agency) 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. 550/9-74-004. Arlington, Virginia: U.S. Environmental Protection Agency. ACC: MOL.20010724.0296.
101822	EPA 1987	EPA (U.S. Environmental Protection Agency) 1987. On-Site Meteorological Program Guidance for Regulatory Modeling Applications. EPA-450/4-87-013. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency. ACC: MOL.20010727.0160.
108989	EPA 1987	EPA (U.S. Environmental Protection Agency) 1987. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/4-87-007. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency. TIC: 228381.
103679	EPA 1991	EPA (U.S. Environmental Protection Agency) 1991. Mobile Sources. Volume II of Supplement A to Compilation of Air Pollutant Emission Factors. AP-42. [Washington, D.C.]: U.S. Environmental Protection Agency. ACC: MOL.20010724.0298.
103245	EPA 1996	EPA (U.S. Environmental Protection Agency) 1996. National Capacity Assessment Report: Capacity Planning Pursuant to CERCLA Section 104(c)(9). EPA530-R-95-016. Washington, D.C.: U.S. Environmental Protection Agency. ACC: MOL.20010727.0171.
178590	EPA 1999	EPA (U.S. Environmental Protection Agency) 1999. "Reports from CWNS 2000 Database, Facility Fact Sheet." Clean Watersheds Needs Survey (CWNS). [Washington, D.C.]: U.S. Environmental Protection Agency, Clean Watershed Needs Survey. Accessed January 18, 2007. ACC: MOL.20070119.0085. URL: http://www.epa.gov/owm/mtb/cwns/index.htm
179932	EPA 1999	EPA (U.S. Environmental Protection Agency) 1999. Guideline on Data Handling Conventions for the PM NAAQS. EPA-454/R-99-008. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. ACC: MOL.20070405.0030.
153733	EPA 2000	EPA (U.S. Environmental Protection Agency) 2000. Cancer Risk Coefficients for Environmental Exposure to Radionuclides. EPA 402-C-99-001. Federal Guidance Report No. 13. CD Supplement. [Washington, D.C.]: U.S. Environmental Protection Agency. TIC: 249372.
176797	EPA 2001	EPA (U.S. Environmental Protection Agency) 2001. Functions and Values of Wetlands. EPA 843-F-01-002c. [Washington, D.C.]: U.S. Environmental Protection Agency, Office of Water, Office of Wetlands, Oceans and Watersheds. ACC: MOL.20060417.0023.
174202	EPA 2002	EPA (U.S. Environmental Protection Agency) 2002. Revised Draft, User's Guide for the AMS/EPA Regulatory Model - Aermod. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency. ACC: MOL.20050714.0435.
175544	EPA 2002	EPA (U.S. Environmental Protection Agency) 2002. Federal Guidance Report 13, CD Supplement, Cancer Risk Coefficients for Environmental Exposure to Radionuclides, EPA. EPA-402-C-99-001, Rev. 1. [Washington, D.C.]: U.S. Environmental Protection Agency. ACC: MOL.20051013.0016.

Reference	Author/Date	Document Title
174201	EPA 2003	EPA (U.S. Environmental Protection Agency) 2003. User's Guide to Mobile6.1 and Mobile6.2, Mobile Source Emission Factor Model. EPA420-R-03-010. Ann Arbor, Michigan: U.S. Environmental Protection Agency, National Vehicle and Fuel Emissions Laboratory. ACC: MOL.20050714.0436.
174089	EPA 2004	EPA (U.S. Environmental Protection Agency) 2004. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling--Compression-Ignition. EPA420-P-04-009. [Washington, D.C.]: U.S. Environmental Protection Agency. ACC: MOL.20050615.0515.
181091	EPA 2004	EPA (U.S. Environmental Protection Agency) 2004. "User's Guide for the AMS/EPA Regulatory Model - AERMOD." Technology Transfer Network Support Center for Regulatory Atmospheric Modeling, AERMOD Modeling. EPA-454/B-03-001. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Accessed May 24, 2007. ACC: MOL.20070529.0122. URL: ://www.epa.gov/scram001/dispersion_prefrec.htm
181955	EPA 2004	EPA (U.S. Environmental Protection Agency) 2004. "Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation." Modeling and Inventories, MOBILE6 Vehicle Emission Modeling Software. EPA420-R-04-013. [Washington, D.C.]: U.S. Environmental Protection Agency, Office of Transportation and and Air Quality. Accessed July 16, 2007. ACC: MOL.20070731.0065. URL: http://www.epa.gove/otaq/m6.htm
176115	EPA 2005	EPA (U.S. Environmental Protection Agency) 2005. "Monitor Values Report - Criteria Air Pollutants." AirData. [Washington, D.C.]: U.S. Environmental Protection Agency. Accessed January 9, 2006. ACC: MOL.20060301.0384. URL: http://www.epa.gov/air/data/monvals.html
178594	EPA 2006	EPA (U.S. Environmental Protection Agency) 2006. Economic Benefits of Wetlands. EPA843-F-06-004. [Washington, D.C.]: U.S. Environmental Protection Agency, Office of Water. ACC: MOL.20070119.0082.
181090	EPA 2007	EPA (Environmental Protection Agency) 2007. "AERMOD (dated 07026)." Model Change Bulletin MCB #2. [Washington, D.C.]: Environmental Protection Agency. Accessed May 29, 2007. ACC: MOL.20070622.0002. URL: http://www.epa.gov/scram001/7thconf/aermod/aermod_mcb2.txt
182951	EPA 2007	EPA 2007. "Landscape Ecology: Nevada Geospatial" GIS Data. x, x: EPA. Accessed 09/12/07. URL: http://www.epa.gov/esd/land-sci/nv_geospatial/pages/nvgeo_gisdata.htm
177760	Esmeralda County School District [n.d.]	Esmeralda County School District [n.d.]. 2005-2006 District Accountability Summary Report. Goldfield, Nevada: Esmeralda County School District. ACC: MOL.20061026.0280.
181394	Everett and Rush 1967	Everett, D.E. and Rush, F.E. 1967. A Brief Appraisal of the Water Resources of the Walker Lake Area, Mineral, Lyon, and Churchill Counties, Nevada. Water Resources-Reconnaissance Series Report 40. [Carson City, Nevada: Nevada Department of Conservation and Natural Resources]. ACC: HQS.19880517.2129.

Reference	Author/Date	Document Title
176453	FCC 2005	FCC (Federal Communications Commission) [2005]. [Local Telephone Competition and Broadband Deployment Data Compiled from FCC Form 477]. [RAIL-ARREF 75333]. [Washington, D.C.]: Federal Communications Commission. ACC: MOL.20060222.0130.
174552	Federal Interagency Committee 1992	Federal Interagency Committee 1992. Federal Agency Review of Selected Airport Noise Analysis Issues. [Washington, D.C.]: Federal Interagency Committee on Noise. ACC: MOL.20050824.0329.
176806	FEMA 1985	FEMA (Federal Emergency Management Agency) 1985. Flood Insurance Study, City of Caliente, Nevada, Lincoln County. Community Number - 320015. San Francisco, California: Federal Emergency Management Agency. ACC: MOL.20060419.0203.
156110	FEMA 2000	FEMA (Federal Emergency Management Agency) 2000. Guidance for Developing State, Tribal, and Local Radiological Emergency Response Planning and Preparedness for Transportation Accidents. FEMA REP-5, Rev. 02. [Washington, D.C.]: Federal Emergency Management Agency. ACC: MOL.20020204.0280.
173387	Fenton 2003	Fenton, M.D. 2003. “Iron and Steel.” Volume I of Minerals Yearbook: Metals and Minerals. Reston, Virginia: U.S. Geological Survey. ACC: MOL.20050420.0230.
176365	Fertig, Black, and Wolken 2005	Fertig, W.; Black, R.; and Wolken, P. 2005. Rangewide Status Review of Ute Ladies’-Tresses (Spiranthes Diluvialis). [Washington, D.C.]: U.S. Fish and Wildlife Service. ACC: MOL.20060216.0165.
180484	FHWA 2006	FHWA (Federal Highway Administration) 2006. Highway Statistics 2005. PB2007-105397. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration. ACC: MOL.20070713.0082.
155054	Finley et al. 1980	Finley, N.C.; Aldrich, D.C.; Daniel, S.L.; Ericson, D.M.; Henning-Sachs, C.; Kaestner, P.C.; Ortiz, N.R.; Sheldon, D.D.; Taylor, J.M.; and Herreid, S.F. 1980. Transportation of Radionuclides in Urban Environs: Draft Environmental Assessment. NUREG/CR-0743. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: NN1.19881102.0029.
157276	Firth 1999	Firth, J.R. 1999. “Update to Office of Nuclear Material Safety and Safeguards Guidance on Environmental Justice in NEPA Documents.” Letter from J.R. Firth (NRC) to W.R. Dixon (DOE/YMSCO), October 13, 1999, with enclosure. ACC: MOL.20000601.0212.
104774	Fischer et al. 1987	Fischer, L.E.; Chou, C.K.; Gerhard, M.A.; Kimura, C.Y.; Martin, R.W.; Mensing, R.W.; Mount, M.E.; and Witte, M.C. 1987. Shipping Container Response to Severe Highway and Railway Accident Conditions. NUREG/CR-4829. Volume 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: NNA.19900827.0230.
174499	Frampton, Lucas, and Plotkin 1993	Frampton, K.D.; Lucas, M.J.; and Plotkin, K.J. 1993. Assessment of the Subsonic Noise Environment in the Nellis Range Complex. Wright-Patterson, Ohio: U.S. Air Force Research Laboratory, Human Effectivenees Directorate. ACC: MOL.20050810.0044.
181909	Fridrich et al. 2007	Fridrich, C.J.; Minor, S.A.; Slate, J.L.; and Ryder, P.L. 2007. “Geologic Map of Oasis Valley Spring-Discharge Area and Vicinity, Nye County, Nevada.” USGS Scientific Investigations Map 2957. Scientific Investigations Map 2957. [Denver, Colorado]: U.S. Geological Survey. Accessed July 13, 2007. ACC: MOL.20070719.0384; MOL.20070719.0385. URL: http://pubs.usgs.gov/sim/2007/2957

Reference	Author/Date	Document Title
173231	Furtek and Tomlinson 2003	Furtek, B. and Tomlinson, C.R. 2003. Breeding Status and Surveys for the Southwestern Willow Flycatcher and Yellow-Billed Cuckoo at Various Sites in Southern Nevada. Canning, S. and Neel, L.A.; eds. [Carson City], Nevada: State of Nevada, Nevada Division of Wildlife. TIC: 256933.
173229	Furtek, Tomlinson, and Griego 2002	Furtek, B.; Tomlinson, C.R.; and Griego, F.R. 2002. Breeding Status and Surveys for the Southwestern Willow Flycatcher and Yellow-Billed Cuckoo at Various Sites in Southern Nevada. Beckstrand, K.M. and Neel, L.A.; eds. [Carson City], Nevada: State of Nevada, Nevada Division of Wildlife. TIC: 256931.
173230	Furtek, Tomlinson, and Williams 2003	Furtek, B.; Tomlinson, C.R.; and Williams, J.A. 2003. Breeding Status and Surveys for the Southwestern Willow Flycatcher and Yellow-Billed Cuckoo at Various Sites in Southern Nevada. Canning, S. and Neel, L.A.; eds. [Carson City], Nevada: State of Nevada, Nevada Division of Wildlife. TIC: 256932.
173228	Gallagher, Tomlinson, and Furtek 2001	Gallagher, T.; Tomlinson, C.R.; and Furtek, B. 2001. Breeding Status of the Southwestern Willow Flycatcher and Initial Surveys for the Yuma Clapper Rail and Yellow-Billed Cuckoo at Various Sites in Southern Nevada. Beckstrand, K.M. and Neel, L.A.; eds. [Carson City], Nevada: State of Nevada, Nevada Division of Wildlife. TIC: 256930.
173573	Gauntt 2004	Gauntt, J. 2004. “Steady as She Grows... Railroads Buy More Wood as Traffic Increases.” Crossties, Pages 14-18. Fayetteville, Georgia: Railway Tie Association. TIC: 257532.
129721	Geldon et al. 1998	Geldon, A.L.; Umari, A.M.A.; Earle, J.D.; Fahy, M.F.; Gemmell, J.M.; and Darnell, J. 1998. Analysis of a Multiple-Well Interference Test in Miocene Tuffaceous Rocks at the C-Hole Complex, May-June 1995, Yucca Mountain, Nye County, Nevada. Water-Resources Investigations Report 97-4166. Denver, Colorado: U.S. Geological Survey. TIC: 236724.
182345	Giampaoli 2007	Giampaoli, M.C. 2007. Yucca Mountain Project Gateway Area Concept Plan. [Pahrump], Nevada: Nuclear Waste Repository Project Office, Nye County, Nevada. ACC: MOL.20070712.0048.
182833	Golan 2005	Golan, P. 2005. Letter Informing Stakeholders of Policy Adopted by the Department to Use Dedicated Trains for its Shipment of Spent Nuclear Fuel and High-Level Radioactive Waste to the Yucca Mountain Repository. Letter from P. Golan (DOE) to Stakeholder, July 18, 2005, with enclosure. ACC: HQO.20051003.0001.
177756	Gormsen 2006	Gormsen, L. 2006. “State or Federal Assistance with Law Enforcement.” Record of conversation from L. Gormsen to R. Marshall (Nye County Sheriff’s Office), October 5, 2006. ACC: MOL.20061026.0275.
177762	Gormsen 2006	Gormsen, L. 2006. “Yucca Mountain Repository Fire Response Resources.” Record of conversation from L. Gormsen to K. McGlothlin (BSC), October 5, 2006. ACC: MOL.20061026.0281.
177867	Gormsen 2006	Gormsen, L. 2006. “BLM Fire Response Resources in Nye County.” Record of conversation from L. Gormsen to K. Oliver (BLM), October 6, 2006. ACC: MOL.20061031.0149.
177925	Gormsen 2006	Gormsen, L. 2006. “BLM Fire Response Resources in Nye County.” Record of conversation from L. Gromsen to D. Ullrich (BLM), October 10, 2006. ACC: MOL.20061031.0150.

Reference	Author/Date	Document Title
180153	Gormsen 2007	Gormsen, L. 2007. "Obtain Information on Baseline Public Health Resources for Lyon County." Record of conversation from L. Gormsen (ICF International) to J.L. Hakin (Lyon County, Coummunity Health Office), April 4, 2007. ACC: MOL.20070412.0015.
180693	Gormsen 2007	Gormsen, L. 2007. "Obtain Information on Baseline Law Enforcement and Fire Protection Resources for Lyon County." Record of conversation from L. Gormsen (ICF Insternational) to J. Page (Lyon County Office of Emergency Management), April 4, 2007. ACC: MOL.20070511.0005.
180977	Gormsen 2007	Gormsen, L. 2007. "Fire Protection Resources in Esmeralda County." Record of Conversation from L. Gormsen (ICF International) to E. Mueller (Esmeralda County Repository Oversight Program), May 17, 2007. ACC: MOL.20070524.0070.
180118	Gormsen and Merritt 2007	Gormsen, L. and Merritt, D. 2007. "Obtain Information on Baseline Public Health Resources for Mineral County." Record of conversation from L. Gormsen (ICF International) and D. Merritt (BSC) to E. Holybee (Mineral County, Public Health Nurse), April 3, 2007. ACC: MOL.20070412.0020.
180221	Gormsen and Merritt 2007	Gormsen, L. and Merritt, D. 2007. "Resource Survey." Record of conversation from L. Gormsen (ICF International) and D. Merritt (BSC) to J. Cripps (Mineral County Sheriff's Department), April 3, 2007, with attachment. ACC: MOL.20070412.0013.
176728	Goudie et al., ed. 1981	Goudie, A.; Lewin, J.; Richards, K.; Anderson, M.; Burt, T.; Whalley, B.; and Worsley, P., eds. 1981. Geomorphological Techniques. Boston, Massachusetts: George Allen & Unwin. TIC: 208461.
174671	Graham and Johnson [n.d.]	Graham, J. and Johnson, W.S. [n.d.]. Managing Common St. Johnswort. Fact Sheet FS-03-14. Reno, Nevada: University of Nevada Reno, Cooperative Extension. TIC: 257805.
174672	Graham and Johnson [n.d.]	Graham, J. and Johnson, W.S. [n.d.]. Managing Spotted Knapweed. Fact Sheet 04-39. Reno, Nevada: University of Nevada Reno, Cooperative Extension. TIC: 257806.
175909	Hafen et al. 2003	Hafen, S.; Hogan, C.; Dunleavy, P.H.; Cyphers, A.; Mulroy, P.; Entsminger, J.J.; Williams, M.; and Hauser, C.K. 2003. Cooperative Agreement Among Lincoln County, the Southern Nevada Water Authority and the Las Vegas Valley Water District. Cooperative Agreement for the Allocation and Management of Water Rights Applications and Groundwater Basins by and Among Lincoln County, Nevada, a Political Subdivision of the State of Nevada Created pursuant to NRS §243.210; the Las Vegas Valley Water District, a Political Subdivision of the State of Nevada Created Pursuant to Chapter 167, Statutes of Nevada 1947; and the Southern Nevada Water Authority, a Joint Power Authority Established Pursuant to NRS Chapter 277. ACC: MOL.20060504.0262.
173838	Hagen 2001	Hagen, L. 2001. "Fine Particulates (Pm10 and PM2.5) Generated by Breakage of Mobile Aggregates During Simulated Wind Erosion" Wind Erosion Research. Manhattan, Kansas: U.S. Department of Agriculture, Agricultural Research Service. Accessed May 13, 2005. ACC: MOL.20050718.0143. URL: http://www.ars.usda.gov/research/publications/Publications.htm?seq_no_115=147995
103439	Hall 1995	Hall, E.R. 1995. Mammals of Nevada. Reno, Nevada: University of Nevada Press. TIC: 234246.

Reference	Author/Date	Document Title
181033	Hamilton-Ray 2007	Hamilton-Ray, B.V. 2007. "Contracting Officer Authorization to Bechtel SAIC Company, LLC (BSC), Directing BSC to Consider Interface Requirements and Include Utility Feed Connections from the Monitored Geological Repository to the Transportation Facilities, Contract No. DE-AC28-01RW12101, LTR. No. 07-020." Letter from B.V. Hamilton-Ray (DOE/OCRWM) to T.C. Feigenbaum (BSC), May 9, 2007, 0509070891, OCE:SB-0992. ACC: CCU.20070509.0005.
148155	Hanson, Saurenman, and Towers 1998	Hanson, C.E.; Saurenman, H.J.; and Towers, D.A. 1998. "Rail Transportation Noise and Vibration." Chapter 46 of Handbook of Acoustical Measurements and Noise Control. Harris, C.M., ed. 3rd Edition. New York, New York: McGraw-Hill. TIC: 250744.
177297	Hanson, Towers, and Meister 2006	Hanson, C.E.; Towers, D.A.; and Meister, L.D. 2006. Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. Washington, D.C.: U.S. Department of Transportation, Federal Transit Administration. ACC: MOL.20060814.0190.
178807	Hardcastle 2006	Hardcastle, J. 2006. Nevada County Population Projections, 2006 to 2026. Reno, Nevada: Nevada State Demographer's Office, Nevada Small Business Development Center. ACC: MOL.20070208.0133.
106094	Harrill, Gates, and Thomas 1988	Harrill, J.R.; Gates, J.S.; and Thomas, J.M. 1988. Major Ground-Water Flow Systems in the Great Basin Region of Nevada, Utah, and Adjacent States. ATLAS HA-694-C. Denver, Colorado: U.S. Geological Survey. ACC: NNA.19940412.0059.
182287	Helscher 2007	Hoelscher, S. 2007. "RE: Follow up on Data Availability." E-mail from S. Hoelscher (NDEP) to S. Hartley (ICF International), July 12, 2007, with attachment. ACC: MOL.20070815.0008.
130301	Hickman 1993	Hickman, J.C., ed. 1993. The Jepson Manual: Higher Plants of California. Berkeley, California: University of California Press. TIC: 241854.
152540	Hoganson 2000	Hoganson, M. 2000. "Waste Generated During the Construction and Maintenance of a Rail Line." Telephone conversation from M. Hoganson (Tetra Tech NUS) to L. Cerny (Association of American Railroads), September 7, 2000. ACC: MOL.20001019.0128.
155558	Hoganson 2001	Hoganson, M. 2001. "Waste Generated During Routine Maintenance of Rail Cars." Telephone log from M. Hoganson (Tetra Tech NUS) to B. Vliek (Thrall Car Manufacturing), March 22, 2001. ACC: MOL.20010802.0210.
155560	Hoganson 2001	Hoganson, M. 2001. "Waste Generated During the Maintenance of Rail Line Stationary Equipment and Rolling Stock (While in Operation)." Telephone log from M. Hoganson (Tetra Tech NUS) to L. Cerny, March 21, 2001. ACC: MOL.20010802.0208.
178017	Holder 2006	Holder, R. 2006. "Fw: Yucca Rail EIS - UP Rail Traffic." E-mail from R. Holder to C. Ong (PHE), September 22, 2006. ACC: MOL.20061031.0152.
181867	Holder 2007	Holder, R. 2007. "Fw: NRL Geotechnical Site Characterization." E-mail from R. Holder to M. West, J. McCann, E. Kavanagh, N. Sullivan, A. Teepe, N. Larson, G. Allen, L. Bishop, and K. Knapp, July 2, 2007. ACC: MOL.20070721.0018.
176007	Home Builders Research 2005	Home Builders Research 2005. "The Las Vegas Housing Market Letter." Home Builders Research, 218, 1-5. [Las Vegas, Nevada]: Home Builders Research. TIC: 258016.

Reference	Author/Date	Document Title
182061	Hopkins 2006	Hopkins, M. 2006. Nevada Transportation GIS Baseline Data, Quarterly Update, 09/29/2006. Las Vegas, NV: Bechtel SAIC Company, LLC. ACC: MOL.20070322.0001.
181617	Hopkins 2007	Hopkins, M. 2007. Nevada Transportation GIS Baseline Data, Quarterly Update, 06/25/2007. T07-00141. Las Vegas, Nevada: Bechtel SAIC Company, LLC. ACC: MOL.20070626.0138.
182063	Hopkins 2007	Hopkins, M. 2007. Nevada Transportation GIS Baseline Data, Quarterly Update, 01/12/2007. Las Vegas, NV: Bechtel SAIC Company, LLC. ACC: MOL.20070419.0100.
182064	Hopkins 2007	Hopkins, M. 2007. Nevada Transportation GIS Baseline Data, Quarterly Update, 04/18/2007. Las Vegas, NV: Bechtel SAIC Company, LLC. ACC: MOL.20070529.0014.
174689	HRA Conservation Archaeology 2005	HRA Convservation Archaeology 2005. Draft, An Archaeological Sample Survey for the Yucca Mountain Project Rail Alignment Environmental Impact Statement, Central Nevada. Archaeological Report No. 04-18. Las Vegas, Nevada: HRA Convservation Archaeology. ACC: MOL.20051013.0053.
180697	Huxel and Harris 1969	Huxel, C.J. and Harris, E.E. 1969. Water Resources and Development in Mason Valley, Lyon and Mineral Counties, Nevada, 1948-65. Water Resources Bulletin No. 38. [Carson City], Nevada: State of Nevada, Department of Conservation and Natural Resources. ACC: MOL.20070626.0098.
101074	ICRP 1975	ICRP (International Commission on Radiological Protection) 1975. Report of the Task Group on Reference Man: A Report Prepared by a Task Group of Committee 2 of the International Commission on Radiological Protection. ICRP Number 23. Tarrytown, New York: Elsevier. ACC: MOL.20000516.0124.
101836	ICRP 1991	ICRP (International Commission on Radiological Protection) 1991. “1990 Recommendations of the International Commission on Radiological Protection.” Volume 21, No. 1-3 of Annals of the ICRP. ICRP Publication 60. New York, New York: Pergamon Press. TIC: 235864.
152446	ICRP 1996	ICRP (International Commission on Radiological Protection) 1996. Age-Dependent Doses to Members of the Public from Intake of Radionuclides: Part 5 Compilation of Ingestion and Inhalation Dose Coefficients. Volume 26, No. 1 of Annals of the ICRP. Smith, H., ed. ICRP Publication 72. New York, New York: Pergamon Press. TIC: 235870.
172935	ICRP 2001	ICRP (International Commission on Radiological Protection) 2001. The ICRP Database of Dose Coefficients: Workers and Members of the Public. ICRP Publication 72. [New York, New York]: Elsevier. TIC: 255638.
176910	IDT 2006	IDT Services 2006. Land Ownership of the Abandoned Union Pacific Rail Line, Land Ownership Analysis, Pioche and Prince Branch Line, Rev. 02. Document No. V0-CL00-NHC4-03389-00001-001-004. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20060426.0003.
176684	ISO 1996	ISO 9613-2:1996(E). 1996. Acoustics — Attenuation of Sound During Propagation Outdoors — Part 2: General Method of Calculation. 1st Edition. Geneva, Switzerland: International Organization for Standardization. TIC: 258194.

Reference	Author/Date	Document Title
157144	Jason Technologies 2001	Jason Technologies 2001. Transportation Health and Safety Calculation/Analysis Documentation in Support of the Final EIS for Yucca Mountain Respository. CAL-HSS-ND-000003. Las Vegas, Nevada: Jason Technologies. ACC: MOL.20020209.0097.
181276	Johnson and Michelhaugh 2003	Johnson, P.E. and Michelhaugh, R.D. 2003. Transportation Routing Analysis Geographic Information System (TRAGIS) User's Manual. ORNL/NTRC-006, Rev. 0. Oak Ridge, Tennessee: Oak Ridge National Laboratory. ACC: MOL.20070712.0024.
174669	Johnson et al. [n.d.]	Johnson, W.S.; Zimmerman, J.R.; Post, E.; Rowley, P.; and Davis, B. [n.d.]. "Yellow Starthistle is Invading Nevada!" Fact Sheet FS-01-02. Reno, Nevada: University of Nevada Reno, Cooperative Extension. TIC: 257802.
174670	Kadrmas and Johnson [n.d.]	Kadrmas, T. and Johnson, W.S. [n.d.]. Managing Musk Thistle. Fact Sheet FS-02-55. Reno, Nevada: University of Nevada, Reno, Cooperative Extension. TIC: 257801.
175509	Kahn 2005	Kahn, S. 2005. "Conversation Regarding Lincoln County's Supplemental Agreement with Nevada Power." Record of conversation from S. Kahn to M. Lloyd (Lincoln County Power District), March 2, 2005. ACC: MOL.20051013.0012.
174623	Kaiser 1998	Kaiser, E.K. 1998. "Re: Railroad Control Application, Finance Docket No. 33556 — Canadian National — Control — Illinois Central: Release of Draft Environmental Assessment for Public Review and Comment." Letter from E.K. Kaiser (STB) to Interested Parties, November 9, 1998, with enclosure. ACC: MOL.20050824.0324.
181957	Kaltenecker and Wicklow-Howard 1994	Kaltenecker, J. and Wicklow-Howard, M. 1994. "Microbiotic Soil Crusts in Sagebrush Habitats of Sounthern Idaho" Interior Columbia Basin Ecosystem, Index of/Science. [Washington, D.C.]: USDA Forest Service, Interior Columbia Basin Ecosystem. Accessed July 13, 2007. ACC: MOL.20070731.0067. URL: http://www.icbemp.gov/science
178697	Kaminski 2003	Kaminski, M.A. 2003. Nevada Division of Environmental Fact Sheet, Town of Round Mountain Public Utilities. Permit Number: NEV87032. [Carson City], Nevada: State of Nevada, Nevada Division of Environmental Protection. ACC: MOL.20070201.0275.
174205	Kane et al. 2005	Kane, G.; Cornelius, B.; Charles, J.; Moose, G.; Frank-Churchill, M.; and Arnold, R. 2005. American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project. [Las Vegas, Nevada]: American Indian Writers Subgroup, Consolidated Group of Tribes and Organizations. ACC: ESU.20050707.0001.
103281	Karl 1981	Karl, A. 1981. "Distribution and Relative Densities of the Desert Tortoise, Gopherus Agassizii, in Lincoln and Nye Counties, Nevada." Proceedings of the Sixth Annual Symposium of the Desert Tortoise Council, 28-30 March 1981, Riverside, California. Pages 76-92. [Riverside, California]: Desert Tortoise Council. TIC: 243166.
174497	Keck Library 2004	[Keck Library] [2004]. [Special Instruction Sheet For Digital Ortho Quads]. [Reno, Nevada: University of Nevada, Reno, Keck Library]. ACC: MOL.20051029.0324.
182774	Kelly and Stegner 2007	Kelly, M.S. and Stegner, M.L. 2007. Cultural Resource Historic Context Summary Report for the U.S. Department of Energy Yucca Mountain Rail Environmetal Impact Statement. Las Vegas, Nevada: URS. ACC: MOL.20070831.0092.

Reference	Author/Date	Document Title
174214	Kleinhampl and Ziony 1985	Kleinhampl, F.J. and Ziony, J.I. 1985. Geology of Northern Nye County, Nevada. Bulletin 99A. Reno, Nevada: Nevada Bureau of Mines and Geology, University of Nevada Reno. ACC: MOL.20050725.0382.
176361	Klute et al. 2003	Klute, D.S.; Ayers, L.W.; Green, M.T.; Howe, W.H.; Jones, S.L.; Shaffer, J.A.; Sheffield, S.R.; and Zimmerman, T.S. 2003. Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States. Biological Technical Publiscation BTP-R6001-2003. Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service. ACC: MOL.20060216.0164.
179571	Knight 2007	Knight, T. 2007. "Communication from BLM Carson City Field Office Regarding VRM Classifications." Memorandum from T. Knight (BLM) to P. Quick, January 10, 2007. ACC: MOL.20070320.0416.
177449	Krebs et al. 2005	Krebs, J.W.; Mandel, E.J.; Swerdlow, D.L.; and Rupprecht, C.E. 2005. "Rabies Surveillance in the United States During 2004." Public Veterinary Medicine: Public Veterinary Medicine, 227, (12), 1912-1925. [Shaumburg, Illinois: American Veterinary Medical Association]. TIC: 258783.
181884	Lamb and Resnikoff 2000	Lamb, M. and Resnikoff, M. 2000. Review of NUREG/CR-6672, Reexamination of Spent Fuel Shipment Risk Estimates. [New York, New York]: Radioactive Waste Management Associates. TIC: 259659.
181892	Lamb, Hintermann, and Resnikoff 2002	Lamb, M.; Hintermann, B.; and Resnikoff, M. 2002. Potential Consequences of a Successful Sabotage Attack on a Spent Fuel Shipping Container: An Analysis of the Yucca Mountain EIS Treatment of Sabotage. New York, New York: Radioactive Waste Management Associates. TIC: 259556.
181756	Lamb, Resnikoff, and Moore 2001	Lamb, M.; Resnikoff, M.; and Moore, R. 2001. Worst Case Credible Nuclear Transportation Accidents: Analysis for Urban and Rural Nevada. New York, New York: Radioactive Waste Management Associates. TIC: 259574.
174559	Lawrence 2002	Lawrence, A. 2002. "Radiation Risk Estimation from Total Effective Dose Equivalents (TEDEs)." Memorandum from A. Lawrence (DOE) to distribution, August 9, 2002, with attachments. ACC: MOL.20050815.0190.
175505	Laymon and Halterman 1987	Laymon, S.A. and Halterman, M.D. 1987. "Can the Western Subspecies of the Yellow-Billed Cuckoo be Saved from Extinction?" Western Birds, 18, 19-25. [Yorba Linda, California: California Field Ornithologists]. TIC: 257840.
177758	Lincoln County School District [n.d.]	Lincoln County School District [n.d.]. 2005-2006 District Accountability Summary Report. Panaca, Nevada: Lincoln County School District. ACC: MOL.20061026.0278.
182067	ListServ 14.5 2007	Brune, R. 2007. "Birds at Ft. Churchil and Weber Reservoir." E-mail from R. Brune to NV Birders, April 21, 2006. ACC: MOL.20070815.0059.
175964	Lopes and Evetts 2004	Lopes, T.J. and Evetts, D.M. 2004. Ground-Water Pumpage and Artificial Recharge Estimates for Calendar Year 2000 and Average Annual Natural Recharge and Interbasin Flow by Hydrographic Area, Nevada. Scientific Investigations Report 2004-5239. Carson City, Nevada: U.S. Geological Service. ACC: MOL.20060116.0023.

Reference	Author/Date	Document Title
180775	Lopes et al. 2006	Lopes, T.J.; Buto, S.G.; Smith, J.L.; and Welborn, T.L. 2006. Map Showing Water-Table Contours in Nevada, 1947-2004. Plate 1 of Water Table Levels and Gradients, Nevada 1947-2004. Scientific Investigations Report 2006-5100. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20070517.0181.
176369	Lowry et al. 2005	Lowry, J.H., Jr.; Ramsey, R.D.; Boykin, K.; Bradford, D.; Comer, P.; Falzarano, S.; Kepner, W.; Kirby, J.; Langs, L.; Prior-Magee, J.; Manis, G.; O'Brien, L.; Pohs, L.; Rieth, W.; Sajwaj, T.; Schrader, S.; Thomas, K.A.; Schrupp, D.; Schulz, K.; Thompson, B.; Wallace, C; Velasquez, C.; Waller, E.; and Wolk, B. 2005. Southwest Regional Gap Analysis Project, Final Report on Land Cover Mapping Methods. Logan, Utah: Utah State University, Remote Sensing/GIS Laboratory. ACC: MOL.20060216.0166.
181279	Luna 2006	Luna, R.E. 2006. "Release Fractions from Multi-Element Spent Fuel Casks Resulting from HEDD Attack." WM'06 Conference, February 26-March 2, 2006, Tucson, AZ. [Tucson, Arizona: WM Symposia]. TIC: 259643.
104918	Luna, Neuhauser, and Vigil 1999	Luna, R.E.; Neuhauser, K.S.; and Vigil, M.G. 1999. Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments. SAND99-0963. Albuquerque, New Mexico: Sandia National Laboratories. ACC: MOL.19990609.0160.
180463	Lyon County School District [n.d.].	Lyon County School District [n.d.]. "Lyon County School District, 2005-2006 District Accountability Summary Report." Carson City, Nevada: Starte of Nevada, Nevada Department of Education. Accessed April 17, 2007. ACC: MOL.20070426.0077. URL: http://nevadareportcard.com/common/home.aspx
101845	Maheras and Pippen 1995	Maheras, S.J. and Pippen, H.K. 1995. Validation of the Transportation Computer Codes HIGHWAY, INTERLINE, RADTRAN 4, and RISKIND. DOE/ID-10511. [Idaho Falls], Idaho: U.S. Department of Energy, Idaho Operations Office. ACC: MOL.20010721.0039.
106695	Malmberg and Eakin 1962	Malmberg, G.T. and Eakin, T.E. 1962. Ground-Water Appraisal of Sarcobatus Flat and Oasis Valley, Nye and Esmeralda Counties, Nevada. Ground-Water Resources – Reconnaissance Series Report 10. [Carson City, Nevada]: State of Nevada, Department of Conservation and Natural Resources. TIC: 208666.
182757	Management and Technical Support Services 2007	MTS (Management and Technical Support Services) 2007. Updates to Methods and Data for Calculating Transportation Risk on Rail Corridors, Rev. 0. [Las Vegas, Nevada]: Management and Technical Support Services. ACC: MOL.20070831.0089.
182772	Management and Technical Support Services 2007	MTS (Management Technical Support Services) 2007. Technical Support Document - Corridor-Level Information for the Mina, Carlin, Jean, and Valley Modified Rail Implementing Alternatives, Rev.0. [Las Vegas, Nevada]: Management Technical Support Services. ACC: MOL.20070907.0046.
174215	Maricopa County 2004	Maricopa County 2004. Emissions Inventory Help Sheet for Vehicle Travel on Unpaved Roads. [Phoenix, Arizona: Maricopa County, Department of Air Quality Control]. TIC: 257528.
176857	Martin 1980	Martin, D.J. 1980. Ground Vibrations from Impact Pile Driving During Road Construction. TRRL Supplementary Report SR544. Crowthorne, Berkshire, [England]: Transport and Road Research Laboratory, Department of the Environment, Department of Transport. TIC: 258289.

Reference	Author/Date	Document Title
180777	Mauer et al. 2004	Mauer, D.K.; Lopes, T.J.; Medina, R.L.; and Smith, J.L. 2004. Hydrogeology and Hydrologic Landscape Regions of Nevada. Scientific Investigations Report 2004-5131. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20070517.0182.
155896	McClelland et al. 1990	McClelland, L.F.; Keller, J.T.; Keller, G.P.; and Melnick, R.Z. [1990]. Guidelines for Evaluating and Documenting Rural Historic Landscapes. National Register Bulletin 30. [Washington, D.C.]: U.S. Department of the Interior, National Park Service, Interagency Resources Division. TIC: 252222.
175507	McCorkel et al. 2005	McCorkel, G.; Anderson, M.; Cowart, B.; and Khan, S. 2005. “Land Use and Socioeconomics Baseline Information for Esmeralda County; Shared Use of Rail Alignment by Esmeralda.” Record of conversation from G. McCorkel, M. Anderson, B. Cowart, S. Khan to G. McCorkel (Esmeralda County), March 10, 2005. ACC: MOL.20051013.0010.
155857	McKenzie 2001	McKenzie, J.M. 2001. Response to Request for the NNPP (Naval Nuclear Propulsion Program) to Submit Information on a Variety of Topics, Including Overall Activity by Nuclide, a Technical Support Document for Transportation Analysis for a Naval Spent Nuclear Fuel and Special Case Waste, and an Update of Naval Spent Nuclear Fuel Shipments to the INEEL since 1998. Letter from J.M. McKenzie (Department of the Navy) to J.R. Dyer (DOE/YMSCO), August 20, 2001, with attachments. ACC: MOL.20011009.0042.
147994	McRae 1994	McRae, C. 1994. Adoption of the Nye County Comprehensive Plan. Resolution No. R94-14. Tonopah, Nevada: Nye County Board of Commissioners. TIC: 247260.
176920	Metscher 2005	Metscher, V. 2005. “Review of the ‘Proposed Caliente to Yucca Mountain Railroad Affected Grazing.’“ Memorandum from V. Metscher (BLM) to W.S. Fisher, April 25, 2005, NV-065.03. ACC: MOL.20060629.0152.
176942	Metscher 2006	Metscher, V. 2006. “Status of Grazing Allotments Along the Proposed Yucca Mountain Railroad.” Memorandum from V. Metscher (BLM) to Potomac-Hudson Engineering, May 11, 2006. ACC: MOL.20060524.0141.
182338	Metscher 2007	Metscher, V. 2007. “Status of Grazing Allotments Along the Proposed Yucca Mountain Railroad.” Memorandum from V. Metscher (BLM) to Potomac-Hudson Engineering, May 16, 2007. ACC: MOL.20070815.0066.
173227	Micone and Tomlinson 2000	Micone, K. and Tomlinson, C.R. 2000. Breeding Status of the Southwestern Willow Flycatcher and Initial Surveys for the Yuma Clapper Rail at Various Sites in Southern Nevada. Beckstrand, K.M. and Neel, L.A.; eds. [Carson City], Nevada: State of Nevada, Nevada Division of Wildlife. TIC: 256929.
181385	Millsap 2007	Millsap, H. 2007. “RE: Hawthorne Permits.” Email from H. Millsap (U.S. Army) to P. Gehner, May 22, 2007, with attachment. ACC: MOL.20070622.0004.
180692	Mineral County Nuclear Projects Office 2004	Mineral County Nuclear Projects Office 2004. “Mineral County Baseline Report - Update 2004.” Mineral County Yucca Mountain Oversight Program - Publications. [Hawthorne, Nevada]: Mineral County Nuclear Projects Office. Accessed April 27, 2007. ACC: MOL.20070523.0041. URL: http://mcnucprojects.com/publications.htm

Reference	Author/Date	Document Title
180702	Mineral County Nuclear Projects Office 2005	Mineral County Nuclear Projects Office 2005. "Mineral County Baseline Report - Update 2005." Mineral County Yucca Mountain Oversight Program - Publications. [Hawthorne, Nevada]: Mineral County Nuclear Projects Office. Accessed April 20, 2007. ACC: MOL.20070523.0040. URL: http://mcnucprojects.com/publications.htm
180465	Mineral County School District [n.d.]	Mineral County School District [n.d.]. "Mineral County School District, 2005-2006 District Accountability Summary Report." Carson City, Nevada: State of Nevada, Nevada Department of Education. Accessed April 17, 2007. ACC: MOL.20070426.0078. URL: www.nevadareportcard.com/common/home.aspx
178746	MSHA 2006	MSHA (Mine Safety and Health Administration) 2006. "Table 04. Number of Fatal Injuries and Fatal Incidence Rates (IR) at Stone Operations in the United States, by Primary Activity, 1978-2005." Mining Industry Accidents, Injuries, Employment, and Production Statistics. Arlington, Virginia: U.S. Department of Labor, Mine Safety and Health Administration. Accessed January 22, 2007. ACC: MOL.20070201.0269. URL: http://www.msha.gov/STATS/PART50/WQ/1978/wq78st04.asp
178747	MSHA 2006	MSHA (Mine Safety and Health Administration) 2006. "Table 05. Number of NonFatal Days Lost (NFDL) Injuries and NFDL Incidence Rates at Stone Operations in the United States, by Primary Activity, 1978-2005." Mining Industry Accidents, Injuries, Employment, and Production Statistics. Arlington, Virginia: U.S. Department of Labor, Mine Safety and Health Administration. Accessed January 22, 2007. ACC: MOL.20070201.0270. URL: http://www.msha.gov/STATS/PART50/WQ/1978/wq78st05.asp
178748	MSHA 2006	MSHA (Mine Safety and Health Administration) 2006. "Table 06. Number of No Days Lost (NDL) Injuries and NDL Incidence Rates (IR) at Stone Operations in the United States, by Primary Activity, 1978-2005" Mining Industry Accidents, Injuries, Employment, and Production Statistics.. Arlington, Virginia: U.S. Department of Labor, Mine Safety and Health Administration. Accessed January 22, 2007. ACC: MOL.20070201.0271. URL: http://www.msha.gov/STATS/PART50/WQ/1978/wq78st06.asp
181425	MTS 2007	MTS (Management and Technical Support Services) 2007. Description of the Cask Maintenance Facility for EIS Purposes. [Las Vegas, Nevada]: Management and Technical Support Services. ACC: MOL.20070628.0132.
155551	NASA 1995	NASA (National Aeronautics and Space Administration) 1995. Final Environmental Impact Statement for the Cassini Mission. Washington, D.C.: National Aeronautics and Space Administration, Solar System Exploration Division. ACC: MOL.20010802.0223.
155550	NASA 1997	NASA (National Aeronautics and Space Administration) 1997. Final Supplemental Environmental Impact Statement for the Cassini Mission. Washington, D.C.: National Aeronautics and Space Administration, Office of Space Science. ACC: MOL.20010802.0218.
180701	National American Indian Housing Counsel 2004	NAIHC (National American Indian Housing Council) 2004. Sustaining Indian Housing: An Evaluation of Tribal Economic Development and Its Impact on Housing in Four Case Studies. Washington, D.C.: National American Indian Housing Counsel. TIC: 259674.

Reference	Author/Date	Document Title
176854	National Register of Historic Places 1982	National Register of Historical Places. 1982. "Goldfield Historic District." National Register of Historical Places, Nevada (NV) - Esmeralda County. [Washington, D.C: National Park Service]. Accessed April 12, 2006. ACC: MOL.20070202.0143. URL: http://www.nationalregisterofhistoricalplaces.com/NV/Esmeralda/state.html
100473	National Research Council 1990	National Research Council. 1990. Health Effects of Exposure to Low Levels of Ionizing Radiation, BEIR V. Washington, D.C.: National Academy Press. TIC: 203650.
181250	National Research Council 2006	National Research Council. 2006. Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2. Washington, D.C.: National Academies Press. TIC: 257529.
182032	National Research Council 2006	National Research Council 2006. Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States. Washington, D.C.: National Academies Press. TIC: 259563.
174324	NatureServe 2004	NatureServe 2004. Landcover Descriptions for The Southwest Regional Gap Analysis Project. [Arlington, Virginia]: NatureServe. TIC: 257833.
180967	NatureServe Explorer [n.d.]	NatureServe Explorer [n.d.]. "Haliaeetus Leucocephalus-(Linnaeus, 1766), Bald Eagle." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed April 13, 2007. TIC: 259441. URL: http://www.natureserve.org/explorer/
182068	NatureServe Explorer 2003	NatureServe Explorer 2003. "Arabis Bodiensis - Rollins, Bodie Hills Rockcress" Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed July 30, 2007. TIC: 259625. URL: http:/www.naturserve.org/explorer/servlet/NatureServe?sourceTemplate=tabular report. wmt&loadTemplate=species
175029	NatureServe Explorer 2005	NatureServe Explorer 2005. "Pyrgulopsis Micrococcus - (Pilsbry, 1893), Oasis Valley Springsnail." Comprehensive Report. Arlington, Virginia: NatureServe. Accessed October 25, 2005. TIC: 257832. URL: http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Pyrgulopsis+micrococcus
175487	NatureServe Explorer 2005	NaturServe Explorer 2005. "Bufo Microscaphus - (Cope, 1867 '1866'), Arizona Toad." Comprehensive Report. Arlington, Virginia: NatureServe. Accessed September 22, 2005. TIC: 257809. URL: http://www.naturserve.org/explorer/servlet/NatureServe?searchName=Bufo+microscaphus
180959	NatureServe Explorer 2007	NatureServe Explorer 2007. "Spizella Breweri, Cassin, 1856, Brewer's Sparrow." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed April 11, 2007. TIC: 259432. URL: http://www.natureserve.org/explorer/
180960	NatureServe Explorer 2007	NatureServe Explorer 2007. "Penstemon Arenarius - Greene, Dune Beardtongue." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed April 11, 2007. TIC: 259433. URL: http://www.natureserve.org/explorer/
180962	NatureServe Explorer 2007	NatureServe Explorer 2007. "Ivesia Arizonica Var. Saxosa - (Brandeg.) Ertter, Rock Purpusia." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed April 11, 2007. TIC: 259435. URL: http://www.natureserve.org/explorer/

Reference	Author/Date	Document Title
180963	NatureServe Explorer 2007	NatureServe Explorer 2007. "Lanius Ludovicianus - Linnaeus, 1766, Loggerhead Shrike." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed April 11, 2007. TIC: 259436. URL: http://www.natureserve.org/explorer/
180964	NatureServe Explorer 2007	NatureServe Explorer 2007. "Catostomus Clarkii Ssp. 2, Meadow Valley Wash Desert Sucker." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed April 11, 2007. TIC: 259437. URL: http://www.natureserve.org/explorer/
180966	NatureServe Explorer 2007	NatureServe Explorer 2007. "Falco Peregrinus-Tunstall, 1771, Peregrine Falcon." Comprehensive Report Species. [Arlington, Virginia]: NatureServe Explorer. Accessed April 13, 2007. TIC: 259440. URL: http://www.natureserve.org/explorer/
181845	NatureServe Explorer 2007	NatureServe Explorer 2007. "Plebejus Icarioides Albihalos - Emmel, Emmel and Mattoon, 1998, White Mountains IcarioidesBlue" Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed June 25, 2007. TIC: 259590. URL: http://www.natureserve.org/explorer/servlet/NatureServe?sourceTemplate=tabular_report.wmt&loadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=107444&paging=home&save=true&startIndex=1&nextStartIndex=1&reset=false&offPageSelectedElKey=109187&offPageSelectedElType=species&offPageYesNo=true&post_processes=&radiobutton=radiobutton&selectedIndexes=109187&selectedIndexes=107444&selectedIndexes=118680&selectedIndexes=113631&selectedIndexes=110962&selectedIndexes=112882&selectedIndexes=119043&selectedIndexes=119857&selectedIndexes=116504&selectedIndexes=735440&selectedIndexes=113349&selectedIndexes=119415&selectedIndexes=111591&selectedIndexes=113379&selectedIndexes=735441&selectedIndexes=114911&selectedIndexes=110524
181846	NatureServe Explorer 2007	NatureServe Explorer 2007. "Mentzelia Agillicola - N.H. Holmgren & P.K. Holmgren, Pioche Blazingstar." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed July 19, 2007. TIC: 259591. URL: http://www.natureserve.org/explorer/servlet/NatureServe?sourceTemplate=tabular_report.wmt&loadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=638311&paging=home&save=true&startIndex=1&nextStartIndex=1&reset=false&offPageSelectedElKey=638311&offPageSelectedElType=species&offPageYesNo=true&post_processes=&radiobutton=radiobutton&selectedIndexes=638311
181847	NatureServe Explorer 2007	NatureServe Explorer 2007. "Rhinichthys Osculuc Ssp. 11, Meadow Valley Speckled Dace." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed June 27, 2007. TIC: 259592. URL: http://www.natureserve.org/explorer/servlet/NatureServe?sourceTemplate=tabular_report.wmt&loadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=102871&paging=home&save=true&startIndex=1&nextStartInd

Reference	Author/Date	Document Title
181883	NatureServe Explorer 2007	NatureServe Explorer 2007. "Orytes Nevadensis - S. Wats., Nevada Oryctes." Comprehensive Report Species. Arlington, Virginia: NatureServe Explorer. Accessed June 25, 2007. TIC: 259593. URL: http://www.natureserve.org/explorer/servlet/NatureServe?sourceTemplate=tabular_report.wmt&loadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=138654&paging=home&save=true&startIndex=1&nextStartIndex=1&reset=false&offPageSelectedElKey=138654&offPageSelectedElType=species&offPageYesNo=true&post_processes=&radiobutton=radiobutton&selectedIndexes=138654
100472	NCRP 1987	NCRP (National Council on Radiation Protection and Measurements) 1987. Exposure of the Population in the United States and Canada From Natural Background Radiation. NCRP Report No. 94. Bethesda, Maryland: National Council on Radiation Protection and Measurements. TIC: 101308.
101855	NCRP 1987	NCRP (National Council on Radiation Protection and Measurements) 1987. Ionizing Radiation Exposure of the Population of the United States. NCRP Report No. 93. Bethesda, Maryland: National Council on Radiation Protection and Measurements. TIC: 229033.
101857	NCRP 1993	NCRP (National Council on Radiation Protection and Measurements) 1993. Risk Estimates for Radiation Protection. NCRP Report No. 115. Bethesda, Maryland: National Council on Radiation Protection and Measurements. TIC: 232971.
176309	NDEP 1994	NDEP (Nevada Division of Environmental Protection) 1994. Best Management Practices Handbook. Carson City, Nevada: State of Nevada, Nevada Division of Environmental Protection. ACC: MOL.20060206.0352.
176306	NDEP 2005	NDEP (Nevada Division of Environmental Protection) [2005]. "Nevada Division of Environmental Protection Bureau of Water Quality Planning, Clean Water Act 305(b) Report." [Carson City], Nevada: Nevada Division of Environmental Protection, Bureau of Water Quality Planning. Accessed January 26, 2006. ACC: MOL.20060206.0350. URL: http://ndep.nv.gov/bwqp/305brpt.htm
180120	NDEP 2005	NDEP (Nevada Division of Environmental Protection) 2005. EPA Approved Final, Nevada's 2004 303(d) Impaired Waters List. Carson City, Nevada: Nevada Division of Environmental Protection, Bureau of Water Quality Planning. ACC: MOL.20070412.0019.
177662	NDEP 2006	NDEP (Nevada Division of Environmental Protection) 2006. "Hazardous Waste Permitted Facilities." Carson City, Nevada: State of Nevada, Nevada Division of Environmental Protection. Accessed September 11, 2006. ACC: MOL.20060925.0028. URL: http://ndep.nv.gov/bwm/hazard01.html
180712	NDETR 2006	NDETR (Nevada Department of Employment, Training & Rehabilitation) 2006. 2006 Nevada Covered Employment. [Carson City, Nevada: State of Nevada, Nevada Department of Employment, Training & Rehabilitation]. ACC: MOL.20070303.0014.
174543	NDOA 2005	NDOA (Nevada Department of Agriculture) 2005. "Noxious Weed List." Reno, Nevada: Nevada Department of Agriculture, Plant Industry Division. Accessed August 30, 2005. TIC: 257697. URL: http://agri.nv.gov/nwac/PLANT_NoxWeedList.htm

Reference	Author/Date	Document Title
178749	NDOT [n.d.]	NDOT (Nevada Department of Transportation) [n.d.]. "2005 Annual Traffic Report." [Carson City], Nevada: Nevada Department of Transportation, Traffic Information Division. Accessed January 24, 2007. ACC: MOL.20070201.0273. URL: http://www.nevadadot.com/reports_pubs/traffic_report/2005/images/TrafficCover.jpg
176307	NDOT 2004	NDOT (Nevada Department of Transportation) 2004. Storm Water Quality Handbooks, Construction Site, Best Management Practices (BMPs) Manual. [Carson City], Nevada: Nevada Department of Transportation. ACC: MOL.20060313.0203.
174474	NDOW 2002	NDOW (Nevada Division of Wildlife) 2002. Nevada Bat Conservation Plan. Elko, Nevada: Nevada Division of Wildlife, Nevada Bat Working Group. TIC: 257667.
180480	NDOW 2005	NDOW (Nevada Department of Wildlife) 2005. "Mason Valley Wildlife Management Area." About NDOW Publications. [Carson City], Nevada: Nevada Department of Wildlife. Accessed April 20, 2007. ACC: MOL.20070703.0121. URL: http://www.ndow.org/about/pubs/
174207	NDWR [n.d.]	NDWR (Nevada Division of Water Resources) [n.d.]. Nevada State Water Plan. Carson City, Nevada: Nevada Division of Water Planning, Department of Conservation and Natural Resources. ACC: MOL.20050714.0439.
182898	NDWR 2007	NDWR (Nevada Division of Water Resources) 2007. "NDWR-Water Rights Database Special Hydrographic Abstract (Caliente Wells)." [Carson City], Nevada: State of Nevada, Nevada Division of Water Resources. Accessed August 2, 2007. ACC: MOL.20070904.0012; MOL.20070910.0352. URL: http://water.nv.gov/water%20Rights/permitdb/hyd_abs1.cfm?CFID=30072&CFTOKEN=30077354
182899	NDWR 2007	NDWR (Nevada Division of Water Resources) 2007. "NDWR-Water Rights Database Special Hydrographic Abstract (Mina Wells)." [Carson City], Nevada: State of Nevada, Nevada Division of Water Resources. Accessed August 2, 2007. ACC: MOL.20070904.0013; MOL.20070910.0353. URL: http://water.nv.gov/water%20Rights/permitdb/hyd_abs1.cfm?CFID=30072&CFTOKEN=30077354
182900	NDWR 2007	NDWR (Nevada Division of Water Resources) 2007. "Nevada Division of Water Resources-Water Rights Database: Special Hydrographic Abstract Data: August 31, 2007" Hydrographic Basin Summary by Manner of Use. [Carson City], Nevada: State of Nevada, Nevada Division of Water Resources. Accessed January 17, 2007. ACC: MOL.20070907.0047. URL: http://water.nv.gov/water%20Rights/permitdb/UG-active2.cfm?CFID=8779&CFTOKEN=80016544
150898	Neuhauser and Kanipe 2000	Neuhauser, K.S. and Kanipe, F.L. 2000. RADTRAN 5, User Guide. SAND2000-1257. Albuquerque, New Mexico: Sandia National Laboratories. TIC: 249356.
155430	Neuhauser, Kanipe, and Weiner 2000	Neuhauser, K.S.; Kanipe, F.L.; and Weiner, R.F. 2000. RADTRAN 5, Technical Manual. SAND2000-1256. Albuquerque, New Mexico: Sandia National Laboratories. ACC: MOL.20010724.0159.

Reference	Author/Date	Document Title
182379	Nevada Commission on Tourism 2004	Nevada Commission on Tourism 2004. "RV Park Details, Goldfield RV Park." Nevada Wide Open. Carson City, Nevada: Nevada Commission on Tourism. Accessed March 30, 2007. TIC: 259648. URL: http://travelnevada.com/results_details.asp
182380	Nevada Commission on Tourism 2004	Nevada Commission on Tourism 2004. "RV Parks Details, Longstreet Inn, Casino & RV Park." Nevada Wide Open. Carson City, Nevada: Nevada Commission on Tourism. Accessed March 30, 2007. TIC: 259649. URL: http://travelnevada.com/results_details.asp
182383	Nevada Commission on Tourism 2004	Nevada Commission on Tourism 2004. "Hotel/Motel Details, Desert Village Motel." Nevada Wide Open. Carson City, Nevada: Nevada Commission on Tourism. Accessed March 30, 2007. TIC: 259652. URL: http://travelnevada.com/accomodations_hotel.asp
182384	Nevada Commission on Tourism 2004	Nevada Commission on Tourism 2004. "Hotel/Motel Details, Phoenix Inn." Nevada Wide Open. Carson City, Nevada: Nevada Commission on Tourism. Accessed March 30, 2007. TIC: 259653. URL: http://travelnevada.com/result_details.asp
182381	Nevada Commission on Tourism n.d.	Nevada Commission on Tourism 2004. "RV Park Details, Space Station RV Park." Nevada Wide Open. Carson City, Nevada: Nevada Commission on Tourism. Accessed March 30, 1997. TIC: 259650. URL: http://travelnevada.com/results_details.asp
173542	Nevada Department of Employment, Training & Rehabilitation 2005	Nevada Department of Employment, Training & Rehabilitation 2005. "Nevada Employer Directory - Lincoln County." Nevada Workforce Informer, Data Analysis. Carson City, Nevada: Nevada Department of Employment, Training & Rehabilitation. Accessed July 21, 2005. ACC: MOL.20060110.0076; MOL.20060112.0045. URL: http://www.nevadaworkforce.com/cgi/dataanalysis/stFirmsReport.asp?tableName=STFIRMS&dataColumns=address1%2C+city%2C+employment%2C+name2%2C+st%2C+zip&ID=5269
173544	Nevada Department of Employment, Training & Rehabilitation 2005	Nevada Department of Employment, Training & Rehabilitation 2005. "Nevada Employer Directory - Nye County." Nevada Workforce Informer, Data Analysis. Carson City, Nevada: Nevada Department of Employment, Training & Rehabilitation. Accessed July 21, 2005. ACC: MOL.20060110.0077; MOL.20060112.0045. URL: http://www.nevadaworkforce.com/cgi/dataanalysis/stFirmsReport.asp?tableName=STFIRMS&dataColumns=address1%2C+city%2C+employment%2C+name2%2C+st%2C+zip&ID=5272
173545	Nevada Department of Employment, Training & Rehabilitation 2005	Nevada Department of Employment, Training & Rehabilitation 2005. "Nevada Employer Directory - Esmeralda County." Nevada Workforce Informer, Data Analysis. Carson City, Nevada: Nevada Department of Employment, Training & Rehabilitation. Accessed July 21, 2005. ACC: MOL.20060110.0075; MOL.20060112.0045. URL: http://www.nevadaworkforce.com/cgi/dataanalysis/stFirmsReport.asp?tableName=STFIRMS&dataColumns=address1%2C+city%2C+employment%2C+name2%2C+st%2C+zip&ID=5265
173575	Nevada Department of Wildlife 2004	Nevada Department of Wildlife 2004. Greater Sage-Grouse Conservation Plan for Nevada and Eastern California. 1st Edition. Carson City, Nevada: Nevada Department of Wildlife. TIC: 257316.

Reference	Author/Date	Document Title
178128	Nevada Division of Environmental Protection 2003	Nevada Division of Environmental Protection 2003. Pahrump Valley Clean Air Action Plan Memorandum of Understanding. Memorandum of Understanding is to Formalize an Understanding Among the Nevada Division of Environmental Protection (NDEP), Nye County Board of Commissioners (NCBOC), Pahrump Town Board (PTB) and the U.S. Environmental Protection Agency (EPA). This Describes the Duties and Responsibilities of These Agencies in a Cooperative Effort to Bring about an Expeditious Resolution to the PM-10 Air Problem in Nye Count Portion of State Hydrographic Area #162 ("Pahrump Valley"). ACC: MOL.20061114.0402.
180459	Nevada Division of State Parks [n.d.]	Nevada Division of State Parks [n.d.]. "Fort Churchill State Historic Park." [Carson City], Nevada: State of Nevada, Nevada Division of State Parks. Accessed April 12, 2007. ACC: MOL.20070501.0083. URL: http://parks.nv.gov/fc.htm
180481	Nevada Division of State Parks [n.d.]	Nevada Division of State Parks [n.d.]. "Lahontan State Recreation Area." [Carson City], Nevada: State of Nevada, Nevada Division of State Parks. Accessed April 12, 2007. ACC: MOL.20070501.0084. URL: http://parks.nv.gov/lah.htm
103406	Nevada Division of Water Planning 1992	Nevada Division of Water Planning 1992. Nevada Water Facts. Carson City, Nevada: Nevada Division of Water Planning. TIC: 241353.
181880	Nevada Natural Heritage Program 2001	Nevada Natural Heritage Program 2001. "Sclerocactus Nyensis Hochstaetter (1992), Tonopah Fishhook Cactus." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0031. URL: http://heritage.nv.gov/atlas/atlasndx.htm
172302	Nevada Power Company 2004	Nevada Power Company 2004. "Nevada Power Facts." Las Vegas, Nevada: Nevada Power Company. Accessed November 11, 2004. TIC: 257153. URL: http://www.nevadapower.com/company/facts/
174087	Nevada Rail Partners 2005	Nevada Rail Partners 2005. Construction Plan Caliente Rail Corridor, Task 14: Construction Planning Support. Document No. T05-00144-R-SYSW-CP-0001-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ESU.20050719.0004.
175945	Nevada Rail Partners 2005	Nevada Rail Partners 2005. Ballast Requirements and Quarries Technical Memorandum Caliente Rail Corridor, Task 14: Construction Planing Support. Document No. NRP-R-SYSW-CP-0003-01A. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060109.0032.
176165	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Alignment Development Report Caliente Rail Corridor, Task 6: Route Alignment Definition, REV. 01. Document No. NRP-R-SYSW-DA-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0017.
176166	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Route Sections and Structures – Typical Concepts of Structural Features Caliente Rail Corridor, Task 7: Route Sections and Structures, REV. 01. Document No. NRP-R-SYSW-TY-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0016.
176168	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, REV. 01. Document No. NRP-R-SYSW-FA-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0019.

Reference	Author/Date	Document Title
176170	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Air Quality Emission Factors and Socio-Economic Input Caliente Rail Corridor, Task 13: EIS Interface Support, REV. 01. Document No. NRP-R-SYSW-EI-0002-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060424.0014.
176172	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Construction Plan Caliente Rail Corridor, Task 14: Construction Planning Support, REV. 01. Document No. NRP-R-SYSW-CP-0008-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0021.
176173	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Operations and Maintenance Report Caliente Rail Corridor, Task 15: Operations and Maintenance Planning Support REV. 01. Document No. NRP-R-SYSW-OM-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060424.0016.
176176	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Comparative Cost Estimates Caliente Rail Corridor, Task 17: Cost Estimating Support, REV. 01. Document No. NRP-R-SYSW-ES-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060424.0015.
176584	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Alignment Development Report Caliente Rail Corridor, Task 6: Route Alignment Definition, REV. 01A. Document No. NRP-R-SYSW-DA-0001-01A. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060302.0017.
179557	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Facilities Design Analysis Report Caliente Rail Corridor. NRP-R-SYSW-FA-0001-02. Las Vegas, Nevada: Nevada Rail Partners.
180872	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Alignment Development Report, Mina Rail Corridor, Task 6: Route Alignment Definition, Rev. 00. Document No. NRP-R-SYSW-DA-0003-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0005.
180873	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Facilities-Design Analysis Report, Mina Rail Corridor, Task 10: Facilities, REV. 00. Document No. NRP-R-SYSW-FA-0002-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0004.
180874	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Air Quality Emission Factors and Socioeconomic Input, Mina Rail Corridor, Task 13: EIS Interface Support, Rev. 00. Document No. NRP-R-SYSW-EI-0003-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0013.
180875	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Construction Plan, Mina Rail Corridor, Task 14: Construction Planning Support, Rev. 00. Document No. NRP-R-SYSW-CP-0010-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0002.
180876	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Operations and Maintenance Report, Mina Rail Corridor, Task 15: Operations & Maintenance Planning Support, Rev. 00. Document No. NRP-R-SYSW-OM-0003-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070612.0003.
180877	Nevada Rail Partners 2007	Nevada Rail Partners 2007. RA EIS Corridor Analysis for Engineering Input for Part 1 Technical Memo, Task 13: EIS Interface Support, Rev.01. Subcontract NN-HC4-00239. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070426.0024.

Reference	Author/Date	Document Title
180916	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Alignment Development Report Caliente Rail Corridor, Task 6: Route Alignment Definition, REV. 03. Document No. NRP-R-SYSW-DA-0001-03. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070620.0014.
180918	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Route Sections and Structures - Typical Concepts of Structural Features Caliente Rail Corridor, Task 7: Route Sections and Structures, Rev. 02. Document No. NRP-R-SYSW-TY-0001-02. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070423.0016.
180919	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Facilities Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 03. Document No. NRP-R-SYSW-FA-0001-03. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070606.0020.
180921	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Air Quality Emissions Factors and Socioeconomic Input Caliente Rail Corridor, Task 13: EIS Interface Support, Rev. 02. Document No. NRP-R-SYSW-EI-0002-02. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070402.0013.
180922	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Construction Plan Caliente Rail Corridor, Task 14: Construction Planning Support, Rev. 03. Document No. NRP-R-SYSW-CP-0008-03. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070606.0023.
180923	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Operations and Maintenance Report Caliente Rail Corridor, Task 15: Operations & Maintenance Planning Support, Rev. 02. Document No. NRP-R-SYSW-OM-0001-02. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070507.0002.
182825	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Air Quality Emissions Factors and Socioeconomic Input Caliente Rail Corridor, Task 13: EIS Interface Support, Rev. 03. Document No. NRP-R-SYSW-EI-0002-03. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070606.0022.
180475	Nevada Small Business Development Center [n.d.]	Nevada Small Business Development Center [n.d.]. "Table of Contents for Schurz, Nevada Census Designated Place Summary File Three Profiles." Nevada 2000 Census Data. [Carson City], Nevada: Nevada Small Business Development Center. Accessed April 20, 2007. ACC: MOL.20070627.0107. URL: http://www2.library.unr.edu/dataworks/NVdemog/index.htm
180476	Nevada Small Business Development Center [n.d.]	Nevada Small Business Development Center [n.d.]. "Table of Contents for Lyon County Summary File Three Profiles." Nevada 2000 Census Data. [Carson City], Nevada: Nevada Small Business Development Center. Accessed April 20, 2007. ACC: MOL.20070627.0108. URL: http://www2.library.unr.edu/dataworks/NVdemog/index.htm
180477	Nevada Small Business Development Center [n.d.]	Nevada Small Business Development Center [n.d.]. "Table of Contents for Mineral County Summary File Three Profiles." Nevada 2000 Census Data. [Carson City], Nevada: Nevada Small Business Development Center. Accessed April 20, 2007. ACC: MOL.20070627.0109. URL: http://www2.library.unr.edu/dataworks/NVdemog/index.htm

Reference	Author/Date	Document Title
180479	Nevada Small Business Development Center [n.d.]	Nevada Small Business Development Center [n.d.]. "Table of Contents for Yerington City, Nevada Census Designated Place Summary File Three Profiles." Nevada 2000 Census Data. [Carson City], Nevada: Nevada Small Business Development Center. Accessed April 20, 2007. ACC: MOL.20070627.0111. URL: http://www2.library.unr.edu/dataworks/NVdemog/index.htm
173564	Nevada Small Business Development Center 2003	Nevada Small Business Development Center 2003. Nevada 2000 Census Data for Nye County Summary File Three Profiles. [Carson City], Nevada: Nevada Small Business Development Center. TIC: 257263.
173565	Nevada Small Business Development Center 2003	Nevada Small Business Development Center 2003. Nevada 2000 Census Data for Lincoln County Summary File Three Profiles. [Carson City], Nevada: Nevada Small Business Development Center. TIC: 257261.
173566	Nevada Small Business Development Center 2003	Nevada Small Business Development Center 2003. Nevada 2000 Census Data for Esmeralda County Summary File Three Profiles. [Carson City], Nevada: Nevada Small Business Development Center. TIC: 257262.
173567	Nevada Small Business Development Center 2003	Nevada Small Business Development Center 2003. Nevada 2000 Census Data for Clark County Summary File Three Profiles. [Carson City], Nevada: Nevada Small Business Development Center. TIC: 257238.
180478	Nevada Small Business Development Center 2003	Nevada Small Business Development Center 2003. "Table of Contents for Hawthorne, Nevada Census Designated Place Summary File Three Profiles." Nevada 2000 Census Data. [Carson City], Nevada: Nevada Small Business Development Center. Accessed April 20, 2007. ACC: MOL.20070627.0110. URL: http://www2.library.unr.edu/dataworks/NVdemog/index.htm
177749	Nevada State Board of Medical Examiners [n.d.]	Nevada State Board of Medical Examiners [n.d.]. 2005 Annual Report. [Reno], Nevada: Nevada State Board of Medical Examiner. ACC: MOL.20061012.0013.
174313	Nevada State Demographer [n.d.]	Nevada State Demographer [n.d.]. Nevada County Population Projections 2004 to 2024. Reno, Nevada: Nevada State Demographer, Nevada Department of Taxation. ACC: MOL.20050725.0384.
177656	Nevada State Demographer's Office 2006	Nevada State Demographer's Office [2006]. Nevada Certified County Population Estimates April 1, 2000 Census to July 1, 2005, Includes Cities and Towns. Reno, Nevada: Nevada State Demographer's Office. ACC: MOL.20060619.0170.
173383	Nevada State Office of Energy 2005	Nevada State Office of Energy 2005. 2005 Status of Energy in Nevada. [Carson City], Nevada: Nevada State Office of Energy, Office of the Governor. ACC: MOL.20050420.0227.
173401	Nevada Telecommunications Association 2005	Nevada Telecommunications Association 2005. State of Nevada Telephone Exchange and Certificated Areas. Reno, Nevada: Nevada Telecommunications Association. TIC: 257544.
155925	Nevada Weed Action Committee 2000	Nevada Weed Action Committee 2000. Nevada's Coordinted Invasive Weed Strategy. [Carson City, Nevada]: Nevada Department of Agriculture. ACC: MOL.20010724.0156.
174673	Newman 1992	Newman, D. 1992. Element Stewardship Abstract for Bromus Rubens. Arlington, Virginia: The Nature Conservancy. TIC: 257691.

Reference	Author/Date	Document Title
175495	Nicholls, Johnson, and Duvall 1971	Nicholls, H.R.; Johnson, C.F.; and Duvall, W.I. [1971]. Blasting Vibrations and Their Effects on Structures. Bulletin 656. Pittsburgh, Pennsylvania: U.S. Department of Interior, Office of Surface Mining Reclamation and Enforcement. ACC: MOL.20051013.0007.
181868	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Arabis Bodiensis Rollins (1982), Bodie Hills Rockcress." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0019. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181869	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Asclepias Eastwoodiana Barneby (1945), Eastwood Milkweed." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0020. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181870	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Astragalus Cimae M.E. Jones Var. Cimae, Cima Milkvetch." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0021. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181871	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Astragalus Lentiginosus Douglas ex Hooker Var. Sesquimetralis (Rydberg) Barneby, Sodaville Milkvetch." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0022. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181872	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Astraalus Funereus M.E. Jones, Black Woollypod." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0023. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181873	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Eriogonum Tiehmii Reveal (1985), Tiehm Buckwheat." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0024. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181874	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Oryctes Nevadensis S. Watson, Oryctes." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0025. URL: http://heritage.nv.gov/atlas/atlasndx.htm

Reference	Author/Date	Document Title
181875	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Penstemon Arenarius E. Greene, Nevada Dune Beardtongue." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0026. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181876	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Penstemon Pahutensis N. Holmgren, Pahute Mesa Beardtongue." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0027. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181877	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Penstemon Rubicundus Keck (1937), Wassuk Beardtongue." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0028. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181878	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Tonestus Graniticus (Tiehm & L. Shultz [1985]) Nesom & Morgan, Lone Mountain Tonestus." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0029. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181879	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Sclerocactus Schlesseri Heil & Welsh, Schlesser Pincushion." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0030. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181881	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Polyctenium Williamsiae Rollins, Williams Combleaf." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0032. URL: http://heritage.nv.gov/atlas/atlasndx.htm
181882	NNHP 2001	NNHP (Nevada Natural Heritage Program) 2001. "Penstemon Pudicus Reveal & Beatley (1971), Bashful Beardtongue." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. Accessed May 3, 2007. ACC: MOL.20070721.0033. URL: http://heritage.nv.gov/atlas/atlasndx.htm
182786	NNHP 2001	Nevada Natural Heritage Program 2001. "Helianthus Deserticola, Heisser (1961), Desert Sunflower." Nevada Rare Plant Atlas Index to Maps and Fact Sheets. Carson City, Nevada: Nevada Natural Heritage Program. Accessed May 3, 2007. ACC: MOL.20070907.0042. URL: http://heritage.nv.gov/atlas/heliadeser.pdf

Reference	Author/Date	Document Title
175489	Noble and Spude 1997	Noble, B.J., Jr. and Spude, R. 1997. “Guidelines for Identifying, Evaluating and Registering Historic Mining Sites.” National Register Bulletin. [Washington, D.C.]: National Park Service. Accessed September 27, 2005. ACC: MOL.20051013.0004. URL: http://www.cr.nps.gov/nr/publications/bulletins/nrb42/mintro.htm
180483	NPS 2004	NPS (National Park Service) 2004. “Lincoln Highway, Special Resource Study/Environmental Assessment.” [Omaha, Nebraska]: U.S. Department of the Interior, National Park Service. Accessed April 23, 2007. ACC: MOL.20070427.0077. URL: http://planning.nps.gov/parkweb/what.cfm?RecordID=
101892	NRC 1977	NRC (U.S. Nuclear Regulatory Commission) 1977. Final Environmental Impact Statement on the Transportation of Radioactive Materials by Air and Other Modes. NUREG-0170. Two volumes. Washington, D.C.: U.S. Nuclear Regulatory Commission. TIC: 221616.
181886	NRC 1989	NRC (U.S. Nuclear Regulatory Commission) 1989. Environmental Assessment for Alaron Corporation. [Washington, D.C.]: U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. ACC: MOL.20070719.0376.
103426	NRC 1995	NRC (U.S. Nuclear Regulatory Commission) 1995. Environmental Justice in NEPA Documents. NMSS Policy and Procedure Letter 1-50, Rev. 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20010725.0140.
181427	NRCS 2007	NRCS (Natural Resources Conservation Service) 2007. “National Soil Survey Handbook, Title 430-VI.” National Soil Survey Handbook (NSSH). Washington, D.C.: U.S. Department of Agriculture, Natural Resources Conservation Service. Accessed June 21, 2007. ACC: MOL.20070622.0008. URL: http://soils.usda.gov/technical/handbook/
173400	NRMCA 2004	NRMCA (National Ready Mix Concrete Association) 2004. Industry Fact Sheet, U.S. Ready Mixed Concrete Production. Silverspring, Maryland: National Ready Mix Concrete Association. TIC: 257545.
175026	NSHD 2005	NSHD (Nevada State Health Division) 2005. West Nile Virus, What Nevadans Need to Know. [Carson City], Nevada: Nevada State Health Division, Office of Public Information. ACC: MOL.20050915.0308.
176808	Nye County Nuclear Waste Repository Project Office 2002	Nye County Nuclear Waste Repository Project Office 2002. “Well No. NC-EWDP-18P Site Summary.” NC-EWDP-18P. [Pahrump, Nevada]: Nye County Nuclear Waste Repository Project Office. Accessed April 11, 2006. ACC: MOL.20060419.0206. URL: http://www.nyecounty.com/ewdp_pages/Phase3/18p_main.htm
177759	Nye County School District [n.d.]	Nye County School District [n.d.]. Nye County School District, 2005-2006 District Accountability Summary Report. [Carson City], Nevada: Nevada Department of Education, Nye County School District. ACC: MOL.20061026.0279.
176370	O’Farrell and Blaustein 1974	O’Farrell, M.J. and Blaustein, A.R. 1974. “Microdipodops Megacephalus.” Mammalian Species, 46, 1-3. [Lawrence, Kansas]: American Society of Mammalogists. TIC: 258173.
176372	O’Farrell and Blaustein 1974	O’Farrell, M.J. and Blaustein, A.R. 1974. “Microdipodops Pallidus.” Mammalian Species, 47, 1-2. [Lawrence, Kansas]: American Society of Mammalogists. TIC: 258176.

Reference	Author/Date	Document Title
176303	Ong 2005	Ong, C. 2005. "Inquiry to Available Flood Data at NV Division of Water Resources." Memorandum for the Record from C. Ong (PHE) to K. Groenewold (NFIP), December 15, 2005. ACC: MOL.20060206.0365.
176304	Ong 2005	Ong, C. 2005. "Inquiry to Available Flood Data at BLM." Memorandum for the Record from C. Ong (PHE) to BLM, December 9 - 15, 2005. ACC: MOL.20060206.0366.
177031	Osborn et al. 2005	Osborn, D.M.; Weiner, R.F.; Mills, G.S.; and Hamp, S.C. 2005. Verification and Validation of RADTRAN 5.5. SAND2005-1274. Albuquerque, New Mexico: Sandia National Laboratories. ACC: MOL.20060629.0148.
175488	OSHA [n.d.]	OSHA (Occupational Safety and Health Administration) [n.d.]. OSHA Forms for Recording Work-Related Injuries and Illnesses. Washington, D.C.: U.S. Department of Labor, Occupational Safety and Health Administration. ACC: MOL.20051013.0003.
174204	Palmer 1998	Palmer, A.R. 1998. "Terminal Early Cambrian Extinction of the Olenellina: Documentation from the Pioche Formation, Nevada." Journal of Paleontology, 72, (4), 650-672. [Tulsa, Oklahoma]: Paleontological Society. TIC: 257487.
155897	Parker and King 2002	Parker, P.L. and King, T.F. 2002. Guidelines for Evaluating and Documenting Traditional Cultural Properties. [Washington, D.C.]: U.S. Department of the Interior. ACC: MOL.20020312.0114.
180119	Parsons Brinckerhoff 2003	Parsons Brinckerhoff 2003. Flood Zones Impacting Mina Alignment - Overview. Rev.0, tracking # 07-00022. x, x: Parsons Brinckerhoff.
182755	Parsons Brinckerhoff 2005	Parsons Brinckerhoff 2005. Hydrologic and Drainage Evaluation Report, Task 2.6, Rev. 0. Subcontract No. NN-HC4-00207. [Las Vegas, Nevada]: Parsons Brinckerhoff. ACC: ENG.20070614.0003.
180885	Parsons Brinckerhoff 2007	Parsons Brinckerhoff 2007. Phase 1 Hydrologic and Drainage Evaluation Report, Mina Rail Corridor, Task 2.3: Preliminary Investigations for Hydrologic and Drainage Evaluations for Conceptual Design, Rev. 00. 07-00022. [Las Vegas, Nevada]: Parsons Brinckerhoff. ACC: ENG.20070523.0007.
174040	PBS&J 2005	PBS&J (Post, Buckley, Schuh & Jernigan) 2005. Waters of the U.S. Jurisdictional Determination Report for Yucca Mountain Project, Caliente Rail Corridor, Draft. [Henderson], Nevada: Post, Buckley, Schuh & Jernigan. ACC: ENG.20060308.0003.
180914	PBS&J 2006	PBS&J (Post, Buckley, Schuh & Jernigan) 2006. Waters of the U.S. Jurisdictional Determination Report for Yucca Mountain Project - Caliente Rail Corridor, Task 1.1 Information on Wetlands and Floodplains, REV. 03. 06-00104. Henderson, Nevada: Post, Buckley, Schuh & Jernigan. ACC: ENG.20070102.0010.
180889	PBS&J 2007	PBS&J (Post, Buckley, Schuh & Jernigan) 2007. Waters of the U.S. Jurisdictional Determination Report for Yucca Mountain Project, Mina Rail Corridor, Task 1.1a Information on Wetlands and Floodplains, Revision 0. 07-00021. Henderson, Nevada: Post, Buckley, Schuh & Jernigan. ACC: ENG.20070426.0022.

Reference	Author/Date	Document Title
174084	Piechota et al. 2002	Piechota, T.; van Ee, J.; Batista, J.; Stave, K.; and James, D. 2002. Potential Environmental Impacts of Dust Suppressants: "Avoiding Another Times Beach.". EPA/600/R-04/031. [Washington, D.C.]: U.S. Environmental Protection Agency. ACC: MOL.20050615.0511.
180696	Potomac-Hudson Engineering 2007	Potomac-Hudson Engineering 2007. RA EIS Caliente Rail Alignment Wetland Reconnaissance Technical Memo, February 6, 2007. Bethesda, Maryland: Potomac-Hudson Engineering. ACC: MOL.20070511.0008.
173554	Price and Meeuwig 2003	Price, J.G. and Meeuwig, R.O. 2003. "Overview." The Nevada Mineral Industry 2002. Meeuwig, D., ed. Special Publication MI-2002. Reno, Nevada: Nevada Bureau of Mines and Geology. TIC: 257557.
103136	Prudic, Harrill, and Burbey 1993	Prudic, D.E.; Harrill, J.R.; and Burbey, T.J. 1993. Conceptual Evaluation of Regional Ground-Water Flow in the Carbonate-Rock Province of the Great Basin, Nevada, Utah, and Adjacent States. Open-File Report 93-170. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.19950105.0016.
174631	Quick 2005	Quick, P. 2005. "Comments on Draft Text and Key Observation Points." Record of conversation from P. Quick to R. Perrin (BLM), January 6, 2005. ACC: MOL.20050810.0020.
174632	Quick 2005	Quick, P. 2005. "Comments on Draft Text and Key Observation Points for Rail Alignment EIS." Record of conversation from P.Quick to D. Siebert (BLM), January 3, 2005. ACC: MOL.20050810.0018.
174635	Quick 2005	Quick, P. 2005. "Availability of Mapping of Visual Resource Management Classifications; Availability of Record of Decision for Caliente Management Framework Plan; Upcoming Resource Management Plan for Garden Valley Area." Record of conversation from P. Quick to J. Tribble (BLM), May 24, 2005. ACC: MOL.20050810.0031.
176988	Quick 2006	Quick, P.M. 2006. Notes on Visual Resources Discussion, Late Request for a DIRS Number. E-mail from P.M. Quick (ICFI) to T. Washington, May 28, 2006, with attachment. ACC: MOL.20060629.0154.
181606	Rautenstrauch 2007	Rautenstrauch, K. 2007. Minutes of a Meeting, Trip Report, U.S. Department of Energy and Fish and Wildlife Service (FWS), April 11, 2007, Reno, NV. Las Vegas, Nevada: Bechtel SAIC Company. ACC: MOL.20070705.0089.
182308	Rautenstrauch 2007	Rautenstrauch, K. 2007. "Re: Trip Report." E-mail from K. Rautenstrauch to M. Westover (URS), July 16, 2007, with attachment. ACC: MOL.20070815.0064.
101914	Rautenstrauch and O'Farrell 1998	Rautenstrauch, K.R. and O'Farrell, T.P. 1998. "Relative Abundance of Desert Tortoises on the Nevada Test Site." Southwestern Naturalist, 43, (3), 407-411. Lubbock, Texas: Southwestern Association of Naturalists. TIC: 242257.
169384	Reiner et al. 2002	Reiner, S.R.; Laczniak, R.J.; DeMeo, G.A.; Smith, J.L.; Elliott, P.E.; Nylund, W.E.; and Fridrich, C.J. 2002. Ground-Water Discharge Determined from Measurements of Evapotranspiration, Other Available Hydrologic Components, and Shallow Water-Level Changes, Oasis Valley, Nye County, Nevada. Water-Resources Investigations Report 01-4239. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20040517.0541; MOL.20040517.0542; MOL.20040517.0543.

Reference	Author/Date	Document Title
174681	REMI 2004	REMI (Regional Economic Models, Inc.) 2004. Policy Insight. Version 6.0.100. Amherst, Massachuetts: Regional Economic Models, Inc. ACC: MOL.20040612.1302.
182251	REMI 2007	REMI Policy Insight V. 9.0.3. 2007. Windows XP. STN: 611543-9.0.3-00.
176949	Resource Concepts 2001	Resource Concepts 2001. Nevada Grazing Statistics Report and Economic Analysis for Federal Lands in Nevada. Carson City, Nevada: Resource Concepts. ACC: MOL.20060627.0066.
173845	Resource Concepts 2005	Resource Concepts 2005. Proposed Yucca Mountain Corridor Affected Grazing Permittees. Carson City, Nevada: Resource Concepts. ACC: MOL.20050726.0387.
182897	Reyes 2005	Reyes, L.A. 2005. Details and Projected Cost of a Demonstration Test of a Full-Scale Spent Nuclear Fuel Rail Transportation Cask Under the Package Performance Study. Policy Issue Notation from L.A. Reyes to the Commissioners.
172307	Riddel, Boyett, and Schwer 2003	Riddel, M.; Boyett M.; and Schwer R.K. 2003. Economic Impact of the Yucca Mountain Nuclear Waste Repository on the Economy of Nevada. Las Vegas, Nevada: University of Nevada, Las Vegas, Center for Business and Economic Research. ACC: MOL.20041207.0449.
180460	Robb-Bradick et al. 2006	Robb-Bradick, A.; Bradick, F.; Hackett, M.; and Alrus Consulting 2006. Monte Cristo’s Castle (Proposed) Nevada State Park, Esmeralda County, Nevada. Reno, Nevada: Andrea Robb-Bradick. ACC: MOL.20070628.0134.
182289	Ross 1961	Ross, D.C. 1961. Geology and Mineral Deposits of Mineral County, Nevada. Nevada Bureau of Mines and Geology Bulletin 58. Reno, Nevada: University of Nevada, Reno, Mackay School of Mines. ACC: MOL.20070815.0010.
176519	Rowley and Shroba 1991	Rowley, P.D. and Shroba, R.R. 1991. Geologic Map of the Indian Cove Quadrangle, Lincoln County, Nevada. GQ-1701. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20010919.0344.
176947	Rowley et al. 1994	Rowley, P.D.; Shroba, R.R.; Simonds, F.W.; Burke, K.J.; Axen, G.J.; and Olmore, S.D. 1994. Geologic Map of the Chief Mountain Quadrangle, Lincoln County, Nevada. Geologic Quadrangle Map GQ-1731. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20060515.0162.
173572	RTA 2000	RTA (Railway Tie Association). 2000. “Stop! Go! Proceed with...Optimism?” Crossties. Pages 20-24. Fayetteville, Georgia: Railway Tie Association. TIC: 257533.
176502	Rush 1964	Rush, F.E. 1964. Ground-Water Appraisal of the Meadow Valley Area, Lincoln and Clark Counties, Nevada. Ground-Water Resources-Reconnaissance Series Report 27. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. TIC: 218944.
176849	Rush 1968	Rush, F.E. 1968. Water–Resources Appraisal of Clayton Valley–Stonewall Flat Area, Nevada and California. Water Resources – Reconnaissance Series Report 45. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. TIC: 217156.

Reference	Author/Date	Document Title
176950	Rush and Everett 1966	Rush, F.E. and Everett, D.E. 1966. Water-Resources Appraisal of Little Fish Lake, Hot Creek, and Little Smoky Valleys, Nevada. Water Resources -- Reconnaissance Series Report 38. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. ACC: MOL.20060524.0139.
180754	Rush et al. 1971	Rush, F.E.; Scott, B.R.; Van Denburgh, A.S.; and Vasey, B.J. 1971. Water Resources and Inter-Basin Flows. [Carson City], Nevada: State of Nevada, Division of Water Resources. TIC: 217394.
174509	Russ 2005	Russ, M. 2005. “Paleontological Resources.” Record of conversation from M. Russ (Ageiss) to N. Thomas (BLM/Ely), January 10, 2005 and January 26, 2005, with attachments. ACC: MOL.20050810.0021.
174412	Ryser 1985	Ryser, F.A., Jr. 1985. Birds of the Great Basin. Great Basin Natural History Series. Reno, Nevada: University of Nevada Press. TIC: 257724.
153277	SAIC 1991	SAIC (Science Application International Corporation) 1991. Special Nevada Report, September 23, 1991. Las Vegas, Nevada: Science Application International Corporation. ACC: NNA.19920131.0361.
147777	SAIC 1992	SAIC (Science Applications International Corporation) 1992. Particulate Matter Ambient Air Quality Data Report for 1989 and 1990. Las Vegas, Nevada: Science Applications International Corporation. ACC: MOL.19980331.0174.
147780	SAIC 1992	SAIC (Science Applications International Corporation) 1992. Particulate Matter Ambient Air Quality Data Report for 1991. Las Vegas, Nevada: Science Applications International Corporation. ACC: NNA.19921218.0092.
154814	Sandquist et al. 1985	Sandquist, G.M.; Rogers, V.C.; Sutherland, A.A.; and Merrell, G.B. 1985. Exposures and Health Effects from Spent Fuel Transportation. RAE-8339/12-1. Salt Lake City, Utah: Rogers and Associates Engineering. TIC: 200593.
174749	Saurenman 2004	Saurenman, H. 2004. Potential Adverse Noise Impacts on “City” Sculpture. Los Angeles, California: ATS Consulting. TIC: 257662.
181849	Sawyer 1999	Sawyer, T.L. 1999. “Complete Report for Unnamed Faults Near Terrill Mountains (Class A) No. 1310.” USGS Earthquake Hazards Program, Text Based. [Denver, Colorado]: U.S. Geological Survey, Earthquake Hazards Program. Accessed June 11, 2007. ACC: MOL.20070721.0005. URL: http://gldims.cr.usgs.gov/webapps/cfusion/Sites/qfault/qf_web_disp.cfm?disp_cd=C&qfault_or=348&ims_cf_cd=cf
181852	Sawyer and Anderson 1999	Sawyer, T.L. and Anderson, R.E. 1999. “Complete Report for Lone Mountain Fault Zone (Class A) No. 1338.” USGS Earthquake Hazards Program, Text Based. [Denver, Colorado]: U.S. Geological Survey, Earthquake Hazards Program. Accessed June 11, 2007. ACC: MOL.20070721.0008. URL: http://gldims.cr.usgs.gov/webapps/cfusion/Sites/qfault/qf_web_disp.cfm?qfault_or=378&ims_cf_cd=cf&disp_cd=C
174643	Seaber, Kapinos, and Knapp 1994	Seaber, P.R.; Kapinos, F.P.; and Knapp, G.L. 1994. Hydrologic Unit Maps. Water-Supply Paper 2294. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20050810.0042.

Reference	Author/Date	Document Title
176363	Shackleton 1985	Shackleton, D. 1985. "Ovis Canadensis." Mammalian Species, 230, 1-9. [Lawrence, Kansas]: American Society of Mammalogists. TIC: 258172.
181603	Shankman 2001	Shankman, S.F. 2001. "Clark County Comments on NUREG/CR-6672." Letter from S. Shankman (NRC) to M. Williams (Clark County Board of Commissioners), February 7, 2001. ACC: MOL.20070705.0087.
173841	Shannon & Wilson 2005	Shannon & Wilson 2005. Mineral and Energy Resource Assessment Report, Task 3.4: Preliminary Mineral and Energy Resource Assessment Report (Submittal No. 7.8), Rev. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20060323.0013.
173842	Shannon & Wilson 2005	Shannon & Wilson 2005. Preliminary Geotechnical Report, DRAFT 2, Phase 1, Caliente Rail Corridor Yucca Mountain Project, Nevada. Job No. 21-1-20102-015. Two volumes. Seattle, Washington: Shannon & Wilson. ACC: ENG.20050815.0012; ENG.20050815.0013.
174296	Shannon & Wilson 2005	Shannon & Wilson 2005. Preliminary Geotechnical Design Criteria Manual, Task 1.3: Development of Draft Geotechnical Engineering Criteria and Parameters (Submittal No. 7.1), Rev. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20060315.0005.
175986	Shannon & Wilson 2005	Shannon & Wilson 2005. Geotechnical Report Supplement 1, Task 1.5: Phase 1 Preliminary Geotechnical Analysis Report (Submittal No. SCN-5), Rev. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20060320.0004.
176034	Shannon & Wilson 2006	Shannon & Wilson 2006. Construction Aggregate Report, Task 4.12: Preliminary Construction Aggregate Report (Submittal No. 8.9), Rev.1a. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20060323.0012.
176182	Shannon & Wilson 2006	Shannon & Wilson 2006. Ballast Quarry Report, Task 4.8: Ballast Quarry Report, (Submittal No. 8.6), Rev. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20060414.0011.
176184	Shannon & Wilson 2006	Shannon & Wilson 2006. Geotechnical Report, Task 4.12: Preliminary Geotechnical Analysis Report (Submittal No. 8.8), Rev. 1. Subcontract No. NN-HC4-00197. Two volumes. Seattle, Washington: Shannon & Wilson. ACC: ENG.20060505.0001; ENG.20060505.0002.
180878	Shannon & Wilson 2007	Shannon & Wilson 2007. Geotechnical Report Mina Rail Corridor Volume 1 of 2, Task 1.4a: Preliminary Geotechnical Analysis Report (Submittal No. 7.28), Rev. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20070516.0010.
180880	Shannon & Wilson 2007	Shannon & Wilson 2007. Geotechnical Report Mina Rail Corridor Volume 2 of 2, Task 1.4a: Preliminary Geotechnical Analysis Report (Submittal No. 7.28), Rev. 0. NN-HC4-00197. [Seattle, Washington]: Shannon & Wilson. ACC: ENG.20070516.0011.
180881	Shannon & Wilson 2007	Shannon & Wilson 2007. Ballast Quarry Report, Mina Rail Corridor, Task 2.5a: Quarry Site Description Report (Submittal No. 7.32), REV. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20070418.0014.

Reference	Author/Date	Document Title
180882	Shannon & Wilson 2007	Shannon & Wilson 2007. Mineral and Energy Resource Occurrence Report, Mina Rail Corridor, Task 3.3a: Preliminary Mineral and Energy Resource Assessment Report (Submittal No. 7.34) Rev.0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20070611.0001.
182854	Shannon & Wilson 2007	Shannon & Wilson 2007. Geotechnical Report Volume 2 of 2. x, x: Shannon & Wilson. ACC: ENG.20070716.0019.
173382	Sierra Pacific Power 2005	Sierra Pacific Power 2005. "Sierra Pacific Power Company Facts." [Reno, Nevada]: Sierra Pacific Power. Accessed April 5, 2005. TIC: 257551. URL: http://www.sierrapacific.com/company/facts/
174085	Sierra Research and Caretto 2004	Sierra Research and Caretto, L.S. 2004. Research Project, Development of Railroad Emission Inventory Methodologies. Report No. SR2004-06-02. Sacramento, California: Sierra Research. TIC: 257524.
181625	Simpson 2007	Simpson, D. 2007. "RE: Appendix 2: Estimated Capacities of Permitted Landfills - 2006." E-mail from D. Simpson (NDEP) to M. Gonzalez, June 28, 2007, with attachment. ACC: MOL.20070712.0036; MOL.20070809.0078.
150228	Slate et al. 2000	Slate, J.L.; Berry, M.E.; Rowley, P.D.; Fridrich, C.J.; Morgan, K.S.; Workman, J.B.; Young, O.D.; Dixon, G.L.; Williams, V.S.; McKee, E.H.; Ponce, D.A.; Hildenbrand, T.G.; Swadley, W C; Lundstrom, S.C.; Ekren, E.B.; Warren, R.G.; Cole, J.C.; Fleck, R.J.; Lanphere, M.A.; Sawyer, D.A.; Minor, S.A.; Grunwald, D.J.; Laczniak, R.J.; Menges, C.M.; Yount, J.C.; Jayko, A.S.; Mankinen, E.A.; Davidson, J.G.; Morin, R.L.; and Blakely, R.J. 2000. Digital Geologic Map of the Nevada Test Site and Vicinity, Nye, Lincoln and Clark Counties, Nevada, and Inyo County, California, Revision 4; Digital Aeromagnetic Map of the Nevada Test Site and Vicinity, Nye, Lincoln, and Clark Counties, Nevada, and Inyo County, California; and Digital Isostatic Gravity Map of the Nevada Test Site and Vicinity, Nye, Lincoln, and Clark Counties, Nevada, and Inyo County, California. Open-File Report 99-554—A, —B, and —C. Denver, Colorado: U.S. Geological Survey. TIC: 248049; 251985; 251981.
176469	SNWA [n.d.]	SNWA (Southern Nevada Water Authority) [n.d.]. "Segment 4, Dry Lake Valley Basin." SNWA's Proposed Action for Public Scoping. [Las Vegas], Nevada: Southern Nevada Water Authority. Accessed February 15, 2006. ACC: MOL.20060419.0204. URL: http://www.nvgroundwaterproject.com/html/documents.html
177516	SNWA 2006	SNWA (Southern Nevada Water Authority) 2006. Southern Nevada Water Authority Clark, Lincoln, and White Pine Counties Groundwater Development Project, Draft Conceptual Plan of Development. Reno, Nevada: U.S. Bureau of Land Management, Nevada State Office. ACC: MOL.20060926.0022.
177757	Snyder, Tan, and Hoffman 2006	Snyder, T.D.; Tan, A.G.; and Hoffman, C.M. 2006. Digest of Education Statistics 2005. NCES 2006-030. Washington, D.C.: U.S. Department of Education, National Center for Education Statistics. ACC: MOL.20061026.0276.

Reference	Author/Date	Document Title
178053	Southern Nevada Water Authority 2005	Southern Nevada Water Authority 2005. General Capacity Agreement for Participation in Southern Nevada Water Authority's Groundwater Project. This Agreement concerns water rights and a capacity interest in certain water conveyance infrastructure by and between the Lincoln County Water District, a political subdivision of the State of Nevada created pursuant to Chapter 474, Statutes of Nevada 2003 and the Southern Nevada Water Authority, a Joint Powers Authority established pursuant to NRS Chapter 277. ACC: MOL.20061101.0030.
152476	Sprung et al. 2000	Sprung, J.L.; Ammerman, D.J.; Breivik, N.L.; Dukart, R.J.; Kanipe, F.L.; Koski, J.A.; Mills, G.S.; Neuhauser, K.S.; Radloff, H.D.; Weiner, R.F.; and Yoshimura, H.R. 2000. Reexamination of Spent Fuel Shipment Risk Estimates. NUREG/CR-6672. Two volumes. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20001010.0217.
173558	State of Nevada [n.d.]	State of Nevada [n.d.]. County Profiles, Lincoln County. [Carson City, Nevada: State of Nevada]. TIC: 257535.
173559	State of Nevada [n.d.]	State of Nevada [n.d.]. County Profiles, Nye County. [Carson City, Nevada: State of Nevada]. TIC: 257536.
173560	State of Nevada [n.d.]	State of Nevada [n.d.]. County Profiles, Esmeralda County. [Carson City, Nevada: State of Nevada]. TIC: 257537.
178301	State of Nevada [n.d.]	State of Nevada [n.d.]. "Nevada Water Law, Water Permits." [Carson City, Nevada]: State of Nevada, Department of Conservation & Natural Resources. Accessed November 13, 2006. ACC: MOL.20061205.0083. URL: http://water.nv.gov/water%20rights/water%20law/water_permits.htm
174520	State of Nevada 2001	State of Nevada 2001. Lincoln County Master Plan. Pioche, Nevada: State of Nevada. TIC: 257836.
173399	State of Nevada 2004	State of Nevada [2004]. Crime and Justice in Nevada 2003. Carson City, Nevada: State of Nevada, Department of Public Safety. ACC: MOL.20050420.0236.
174041	State of Nevada 2004	State of Nevada 2004. "Draft Solid Waste Management Plan." Carson City, Nevada: State of Nevada, Nevada Division of Environmental Protection. Accessed May 25, 2005. ACC: MOL.20050614.0133. URL: http://ndep.nv.gov/bwm/SWMP2004/swp01.htm
174663	State of Nevada 2005	State of Nevada 2005. Nevada's Solid Waste Management Plan. [Carson City], Nevada: State of Nevada, Nevada Division of Environmental Protection, Bureau of Waste Management. ACC: MOL.20060110.0069.
174664	State of Nevada 2005	State of Nevada 2005. "About Solid Waste." [Carson City, Nevada]: State of Nevada. Division of Environmental Protection, Burearu of Waste Management. Accessed July 21, 2005. ACC: MOL.20050815.0192. URL: http://ndep.nv.gov/bwm/back.htm
177741	State of Nevada 2005	State of Nevada 2005. Designated Groundwater Basins of Nevada. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. ACC: MOL.20061012.0010.
177747	State of Nevada 2005	State of Nevada [2005]. Crime and Justice in Nevada 2004. Carson City, Nevada: State of Nevada, Department of Public Safety. ACC: MOL.20061012.0011.

Reference	Author/Date	Document Title
180466	State of Nevada 2005	State of Nevada 2005. "County Profiles, Lyon County." [Carson City, Nevada]: State of Nevada, Nevada State Health Division. Accessed April 20, 2007. ACC: MOL.20070426.0075. URL: http://health2k.state.nv.us/primary/profile/index.thm
180467	State of Nevada 2005	State of Nevada 2005. "County Profiles, Mineral County." [Carson City, Nevada]: State of Nevada, Nevada State Health Division. Accessed April 20, 2007. ACC: MOL.20070426.0076. URL: http://health2k.state.nv.us/primary/profile/index.htm
176488	State of Nevada 2006	State of Nevada 2006. "Nevada's Hydrographic Regions (Basins), Areas and Sub-Areas Nevada Division of Water Resources." [Carson City], Nevada: State of Nevada, Department of Conservation & Natural Resources, Division of Water Resources. Accessed February 20, 2006. ACC: MOL.20060320.0120. URL: http://water.nv.gov/water%20planning/basins/hydro_nv.htm
177748	State of Nevada 2006	State of Nevada [2006]. Crime and Justice in Nevada 2005. Carson City, Nevada: State of Nevada, Department of Public Safety. ACC: MOL.20061012.0012.
178100	State of Nevada 2006	State of Nevada 2006. Personal Health Choices: 2001-2005. 18th Edition. Carson City, Nevada: State of Nevada Health Division, Bureau of Health Planning and Statistics. ACC: MOL.20061114.0405.
178726	State of Nevada 2006	State of Nevada 2006. "Special Hydrographic Abstract." Nevada Division of Water Resources Water Rights Database. [Carson City], Nevada: State of Nevada, Department of Conservation & Natural Resources. Accessed January 17, 2007. ACC: MOL.20070201.0268. URL: http://water.nv.gov/water%20Rights/permitdb/hyd_abs2.cfm?
179933	State of Nevada 2007	State of Nevada 2007. "Fallon - West End School." State of Nevada Bureau of Air Quality Planning Trend Report, 2003 Report Monitoring Data. Carson City, Nevada: State of Nevada Bureau of Air Quality Planning. Accessed March 16, 2007. ACC: MOL.20070405.0031. URL: http://ndep.nv.gov/baqp/trndrpt/index.html
182288	State of Nevada Department of Conservation & Natural Resources, Division of Water 2007	State of Nevada Department of Conservation & Natural Resources, Division of Wate 2007. "Water Rights Database." Hydrographic Abstract. x, x: State of Nevada Department of Conservation & Natural Resources, Division of Water Resources. Accessed 03/15-05/01/07. ACC: MOL.20070815.0009. URL: http://water.nv.gov/water%20Rights/permitdb/hyd_abs1.cfm?CFID=30072&CFTOKEN=30077354
174622	STB 1997	STB (Surface Transportation Board) 1997. Before the Surface Transportation Board, Finance Docket No. 33388, CSX Corporation and CSX Transportation, Inc., Norfolk Southern Corporation and Norfolk Southern Railway Company — Control and Operating Leases/Agreements — Conrail Inc. and Consolidated Rail Corporation. Railroad Control Application, Volume 6A of Environmental Report. CSX/NS-23. Washington, D.C.: Surface Transportation Board. ACC: MOL.20060404.0002.

Reference	Author/Date	Document Title
173225	STB 2003	STB (Surface Transportation Board) 2003. Final Environmental Impact Statement, Construction and Operation of a Rail Line from the Bayport Loop in Harris County, Texas. Decision ID No. 33543. Finance Docket No. 34079. [Washington, D.C.]: Surface Transportation Board. ACC: MOL.20050418.0040.
174414	Stebbins 2003	Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians. 3rd Edition. New York, New York: Houghton Mifflin Company. TIC: 257592.
180975	Stewart, Carlson, and Johannessen 1982	Stewart, J.H.; Carlson, J.E.; and Johannessen, D.C. 1982. Geologic Map of the Walker Lake 1º by 2º Quadrangle, California and Nevada. Miscellaneous Field Studies Map MF-1382-A. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20070524.0071.
176308	Stockman et al. 2003	Stockman, E.L.; Jones, C.Z.; Rowland, R.C.; and Medina, R.L. 2003. Water Resources Data Nevada Water Year 2003. USGS-WRD-NV-03-1. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20060206.0351.
103465	Stoffle et al. 1990	Stoffle, R.W.; Halmo, D.B.; Olmsted, J.E.; and Evans, M.J. 1990. Native American Cultural Resource Studies at Yucca Mountain, Nevada. Ann Arbor, Michigan: Institute for Social Research, University of Michigan. ACC: MOL.20010724.0306.
180154	Sullivan 2007	Sullivan, N. 2007. “Fw: FW: Union Pacific Document for DIRS” E-mail from N. Sullivan (ICF International) to T. Washington, May 16, 2007, with attachment. ACC: MOL.20070529.0021.
174558	Sweeney 2004	Sweeney, R.L. 2004. Response to Bureau of Indian Affairs Letter dated June 18, 2004 Concerning Timbisha Shoshone Tribe and Rail Alignment, Environmental Impact Statement. Correspondence from R.L. Sweeney (DOE/ORD) to A.L. Dutschke (Bureau of Indian Affairs), September 20, 2004, 0921043296, MFR:OSPD:RLS-1755. ACC: MOL.20041129.0011.
173837	Sweeney 2005	Sweeney, R.L. 2005. “Re: Nye County Surveys.” E-mail from R.L. Sweeney to juliannet@ageiss and eharr@jason, February 18, 2005, with attachment. ACC: MOL.20050526.0112.
157312	Sweetwater Consulting Services and R.O. Anderson Engineering 1992	Sweetwater Consulting Services and R.O. Anderson Engineering. 1992. City of Caliente Master Plan. Caliente, Nevada: City of Caliente, Caliente Planning Commission. TIC: 252151.
159895	Tanko and Glancy 2001	Tanko, D.J. and Glancy, P.A. 2001. Flooding in the Amargosa River Drainage Basin, February 23-24, 1998, Southern Nevada and Eastern California, Including the Nevada Test Site. Fact Sheet 036-01. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20010924.0092.
174498	Taylor 1992	Taylor, R.J. 1992. Sagebrush Country, A Wildflower Sanctuary. Missoula, Montana: Mountain Press Publishing Company. TIC: 257721.
173393	Tepordei 2003	Tepordei, V.V. 2003. “Minerals Yearbook: Metals and Minerals.” Volume I of Stone, Crushed. Reston, Colorado: U.S. Geological Survey. ACC: MOL.20050420.0232.
182749	Tetra Tech EM Inc. 2007	Tetra Tech EM Inc. 2007. FINAL Annual 2005 Groundwater Monitoring Report, Hawthorne Army Depot, Hawthorne Nevada. Sacramento, California: U.S. Army Corps of Engineers, Environmental Engineering Branch.

Reference	Author/Date	Document Title
174634	Thebeau and Huenfeld 2005	Thebeau, L. and Huenfeld, R. 2005. "Technical Review of RA-EIS Section 3.7 and Advice on Treatment of Plant Taxonomy." Record of conversation from L. Thebeau (Ageiss) and R. Huenefeld (Ageiss) to K. Ostler (Jason Associates), July 12, 2005. ACC: MOL.20050810.0039.
147766	Thiel 1999	Thiel Engineering Consultants 1999. Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin. Reno, Nevada: Thiel Engineering Consultants. ACC: MOL.19990218.0214.
103470	Timbisha Shoshone Tribe [n.d.]	Timbisha Shoshone Tribe [n.d]. "The Timbisha Shoshone Tribal Homeland, A Draft Secretarial Report to Congress to Establish a Permanent Tribal Land Base and Related Cooperative Activities." [Death Valley National Park, California]: Timbisha Shoshone Tribe. Accessed June 12, 2000. ACC: MOL.20010727.0168. URL: http://www.nps.gov/deva/Timbisha_toc.html
150524	Tingley 1998	Tingley, J.V. 1998. Mining Districts of Nevada. 2nd Edition. Nevada Bureau of Mines and Geology Report 47. Reno, Nevada: University of Nevada, Reno, Mackay School of Mines. TIC: 235037.
174505	Torell, Young, and Kvasnicka 2005	Torell, R.; Young, J.A.; and Kvasnicka, B. 2005. Halogeton Poisoning. Fact Sheet: 00-20. Reno, Nevada: University of Nevada, Cooperative Extension. TIC: 257665.
176524	Transportation Research Board 2001	Transportation Research Board 2001. Highway Capacity Manual 2000. HCM2000. Washington, D.C.: National Research Council, Transportation Research Board. TIC: 258170.
180073	Tribal Environmental Exchange Network 2007	TREX (Tribal Environmental eXchange Network) 2007. "CAMS 1017 C1017--NV." Monitoring Operations, Data by Month by Site by Parameter. [Boulder, Colorado: National Center for Atmospheric Research, Earth Observing Laboratory]. Accessed March 27, 2007. ACC: MOL.20070830.0188. URL: http://trex-network.meteostar.com/cgi-bin/lsr/monthly_summary.pl
181384	U.S. Census Bureau [n.d.]	U.S. Census Bureau [n.d.]. "PCT12. Sex by Age [209]-Universe: Total Population, Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data, [Lyon, Mineral, Nye Counties]." American FactFinder Census 2000. [Washington, D.C.]: U.S. Census Bureau. Accessed June 18, 2007. ACC: MOL.20070622.0003. URL: http://factfinder.census.gov/servlet/DTTable?_bm=y&-context=dt&-ds_name=DEC_2000_SF1_U&mt_name=DEC_2000_SF1_U_PCT012&-CONTEXT=dt&-tree_id=4001&-all_geo_types=N&-geo_id=05000US32019&-geo_id=05000US32021&-geo_id=05000US32023&-search_results=01000US&-geo?id=050
181905	U.S. Census Bureau [n.d.]	U.S. Census Bureau [n.d.]. "Glossary for C." American FactFinder Help. [Washington, D.C.]: U.S. Census Bureau. Accessed July 13, 2007. ACC: MOL.20070719.0381. URL: http://factfinder.census.gov/home/en/epss/glossary_c.html
176855	U.S. Census Bureau 2003	U.S. Census Bureau 2003. Nevada: 2000, Population and Housing Unit Counts. 2000 Census of Population and Housing. PHC-3-30. Washington, D.C.: U.S. Department of Commerce, U.S. Census Bureau. ACC: MOL.20060420.0074.

Reference	Author/Date	Document Title
176856	U.S. Census Bureau 2003	U.S. Census Bureau 2003. Nevada: 2000, Summary Social, Economic, and Housing Characteristics. 2000 Census of Population and Housing. PHC-2-30. Washington, D.C.: U.S. Department of Commerce, U.S. Census Bureau. ACC: MOL.20060420.0075.
181904	U.S. Census Bureau 2007	U.S. Census Bureau 2007. "Glossary for B" American FactFinder Help. [Washington, D.C.]: U.S. Census Bureau. Accessed July 13, 2007. ACC: MOL.20070719.0380. URL: http://factfinder.census.gov/home/en/epss/glossary_b.html
175729	U.S. Department of Homeland Security 2004	U.S. Department of Homeland Security 2004. National Response Plan. [Washington, D.C.]: U.S. Department of Homeland Security. ACC: MOL.20051020.0132.
182785	UC Davis 2007	Shapiro, A. 2007. "Euphilotes Enoptes." Art Shapiro's Butterfly Site. Davis, California: University of California, Davis. Accessed June 25, 2007. ACC: MOL.20070907.0043. URL: http://butterfly.ucdavis.edu/butterfly/euphilotes/enoptes
176807	Union Pacific 2005	Union Pacific 2005. "Union Pacific Reopens Flood-Damaged Lines." Omaha, Nebraska: Union Pacific. Accessed April 11, 2006. ACC: .20061101.0032. URL: http://www.uprr.com/newsinfo/releases/service/2005/0124_reopen.shtml
148197	United States v. Dann et al. 1985	United States v. Dann et al., 470 U.S. 39; 105 S. Ct. 1058. Decided February 20, 1985. ACC: MOL.20010724.0314.
181387	University of Nevada, Reno 2007	University of Nevada, Reno 2007. "Environmental Health and Safety University of Nevada, Reno, 2006 Annual Report." EH&S Annual Reports. Reno, Nevada: University of Nevada, Reno, Environmental, Health &Safety. Accessed June 18, 2007. ACC: MOL.20070703.0115. URL: http://www.ehs.unr.edu/website/Misc/AnnualReport/tabid/85/Default.aspx
182760	URS Corporation/Potomac-Hudson Engineering 2006	URS Corporation/Potomac-Hudson Engineering 2006. Biological Field Findings Report for Potential Rail Alignments Along the Mina Route. [Las Vegas, Nevada]: URS Corporation/Potomac-Hudson Engineering. ACC: MOL.20070831.0090.
103472	USAF 1999	USAF (U.S. Air Force) 1999. Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement. Washington, D.C.: U.S. Department of the Air Force. ACC: MOL.20010726.0068.
172314	USAF 2003	USAF (U.S. Air Force) 2003. Predator Force Structure Change at Indian Springs Air Force Auxiliary Airfield, Nevada. [Washington, D.C.]: U.S. Air Force. ACC: MOL.20041206.0122.
181607	USAF 2006	USAF (U.S. Air Force) 2006. Environmental Assessment for Increased Depleted Uranium Use on Target 63-10, Nevada Test and Training Range. Nellis Air Force Base, Nevada: U.S. Air Force. ACC: MOL.20070712.0025.
182839	USAF 2006	USAF (U.S. Air Force) 2006. Wing Infrastructure Development Outlook, Final Environmental Assessment, (WINDO) Nellis AFB. Nellis AFB, Nevada: U.S. Air Force.

Reference	Author/Date	Document Title
181492	USAF 2007	USAF (U.S. Air Force) 2007. Final Base Realignment and Closure (BRAC) Environmental Assessment for Realignment of Nellis Air Force Base. Nellis Air Force Base, Nevada: U.S. Air Force. ACC: MOL.20070712.0026.
181899	USAF 2007	USAF (U.S. Air Force) 2007. "Draft Environmental Assessment for the Integrated Natural Resource Management Plan, Nellis Air Force Base and Nevada Test and Training Range, NV." Nellis Air Force Base - Environment. Nellis Air Force Base, Nevada: U.S. Department of the Air Force. Accessed July, 12, 2007. ACC: MOL.20070719.0378. URL: http://www.nellis.af.mil/library/environmental.asp
182840	USAF 2007	USAF (U.S. Air Force) 2007. Draft Range 74 Target Complexes Environmental Assessment Nevada Test and Training Range, Nevada. AFD-070507-031. Nellis AFB, Nevada: U.S. Air Force.
182838	USAF, Air Combat Command 2006	United States Air Force, Air Combat Command 2006. Expeditionary Readiness Training Course Expansion, Final Environmental Assessment, Creech AFB. Nellis Air Force Base, Nevada: U.S. Air Force.
173561	USDA 2004	USDA (U.S. Department of Agriculture) 2004. 2003 Annual Report. Carson City, Nevada: U.S. Department of Agriculture, Rural Development. ACC: MOL.20050505.0109.
173571	USDA 2004	USDA (U.S. Department of Agriculture) 2004. "Nevada State and County Data, Geographic Area Series, Part 28." Volume 1 of 2002 Census of Agriculture. Washington, D.C.: U.S. Department of Agriculture. ACC: MOL.20050505.0112.
181954	USEPA, Office of Transportation and Air Quality 2007	EPA (U.S. Environmental Protection Agency) 2007. "MOBILE6 Vehicle Emission Modeling Software, MOBILE6 Model." Modeling and Inventories. [Washington, D.C]: U.S. Environmental Protection Agency, Office of Transportation and Air Quality. Accessed July 16, 2007. ACC: MOL.20070731.0066. URL: http://www.epa.gov/otaq/m6.htm
181392	USGS 1984	Poland, J.F., ed. 1984. Guidebook to Studies of Land Subsidence Due to Ground-Water Withdrawal. Paris, France: United Nations Educational, Scientific and Cultural Organization. TIC: 259631.
172905	USGS 1995	USGS (U.S. Geological Survey) 1995. "California, Nevada." Ground Water Atlas of the United States. HA 730-B. [Denver, Colorado]: U.S. Geological Survey. Accessed March 1, 2005. ACC: MOL.20050404.0254. URL: http://capp.water.usgs.gov/gwa/gwa.html
174194	USGS 2005	USGS (U.S. Geological Survey) 2005. "2002 USGS National Seismic Hazard Maps, Expanation [Explanation] of April 2003 Revision." USGS National Seismic Hazard Mapping Project. [Denver, Colorado]: U.S. Geological Survey. Accessed January 20, 2005. ACC: MOL.20050822.0187. URL: http://eqhazmaps.usgs.gov/html/wus2002.html
175028	USGS 2005	USGS (U.S. Geological Survey) 2005. "West Nile Virus Maps: Nevada - Human." [Denver, Colorado]: U.S. Geological Survey. Accessed June 22, 2005. ACC: MOL.20050915.0310. URL: http://westnilemaps.usgs.gov/2004/nv_human.html

Reference	Author/Date	Document Title
180064	USGS 2005	USGS (U.S. Geological Survey) 2005. "Water Quality Samples for the Nation." USGS 10302025 Walker R NR Mouth at Walker Lake. [Denver, Colorado]: U.S. Geological Survey, Water Resources. Accessed March 15, 2007. ACC: MOL.20070412.0012. URL: http://nwis.waterdata.usgs.gov/nwis/nwisman/?site_no=10302025 &agency_cd=USGS
176325	USGS 2006	USGS (U.S. Geological Survey) 2006. "Water Resources of the United States." National Water Information System Web Site. Reston, Virginia: U.S. Geological Survey. Accessed February 1, 2006. ACC: MOL.20060301.0385. URL: http://www.usgs.gov/
177618	USGS 2006	USGS (U.S. Geological Survey) 2006. "West Nile Virus Maps: Nevada - Human." Menlo Park, California: U.S. Geological Survey. Accessed September 21, 2006. ACC: MOL.20060925.0026. URL: http://westnilemaps.usgs.gov/nv_human.html
180969	USGS 2006	USGS (U.S. Geological Survey) 2006. "Magnitude/Intensity Comparison." [Denver, Colorado]: U.S. Geological Survey, Earthqualke Hazards Program. Accessed May 15, 2007. ACC: MOL.20070524.0069. URL: http://earthquake.usgs.gov/learning/topics/mag_vs_int.ph
178696	USGS 2007	USGS (U.S. Geological Survey) 2007. "West Nile Virus: Nevada - Human." [Denver, Colorado]: U.S. Geological Survey. Accessed January 19, 2007. ACC: MOL.20070201.0266. URL: http://diseasemaps.usgs.gov/wnv_nv_human.html
148199	USN 1998	USN (U.S. Department of the Navy) 1998. Final Environmental Impact Statement (FEIS) for the Withdrawal of Public Lands for Range Safety and Training Purposes at Naval Air Station (NAS) Fallon, Nevada. Fallon, Nevada: U.S. Department of the Navy. ACC: MOL.20010726.0066.
180759	Van Denburgh and Glancy 1970	Van Denburgh, A.S. and Glancy, P.A 1970. Water-Resources Appraisal of the Columbus Salt Marsh - Soda Spring Valley Area, Mineral and Esmeralda Counties, Nevada. Water Resources - Reconnaissance Series Report 52. [Carson City, Nevada: Nevada Department of Conservation and Natural Resources]. TIC: 217168.
176848	Van Denburgh and Rush 1974	Van Denburgh, A.S. and Rush, F.E. 1974. Water–Resources Appraisal of Railroad and Penoyer Valleys, East–Central Nevada. Water Resources – Reconnaissance Series Report 60. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. TIC: 217169.
173392	van Oss 2003	van Oss, H.G. 2003. "Cement." Volume I of Minerals Yearbook: Metals and Minerals. Reston, Virginia: U.S. Geological Survey. ACC: MOL.20050420.0231.
176798	Varnell et al. 1994	Varnell, J.C.; Wilkinson, D.; O'Brien, W.M., Jr.; Willis, W.M.; Savinsky, D.; Frampton, K.D.; Lucas, M.J.; Plotkin, K.J.; Delano, L.L.; Beacham, C.W.; Witt, J.D.; Green, M.; Pitts, D.; Moore, R.V.; and Wood, R. 1994. Environmental Assessment for Supersonic Flight Over the Nellis Range Complex. Las Vegas, Nevada: U. S. Air Force. ACC: MOL.20060509.0075.

Reference	Author/Date	Document Title
182896	Vietti-Cook 2005	Vietti-Cook, A. L. 2005. Details and Projected Cost of a Demonstration Test of a Full-Scale Spent Nuclear Fuel Rail Transportation Cask Under the Package Performance Study. Commission Voting Record from A. L. Vietti-Cook to Distribution, June 9, 2005, with enclosures.
176456	Welsh et al. 1993	Welsh, S.L.; Atwood, N.D.; Goodrich, S.; and Higgins, L.C., eds. 1993. A Utah Flora. 2nd Edition. Provo, Utah: Brigham Young University, Jones Endowment Fund. TIC: 258096.
176912	Wenker et al. 2006	Wenker, R.; Lanthum, J.G.; Baldrica, A.M.; and Rutson, V. 2006. Programmatic Agreement Among the U.S. Department of Interior Bureau of Land Management, Nevada (BLM); the U.S. Department of Energy (DOE); Surface Transportation Board (STB); and the Nevada State Historic Preservation Office (SHPO) Regarding the Nevada Rail Project (NRP). Agreement that Construction of the NRP Shall be Administered in Accordance with Stipulations in the Agreement to Ensure that Historic Properties Will be Treated to Avoid or Mitigate Effects to the Extent Practicable, Regardless of Surface Ownership, and to Satisfy DOE and BLM Section 106 Responsibilities for All Aspects of the Undertaking. ACC: MOL.20060531.0087.
102216	Western Shoshone National Council v. United States of America 1998	Western Shoshone National Council v. United States of America, No. CV-S-97-23237-HDM (RLH) (U.S. District Court for the District of Nevada). Dated April 23, 1998. Plaintiffs' opposition to defendants' motion to dismiss. TIC: 243975.
181844	Westover 2007	Westover, M. 2007. "Bald Eagles at Lahontan Reservoir." Record of conversation from M. Westover to J. Jeffers (NDOW-Fallon), May 24, 2007. ACC: MOL.20070721.0003.
176454	Whitaker 1992	Whitaker, J.O., Jr. 1992. The Audubon Society Field Guide to North American Mammals. New York, New York: Alfred A. Knopf. TIC: 258125.
174090	Wilbur Smith Associates 2005	Wilbur Smith Associates 2005. Final Report, Rail Transportation Economic Impact Evaluation & Planning. Nye County, Nevada: Nye County, Department of Natural Resources and Federal Facilities. TIC: 257526.
176649	Williams 2003	Williams, R.D. 2003. "Final Programmatic Biological Opinion for Implementation of Proposed Actions Within Desert Tortoise Habitat Administered by the Tonopah Field Station, Nye County, Nevada." Memorandum from R.D. Williams (Nevada Fish and Wildlife Office) to Assistant Field Manager (BLM), March 14, 2003, with attachment. ACC: MOL.20060329.0273.
174439	Williams 2005	Williams, R.D. 2005. "Species List for U.S. Department of Energy Rail Line from near Caliente, Lincoln County, Nevada to Yucca Mountain, Nye County, Nevada." Letter from R.D. Williams (Nevada Fish and Wildlife Service) to R. Sweeney (DOE), March 18, 2005, File No. 1-5-05-SP-439. ACC: MOL.20050714.0434.
182775	Williams 2006	Williams, G. 2006. Decision to Allow the Completion of an Environmental Impact Statement (EIS) for the Transportation of Nuclear Waste on a New Railroad Alignment through the Northern Portion of the Walker River Paiute Reservation. Letter from G. Williams (Walker Paiute Tribe) to G. Lanthrum (DOE/OCRWM), May 4, 2006. ACC: MOL.20070831.0093.

Reference	Author/Date	Document Title
181055	Williams 2007	Williams, R.D 2007. "Species List for U.S. Department of Energy Yucca Mountain Rail Line for the Mina Corridor in Lyon, Mineral, Esmeralda, and Nye Counties and the Caliente Corridor in Lincoln and Nye Counties, Nevada." Letter from R.D. Williams (Nevada Fish and Wildlife) to N.B. Larson (DOE/OCRWM), March 8, 2007, 0312075935, File Nos. 1-5-07-SP-482, 1-5-07-SP-070. ACC: MOL.20070529.0121.
181604	Williams, G. 2007	Williams, G. 2007. "Walker River Paiute Tribe." Letter from G. Williams (Walker River Paiute Tribe) to G. Lanthrum (DOE/OCRWM), April 29, 2007. ACC: MOL.20070716.0129.
176801	Wills 2005	Wills, C.A. 2005. Nevada Test Site Environmental Report 2004. DOE/NV/11718--1080. Las Vegas, Nevada: U.S. Department of Energy, National Nuclear Security Administration, Nevada Site Office. ACC: MOL.20060417.0025.
182285	Wills 2006	Wills, C.A. 2006. Nevada Test Site Environmental Report 2005. DOE/NV/11718--1214-ATT A. Las Vegas, Nevada: .S. Department of Engergy, National Nuclear Security Administration. ACC: MOL.20070718.0188.
179587	Wilson 2007	Wilson, W. 2007. "Re: Fw: YMR Oil and Gas Leases." E-mail from W. Wilson to D. Metcalf, January 8, 2007. ACC: MOL.20070412.0011.
101167	Winograd and Thordarson 1975	Winograd, I.J. and Thordarson, W. 1975. Hydrogeologic and Hydrochemical Framework, South-Central Great Basin, Nevada-California, with Special Reference to the Nevada Test Site. Geological Survey Professional Paper 712-C. Washington, [D.C.]: United States Government Printing Office. ACC: NNA.19870406.0201.
176796	Winslow 2006	Winslow, B.A. 2006. U.S. Department of Energy Proposed Yucca Mountain Railroad Corridor, Impacts on Recreation, Wilderness, Wilderness Study Areas in Lincoln and Nye Counties, Nevada. Caliente, Nevada: U. S. Department of the Interior, Bureau of Land Management. ACC: MOL.20060417.0022.
176905	Workman et al. 2002	Workman, J.B.; Menges, C.M.; Page, W.R.; Ekren, E.B.; Rowley, P.D.; and Dixon, G.L. 2002. Tectonic Map of the Death Valley Ground-Water Model Area, Nevada and California. Miscellaneous Field Studies Map MF-2381-B. Version 1.0. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20060131.0111; MOL.20060131.0112.
174083	WPI 2003	WPI (Worldwide Performance and Innovation) 2003. Fleet Management Facility Performance Specification. FMF Performance Specification, Rev. 3. Richmond, Virginia: Worldwide Performance and Innovation. ACC: MOL.20060314.0160.
165987	WRCC 2002	WRCC (Western Regional Climate Center) [2002]. Western U.S. Historical Summaries by State [Arizona, California, Idaho, Nevada, New Mexico, Oregon, Utah, and Washington]. [Reno, Nevada]: Western Regional Climate Center, Desert Research Institute. TIC: 253357.
104792	YMP 1990	YMP (Yucca Mountain Site Characterization Project) 1990. Preliminary Rail Access Study. YMP/89-16. Las Vegas, Nevada: Yucca Mountain Site Characterization Office. ACC: MOL.19980817.0094.

Reference	Author/Date	Document Title
104735	YMP 1991	YMP (Yucca Mountain Site Characterization Project) 1991. The Nevada Railroad System: Physical, Operational, and Accident Characteristics. YMP 91-19. Las Vegas, Nevada: Yucca Mountain Site Characterization Office. ACC: NNA.19920608.0151.
102188	YMP 1995	YMP (Yucca Mountain Site Characterization Project) 1995. Reclamation Implementation Plan. YMP/91-14, Rev. 1. Las Vegas, Nevada: Yucca Mountain Site Characterization Office. ACC: MOL.19970109.0256.
101483	Yuan et al. 1995	Yuan, Y.C.; Chen, S.Y.; Biwer, B.M.; and LePoire, D.J. 1995. RISKIND - A Computer Program for Calculating Radiological Consequences and Health Risks from Transportation of Spent Nuclear Fuel. ANL/EAD-1. Argonne, Illinois: Argonne National Laboratory. ACC: HQV.19930517.0008.
181594	Zuber 2007	Zuber, S. 2007. "Re: FW: Law Enforcement on the Walker River Reservation." E-mail from S. Zuber (BLM) to M. Arcaya, June 12, 2007. ACC: MOL.20070705.0083.

Reference	Data Tracking Number	Data Title
DATA		
176781	MO0603GSCSSGEO.000	MO0603GSCSSGEO.000. Soil Survey Geographic (SSURGO) Database for Virgin River Area Nevada and Arizona, Parts of Clark and Lincoln Counties Nevada, and Mohave County, Arizona. Submittal date: 03/31/2006.
176978	MO0604GISBLCAM.000	MO0604GISBLCAM.000. BLM, Lincoln County Conservation, Recreation, and Development Act Map. Submittal date: 04/05/2006.
176899	MO0604GISNVFL3.000	MO0604GISNVFL3.000. NVFault3. Submittal date: 04/05/2006.
176979	MO0605GISGNISN.000	MO0605GISGNISN.000. GNIS - Nevada Springs. Submittal date: 05/03/2006.
176976	MO0605GISNWIDQ.000	MO0605GISNWIDQ.000. NWI - National Wetlands Inventory Data by Quadrangle. Submittal date: 05/03/2006.
177713	MO0607LFAFUS96.000	MO0607LFAFUS96.000. Location of Faults and Associated Folds in the United States (1996). Submittal date: 07/18/2006.
177292	MO0607NDWRWELD.000	MO0607NDWRWELD.000. Nevada Division of Water Resources Well Data. Submittal date: 07/18/2006.
177709	MO0607NEI2002D.000	MO0607NEI2002D.000. National Emissions Inventory 2002 All-Sector Summary Data for Criteria Air Pollutants. Submittal date: 07/18/2006.
177714	MO0607NHDFLM06.000	MO0607NHDFLM06.000. National Hydrological Data - FLOWLINE_MERGE(3-22-06). Submittal date: 07/18/2006.
177712	MO0607NHDPOINT.000	MO0607NHDPOINT.000. National Hydrological Dataset Point Information for the State of Nevada. Submittal date: 07/18/2006.
177710	MO0607NHDWBDYD.000	MO0607NHDWBDYD.000. National Hydrological Dataset Waterbody Information for the State of Nevada. Submittal date: 07/18/2006.
177291	MO0607NPWINFSN.000	MO0607NPWINFSN.000. Non Permitted Well Information for the State of Nevada. Submittal date: 07/18/2006.
177293	MO0607PWMAR06D.000	MO0607PWMAR06D.000. Two New Existing Wells Within Dry Lake Valley. Submittal date: 07/18/2006.
177294	MO0607USGSWNVD.000	MO0607USGSWNVD.000. USGS Existing Wells Location Information for the State of Nevada. Submittal date: 07/18/2006.
174399	MO9901COV97208.000	MO9901COV97208.000. Coverage: NVLNDCVU. Submittal date: 01/21/1999.

APPENDIX A

FEDERAL REGISTER NOTICES

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APPENDIX A

FEDERAL REGISTER NOTICES

This appendix contains copies of *Federal Register* (*FR*) notices applicable to *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor* (DOE/EIS-0250F-S2D) and *Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0369D).

A.1 68 *FR* 74951, December 29, 2003

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DEPARTMENT OF ENERGY

Notice of Preferred Nevada Rail Corridor

AGENCY: Office of Civilian Radioactive Waste Management, U.S. Department of Energy.

ACTION: Notice of the Preferred Nevada Rail Corridor.

SUMMARY: On July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. The Department of Energy (DOE or Department) is now responsible for planning and implementing a transportation program for the shipment of spent nuclear fuel and high-level radioactive waste, in the event the Nuclear Regulatory Commission authorizes receipt and possession of spent nuclear fuel and high-level radioactive waste at Yucca Mountain.

In the Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS–0250F) (Final EIS), the Department evaluated various modes of transportation including mostly rail, mostly legal-weight truck and mostly heavy-haul truck. The Department identified the mostly rail alternative as its preferred mode of transportation in the Final EIS.

In the event that DOE selects the mostly rail alternative, a rail line would need to be constructed to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada. Accordingly, the Final EIS evaluated five rail corridors [1]—Caliente, Carlin, Caliente-Chalk Mountain, Jean, and Valley Modified. The Department, however, did not identify a preferred rail corridor in the Final EIS, but indicated it would do so at least 30 days before making any decisions on the selection of a corridor.

The Department is now announcing the Caliente rail corridor as its preferred corridor in which to construct a rail line in Nevada, and Carlin as a secondary preference. If the Department adopts the mostly rail mode in Nevada, DOE will issue a Record of Decision selecting a rail corridor no sooner than 30 days after publication of this preference announcement. If the Department selects a rail corridor, DOE will issue a Notice of Intent in the **Federal Register** to initiate the preparation of a rail alignment EIS under the National Environmental Policy Act (NEPA) to consider alternative alignments within the selected corridor for construction of a rail line. Under this scenario, the Department would anticipate holding public scoping meetings in early-to-mid February, 2004. The exact date, time and locations of the meetings would be announced in the Notice of Intent.

FOR FURTHER INFORMATION CONTACT: To obtain a copy of the Final EIS or for further information contact: Ms. Robin Sweeney, Office of National Transportation, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, Telephone 1–800–967–3477. The Final EIS is available on the Internet at *ocrwm.doe.gov*.

For further information regarding the DOE NEPA process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (EH–42), U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone (202) 586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Background

In the Final EIS, DOE analyzed a Proposed Action to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain. As part of the Proposed Action, DOE analyzed the potential impacts of transporting spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites to the Yucca Mountain site.[2] Transportation

[1] A corridor is a strip of land, approximately 400 meters (0.25 mile) wide, that encompasses one of several possible routes through which DOE could build a branch rail line. An alignment is the specific location of a rail line in a corridor.

[2] Additional sites (primarily research reactors) will ship spent nuclear fuel to DOE for disposal at the repository. Shipment from these sites to DOE is covered under a separate Environmental Impact Statement, *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environment Restoration and Waste Management Programs Environmental Impact Statement* (DOE/EIS–0203; April 1995), and associated Record of Decision (June 1, 1995; 60 FR 28680)). Two of these research reactors were recently closed and the spent fuel removed. Adding

Continued

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could be accomplished using a variety of modes, including legal-weight truck, rail, heavy-haul truck, and possibly barge.

The Final EIS examined various national transportation scenarios and Nevada transportation implementing alternatives to estimate the range of potential environmental impacts that could occur. Two national transportation scenarios, referred to as the mostly legal-weight truck [3] scenario and the mostly rail [4] scenario, and three Nevada implementing alternatives, referred to as the legal-weight truck alternative, the rail alternative, and the heavy-haul truck [5] alternative are evaluated. In the Final EIS, the Department identified the mostly rail scenario as its preferred mode of transportation, both nationally and in the State of Nevada.

Implementation of the mostly rail scenario would require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada. Accordingly, the Final EIS evaluated five rail corridors—Caliente, Carlin, Caliente-Chalk Mountain [6], Jean and Valley Modified. The Department, however, did not identify a preferred rail corridor in the Final EIS.

Preferred Nevada Rail Corridor

After consideration of public comments, the analyses of the Final EIS and other information, the Department has identified the Caliente corridor as its preferred rail corridor with the Carlin Corridor as the secondary preference. The Department's preference for Caliente takes into consideration many factors, including its more remote location, the diminished likelihood of land use conflicts, concerns raised by Nevadans, and national security issues raised by the U.S. Air Force on the Caliente-Chalk Mountain corridor. Approximately one-third of the Caliente and Carlin corridors overlap. Since the Carlin corridor has similar attributes overall, DOE has identified the Carlin corridor as the secondary preference in the event the Caliente corridor is not selected.

If the Department adopts the mostly rail mode, DOE will issue a Record of Decision selecting a rail corridor no sooner than 30 days after publication of this preference announcement. If the Department selects a rail corridor, DOE will issue a Notice of Intent in the **Federal Register** to initiate the preparation of a rail alignment EIS under NEPA to consider alternative alignments within the selected corridor for construction of a rail line.

Issued in Washington, DC, December 23, 2003.

Margaret S.Y. Chu,

Director, Office of Civilian Radioactive Waste Management.

[FR Doc. 03–32029 Filed 12–24–03; 8:45 am]

BILLING CODE 6450–01–P

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these sites to the 77 sites listed above results in a total of 129 sites with spent nuclear fuel or high-level waste destined for repository disposal.

[3] A truck with a gross vehicle weight (truck and cargo) of less than 80,000 pounds having dimensions, axle spacing, and if applicable, axle loads within Federal and state limits.

[4] Rail is defined to include vehicles, such as locomotives and specialized freight cars, with steel wheels running on steel rails using standard gauge that is compatible with the U.S. freight rail network.

[5] A heavy-haul truck is an overweight, overdimension vehicle that must have permits from state highway authorities to use public highways. An intermodal transfer station is a facility at the junction of rail and road transportation used to transfer shipping casks containing radioactive materials from rail to truck, and empty casks from truck to rail.

[6] As stated in the Final EIS, DOE considers the Caliente-Chalk Mountain rail corridor to be non-preferred, because of adverse effects on the security and operations of the Nevada Test and Training Range.

A.2 68 FR 74965, December 29, 2003

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DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[NV–930–1430–ET; NVN–77880; 4–08807]

Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice.

SUMMARY: The Bureau of Land Management has received a request from the Department of Energy to withdraw 308,600 acres of public land from surface entry and mining for a period of 20 years to evaluate the land for the potential construction, operation, and maintenance of a branch rail line for the transportation of spent nuclear fuel and high-level radioactive waste in the event the Nuclear Regulatory Commission authorizes a geologic repository at Yucca Mountain as provided for under the Nuclear Waste Policy Act of 1982, as amended. This notice segregates the land from surface entry and mining for up to 2 years while various studies and analyses are made to support a final decision on the withdrawal application.

DATES: Comments and requests for a meeting should be received on or before March 29, 2004.

ADDRESSES: Comments and meeting requests should be sent to the Nevada State Director, BLM, 1340 Financial Blvd., PO Box 12000, Reno, Nevada 89520–0006.

FOR FURTHER INFORMATION CONTACT: Dennis J. Samuelson, BLM Nevada State Office, 775–861–6532.

SUPPLEMENTARY INFORMATION: The Department of Energy has filed an application (NVN 77880) to withdraw the following described public land from settlement, sale, location, or entry under the general land laws, including the mining laws and the mineral leasing laws, subject to valid existing rights:

Mount Diablo Meridian

A corridor one mile in width that contains a portion of, or are wholly encompassed within, the following sections:

10S 46E 01	1N 55E 24	2N 58E 03	3N 48E 35	4N 49.2E 35
10S 46E 02	1N 55E 25	2N 58E 04	3N 48E 36	4N 49.2E 36
10S 46E 12	1N 55E 26	2N 58E 05	3N 49E 02	4N 49E 24
10S 46E 13	1N 55E 27	2N 58E 07	3N 49E 03	4N 49E 25
10S 47E 06	1N 55E 28	2N 58E 08	3N 49E 04	4N 49E 26
10S 47E 07	1N 55E 29	2N 58E 09	3N 49E 05	4N 49E 33
10S 47E 08	1N 55E 30	2N 58E 13	3N 49E 07	4N 49E 34
10S 47E 09	1N 55E 31	2N 58E 17	3N 49E 08	4N 49E 35
10S 47E 15	1N 55E 32	2N 58E 18	3N 49E 09	4N 49E 36
10S 47E 16	1N 55E 33	2N 58E 19	3N 49E 10	4N 50E 30
10S 47E 17	1N 56E 01	2N 58E 20	3N 49E 17	4N 50E 31
10S 47E 18	1N 56E 02	2N 58E 21	3N 49E 18	4N 50E 32

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10S 47E 21	1N 56E 09	2N 58E 22	3N 49E 19	4N 60E 20
10S 47E 22	1N 56E 10	2N 58E 23	3N 50E 02	4N 60E 21
10S 47E 23	1N 56E 11	2N 58E 24	3N 50E 03	4N 60E 22
10S 47E 26	1N 56E 12	2N 58E 25	3N 50E 04	4N 60E 23
10S 47E 27	1N 56E 13	2N 58E 26	3N 50E 10	4N 60E 24
10S 47E 28	1N 56E 14	2N 58E 27	3N 50E 11	4N 60E 25
10S 47E 34	1N 56E 15	2N 58E 28	3N 50E 14	4N 60E 26
10S 47E 35	1N 56E 16	2N 58E 29	3N 50E 15	4N 60E 27
11S 47E 01	1N 56E 17	2N 58E 30	3N 50E 22	4N 60E 28
11S 47E 02	1N 56E 18	2N 58E 31	3N 50E 23	4N 60E 29
11S 47E 03	1N 56E 19	2N 58E 32	3N 50E 24	4N 60E 31
11S 47E 11	1N 56E 20	2N 59E 02	3N 50E 25	4N 60E 32
11S 47E 12	1N 56E 21	2N 59E 03	3N 50E 26	4N 60E 33
11S 47E 13	1N 57E 03	2N 59E 04	3N 50E 35	4N 61E 19
11S 47E 14	1N 57E 04	2N 59E 08	3N 50E 36	4N 61E 20
11S 47E 24	1N 57E 05	2N 59E 09	3N 58E 24	4N 61E 28
11S 47E 25	1N 57E 06	2N 59E 10	3N 58E 25	4N 61E 29
11S 48E 07	1N 62E 01	2N 59E 16	3N 58E 26	4N 61E 30
11S 48E 08	1N 62E 12	2N 59E 17	3N 58E 33	4N 61E 32
11S 48E 09	1N 63E 06	2N 59E 18	3N 58E 34	4N 61E 33
11S 48E 10	1N 63E 07	2N 59E 19	3N 58E 35	4N 61E 34
11S 48E 11	1N 63E 08	2N 59E 20	3N 58E 36	4S 43E 01
11S 48E 14	1N 63E 17	2N 60E 01	3N 59E 12	4S 43E 02
11S 48E 15	1N 63E 18	2N 61E 06	3N 59E 13	4S 43E 03
11S 48E 16	1N 63E 19	2N 62E 01	3N 59E 14	4S 43E 10
11S 48E 17	1N 63E 20	2N 62E 02	3N 59E 19	4S 43E 11
11S 48E 18	1N 63E 21	2N 62E 03	3N 59E 20	4S 43E 12
11S 48E 19	1N 63E 26	2N 62E 04	3N 59E 21	4S 43E 14
11S 48E 20	1N 63E 27	2N 62E 05	3N 59E 22	4S 43E 15
11S 48E 21	1N 63E 28	2N 62E 10	3N 59E 23	4S 43E 22
11S 48E 22	1N 63E 29	2N 62E 11	3N 59E 24	4S 43E 23
11S 48E 27	1N 63E 30	2N 62E 12	3N 59E 25	4S 43E 26
11S 48E 28	1N 63E 32	2N 62E 13	3N 59E 26	4S 43E 27
11S 48E 29	1N 63E 33	2N 62E 14	3N 59E 27	4S 43E 28
11S 48E 30	1N 63E 34	2N 62E 15	3N 59E 28	4S 43E 33
11S 48E 31	1N 63E 35	2N 62E 24	3N 59E 29	4S 43E 34
11S 48E 32	1S 43E 01	2N 62E 25	3N 59E 30	4S 67E 01
11S 48E 33	1S 43E 02	2N 62E 36	3N 59E 33	4S 67E 02
11S 48E 34	1S 43E 03	2N 63E 07	3N 59E 34	4S 67E 04
12S 48E 02	1S 43E 04	2N 63E 18	3N 59E 35	4S 67E 05
12S 48E 03	1S 43E 09	2N 63E 19	3N 59E 36	4S 67E 06
12S 48E 04	1S 43E 10	2N 63E 30	3N 60E 05	4S 67E 07
12S 48E 05	1S 43E 11	2N 63E 31	3N 60E 06	4S 67E 08
12S 48E 06	1S 43E 12	2S 43E 03	3N 60E 07	4S 67E 09
12S 48E 09	1S 43E 13	2S 43E 04	3N 60E 08	4S 67E 12
12S 48E 10	1S 43E 14	2S 43E 09	3N 60E 18	4S 68E 06
12S 48E 11	1S 43E 15	2S 43E 10	3N 60E 19	4S 68E 07
12S 48E 13	1S 43E 16	2S 43E 15	3N 60E 20	4S 68E 08
12S 48E 14	1S 43E 21	2S 43E 16	3N 60E 21	4S 68E 17
12S 48E 15	1S 43E 22	2S 43E 20	3N 60E 22	4S 68E 18
12S 48E 23	1S 43E 23	2S 43E 21	3N 60E 25	5S 43E 03
12S 48E 24	1S 43E 24	2S 43E 22	3N 60E 26	5S 43E 04
12S 48E 25	1S 43E 25	2S 43E 27	3N 60E 27	5S 43E 05
12S 48E 26	1S 43E 27	2S 43E 28	3N 60E 28	5S 43E 08
12S 48E 35	1S 43E 28	2S 43E 29	3N 60E 29	5S 43E 09
12S 48E 36	1S 43E 33	2S 43E 32	3N 60E 30	5S 43E 15
12S 49E 31	1S 43E 34	2S 43E 33	3N 60E 31	5S 43E 16
13S 48E 09	1S 44E 18	2S 43E 34	3N 60E 34	5S 43E 17
13S 48E 10	1S 44E 19	2S 43E 35	3N 60E 35	5S 43E 21
13S 48E 14	1S 44E 29	2S 43E 36	3N 60E 36	5S 43E 22
13S 48E 15	1S 44E 30	2S 44E 04	3N 61E 02	5S 43E 27
13S 48E 16	1S 44E 31	2S 44E 05	3N 61E 03	5S 43E 28
13S 48E 22	1S 44E 32	2S 44E 06	3N 61E 04	5S 43E 33
13S 48E 23	1S 51.2E 06	2S 44E 08	3N 61E 09	5S 43E 34
13S 48E 24	1S 51.2E 07	2S 44E 09	3N 61E 10	5S 43E 35
13S 48E 25	1S 51.2E 08	2S 44E 16	3N 61E 11	6S 43E 01
13S 48E 26	1S 51.2E 17	2S 44E 17	3N 61E 12	6S 43E 02
13S 48E 36	1S 51.2E 18	2S 44E 20	3N 61E 13	6S 43E 03
13S 49E 13	1S 51.2E 19	2S 44E 21	3N 61E 14	6S 43E 10
13S 49E 14	1S 51.2E 20	2S 44E 22	3N 61E 22	6S 43E 11
13S 49E 19	1S 51.2E 28	2S 44E 27	3N 61E 23	6S 43E 12
13S 49E 22	1S 51.2E 29	2S 44E 28	3N 61E 24	6S 43E 13
13S 49E 23	1S 51.2E 30	2S 44E 32	3N 61E 25	6S 43E 14
13S 49E 24	1S 51.2E 31	2S 44E 33	3N 61E 26	6S 43E 15
13S 49E 25	1S 51.2E 32	2S 44E 34	3N 61E 27	6S 43E 23
13S 49E 26	1S 51.2E 33	2S 51.2E 04	3N 61E 28	6S 43E 24

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13S 49E 27	1S 51E 01	2S 51.2E 05	3N 61E 29	6S 43E 25
13S 49E 29	1S 51E 02	2S 51.2E 06	3N 61E 30	6S 43E 26
13S 49E 30	1S 51E 03	2S 51.2E 07	3N 61E 31	6S 43E 27
13S 49E 31	1S 51E 10	2S 51.2E 08	3N 61E 32	6S 43E 34
13S 49E 32	1S 51E 11	2S 51.2E 09	3N 61E 33	6S 43E 35
13S 49E 33	1S 51E 12	2S 51.2E 16	3N 61E 34	6S 43E 36
13S 49E 34	1S 51E 13	2S 51.2E 17	3N 61E 35	6S 44E 06
13S 49E 35	1S 51E 14	2S 51.2E 18	3N 61E 36	6S 44E 07
13S 49E 36	1S 51E 24	2S 51.2E 20	3N 62E 18	6S 44E 08
13S 50E 30	1S 51E 25	2S 51.2E 21	3N 62E 19	6S 44E 15
13S 50E 31	1S 51E 36	2S 51E 01	3N 62E 20	6S 44E 16
14S 49E 01	1S 52E 31	2S 51E 12	3N 62E 28	6S 44E 17
14S 49E 02	1S 53E 25	2S 52E 06	3N 62E 29	6S 44E 18
14S 49E 03	1S 53E 35	2S 52E 07	3N 62E 30	6S 44E 20
14S 49E 04	1S 53E 36	2S 52E 08	3N 62E 31	6S 44E 21
14S 49E 05	1S 54E 01	2S 52E 11	3N 62E 32	6S 44E 22
14S 49E 08	1S 54E 10	2S 52E 12	3N 62E 33	6S 44E 27
14S 49E 09	1S 54E 11	2S 52E 13	3N 62E 34	6S 44E 28
14S 49E 10	1S 54E 12	2S 52E 14	3N 62E 35	6S 44E 31
14S 49E 11	1S 54E 13	2S 52E 15	3S 43E 01	6S 44E 33
14S 49E 12	1S 54E 14	2S 52E 16	3S 43E 02	6S 44E 34
14S 49E 15	1S 54E 15	2S 52E 17	3S 43E 03	7S 43E 01
14S 49E 16	1S 54E 16	2S 52E 18	3S 43E 04	7S 43E 02
14S 50E 06	1S 54E 20	2S 52E 19	3S 43E 10	7S 43E 03
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1N 43E 25	1S 54E 23	2S 52E 22	3S 43E 13	7S 43E 13
1N 43E 26	1S 54E 28	2S 52E 23	3S 43E 14	7S 43E 14
1N 43E 27	1S 54E 29	2S 53E 01	3S 43E 15	7S 43E 24
1N 43E 34	1S 54E 30	2S 53E 02	3S 43E 22	7S 43E 25
1N 43E 35	1S 54E 31	2S 53E 03	3S 43E 23	7S 44E 03
1N 43E 36	1S 55E 05	2S 53E 07	3S 43E 24	7S 44E 04
1N 44E 19	1S 55E 06	2S 53E 08	3S 43E 25	7S 44E 05
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1N 44E 22	1S 63E 02	2S 53E 11	3S 43E 34	7S 44E 08
1N 44E 23	1S 63E 11	2S 53E 15	3S 43E 35	7S 44E 09
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1N 44E 30	1S 64E 18	2S 65E 11	3S 44E 17	7S 44E 19
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1N 45E 20	1S 64E 20	2S 65E 13	3S 44E 19	7S 44E 22
1N 45E 25	1S 64E 21	2S 65E 14	3S 44E 20	7S 44E 23
1N 45E 26	1S 64E 22	2S 66E 01	3S 44E 30	7S 44E 25
1N 45E 27	1S 64E 23	2S 66E 02	3S 44E 31	7S 44E 26
1N 45E 28	1S 64E 24	2S 66E 03	3S 67E 01	7S 44E 27
1N 45E 29	1S 64E 25	2S 66E 04	3S 67E 02	7S 44E 29
1N 45E 30	1S 64E 26	2S 66E 05	3S 67E 03	7S 44E 30
1N 45E 32	1S 64E 27	2S 66E 07	3S 67E 10	7S 44E 31
1N 45E 33	1S 65E 19	2S 66E 08	3S 67E 11	7S 44E 32
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1N 45E 35	1S 65E 27	2S 66E 10	3S 67E 13	7S 44E 35
1N 45E 36	1S 65E 28	2S 66E 11	3S 67E 14	7S 44E 36
1N 46E 25	1S 65E 29	2S 66E 12	3S 67E 15	8S 44E 01
1N 46E 26	1S 65E 30	2S 66E 13	3S 67E 16	8S 44E 02
1N 46E 27	1S 65E 32	2S 66E 14	3S 67E 21	8S 44E 03
1N 46E 28	1S 65E 33	2S 66E 16	3S 67E 22	8S 44E 04
1N 46E 29	1S 65E 34	2S 66E 17	3S 67E 23	8S 44E 05
1N 46E 30	1S 65E 35	2S 66E 18	3S 67E 24	8S 44E 09
1N 46E 31	2N 47E 25	2S 66E 20	3S 67E 25	8S 44E 10
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1N 46E 35	2N 48E 03	2S 67E 09	3S 67E 32	8S 44E 14
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1N 47E 10	2N 48E 16	2S 67E 18	3S 68E 12	8S 44E 24
1N 47E 11	2N 48E 17	2S 67E 19	3S 68E 19	8S 44E 25
1N 47E 12	2N 48E 18	2S 67E 20	3S 68E 30	8S 44E 26
1N 47E 14	2N 48E 19	2S 67E 21	3S 68E 31	8S 44E 36

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1N 47E 15	2N 48E 20	2S 67E 22	3S 69E 03	8S 45E 06
1N 47E 16	2N 48E 21	2S 67E 23	3S 69E 04	8S 45E 07
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1N 47E 21	2N 48E 30	2S 67E 25	3S 69E 06	8S 45E 19
1N 47E 22	2N 48E 31	2S 67E 26	3S 69E 07	8S 45E 20
1N 47E 28	2N 50E 01	2S 67E 29	3S 69E 08	8S 45E 28
1N 47E 29	2N 50E 02	2S 67E 30	3S 69E 09	8S 45E 29
1N 47E 30	2N 50E 11	2S 67E 35	3S 69E 10	8S 45E 30
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1N 50E 12	2N 50E 24	2S 68E 25	3S 69E 15	9S 45E 02
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1N 51E 19	2N 57E 13	2S 68E 33	3S 70E 11	9S 45E 12
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1N 51E 22	2N 57E 23	2S 68E 36	3S 70E 14	9S 45E 24
1N 51E 26	2N 57E 24	2S 69E 30	3S 70E 15	9S 46E 07
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1N 55E 22	2N 57E 36	3N 48E 27	4N 49.2E 27	9S 46E 33
1N 55E 23	2N 58E 02	3N 48E 34	4N 49.2E 34	9S 46E 34
				9S 46E 35
				9S 46E 36

The area described contains 308,600 acres in Clark, Esmeralda, Lincoln, and Nye Counties.

This withdrawal approximates the land encompassed by the Caliente rail corridor as described in the Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, February 2002. The purpose of the withdrawal is to evaluate the land for the potential construction and operation of a branch rail line for the transportation of spent nuclear fuel and high-level radioactive waste in the event the Nuclear Regulatory Commission authorizes a geologic repository at Yucca Mountain as provided for under the Nuclear Waste Policy Act of 1982, as amended.

For a period of 90 days from the date of publication of this notice, all persons who wish to submit comments, suggestions, or objections in connection with the proposed withdrawal may present their views in writing to the Nevada State Director of the Bureau of Land Management.

Notice is hereby given that there will be at least one public meeting in connection with the proposed withdrawal to be announced at a later date. A notice of the time, place, and date will be published in the **Federal Register** and a local newspaper at least 30 days before the scheduled date of a meeting.

Comments, including names and street addresses of commenters, will be available for public review at the Nevada State Office, 1340 Financial Boulevard, Reno, Nevada, during regular business hours 7:30 a.m. to 4:30 p.m., Monday through Friday, except holidays. Individual respondents may request confidentiality. If you wish to hold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses will be made available for public inspection in their entirety.

The application will be processed in accordance with the regulations set forth in 43 CFR Part 2300.

For a period of 2 years from December 29, 2003, in accordance with 43 CFR 2310.2(a), the lands described in this notice will be segregated from surface entry and mining, unless the application is denied or canceled, or the withdrawal is approved prior to that date. Other uses which may be permitted during this segregative period are rights-of-way, leases, and permits as long as they do not conflict with the proposed withdrawal.

Dated: December 19, 2003.

Margaret L. Jensen,

Deputy State Director, Natural Resources, Lands, and Planning.

[FR Doc. 03–31901 Filed 12–24–03; 8:45 am]

BILLING CODE 4310–HC–P

A.3 69 FR 18557, April 8, 2004

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DEPARTMENT OF ENERGY

Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV

AGENCY: Office of Civilian Radioactive Waste Management, U.S. Department of Energy.

ACTION: Record of decision.

SUMMARY: On July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. In the event the Nuclear Regulatory Commission (NRC) authorizes construction of the repository and receipt and possession of spent nuclear fuel and high-level radioactive waste at Yucca Mountain, the Department of Energy (Department or DOE) would be responsible for transporting these materials to the Yucca Mountain Repository as part of its obligations under the Nuclear Waste Policy Act (NWPA). Pursuant to the NWPA and the National Environmental Policy Act (NEPA), DOE issued the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (DOE/EIS–0250F, February 2002) (Final EIS). That document analyzed the environmental impacts of the proposed action of constructing, operating and monitoring, and eventually closing a geologic repository for the disposal of 70,000 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste at Yucca Mountain, as well as of transporting spent nuclear fuel and high-level radioactive waste from commercial and DOE sites to the Yucca Mountain site.

In preparing the Final EIS, DOE initiated public scoping in 1995, and subsequently issued for public comment a Draft EIS in 1999 and a Supplement to the Draft EIS in 2000. During the 199-day public comment period on the Draft EIS, DOE held public hearings in 21

locations across the country, 10 of which were held throughout the State of Nevada. An additional hearing was convened in Las Vegas for members of Native American Tribes in the region. During the 56–day public comment period on the Supplement to the Draft EIS, DOE held three public hearings in Nevada. The Department received more than 13,000 comments on the Draft EIS and the Supplement to the Draft EIS; about 3,600 of these comments addressed transportation related matters.

DOE is now in the process of preparing an application to the Nuclear Regulatory Commission (NRC) seeking authorization to construct the repository. In addition, in order to be in a position to transport waste to the repository should the NRC approve construction and waste receipt, DOE must proceed with certain decisions relating to the transportation of this material. In particular, the Department has decided to select the mostly rail scenario analyzed in the Final EIS as the transportation mode both on a national basis and in the State of Nevada. Under the mostly rail scenario, the Department would rely on a combination of rail, truck and possibly barge to transport to the repository site at Yucca Mountain up to 70,000 MTHM of spent nuclear fuel and high-level radioactive waste, with most of the spent nuclear fuel and high-level radioactive waste being transported by rail. This will ultimately require construction of a rail line in Nevada to the repository. In addition, the Department has decided to select the Caliente rail corridor [1] in which to examine potential alignments within which to construct that rail line. Should the Department select an alignment within that corridor, it will obtain all necessary regulatory approvals before beginning construction.

ADDRESSES: Copies of the Final EIS and this Record of Decision may be obtained by calling or mailing a request to: Ms. Robin Sweeney, Office of National Transportation, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, Telephone 1–800–967–3477. The Final EIS, including the Readers Guide and Summary, is available via the Internet at *http://www.ocrwm.doe.gov/ documents/feis_a/index.htm*. This Record of Decision is available at *http://www.ocrwm.doe.gov* under "What's New". Questions regarding the Final EIS or this Record of Decision can be submitted by calling or mailing them to Ms. Robin Sweeney at the above phone number or address.

FOR FURTHER INFORMATION CONTACT: For general information regarding the DOE National Environmental Policy Act (NEPA) process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (EH–42), U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone 202–586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Transportation-Related Decisions

The analyses in the Final EIS provide the bases for the following three decisions under NEPA related to the establishment of a transportation program under which the Department would transport spent nuclear fuel and high-level radioactive waste to a repository at Yucca Mountain:

1. Outside Nevada, the selection of a national mode of transportation scenario (mostly rail or mostly legal-weight truck),
2. In Nevada, the selection among transportation mode scenarios (mostly rail, mostly legal-weight truck, or mostly heavy-haul truck with an associated intermodal transfer station), and
3. In Nevada, if the mostly rail scenario or mostly heavy-haul truck scenario were selected, the selection among rail corridor implementing alternatives, or heavy-haul truck route implementing alternatives with use of an associated intermodal transfer station.

See Figure 2–5 on page 2–7 of the Final EIS for a graphical depiction of the different transportation scenarios and implementing alternatives.

Part I. Record of Decision for Mode of Transportation

Proposed Action and Transportation Mode Scenarios Considered in the Final EIS

The Final EIS examines a Proposed Action under which DOE would ship spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites [2] to the Yucca Mountain Repository. The Final EIS considers the potential environmental impacts of transporting spent nuclear fuel and high-level radioactive waste to the repository under a variety of modes, including legal-weight truck, rail, heavy-haul truck, and possibly barge. The Final EIS also considers the environmental impacts of two No-Action Alternatives, one under which spent nuclear fuel and high-level radioactive waste would remain at the 72 commercial and five DOE sites under institutional control for at least 10,000 years, and one under which these materials would remain at the 77 sites in perpetuity, but under institutional control for only 100 years.

At the outset, we note that over the past 30 years, more than 2,700 shipments of spent nuclear fuel have been completed, none of which has resulted in an identified injury caused by the release of radioactive material. That basic fact provides important context for our decisionmaking today.

The Final EIS examines various national transportation scenarios and Nevada transportation implementing alternatives to reflect the range of potential environmental impacts that could occur. Two national transportation scenarios, referred to as the "mostly legal-weight truck" scenario and the "mostly rail" scenario, and three Nevada scenarios, referred to as the legal-weight truck scenario, the rail scenario, and the heavy-haul truck scenario, were evaluated. The three broad scenarios discussed below represent the combinations of the scenarios and implementing alternatives as analyzed in the Final EIS.

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[1] A corridor is a strip of land, approximately 0.25 miles (400 meters) wide, that encompasses one of several possible routes through which DOE could build a rail line. An alignment is the specific location of a rail line in a corridor.

[2] Fifty-four additional sites (primarily domestic research reactors) were expected to ship spent nuclear fuel to two DOE sites prior to disposal at the repository. DOE plans to consolidate these materials at the two DOE sites are independent of the decisions relating to a repository at Yucca Mountain. Shipments from these sites to DOE sites were analyzed in the "Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement" (PEIS) (DOE/EIS–0202–F; April 1995), and associated Records of Decision (June 1, 1995; 60 FR 28680 and March 8, 1996; 61 FR 9441). The direct impacts of this consolidation are not included in the analysis of the alternatives analyzed in the Final EIS for the repository, because they would occur whether or not DOE proceeds with the repository at Yucca Mountain. Since the PEIS was published, three research reactors have closed. As provided for in the Record of Decision (ROD) for the PEIS, spent nuclear fuel from one reactor was sent to the Savannah River Site and fuel from another reactor was sent to the Idaho National Engineering and Environmental Laboratory (INEEL). Fuel from the third reactor, which the ROD for the PEIS anticipated would be consolidated at INEEL, was sent on an interim basis to the United States Geological Survey (USGS) site in Lakewood, Colorado (which also was one of the fifty-four sites analyzed in the PEIS). It is still ultimately expected to be consolidated at INEEL as provided in the ROD for the PEIS, whence it will be shipped to the repository. The fuel that went to USGS is within the amounts analyzed by the PEIS as going from USGS to INEEL. Moreover, since the change in interim storage plans does not affect the shipment of fuel to Yucca Mountain, it does not affect the transportation analysis in the Final EIS for the repository.

Mostly Rail to the Yucca Mountain Repository—Preferred Mode of Transportation

Under the preferred mode of transportation as analyzed in the Final EIS (the mostly rail scenario), DOE would ship most of the spent nuclear fuel and high-level radioactive waste from the 77 sites to the Yucca Mountain Repository by rail. DOE would construct a rail line in one of five rail corridors considered in the Final EIS to connect the repository at Yucca Mountain to an existing main rail line in Nevada.

Under the mostly rail scenario analyzed in the Final EIS, radioactive materials from certain commercial nuclear sites that do not have the capability to load rail-shipping casks would be shipped by legal-weight truck to the repository. For other commercial sites that have the capability to load rail shipping casks, but do not have rail access, materials would be shipped either by heavy-haul truck or possibly barge to a nearby railhead outside Nevada for shipment by rail to the repository at Yucca Mountain.

Under the mostly rail alternative, about 9,000 to 10,000 train shipments (assuming one cask per train [3]) of spent nuclear fuel and high-level radioactive waste would travel on the nation's rail network over the anticipated 24–year period (DOE's current plan calls for three casks per train shipment, about 3,000 to 3,300 total shipments). In addition, there would be about 1,000 legal-weight truck shipments from commercial sites that do not have the capability to load rail-shipping casks to the repository at Yucca Mountain.

Mostly Rail to Nevada With Transfer to Heavy-Haul Truck for Shipment to the Repository

Under this scenario as analyzed in the Final EIS, DOE would ship most spent nuclear fuel and high-level radioactive waste from the 77 sites to Nevada by rail. Rail shipments would terminate in Nevada at an intermodal transfer station where shipping casks would be transferred from rail cars to heavy-haul trucks for shipment to the Yucca Mountain Repository. DOE would construct an intermodal transfer station at one of three locations analyzed in the Final EIS. One of the five heavy-haul routes analyzed in the Final EIS would be upgraded to improve transportation operations, reduce traffic congestion, and enable year-round shipments to the repository.

Under this scenario, radioactive materials from certain commercial nuclear sites that do not have the capability to load rail-shipping casks would be shipped by legal-weight truck directly to the repository.

Under this alternative, about 9,000 to 10,000 train shipments (assuming one cask per train) of spent nuclear fuel and high-level radioactive waste would travel on the nation's rail network to Nevada over the 24-year period. There also would be about 9,000 to 10,000 heavy-haul truck shipments in Nevada from the intermodal transfer station to the repository. In addition, there would be about 1,000 legal-weight truck shipments from commercial sites that do not have the capability to load rail-shipping casks to the repository at Yucca Mountain.

Mostly Legal-Weight Truck to the Yucca Mountain Repository

Under the mostly legal-weight truck scenario, as analyzed in the Final EIS, DOE would ship most spent nuclear fuel and high-level radioactive waste from the 77 sites to the repository by legal-weight truck. About 53,000 legal-weight trucks carrying these materials would travel primarily on the nation's interstate highway system during the 24-year period. About 300 shipments of naval spent nuclear fuel would travel from the Idaho National Engineering and Environmental Laboratory to Nevada by rail, where the rail casks would be transferred to heavy-haul trucks for shipment to the repository.

Environmentally Preferable Transportation Mode Alternative

In making this determination, DOE considered human health and environmental impacts that could occur from shipping spent nuclear fuel and high-level radioactive waste from the 77 sites to the repository at Yucca Mountain. DOE also considered the human health and environmental impacts that could occur from the construction of a rail line and from any upgrades to existing highways (the heavy-haul truck routes) in Nevada.

The Final EIS indicates that some potential non-radiological fatalities could occur as a result of traffic accidents during the transportation of spent nuclear fuel and high-level radioactive waste to the repository at Yucca Mountain. The Final EIS indicates that the highest number of potential traffic fatalities (about five) could occur under the mostly legal-weight truck scenario, whereas the mostly rail scenario could result in about three potential traffic fatalities during the 24-year period of shipping spent nuclear fuel and high-level radioactive waste to the repository at Yucca Mountain.

The Final EIS also considers the potential health effects that could result from radiation exposure to workers during shipping and from cask loading and unloading, and to the general population along the transportation routes to the repository. Under the mostly legal-weight truck scenario, the Final EIS indicates that about 12 worker and three general public latent cancer fatalities could occur from routine (incident-free) exposures during the 24-year period of shipping spent nuclear fuel and high-level radioactive waste to the repository. Under the mostly rail scenario, about three worker and one general public latent cancer fatalities could occur during the 24-year period. The radiation dose to any one individual would be extremely small.

DOE also estimated the potential health effects to the general public that could result from a severe transportation accident during shipments to the repository (referred to in the Final EIS as a maximum reasonably foreseeable accident). The probability that this accident could occur is extremely unlikely—about three chances in 10 million per year. If such an accident were to occur in an urban population setting, less than one latent cancer fatality could be expected under the mostly legal-weight truck scenario, whereas about five latent cancer fatalities could be expected under the mostly rail scenario, primarily because of the greater amounts of radioactive materials that could be released from a rail cask in such an accident.

In Nevada, construction of a rail line, regardless of the rail corridor selected, would involve the disturbance of land (and associated impacts, although low, to natural resources such as biological and cultural resources) in amounts greater than those associated with any heavy-haul truck alternative. For example, construction of a rail line in the shortest rail corridor (Valley Modified) would result in the disturbance of about 1,240 acres; rail line construction in the longest corridor (Carlin) would disturb about 4,900 acres. Construction of an intermodal transfer station and the upgrade of the longest heavy-haul route would result in the disturbance of about 1,000 acres. Furthermore, the construction of any rail line would involve various land use conflicts that, for the most part, would not occur with the limited construction required to improve any of the heavy-haul truck routes. No land disturbances

[3] The final EIS stated that DOE anticipated as many as 5 casks per train. However, DOE conservatively estimated 1 cask per train for analytical purposes to ensure that it considered routine and accident transportation risks that could result from a larger number of train shipments (9,000 to 10,000).

would occur under the legal-weight truck alternative.

The Department also evaluated the risk of sabotage, including terrorism. For reasons the NRC has carefully explained, this analysis is most likely not required by NEPA.[4] It is not possible to predict whether such acts would occur and, if they did, the nature of such acts. Moreover, such analysis does not advance the public participation purpose of NEPA, since there are serious limits on what information can responsibly be disseminated on these issues without risking disclosure of information that might be used in planning or carrying out such an act.[5] Nevertheless, the Final EIS includes the consequences of a potentially successful attempt on a cask during shipment via rail or legal-weight truck. In both instances, a successful attack would result in the release of contaminants into the environment. The consequences estimated for a rail shipment would be less than those estimated for a legal-weight truck shipment, mostly because the thicker shield wall of the heavier rail cask would tend to mitigate the effects of the sabotage event when compared to the lighter, legal-weight truck transportation cask.

None of the three transportation scenarios analyzed in the Final EIS is clearly environmentally preferable. Each would result in some impact to the environment, and public health and safety, although all impacts would be small. For example, transporting by either rail or heavy-haul truck in Nevada would result in some land disturbance, although the impacts would be greater for rail because more land would be disturbed during the construction of a rail line than during the upgrading of existing highways to accommodate heavy-haul trucks. Radiation exposure to workers and the public from either routine rail or truck shipments to the repository at Yucca Mountain would be very small, and the differences among the different modes of transportation also would be very small. Similarly, accident risks under each alternative would be very small, and associated differences among alternatives also very small. The Department does not consider the differences among modes to be sufficiently distinct to make any of them clearly environmentally preferable.

Although the potential impacts of any of the transportation alternatives would be small, they would be greater than the transportation-related impacts of the No-Action Alternatives. Overall however, as analyzed in the Final EIS, the impacts of proceeding with construction and operation of a repository at Yucca Mountain, including transportation, would cause relatively small public health impacts through the period 10,000 years after repository closure and would cause fewer public health impacts than the No-Action Alternative. For the No-Action Alternative with institutional controls for 10,000 years, the potential long-term environmental impacts also would be small, but significantly greater than the proposed action because the potential for nonradiological fatalities to workers under this alternative is significantly greater. Additional information may be found on pages S–82 through S–88 and Chapters 2 and 7 of the Final EIS. The cost of this No-Action Alternative is also significantly greater than that of the proposed action ($42.7 billion to $57.3 billion (in 2001 dollars) for the proposed action versus $167 billion to $184 billion for the first 300 years of institutional control and $519 million to $572 million per year thereafter). Additionally, the public health and safety impacts of the No-Action Alternative without effective institutional control are significantly greater than the proposed action. Likewise, in the long run, securing these materials by consolidating them and disposing of them in a secure, remote location, better protects against terrorist attack than leaving them at 72 commercial and 5 DOE sites in 35 states within 75 miles of more than 161 million Americans.[6] Moreover, for the reasons expressed by the Secretary and the President in their site recommendations and by the Congress in passing the joint resolution, it is in the national interest to move forward with this project.

In any event, in the Yucca Mountain Development Act, Pub. L. 107–200, Congress directed DOE to proceed with the development of a license application for a repository for the disposal of spent nuclear fuel and high-level radioactive waste. DOE believes that this statute and the NWPA make it incumbent on DOE to proceed with appropriate transportation planning so the Department will be in a position to fulfill its responsibility under the NWPA to begin disposal of this material promptly, should the NRC grant the necessary authorizations for it to do so.

Transportation-Related Comments on the Final EIS

DOE distributed about 6,200 copies of the Final EIS and has received written comments on the Final EIS from the White Pine County Nuclear Waste Project Office, White Pine County Board of County Commissioners, Board of County Commissioners Lincoln County, Board of Mineral County Commissioners, and a member of the public. Although comments were received on a variety of issues, the following summation addresses only those few comments related to the transportation of spent nuclear fuel and high-level radioactive waste to a Yucca Mountain repository.

Commenters stated that DOE should develop specific transportation-related mitigation measures, and encouraged DOE to do so in a cooperative manner. Commenters also stated that additional, more detailed and community-specific transportation analyses are needed for purposes of mitigation planning, as well as to support DOE in its transportation decisionmaking, such as the decision on the mode of transportation. Commenters also encouraged DOE to develop plans for transportation, such as route selection for shipments of spent nuclear fuel and high-level radioactive waste, and emergency planning and response. Commenters also requested clarification of the roles of the NRC and DOE's transportation services contractors, and whether counties are eligible for technical assistance and funding under Section 180(c) of the Nuclear Waste Policy Act (NWPA).

As discussed below in Use of All Practicable Means to Avoid or Minimize Harm (Parts I and II), DOE has already adopted measures to avoid or minimize environmental harm that could result from the transportation of spent nuclear fuel and high-level radioactive waste. Additional potential mitigation measures associated with the construction of a rail line will be identified during preparation of an environmental impact statement that considers alternative alignments within the Caliente corridor for construction of the rail line (see PART II of this ROD). DOE also will consult with states, Native American tribes, local governments, utilities, the transportation industry and other interested parties in a cooperative

[4] *See Duke Cogema Stone & Webster*, 56 N.R.C. 335 (2002); *Private Fuel Storage, L.L.C.*, 56 N.R.C. 340 (2002); *Duke Energy Corp.*, 56 N.R.C. 358 (2002); *Dominion Nuclear Connecticut, Inc.*, 56 N.R.C. 367 (2002); *Pacific Gas & Electric Company*, 57 N.R.C. 1 (2003); and *Pacific Gas & Electric Company*, 58 N.R.C. 185 (2003), appeal docketed, No. 03–74628 (9th Cir. Dec. 12, 2003).

[5] *See* materials cited in footnote 4

[6] As explained in footnote 2, some additional materials are currently stored at 50 additional sites (54 at the time of site recommendation), consisting primarily of research reactors, in four additional states, but DOE plans to consolidate these materials at two DOE sites for reasons unrelated to its repository plans.

manner to refine the transportation system as it is developed. Furthermore, DOE must comply with the transportation-related provisions of the NWPA. Spent nuclear fuel and high-level radioactive waste will be shipped to Yucca Mountain in casks that have been certified by the NRC (Section 180(a)). Prior to these shipments, DOE will comply with the regulations of the NRC regarding advanced notification of state and local governments (Section 180(b)).

Transportation Mode Decision

Under the NWPA, the Department is responsible for planning that will allow for the transportation of spent nuclear fuel and high-level radioactive waste in the event the NRC authorizes receipt and possession of these materials at Yucca Mountain. Accordingly, as the next step in fulfilling that responsibility, the Department is issuing this Record of Decision to select a transportation mode. The Department has decided to select the preferred mode of transportation analyzed in the Final EIS, the mostly rail scenario, both on a national basis and in the State of Nevada. Under this decision, the Department would rely on a combination of rail, truck and possibly barge to transport to the repository up to 70,000 MTHM of spent nuclear fuel and high-level radioactive waste. Most of the spent nuclear fuel and high-level radioactive waste would be transported by rail. The Department would use truck transport where necessary, depending on certain factors such as the timing of the completion of the rail line proposed to be constructed in Nevada. This could include building an intermodal capability at a rail line in Nevada to take legal-weight truck casks from rail cars and transport them the rest of the way to the repository via highway, should the rail system be unavailable at the time of the opening of the repository [7]. In addition, since some commercial utilities are not able to accommodate rail casks, they would ship by legal-weight truck to the repository. Additionally, the Department would use heavy-haul truck and possibly barge as needed to ship spent nuclear fuel from commercial nuclear sites to nearby railheads outside Nevada for shipment to the repository.

Basis for Transportation Mode Decision

As we explain below, the Department has concluded that it should use mostly rail nationwide and in Nevada based, in large part, on the analyses of the Final EIS. The Department also considered the preferences for rail transportation expressed by the State of Nevada and other factors described below.

The analyses in the Final EIS demonstrate that the potential radiation doses to workers and the general public from rail, truck or barge transportation would be very small, and that the differences in resulting potential impacts from such exposures among the different modes of transportation also would be very small. Nevertheless, using mostly rail tends to minimize the potential environmental impacts that could occur. The decision to rely primarily on the nation's rail system to ship these materials would result in fewer shipments than would occur if legal-weight trucks were the primary mode of transportation. This in turn would result in fewer trucks on public highways. The lower number of rail shipments as compared to truck shipments is estimated to result in fewer potential traffic fatalities and, under routine conditions, slightly fewer latent cancer fatalities to workers and the general public relative to mostly legal-weight truck shipments.

In reaching its decision, DOE also considered the number of commercial nuclear sites having, or expected to have, the capability to handle rail casks, the distances to suitable railheads near the commercial nuclear sites, and historical experience using rail to ship spent nuclear fuel and other large reactor-related components. The Department found that the preponderance of commercial sites have the capability and experience to ship to nearby railheads.

The Department also considered preferences expressed by the State of Nevada in its comments on the Draft EIS. In these comments, the state indicated that DOE should plan its transportation system to maximize the use of rail.

The Department also considered irreversible and irretrievable commitments of resources and cumulative impacts in making its decision. There would be an irreversible and irretrievable commitment of resources, such as land, electric power, fossil fuels and construction materials, associated with the construction of a rail line in Nevada, although this commitment of resources would not significantly diminish these resources, either nationwide or in Nevada. DOE also recognizes that for all alternatives involving transportation of spent nuclear fuel and high-level radioactive waste, there could be cumulative impacts from past, present and reasonably foreseeable future activities involving transportation of other radioactive materials. Based on the analyses in the Final EIS, DOE does not expect that any cumulative impacts would be significant over the duration of shipping spent nuclear fuel and high-level radioactive waste to the repository.

Based on these various considerations, DOE concludes that shipping by mostly rail, both nationally and in the State of Nevada, would be preferable to shipping by mostly truck or using heavy-haul trucks in Nevada.

Use of All Practicable Means To Avoid or Minimize Harm—Transportation Mode

The shipment of spent nuclear fuel and radioactive waste is highly regulated and subject to the utmost scrutiny. DOE carefully follows the Department of Transportation (DOT) and NRC transportation rules now and will follow or exceed any others that may be established in the future whether by the Congress or by DOT or NRC. DOE also will consult with states, Native American tribes, local governments, utilities, the transportation industry and other interested parties in a cooperative manner to refine the transportation system as it is developed.

Measures DOE will implement to avoid or minimize harm include the following [8]: prior to the shipment of spent nuclear fuel, the shipper or carrier must select routes and prepare a written plan listing origin and destination of the shipment, scheduled route, all planned stops, estimated time of departure and arrival, and emergency telephone numbers; advance notice must be provided to State and local governments prior to shipping irradiated reactor fuel through their states; anyone involved in the preparation or transport of radioactive materials will be required to have proper training; carriers must be provided with shipping papers containing emergency information, including contacts and telephone numbers, readily available during transport for inspection by appropriate officials; clearly identifiable markings, labels, and placards of hazardous contents must be provided; and all spent nuclear fuel and high-level

[7] In March 2004, DOE issued a Supplement Analysis and determined, in accordance with 10 CFR 1021.314, that this rail/legal-weight truck scenario would not constitute a substantial change to the proposal previously analyzed in the Final EIS or significant new circumstances or information relevant to environmental concerns, as discussed in 40 CFR 1502.9(c)(1).

[8] Application of these measures to national security activities may, in some respects, be subject to section 7 of the Nuclear Waste Policy Act, 42 U.S.C. section 10106.

radioactive waste shipments would be in the most rugged casks (Type B, which range from small containers of sealed radioactive sources to heavily shielded steel casks that sometimes weigh as much as 150 tons).

The NRC has promulgated rules (10 CFR 73.37) and interim compensatory measures (March 4, 2002; 67 FR 9792) specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. These security rules are designed to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under the control of unauthorized persons. The use of armed escorts for all shipments; safeguarding the detailed shipping schedule information, monitoring of shipments through satellite tracking and a communication center with 24-hour staffing; and coordinating logistics with state and local law enforcement agencies all contribute to shipment security. Additionally, the cask safety features that provide containment, shielding, and thermal protection provide protection against sabotage. The Department and other agencies continue to examine the protections built into their physical security and safeguards systems for transportation shipments.

DOE is now developing its transportation security plan and its design basis threat for transportation. The transportation security plan will be developed in cooperation with other Federal agencies, including the NRC, DOT, and the Department of Homeland Security. The Office of Civilian Radioactive Waste Management is exploring the use of armed Federal agents as escorts for all shipments and other operational techniques employed by the National Nuclear Security Administration's Office of Secure Transportation as well as the design of special security cars for rail transport, to further mitigate the potential threat of a terrorist act. In addition to its domestic efforts, the Department is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the consequences of a potential act of sabotage and is exploring opportunities to enhance the physical protection of casks. As a result of the above efforts, DOE will modify its methods and systems as appropriate between now and the time shipments start.

In compliance with section 180(c) of the NWPA, DOE will provide technical assistance and funds to states for training public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions the Department plans to ship spent nuclear fuel and high-level radioactive waste. The training of public safety officials will cover procedures required for safe routine transportation of these materials and for dealing with emergency response situations.

Pursuant to the NWPA, spent nuclear fuel and high-level radioactive waste will be transported in casks certified by the NRC. The NRC regulates and certifies the design, manufacture, testing and use of these casks. Additionally, the NWPA requires that DOE comply with NRC regulations regarding advance notification of State and local governments prior to transportation of spent nuclear fuel or high-level radioactive waste.

At this stage in the decision-making, the Department believes it has incorporated all practicable mitigation measures. The Department will continue to identify and evaluate potential mitigation measures as the transportation system develops and as a result of the lessons learned from the shipping of spent nuclear fuel and high-level radioactive waste.

Part II. Record of Decision for Nevada Rail Corridor

Background

As noted above, the mostly rail scenario assumes that DOE will ultimately construct a rail line in Nevada to ship spent nuclear fuel and high-level radioactive waste to the repository. To implement that scenario, DOE therefore needs to select among alternative rail corridors within which to study possible alignments in which it will pursue construction of a rail line that would connect the repository at Yucca Mountain to an existing main rail line in Nevada in the event the NRC authorizes construction of a repository at Yucca Mountain. In the Final EIS, DOE analyzed five potential rail corridors—Caliente, Carlin, Caliente-Chalk Mountain, Jean and Valley Modified—for this potential rail line. Additional descriptive information, including variations associated with each corridor, may be found in section 2.1.3.3 and Appendix J, section J.3.1.2, of the Final EIS. The Final EIS did not specify a corridor preference, but in December 2003, DOE announced its preference for the Caliente corridor (*Notice of Preferred Nevada Rail Corridor*, 68 FR 74951; December 29, 2003.

Proposed Action and Nevada Rail Corridors Considered in the Final EIS

A. Caliente Rail Corridor—Preferred Alternative

The Caliente corridor originates at an existing siding to the mainline railroad near Caliente, Nevada. The corridor extends in a westerly direction to the northwest corner of the Nevada Test and Training Range (previously known as Nellis Air Force Range), before turning south-southeast to the repository at Yucca Mountain. The corridor ranges between 318 miles (512 kilometers) and 344 miles (553 kilometers), depending on the variations to the corridor considered in the Final EIS. Construction of a rail line within the Caliente corridor would take about 46 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $880 million (2001 dollars).

B. Carlin Rail Corridor

The Carlin corridor originates at the mainline railroad near Beowawe in north central Nevada. The Carlin and Caliente corridors converge near the northwest boundary of the Nevada Test and Training Range. Past this point, they are identical. The Carlin corridor ranges between 319 miles (513 kilometers) and 338 miles (544 kilometers) long, depending on the variations to the corridor. Construction of a rail line within the Carlin corridor would take about 46 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $821 million (2001 dollars).

C. Caliente-Chalk Mountain Rail Corridor

The Caliente-Chalk Mountain corridor is identical to the Caliente corridor until it approaches the northern boundary of the Nevada Test and Training Range. At that point the Caliente-Chalk Mountain corridor turns south through the Nevada Test and Training Range and the Nevada Test Site to the Yucca Mountain site. Depending on the variations, the corridor is between 214 miles (344 kilometers) and 242 miles (382 kilometers) long from the tie-in at the mainline near Caliente to the Yucca Mountain site. Construction of a rail line within the Caliente-Chalk Mountain corridor would take about 43 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $622 million (2001 dollars). The Department designated the Caliente-Chalk Mountain alternative as non-preferred in the Final EIS due to national security concerns raised by the U.S. Air Force.

D. Jean Rail Corridor

The Jean corridor originates at the existing mainline railroad near Jean, Nevada. The corridor ranges between 112 miles (181 kilometers) and 127 miles (204 kilometers) long from the tie-in with the mainline to the Yucca Mountain site. Construction of a rail line within the Jean corridor would take about 43 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $462 million (2001 dollars).

E. Valley Modified Rail Corridor

The Valley Modified corridor originates at an existing rail siding off the mainline railroad northeast of Las Vegas. Depending on the variations, the corridor is between 98 miles (157 kilometers) and 101 miles (163 kilometers) long from the tie-in with the mainline to the Yucca Mountain site. Construction of a rail line within the Valley Modified corridor would take about 40 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $283 million (2001 dollars).

Environmentally Preferable Rail Corridor Alternative

DOE considered human health and environmental impacts that could occur from the construction of a rail line, as well as from shipping spent nuclear fuel and high-level radioactive waste in Nevada.

Construction of a rail line, regardless of the rail corridor selected, would involve the disturbance of land and associated impacts, although low, to natural resources such as biological and cultural resources. For example, construction of a rail line in the Valley Modified corridor (shortest) would result in the disturbance of about 1,240 acres; rail line construction in the Carlin corridor (longest) would disturb about 4,900 acres.

Construction of any rail line in Nevada also would conflict with existing land uses. Depending on the variations considered, privately-owned lands occur on less than one percent of the lands analyzed under the Caliente (ranges from 222 to 618 acres), Caliente-Chalk Mountain (ranges from 198 to 272 acres) and Valley Modified (ranges from 0 to 44 acres) corridors, but up to about five and seven percent of the lands analyzed under the Jean (ranges from 32 to 865 acres) and Carlin (ranges from 1,804 to 3,756 acres) corridors, respectively. The Caliente and Carlin corridors cross Timbisha-Shoshone trust lands, and a relatively short distance on the Nevada Test and Training Range, although variations are available that would avoid these lands. The Caliente corridor crosses two wilderness study areas, and the Valley Modified corridor passes through the Desert National Wildlife Range, although variations may be available to avoid these lands. The Caliente-Chalk Mountain corridor crosses land dedicated to testing and training activities of the U.S. Air Force and Department of Defense on the Nevada Test and Training Range; no variations are available that would avoid the Range under this corridor alternative.

Under any rail corridor alternative, water would be used for compaction of the rail bed and dust suppression, and by workers during construction. Water consumption would vary, primarily because of the length of the corridor, ranging from 320 acre-feet for the Valley Modified corridor to 710 acre-feet for the Caliente corridor.

During the 24-year shipping period, assuming standard nationwide rail routing practices, the incident-free (routine) collective dose to members of the public from the transportation of spent nuclear fuel and high-level radioactive waste by rail would result in less than one latent cancer fatality regardless of which corridor is selected. The difference in impacts among the corridors is minimal. Similarly, less than one latent cancer fatality would occur in the exposed worker population, and that is not affected by the Nevada corridor selection.

DOE also estimated the potential health effects to the general public that could result from a severe transportation accident during shipments to the repository (referred to in the Final EIS as a maximum reasonably foreseeable accident). If such an accident were to occur in a rural population setting, the collective radiological dose to members of the public would result in less than one latent cancer fatality. The probability that this accident could occur is extremely unlikely—about 2 chances in 1 million per year.

The environmental impacts identified in the Final EIS do not provide a clear basis for discriminating among alternative rail corridors in Nevada. Each of these alternatives would result in some impact to the environment and public health and safety. Construction of a rail line within any rail corridor would involve certain land use conflicts, and land disturbance with attendant impacts (although small, the impacts tend to increase with increasing corridor length). Radiation exposure to workers and the public in Nevada would be small, and the differences among the rail corridor alternatives also would be very small.

For these reasons, DOE does not consider the differences among the corridor alternatives to be sufficient to make any of them clearly environmentally preferable.

Finally, although the potential impacts of any of the five potential rail corridors would be small, they would be greater than the potential transportation-related impacts of the No-Action Alternatives. Nevertheless, as explained above, the impacts of proceeding with construction and operation of a repository at Yucca Mountain, including transportation, are relatively small and less than either of the No-Action Alternative scenarios. Part I (of this ROD) provides further comparison of the proposed action and the No-Action Alternative scenarios. In any event, given DOE's responsibilities under the Yucca Mountain Development Act and the NWPA, DOE believes it is obligated to proceed with appropriate transportation planning, including, given its selection of the mostly rail scenario in Nevada, the selection of a corridor in which to study possible alignments for the Nevada rail line, in preference to either No-Action Alternative scenario.

Comments on Preferred Rail Corridor

DOE noticed its preference for the Caliente corridor in the **Federal Register** (December 29, 2003; 68 FR 74951). The Carlin corridor was identified as a secondary preference. The Department has received comments on the preference announcement. Concerns expressed in these comments included the need for a comprehensive programmatic EIS covering all aspects of nuclear waste transportation to Yucca Mountain, avoidance of all major population centers with transportation routes, and provision of documentation supporting the preference decision. Other comments addressed the need for adequate opportunities for public participation and comment on the corridor preference announcement, including a request for cooperating agency status for any future rail alignment EIS. Selection of a corridor preference prior to having a mode of transportation decision was raised as a concern. In addition, there was confusion regarding the designation of the Carlin corridor as a secondary preference and its relationship to the upcoming rail alignment EIS process. Furthermore, commenters indicated that a rail line in the Caliente corridor would have significant negative impacts on cultural, socioeconomic, and wildlife resources, as well as a massive modern sculpture project. Others raised the potential for impacts to ranchers living in proximity to the proposed Caliente corridor, including questions regarding the design and operation of a rail line and the nature of measures that could mitigate resulting adverse impacts. Finally, several commenters thanked DOE for announcing its corridor preference, recognizing the challenges and opportunities and associated need to coordinate closely as DOE proceeds with transportation planning.

Comments calling for DOE to prepare a programmatic transportation EIS and the need to avoid all major Nevada population centers with transportation routes were addressed in the response to comments in the Final EIS. DOE believes a programmatic EIS to be unnecessary as its Final EIS provides the environmental impact information necessary to make certain broad transportation-related decisions (as described above in Transportation-Related Decisions).

With regard to avoiding population centers, the analyses of the Final EIS illustrate that potential public health and safety impacts would be so low for individuals who lived and worked along any route that individual impacts would not be discernible, even if the corresponding doses could be measured.

Although some commenters stated that DOE's intent in identifying the Carlin corridor as a secondary preference was unclear, the decision to select the Caliente corridor also represents DOE's intent to no longer consider the Carlin corridor for development of a rail line. This decision and the basis for not selecting the Carlin corridor are discussed below in Rail Corridor Decision and Basis for Rail Corridor Decision.

The remaining concerns and issues regarding potential environmental impacts associated with the development of a rail line, potential mitigation measures, and opportunities for public involvement and project participation will be addressed during the future preparation of a rail alignment EIS. As part of developing this documentation, DOE will identify and adopt measures to avoid or minimize environmental harm that could result from the construction and operation of a rail line within the Caliente corridor.

Rail Corridor Decision

In Part I of this Record of Decision, the Department selected, both on a national basis and in the State of Nevada, the mostly rail scenario. That decision is premised on the assumption that DOE will ultimately construct a rail line to connect the repository site to an existing rail line in the State of Nevada. To that end, the Department has decided to select the preferred rail corridor alternative, the Caliente corridor, in which to evaluate alignments for a rail line.

Basis for Rail Corridor Decision

The Department decided to evaluate alignments within the Caliente corridor for possible construction of a rail line based, in large part, on the analyses of the Final EIS. The Department, however, also considered other factors discussed below, such as potential for construction delay, direct and indirect costs of each alternative, and comments received from the public.

The Department considered irreversible and irretrievable commitments of resources and cumulative impacts in making its decision. There would be an irreversible and irretrievable commitment of resources, such as electric power, fossil fuels, construction materials, and water associated with the construction of a rail line in Nevada, although this commitment of resources would not significantly diminish the resources in question in Nevada. DOE recognizes that for all rail corridors there could be cumulative impacts from past, present and reasonably foreseeable future activities.

The Department considered potential land use conflicts and their potential to affect adversely construction of a rail line, as analyzed in the Final EIS in making this decision. If the Department were to select the Valley Modified rail corridor there may be conflicts with the Desert National Wildlife Range and local community plans for development in the greater Las Vegas metropolitan area. If the Department were to select the Caliente-Chalk Mountain corridor there would be conflicts with U.S. Air Force and Department of Defense testing and training activities directly related to national security interests on the Nevada Test and Training Range. If the Department were to select the Jean corridor it may require crossing relatively greater amounts of private land, and would pose greater potential land use conflicts because of its proximity to the greater Las Vegas metropolitan area. If the Department were to select the Carlin corridor it would also require crossing relatively greater amounts of private land. Moreover, little infrastructure, such as roads and electric power, is available over long segments, which would tend to make logistics during construction as well as emergency response capabilities more challenging. Overall, the Caliente rail corridor appears to have the fewest land use or other conflicts that could lead to substantial delays in acquiring the necessary land and rights-of-way, or in beginning construction.

DOE also considered concerns expressed by the public in Nevada. In these comments, the public stated that DOE should avoid rail corridors in the Las Vegas Valley.

The Department also considered the direct costs of constructing and operating a rail line, and the indirect costs resulting from potential delays in the availability of the rail line. The Jean and Valley Modified corridors are the shortest and have the lowest estimated construction costs. The Carlin and Caliente corridors are the longest and on the basis of construction cost alone would be more expensive to develop. However, delays in the construction of the rail line because of land use or other conflicts and the resulting inability to accept large amounts of spent nuclear fuel and high-level radioactive waste transported by a railroad to the repository in a timely manner could add to both the liability costs for delayed acceptance of commercial spent nuclear fuel and the costs of continued storage of DOE wastes.

Based on all of the above, DOE concludes that the Caliente corridor is preferable to the other corridors it evaluated as a potential corridor in which to construct a rail line. Therefore, DOE has decided to select the Caliente corridor as the one within which to evaluate possible alignments for the rail line connecting the repository to an existing main rail line in Nevada.

Use of All Practicable Means To Avoid or Minimize Harm—Rail Corridor

In the Final EIS, DOE identified transportation-related measures that would be implemented, and other measures that would require further consideration and refinement before adoption to avoid or minimize environmental harm. As described in Part I, this decision adopts all practicable measures to avoid or minimize adverse environmental impact that could result from the transportation of spent nuclear fuel and high-level radioactive wastes to a repository at Yucca Mountain appropriate at this stage of decision-making. Construction of a rail line will be consistent with applicable Federal, state and Native American tribal requirements. In addition to these measures, other potential mitigation measures associated with the construction of a rail line will be identified and evaluated during preparation of future NEPA documentation.

A.4 69 *FR* 18565, April 8, 2004

Federal Register / Vol. 69, No. 68 / Thursday, April 8, 2004 / Notices 18565

DEPARTMENT OF ENERGY

Notice of Intent to Prepare an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV

AGENCY: U.S. Department of Energy.

ACTION: Notice of intent.

SUMMARY: The U.S. Department of Energy (DOE or the Department) announces its intent to prepare an environmental impact statement (EIS) under the National Environmental Policy Act (NEPA) for the alignment, construction, and operation of a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada. On April 2, 2004, the Department signed a Record of Decision announcing its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (DOE/EIS–0250F, February 2002) (Repository Final EIS). This decision will ultimately require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada for the shipment of spent nuclear fuel and high-level radioactive waste, in the event that the Nuclear Regulatory Commission authorizes construction of the repository and receipt and possession of these materials at Yucca Mountain. To that end, the Department also decided to select the Caliente rail corridor[1] in which to examine possible alignments for construction of a rail line that would connect the repository at Yucca Mountain to an existing main rail line in Nevada. DOE is now announcing its intent to prepare this Rail Alignment EIS to assist in selecting this alignment. The EIS also would consider the potential construction and operation of a rail-to-truck intermodal transfer facility, proposed to be located at the confluence of an existing mainline railroad and a highway, to support legal-weight truck transportation until the rail system is fully operational.

DATES: The Department invites and encourages comments on the scope of the EIS (hereafter referred to as the Rail Alignment EIS) to ensure that all relevant environmental issues and reasonable alternatives are addressed. Public scoping meetings are discussed below in the **SUPPLEMENTARY INFORMATION** section. DOE will consider all comments received during the 45-day public scoping period, which starts with the publication of this Notice of Intent and ends May 24, 2004. Comments received after the close of the public scoping period will be considered to the extent practicable.

ADDRESSES: Written comments on the scope of this Rail Alignment EIS, questions concerning the proposed action and alternatives, requests for maps that illustrate the Caliente corridor and alternatives, or requests for additional information on the Rail Alignment EIS or transportation planning in general should be directed to: Ms. Robin Sweeney, EIS Document Manager, Office of National Transportation, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, Telephone 1–800–967–3477, or via the Internet at *http://www.ocrwm.doe.gov* under "What's New."

FOR FURTHER INFORMATION CONTACT: For general information regarding the DOE NEPA process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (EH–42), U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone 202–586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Background

On July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. Subsequently, the Department issued a Record of Decision (April 2, 2004) to announce its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Repository Final EIS as the mode of transportation of spent nuclear fuel and high-level radioactive waste to the repository. Under the mostly rail scenario, the Department would rely on a combination of rail, truck and possibly barge to transport to the repository site at Yucca Mountain up to 70,000 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste. Most of the spent nuclear fuel and high-level radioactive waste, however, would be transported by rail.

The Department's decision to select the mostly rail scenario in Nevada will ultimately require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada for the shipment of spent nuclear fuel and high-level radioactive waste in the event that the Nuclear Regulatory Commission authorizes construction of the repository and receipt and possession of these materials at Yucca Mountain. To that end, in the same Record of Decision, the Department also decided to select the Caliente rail corridor to study possible alignments for this rail line.

In the Repository Final EIS, DOE defined a rail corridor as a 0.25 miles (400-meter) wide strip of land that encompasses one of several possible alignments or specific locations within which DOE could build a rail line. The Caliente rail corridor was described as originating at an existing siding to the mainline railroad near Caliente, Nevada, and extending in a westerly direction to the northwest corner of the Nevada Test and Training Range, before turning south-southeast to the repository at Yucca Mountain.

In the Repository Final EIS, DOE also identified eight variations along the Caliente corridor that may minimize or avoid environmental impacts and/or mitigate construction complexities. Variations were defined as a strip of land 0.25 miles (400-meters) wide that describes a different route, from one point along the corridor to another point on the corridor. Thus, the Caliente corridor ranges between 318 miles (512 kilometers) and 344 miles (553 kilometers) in length, depending on the variations considered. In the Repository Final EIS, DOE did not identify variations for about 55 percent of the length of the corridor (hereafter these areas are referred to as "common segments").

DOE proposes to consider the common segments and the eight variations as preliminary alternatives to be evaluated in the Rail Alignment EIS. These alternatives are described in the *Preliminary Alternatives* section. In addition, DOE will consider other potential variations outside of the 0.25

[1] A corridor is a strip of land 0.25 miles (400 meters) wide that encompasses one of several possible routes through which DOE could build a rail line. An alignment is the specific location of a rail line in a corridor.

mile wide corridor that might minimize, avoid or mitigate adverse environmental impacts.

For purposes of analysis in the Rail Alignment EIS, a rail line alignment is defined as a strip of land 100 feet (30 meters) on either side of the centerline of the track within the Caliente corridor, passing through the common segments and variations. DOE will define regions of influence for each environmental resource (for example, biological or cultural resources) that will extend beyond the dimensions of the alignment and allow DOE to estimate environmental impacts over the geographic area in which the impact is likely to be realized. Within these regions of influence, DOE will estimate environmental impacts of the common segments and alternatives, both separately and in aggregate. In this way, the analyses of the Rail Alignment EIS will offer DOE flexibility to minimize, avoid or otherwise mitigate potential environmental impacts of the final alignment chosen for construction.

Proposed Action

In the Rail Alignment EIS, the Proposed Action is to determine a rail alignment, and to construct and operate a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials [2] from a site near Caliente, Lincoln County, Nevada to a geologic repository at Yucca Mountain, Nye County, Nevada. Under the Proposed Action, the Caliente rail line would be designed and built consistent with Federal Railroad Administration safety standards. Construction would take between three and four years.

Construction activities would include the development of construction support areas; construction of access roads to the rail line construction initiation points [3] and to major structures to be built, such as bridges and culverts; and movement of materials and equipment to the construction initiation points. The number and location of construction initiation points would be based on such variables as the length of the rail line, the construction schedule, the number of contractors used for construction, the number of structures to be built, the supply of materials, and the locations of existing access roads adjacent to the rail line.

The construction of the rail line would require the clearing and excavation of previously undisturbed lands, and the establishment of borrow and spoils [4] areas. To establish a stable base for the rail track, construction crews would excavate some areas and fill (add more soil to) others, as determined by terrain features. To the extent possible, material excavated from one area would be used in areas that required fill material. However, if the distance to an area requiring fill material were excessive, the excavated material would be disposed of in spoils areas, and a borrow area would be established adjacent to the area requiring fill material. Access roads to spoils and borrow areas would be built during the track base construction work.

Under the Proposed Action, DOE would construct a secure railyard and facilities at the operational interface with the mainline railroad near Caliente, Nevada. The facilities would include sidings connected to the mainline, and buildings and associated equipment for track and equipment maintenance, locomotive refueling, and train crew quarters.

DOE also will consider the potential construction and operation of a rail-to-truck intermodal transfer facility to support limited legal-weight truck transportation until the rail system is fully operational. This intermodal transfer facility could be constructed at the confluence of an existing mainline railroad and a highway.

Typical construction equipment (front-end loaders, power shovels, and other diesel-powered support equipment) would be used for clearing and excavation work. Trucks would spray water along graded areas for dust control and soil compaction. The fill material used along the rail line to establish a stable base for the track would be compacted to meet design requirements. Water could be shipped from other locations or obtained from wells drilled along the rail line.

Railroad track construction would consist of the placement of railbed material (sub-ballast), ballast (support and stabilizing materials for the rail ties), ties and rail over the completed railbed base. Other activities would include: installation of at-grade crossings, fencing as needed, train monitoring and signals and communication equipment, and final grading of slopes, rock-fall protection devices, and restoration of disturbed areas.

Operation of the Caliente rail line would be consistent with Federal Railroad Administration standards for maintenance, operations, and safety. A typical spent nuclear fuel and high-level radioactive waste train would consist of two diesel-electric locomotives; three or more rail cars containing spent nuclear fuel or high-level radioactive waste; buffer cars; and an escort car. A typical train carrying construction materials would not have buffer cars or an escort car.

At the Yucca Mountain repository, rail cars containing casks of spent nuclear fuel and high-level radioactive waste would move through a security check into the radiologically controlled area. The casks would be inspected and protective barriers removed, in preparation for waste handling at the repository. Rail cars carrying construction materials would be offloaded and the materials stockpiled on site.

Preliminary Alternatives

As required by the Council on Environmental Quality and Department regulations that implement NEPA, the Rail Alignment EIS will analyze and present the environmental impacts associated with the range of reasonable alternatives to meet DOE's purpose and need for a rail line, and a no action alternative. The preliminary alternatives for the alignment comprise a series of common segments and alternatives (maps may be obtained as described above in **ADDRESSES**). The Department is particularly interested in identifying and subsequently evaluating any additional reasonable alternatives that would reduce or avoid known or potential adverse environmental impacts, national security activities, features having aesthetic values, and land-use conflicts, or alternatives that should be eliminated from detailed consideration. This could include identifying alternatives that could avoid wilderness study areas or other land use conflicts. The preliminary alternatives include:

Interface With Mainline Railroad

Three alternatives are available to connect to the existing mainline railroad, each of which would intersect the common segment of the rail alignment about 4 miles (6.5 kilometers) southwest of Panaca, Nevada, along U.S. 93 in the Meadow Valley area. The Caliente Alternative would begin at the town of Caliente, enter Meadow Valley at Indian Cove and extend north

[2] Other materials refer to materials related to the construction (e.g., reinforcing steel, cement) and operation (e.g., waste packages, fuel oil) of the repository.

[3] DOE anticipates that construction of the rail line may occur at several locations simultaneously along the alignment.

[4] Borrow areas are areas outside of the rail alignment where construction personnel could obtain earthen materials such as aggregate for construction of the rail line. Spoil areas are areas outside of the alignment for the deposition of excess earthern materials excavated during construction of the rail line.

through Meadow Valley to converge with the common segment. This alternative is about 10.5 miles (17 kilometers) in length.

The Eccles Alternative would begin at the Eccles siding along Clover Creek about 5 miles (8 kilometers) east of Caliente, trend generally north entering Meadow Valley on the southeast, and would then trend northward to converge with the common segment. This alternative is about 11 miles (18 kilometers) in length.

The Crestline Alternative would begin north of the Crestline siding in Sheep Spring Draw, extend west after crossing Lincoln County Road 75, and pass north of the Cedar Range. It would then veer northwesterly just north of Miller Spring Wash and converge with the common segment just south of the Big Hogback. This alternative is about 23 miles (38 kilometers) in length.

White River

The two White River Alternatives would depart from the common segment about 1.5 miles (2.5 kilometers) west of its crossing of the White River immediately west of State Route 318. The northern White River Alternative (WR1) would follow the White River, curve around the northern end of the Seaman Range, and then turn southwest entering Coal Valley. This alternative is about 25 miles (40 kilometers) in length.

The southern White River Alternative (WR2) would depart the same common segment but would extend westerly along the flanks of Timber Mountain, proceed through Timber Mountain Pass, and then enter Coal Valley. This alternative is about 18.5 miles (30 kilometers) in length.

Once in Coal Valley, both alternatives would merge with the Garden Valley Alternatives. Several options are available to merge the White River Alternatives with the Garden Valley Alternatives.

Garden Valley

The southern Garden Valley Alternative (GV2) would start about 2 miles (3 kilometers) east of the water gap located along Seaman Wash Road, proceed westward through the Golden Gate Mountains, and turn southwesterly through Garden Valley to reconnect to a common segment about 2.5 miles (4 kilometers) northeast of the pass between the Worthington Mountains and the Quinn Canyon Range. This alternative is about 17 miles (27.5 kilometers) in length.

The northern Garden Valley Alternative (GV1) would diverge from the same common segment as Alternative GV2, but would pass through the Golden Gate Mountains about 4 miles (6.5 kilometers) further north of the Alternative GV2 location. Alternative GV1 would then continue southwesterly through Garden Valley to reconnect with the common segment described for Alternative GV2. This alternative is about 19 miles (31 kilometers) in length.

Mud Lake

The Mud Lake Alternatives would depart a common segment located near the northwest corner of the Nevada Test and Training Range (previously known as Nellis Air Force Range) immediately north of Mud Lake. The western Mud Lake Alternative (ML1) would pass about 1.5 miles (2.5 kilometers) northwest of Mud Lake avoiding its western shoreline, and would extend southward to reconnect with a common segment. This alternative is about 3 miles (5 kilometers) in length.

The eastern Mud Lake Alternative (ML2) also would skirt Mud Lake to avoid its western shoreline and would reconnect with the same common segment as the western Mud Lake Alternative. This alternative is about 4 miles (6.5 kilometers) in length.

Goldfield

There are two alternatives associated with Goldfield. The western Goldfield Alternative (GF1), from its connection to Alternative ML1, would extend southward into the Goldfield Hills area passing about 1 mile (1.5 kilometers) east of Black Butte. This alternative would then turn east to pass about 1 mile (1.5 kilometers) northeast of Espina Hill and then would bear south to pass about 1 mile (1.5 kilometers) east of Blackcap Mountain. Alternative GF1 would then continue in a southerly direction following an abandoned rail line to reconnect to a common segment located about 2.5 miles (4 kilometers) north-northeast of Ralston, Nevada. This alternative is about 25 miles (41 kilometers) in length.

From its connection with Alternative ML2, the eastern Goldfield Alternative (GF2) would extend south-southeast into the Nevada Test and Training Range, and then would emerge from the Range turning southwest to converge with the western Goldfield Alternative (GF1) as it enters Stonewall Flat. This alternative is about 22 miles (35.5 kilometers) in length.

DOE is aware of concerns raised by the Department of Defense and the U.S. Air Force regarding the alternatives that intersect the Nevada Test and Training Range lands, and will consult with the Department of Defense and the U.S. Air Force during the Rail Alignment EIS process to ensure the transportation alignment selected does not compromise public safety, national security interests, or training and testing at the Nevada Test and Training Range.

Bonnie Claire

Bonnie Claire comprises two alternatives that would depart a common segment located about 3.3 miles (5.5 kilometers) southeast of Lida Junction, Nevada. The western Bonnie Claire Alternative (BC1) would follow an abandoned rail line to cross U.S. 95 about 1 mile (1.5 kilometers) south of Stonewall Pass, and would then trend southeast paralleling U.S. 95 on the west across Sarcobatus Flat. This alternative would then cross State Route 267 about 1.5 miles (2.5 kilometers) southwest of Scotty's Junction, continuing southeasterly until crossing U.S. 95 again on the eastern edge of Sarcobatus Flat about 14 miles (22.5 kilometers) northwest of Springdale, Nevada. This alternative is about 22 miles (35.5 kilometers) in length.

The eastern Bonnie Claire Alternative (BC2) would parallel the contours of Stonewall Mountain to the southeast and would then extend south, adjacent to the western edge of Pahute Mesa. This alternative would then parallel the northern side of U.S. 95 about 1 mile (1.5 kilometers) until it converges with the western Bonnie Claire Alternative (BC1) on the eastern edge of Sarcobatus Flat. This alternative is about 25.5 miles (41 kilometers) in length.

DOE is aware of concerns raised by the Department of Defense and the U.S. Air Force regarding the alternatives that intersect the Nevada Test and Training Range lands, and will consult with the Department of Defense and the U.S. Air Force during the Rail Alignment EIS process to ensure the transportation alignment selected does not compromise public safety, national security interests, or training and testing at the Nevada Test and Training Range.

Oasis Valley

Oasis Valley includes two alternatives that would avoid naturally-occurring springs. Both alternatives would depart a common segment about 2 miles (3 kilometers) east-northeast of Oasis Mountain. Alternative OV1 is about 3 miles (5 kilometers) in length. Alternative OV2, which is about 3.5 miles (5.5 kilometers) in length, would cross Oasis Valley further to the east of Alternative OV1, thereby increasing the distance to the springs.

Beatty Wash

The Beatty Wash alternatives would depart from a common segment about 3 miles (5 kilometers) east-northeast of the hot springs north of Beatty and about 2 miles (3 kilometers) north-northeast of Beatty Wash. The eastern Beatty Wash Alternative (BW2) would extend east for about 5 miles (8 kilometers), then turn southward crossing a pass about 1 mile (1.5 kilometers) east of the Silicon and Thompson Mines. Alternative BW2 would then turn south to converge with Alternative BW1 about 4 miles (6.5 kilometers) east-northeast of Merklejohn Peak. This alternative is about 14 miles (22 kilometers) in length.

The western Beatty Wash Alternative (BW1) would extend south from the common segment described for Alternative BW2, crossing Beatty Wash and proceeding to the west of the Silicon and Thompson Mines before reconnecting with a common segment. This alternative is about 8 miles (13 kilometers) in length.

No Action Alternative

The No Action Alternative would evaluate the consequences of not constructing a rail line in Nevada for the transportation of spent nuclear fuel, high-level radioactive waste and other materials. Under the No Action Alternative, these materials would be shipped by legal-weight and heavy-haul truck within the State of Nevada to a repository at Yucca Mountain. About 53,000 legal-weight truck and 300 heavy-haul truck shipments of spent nuclear fuel and high-level radioactive waste would be required.

Environmental Issues and Resources To Be Examined

To facilitate the scoping process, DOE has identified a preliminary list of issues and environmental resources that it may consider in the Rail Alignment EIS. The list is not intended to be all-inclusive or to predetermine the scope or alternatives of the Rail Alignment EIS, but should be used as a starting point from which the public can help DOE define the scope of the EIS. DOE anticipates incorporating by reference the relevant analyses of the Repository Final EIS, supplemented as appropriate.

• Potential impacts to the concept of multiple use as it applies to public land use planning and management specified by the Federal Land Policy and Management Act of 1976.
• Potential impacts to land use and ownership.
• Potential impacts to plants, animals and their habitats, including impacts to wetlands, and threatened and endangered and other sensitive species.
• Potential impacts to cultural and Native American resources.
• Potential impacts to paleontological resources.
• Potential impacts to the public from noise and vibration.
• Potential impacts to the general public and workers from radiological exposures during incident-free operations of the rail line in Nevada.
• Potential impacts to the general public and workers from radiological exposures from potential accidents during operations of the rail line in Nevada.
• Potential impacts to water resources and floodplains.
• Potential impacts to aesthetic values.
• Potential disproportionately high and adverse impacts to low-income and minority populations (environmental justice).
• Irretrievable and irreversible commitment of resources.
• Compliance with applicable Federal, state and local requirements.

The Department specifically invites comments on the following:

1. Should additional alternatives be considered that might minimize, avoid or mitigate adverse environmental impacts (for example, looking beyond the 0.25 mile wide corridor, avoiding wilderness study areas, Native American Trust Lands, or encroachment on the Nevada Test and Training Range)?
2. Should any of the preliminary alternatives be eliminated from detailed consideration?
3. Should additional environmental resources be considered?
4. Should DOE allow private entities to ship commercial commodities on its rail line?
5. What mitigation measures should be considered?
6. Are there national security issues that should be addressed?

Schedule

The DOE intends to issue the Draft Rail Alignment EIS early in 2005 at which time its availability will be announced in the **Federal Register** and local media. A public comment period will start upon publication of the Environmental Protection Agency's Notice of Availability in the **Federal Register**. The Department will consider and respond to comments received on the Draft Rail Alignment EIS in preparing the Final Rail Alignment EIS.

Other Agency Involvement

The Department expects to invite the following agencies to be cooperating agencies in the preparation of the Rail Alignment EIS: U.S. Bureau of Land Management, the U.S. Air Force, and the U.S. Surface Transportation Board. These agencies were selected because they have management and regulatory authority over lands traversed by an alternative rail alignment within the Caliente rail corridor, or special expertise germane to the construction and operation of a rail line. DOE will consult with the U.S. Bureau of Indian Affairs, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. Nuclear Regulatory Commission, Native American Tribal organizations, the State of Nevada, and Nye, Lincoln and Esmeralda Counties regarding the environmental and regulatory issues germane to the Proposed Action. DOE invites comments on its identification of cooperating and consulting agencies and organizations.

Public Scoping Meetings

DOE will hold public scoping meetings on the Rail Alignment EIS. The meetings will be held at the following locations and times:

• Amargosa Valley, Nevada. Longstreet Inn and Casino, Highway 373, May 3, 2004 from 4–8 p.m.
• Goldfield, Nevada. Goldfield Community Center, 301 Crook Street, May 4, 2004 from 4–8 p.m.
• Caliente, Nevada. Caliente Youth Center, U.S. Highway 93, Caliente, Nevada, May 5, 2004 from 4–8 p.m.

The public scoping meetings will be an open meeting format without a formal presentation by DOE. Members of the public are invited to attend the meetings at their convenience any time during meeting hours and submit their comments in writing at the meeting, or in person to a court reporter who will be available throughout the meeting. This open meeting format increases the opportunity for public comment and provides for one-on-one discussions with DOE representatives involved with the Rail Alignment EIS and Nevada transportation project.

The public scoping meetings will be held during the public scoping comment period. The comment period begins with publication of this NOI in the **Federal Register** and closes May 24, 2004. Comments received after this date will be considered to the extent practicable. Written comments may be provided in writing, facsimile, or by email to Ms. Robin Sweeney, EIS Document Manager (see **ADDRESSES** above).

Public Reading Rooms

Documents referenced in this Notice of Intent and related information are available at the following locations: Beatty Yucca Mountain Information Center, 100 North E. Avenue, Beatty, NV

A.5 69 *FR* 22496, April 26, 2004

22496 **Federal Register** / Vol. 69, No. 80 / Monday, April 26, 2004 / Notices

DEPARTMENT OF ENERGY

Comment Period Extension and Additional Public Scoping Meetings for an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV

AGENCY: U.S. Department of Energy.

ACTION: Notice of comment period extension and additional public meetings.

SUMMARY: On April 8, 2004, the U.S. Department of Energy (DOE) published a Notice of Intent (69 FR 18565) announcing its intent to prepare an environmental impact statement (EIS) under the National Environmental Policy Act for the alignment, construction, and operation of a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada, and announced three public scoping meetings during a 45-day public comment period ending May 24, 2004. In response to a request from the State of Nevada, DOE is now announcing two additional public meetings, one in Las Vegas, Nevada, and one in Reno, Nevada, and extending the comment period to June 1, 2004.

DATES: The additional public meetings will be held at the following locations and times:

- Las Vegas, Nevada. Las Vegas Yucca Mountain Information Center, 4101 B Meadows Lane, May 10, 2004, from 4–8 p.m.
- Reno, Nevada. University of Nevada-Reno, Lawlor Event Center-Silver and Blue Room, 15th & North Virginia, May 12, 2004, from 4–8 p.m.

The comment period on the Notice of Intent is being extended to June 1, 2004. DOE will consider comments on the proposed scope of the Rail Alignment EIS received after June 1, 2004, to the extent practicable.

ADDRESSES: Written comments on the scope of this Rail Alignment EIS, questions concerning the proposed action and alternatives, requests for maps that illustrate the Caliente corridor and alternatives, or requests for additional information on the Rail Alignment EIS or transportation planning in general should be directed to: Ms. Robin Sweeney, EIS Document Manager, Office of National Transportation, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, telephone 1–800–967–3477, or via the Internet at *http://www.ocrwm.doe.gov* under "What's New."

Issued in Washington, DC, on April 20, 2004.

Margaret S. Y. Chu,

Director, Office of Civilian Radioactive Waste Management.

[FR Doc. 04–9524 Filed 4–23–04; 8:45 am]

BILLING CODE 6450–01–P

A.6 69 *FR* 23177, April 28, 2004

Federal Register / Vol. 69, No. 82 / Wednesday, April 28, 2004 / Notices 23177

DEPARTMENT OF ENERGY

Comment Period Extension and Additional Public Scoping Meetings for an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, Nevada; Correction

AGENCY: Department of Energy.

ACTION: Notice of Comment Period Extension and Additional Public Meetings; correction.

SUMMARY: The Department of Energy published a document in the **Federal Register** of April 26, 2004, concerning the additional scoping meetings to be held in support of the Rail Alignment EIS. The document contained an incorrect date and location for the Las Vegas, NV scoping meetings.

FOR FURTHER INFORMATION CONTACT: Robin Sweeney at 1–800–967–3477.

Correction

In the **Federal Register** of April 26, 2004, in FR Vol 69, No. 80, on Page 22496, in the first column, correct the date and location for the Las Vegas, NV scoping meeting to read: Las Vegas, Nevada, Cashman Center, Rooms 103–106, 850 Las Vegas Blvd. North, May 17, 2004, from 4–8 p.m.

Dated: April 26, 2004.

Margaret S.Y. Chu,

Director, Office of Civilian Radioactive Waste Management.

[FR Doc. 04–9719 Filed 4–27–04; 8:45 am]

BILLING CODE 6450–01–P

A.7 70 *FR* 51029, August 29, 2005

Federal Register / Vol. 70, No. 166 / Monday, August 29, 2005 / Notices 51029

DEPARTMENT OF ENERGY

Notice of Availability of the Environmental Assessment Supporting the Department of Energy's Application to the Department of the Interior for a Public Land Order To Withdraw Public Lands Within and Around the Caliente Rail Corridor, Nevada, From Surface Entry and New Mining Claims

AGENCY: Office of Civilian Radioactive Waste Management, U.S. Department of Energy.

ACTION: Notice of availability.

SUMMARY: This notice announces the availability, and opportunity for public review and comment, of the environmental assessment (EA) that supports the Department of Energy's (DOE) application to the Department of the Interior, filed with the Bureau of Land Management (BLM), for a Public Land Order to withdraw public lands within and surrounding the Caliente Rail Corridor. As applied for, the withdrawal would preclude surface entry and new mining claim locations for a 20 year period.

DATES: Comments should be received by DOE no later than September 28, 2005.

ADDRESSES: Comments, or requests for copies of the draft EA, should be sent to Lee Bishop, EA Document Manager, United States Department of Energy, 1551 Hillshire Drive, Las Vegas, NV 89134. Requests for copies of the draft EA may also be made by calling 1–800–225–6972. The draft EA and electronic comment forms are available at *http://www.ocrwm.doe.gov*. Comments may also be faxed to 1–800–967–0739.

FOR FURTHER INFORMATION CONTACT: Lee Bishop, EA Document Manager, at the address above or at 1–800–225–6972.

SUPPLEMENTARY INFORMATION: A notice of proposed withdrawal was published in the **Federal Register** on December 29, 2003 (68 FR 74965–74968), stating that the Bureau of Land Management had received an application from DOE to withdraw for 20 years approximately 308,600 acres of public land from surface entry and mining locations while DOE evaluates the land for the potential construction, operation, and maintenance of a branch rail line. The rail line would be used for the transportation of spent nuclear fuel and high-level radioactive waste as provided under the Nuclear Waste Policy Act of 1982, as amended (42 U.S.C. 10101 *et seq.*). BLM held public meetings on the application in June 2004.

In accordance with 43 CFR 2310.3–2(b)(3), DOE has prepared a draft EA to support its application, with the BLM participating as a cooperating agency. The application seeks a Public Land Order for the purpose of precluding surface entry and the location of new mining claims which could interfere with the evaluation of the land. The proposed Public Land Order would not affect existing mining claims or other activities such as grazing rights, water rights, and recreational uses.

The draft EA may be reviewed on the Internet at *http://www.ocrwm.doe.gov*. Copies of the EA may also be obtained by contacting Mr. Lee Bishop (see address above). Comments may be submitted to Mr. Bishop or through the comment form at the above website, and should be received by September 28, 2005.

Three public meetings on the draft EA will be held as follows:

Monday, September 12, 2005, 4 p.m. to 8 p.m., Longstreet Inn & Casino, Highway 373, Amargosa Valley, NV;

Tuesday, September 13, 2005, 4 p.m. to 8 p.m., Goldfield School Gymnasium, 233 Ramsey, Goldfield, NV; and

Thursday, September 15, 2005, 4 p.m. to 8 p.m., Caliente Youth Center, U.S. Highway 93, Caliente, NV.

Comments received will be considered in finalizing the EA. After the EA is finalized it will be formally submitted to the BLM. The BLM will subsequently make a recommendation to the Secretary of the Interior, who will make a final determination regarding DOE's application for a Public Land Order.

Issued in Washington, DC.

Paul M. Golan,

Principal Deputy Director, Office of Civilian Radioactive Waste Management.

[FR Doc. 05–17143 Filed 8–26–05; 8:45 am]

BILLING CODE 6450–01–P

A.8 70 *FR* 76854, December 28, 2005

76854 Federal Register / Vol. 70, No. 248 / Wednesday, December 28, 2005 / Notices

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[NV–040–1920–ET–4662; NVN–77880; 6–08807]

Public Land Order No. 7653; Withdrawal of Public Lands for the Department of Energy To Protect the Caliente Rail Corridor; Nevada

AGENCY: Bureau of Land Management, Interior.

ACTION: Public Land Order.

SUMMARY: This order withdraws approximately 308,600 acres of public lands within the Caliente Rail Corridor, Nevada, from surface entry and the location of new mining claims, subject to valid existing rights, for a period of 10 years to allow the Department of Energy to evaluate the lands for the potential construction, operation, and maintenance of a rail line which would be used to transport spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository as part of the Department of Energy's responsibility under the Nuclear Waste Policy Act, as amended, 42 U.S.C. 10101 *et seq.*

DATES: Effective Date: December 28, 2005.

FOR FURTHER INFORMATION CONTACT: Dennis J. Samuelson, BLM Nevada State Office, P.O. Box 12000, Reno, Nevada 89520, 775–861–6532.

SUPPLEMENTARY INFORMATION: The evaluation of the Caliente Rail Corridor will assist the Department of Energy to determine through the preparation of the Caliente Corridor rail alignment environmental impact statement, conducted pursuant to the National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 *et seq.*, whether to construct the rail line in that location. Construction of a rail line within the Caliente Rail Corridor would require that the Department of Energy apply for and receive a right-of-way grant from the Bureau of Land Management in accordance with the Federal Land Policy and Management Act, as amended, 43 U.S.C. Subchapter V.

Order

By virtue of the authority vested in the Secretary of the Interior by section 204 of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1714 (2000), it is ordered as follows:

1. Subject to valid existing rights, the following described public lands are hereby withdrawn from settlement, sale, location, or entry under the general land laws, including the United States mining laws (30 U.S.C. Ch. 2 (2000)), but not from leasing under the mineral leasing laws, for a period of 10 years, to allow the Department of Energy to evaluate lands within the Caliente Rail Corridor for the potential construction, operation, and maintenance of a rail line which would be used to transport spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository as part of the Department of Energy's responsibility under the Nuclear Waste Policy Act, as amended, 42 U.S.C. 10101 *et seq.*

A corridor 1-mile in width that contains a portion of, or is wholly encompassed within the following sections and/or quarter sections and government lots:

T. 1 N., R. 43 E.,
- Sec. 23, S½;
- Sec. 24, NE¼ and S½;
- Secs. 25 and 26;
- Sec. 27, E½;
- Secs. 34, 35, and 36.

T. 1 S., R. 43 E.,
- Sec. 1, lots 2, 3, and 4, S½NW¼, and SW¼;
- Secs. 2 and 3;
- Sec. 4, E½;
- Sec. 9, E½;
- Secs. 10 and 11;
- Sec. 12, W½;
- Sec. 13;
- Sec. 14, E½ and NW¼;
- Sec. 15;
- Sec. 16, E½;
- Sec. 21;
- Sec. 22, NE¼ and W½;
- Sec. 23, NE¼;
- Sec. 24;
- Sec. 25, E½;
- Sec. 27, W½;
- Secs. 28 and 33;
- Sec. 34, W½.

T. 2 S., R. 43 E.,
- Sec. 3, lots 3 and 4, S½NW¼, and SW¼;
- Secs. 4 and 9;
- Sec. 10, W½;
- Sec. 15, W½;
- Sec. 16 (except patented land);
- Sec. 20, SE¼ (except patented land);
- Sec. 21 (except patented land);
- Sec. 22, W½ (except patented land);
- Sec. 27, SW¼ (except patented land);
- Sec. 28 (except patented land);

Sec. 29, E½ (except patented land);
Sec. 32, NE¼ (except patented land);
Secs. 33 and 34 (except patented land);
Sec. 35, W½ and SE¼ (except patented land);
Sec. 36, SW¼.
T. 3 S., R. 43 E.,
Secs. 1, 2, and 3 (except patented land);
Sec. 4, NE¼ (except patented land);
Sec. 10 (except patented land);
Secs. 11 and 12;
Sec. 13, NE¼ and W½;
Sec. 14;
Sec. 15, E½;
Sec. 22, E½;
Secs. 23 to 26, inclusive;
Sec. 27, E½;
Sec. 34, E½;
Secs. 35 and 36.
T. 4 S., R. 43 E.,
Sec. 1, lots 2, 3, and 4, S½NE¼, S½NW¼, and SW¼;
Sec. 2;
Sec. 3; lots 1 and 2, S½NE¼, and S½;
Secs. 10 and 11;
Sec. 12, W½;
Secs. 14, 15, and 22;
Sec. 23, W½;
Sec. 26, NW¼;
Sec. 27;
Sec. 28, E½;
Sec. 33;
Sec. 34, NE¼ and W½.
T. 5 S., R. 43 E., Unsurveyed
Sec. 3, NW¼;
Secs. 4, 5, 8, 9, 15, and 16;
Sec. 17 (except patented land);
Secs. 21, 22, 27, 28, 33, 34, and 35.
T. 6 S., R. 43 E., Unsurveyed
Secs. 1, 2, 3, Secs. 10 to 15, inclusive, and Sec. 23;
Secs. 24 and 25 (except patented land);
Sec. 26;
Sec. 27, E½;
Sec. 34, E½;
Secs. 35 and 36.
T. 7 S., R. 43 E., Unsurveyed
Secs. 1 and 2;
Sec. 3, E½;
Secs. 11 to 14, inclusive, Secs. 24 and 25.
T. 1 N., R. 44 E.,
Sec. 19, lots 2, 3, and 4, E½SW¼, and E½;
Secs. 20, 21, and 22;
Sec. 23, W½ and SE¼;
Sec. 24, S½;
Secs. 25 and 26;
Sec. 27, N½;
Sec. 28, N½;
Sec. 29, N½;
Sec. 30, lots 1, 2, and 3, NE¼, E½NW¼, and E½SW¼.
T. 7 S., R. 44 E., Partially Surveyed
Secs. 6, 7, 17, 18, 19, and 20;
Sec. 21, NE¼ and N½NW¼;
Sec. 27;
Sec. 29, W½;
Sec. 29, SE¼ (reserved minerals only);
Secs. 30 and 31.
T. 8 S., R. 44 E., Partially Surveyed
Sec. 2, E½;
Sec. 9, N½ (reserved minerals only);
Sec. 9, S½;
Sec. 10, N½ (reserved minerals only);
Sec. 10, S½;
Sec. 11, SW¼;
Sec. 12, E½;
Secs. 13 to 16, inclusive;
Sec. 22, NE¼;
Secs. 23 to 26, inclusive, and Sec. 36.
T. 1 N., R. 45 E.,
Sec. 19, lot 4, E½SW¼, and SE¼;
Sec. 20, S½;
Sec. 25, S½;
Sec. 26, NW¼ and S½;
Secs. 27 to 30, inclusive;
Sec. 32, N½;
Sec. 33, N½;
Sec. 34, N½;
Secs. 35 and 36.
T. 8 S., R. 45 E., Unsurveyed
Sec. 19 and Secs. 28 to 33, inclusive.
T. 9 S., R. 45 E., Unsurveyed
Secs. 2 to 6, inclusive, Secs. 8 to 14, inclusive, and Sec. 24.
T. 1 N., R. 46 E.,
Sec. 25, NE¼ and S½;
Sec. 26, S½;
Sec. 27, S½;
Sec. 28, S½;
Sec. 29, S½;
Sec. 30, lot 4, E½SW¼, and SE¼;
Secs. 31 to 36, inclusive.
T. 9 S., R. 46 E., Unsurveyed
Sec. 7 and Secs. 17 to 21, inclusive;
Sec. 22, SW¼;
Secs. 26 to 29, inclusive, and Secs. 33 to 36, inclusive.
T. 10 S., R. 46 E., Unsurveyed
Secs. 1, 2, 12, and 13.
T. 1 N., R. 47 E.,
Sec. 1, lots 1 to 4, inclusive, S½NE¼, S½NW¼, and SW¼;
Sec. 2;
Sec. 3, SE¼;
Secs. 10 and 11;
Sec. 12, NW¼;
Sec. 14, NW¼;
Sec. 15;
Sec. 16, NE¼ and S½;
Sec. 20, NE¼ and S½;
Sec. 21;
Sec. 22, NE¼ and W½;
Sec. 28, NE¼ and W½;
Secs. 29 and 30;
Sec. 31, lots 1, 2 and 3, NE¼, and E½NW¼;
Sec. 32 NW¼.
T. 2 N., R. 47 E.,
Sec. 25, NE¼ and S½;
Sec. 35, E½;
Sec. 36.
T. 10 S., R. 47 E., Partially Surveyed
Sec. 6, SW¼;
Secs. 7 and 8;
Sec. 9, SW¼;
Sec. 15, NW ¼ and S½;
Secs. 16, 17, and 18;
Sec. 21, N½ and SE½;
Sec. 22, E½NE¼, W½, and SE¼SE¼;
Sec. 23, S½NW¼ and SW¼;
Sec. 26, W½;
Sec. 27; E½ and SW¼SW¼;
Sec. 28, NE¼;
Sec. 34;
Sec. 35, W½ and SE¼.
T. 11 S., R. 47 E.,
Sec. 1, SW¼;
Sec. 2;
Sec. 3, lots 1 and 2, S½NE¼, and SE¼;
Sec. 11;
Sec. 12, W½ and SE¼;
Sec. 13;
Sec. 14, N½ and SE¼;
Sec. 24, N½ and SE¼;
Sec. 25, NE¼.
T. 2 N., R. 48 E.,
Sec. 2, lots 3 and 4, and S½NW¼;
Sec. 3;
Sec. 4, lot 1, S½NE¼, and S½;
Sec. 8, E½;
Sec. 9;
Sec. 10, NE¼ and W½;
Sec. 16, NE¼ and W½;
Sec. 17;
Sec. 18, SE¼;
Sec. 19, lots 3 and 4, E½, and E½SW¼;
Sec. 20;
Sec. 21, NW¼;
Sec. 29, NW¼;
Sec. 30;
Sec. 31, lots 1 to 4, inclusive, NE¼, and E½NW¼.
T. 3 N., R. 48 E.,
Sec. 13, E½ and SW¼;
Sec. 23, E½;
Sec. 24;
Sec. 25, N½ and SW¼;
Sec. 26;
Sec. 27, SE¼;
Secs. 34 and 35;
Sec. 36, NW¼.
T. 11 S., R. 48 E., Unsurveyed
Sec. 7, S½;
Secs. 8 to 11, inclusive, Secs. 14 to 22, inclusive, and Secs. 27 to 34, inclusive.
T. 12 S., R. 48 E., Unsurveyed
Secs. 2 to 6, inclusive;
Sec. 9, NE¼;
Secs. 10 and 11;
Sec. 13, SW¼;
Secs. 14, 15, and Secs. 23 to 26, inclusive;
Sec. 35, E½;
Sec. 36.
T. 13 S., R. 48 E., Unsurveyed
Secs. 9, 10, 14, 15, 16, and Secs. 22 to 26, inclusive;
Sec. 36, NE¼.
T. 3 N., R. 49 E.,
Sec. 2, lots 3 and 4, and S½NW¼;
Secs. 3 and 4;
Sec. 5, SE¼;
Sec. 7, E½SW¼ and SE¼;
Secs. 8 and 9;
Sec. 10, NW¼;
Sec. 16, NW¼;
Sec. 17, N½ and SW¼;
Sec. 18;
Sec. 19, lots 1, 2, and 3, NE¼, and E½NW¼.
T. 4 N., R. 49 E.,
Sec. 24, SE¼;
Sec. 25;
Sec. 26, NE¼ and S½;
Sec. 33, SE¼;
Secs. 34 and 35;
Sec. 36, N½ and SW¼.
T. 12 S., R. 49 E., Unsurveyed
Sec. 31.
T. 13 S., R. 49 E., Unsurveyed
Secs. 13, 14,
Secs. 22 to 27, inclusive, and
Secs. 29 to 36, inclusive.
T. 14 S., R. 49 E., Unsurveyed
Secs. 1 to 5, inclusive,
Secs. 8 to 11, inclusive,
Secs. 15 and 16.
T. 4 N., R. 49½ E., Unsurveyed
Secs. 25, 26, 27, 34, 35, and 36.

T. 1 N., R. 50 E.,
Sec. 1, lots 1 and 2, S½NE¼, and SE¼;
Sec. 12, NE¼ (excluding Kawich Wilderness Study Area).
T. 2 N., R. 50 E.,
Sec. 1;
Sec. 2, lots 1 and 2, S½NE¼, and SE¼;
Sec. 11, E½;
Secs. 12 and 13;
Sec. 14, NE¼;
Secs. 24 and 25;
Sec. 36, E½ and NW¼.
T. 3 N., R. 50 E., Unsurveyed
Secs. 2, 3, 4, 10, 11, and 14;
Sec. 15, E½;
Sec. 22, NE¼;
Secs. 23 to 26, inclusive, Secs. 35 and 36.
T. 3½ N., R. 50 E., Unsurveyed
Secs. 33 and 34.
T. 4 N., R. 50 E., Partially Surveyed
Secs. 30 and 31;
Sec. 32, SW¼.
T. 13 S., R. 50 E., Unsurveyed
Secs. 30 and 31.
T. 1 N., R. 51 E.,
Sec. 6 (excluding South Reveille Wilderness Study Area);
Sec. 7 (excluding Kawich and South Reveille Wilderness Study Areas);
Sec. 17 (excluding South Reveille Wilderness Study Area);
Sec. 18 (excluding Kawich and South Reveille Wilderness Study Areas);
Sec. 19 NE¼ (excluding Kawich Wilderness Study Area);
Sec. 20 and 28 (excluding South Reveille Wilderness Study Area);
Sec. 29, E½ and NW¼;
Sec. 33, E½ and NW¼;
Sec. 34 (excluding South Reveille Wilderness Study Area).
T. 2 N., R. 51 E.,
Sec. 18, lots 3 and 4;
Sec. 19, lots 1 to 4, inclusive, E½NW¼, and E½SW¼;
Sec. 30, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and SE¼;
Sec. 31, (excluding South Reveille Wilderness Study Area).
T. 1 S., R. 51 E., Unsurveyed
Sec. 2, (excluding South Reveille Wilderness Study Area);
Sec. 3;
Secs. 11, 12, and 13 (excluding South Reveille Wilderness Study Area);
Sec. 14, E½;
Sec. 24; Sec. 25, E½;
Sec. 36, E½.
T. 1 S., R. 51½ E., Unsurveyed
Secs. 19, 29, and 30 (excluding South Reveille Wilderness Study Area);
Sec. 31;
Sec. 32 (excluding South Reveille Wilderness Study Area).
T. 2 S., R. 51½ E., Unsurveyed
Secs. 4 and 5 (excluding South Reveille Wilderness Study Area);
Secs. 6, 7, and 8;
Sec. 9, (excluding South Reveille Wilderness Study Area);
secs. 16 and 17;
Sec. 18, NE¼;
Sec. 20, NE¼;
Sec. 21.
T. 2 S., R. 52 E., Unsurveyed
Secs. 7 and 11 (excluding South Reveille Wilderness Study Area);
Secs 12 and 13;
Secs. 14 to 18, inclusive (excluding South Reveille Wilderness Study Area);
Secs. 19, 20, and 21;
Sec. 22, N½;
Sec. 23, N½.
T. 1 S., R. 53 E.,
Sec. 25;
Sec. 35, E½ and SW¼;
Sec. 36.
T. 2 S., R. 53 E.,
Sec. 1, lots 3 and 4, and S½NW¼;
Sec. 2;
Sec. 3, lot 1, S½NE¼, and S½;
Sec. 7, lot 4, E½SW¼, and SE¼;
Sec. 8, S½;
Secs. 9 and 10;
Sec. 11, N½ and SW¼;
Sec. 15, N½;
Sec. 16, N½ and SW¼;
Secs. 17 and 18.
T. 1 S., R. 54 E.,
Sec. 1, S½NE¼ and S½;
Sec. 10, SE¼;
Secs. 11 and 12;
Sec. 13, N½;
Secs. 14 and 15;
Sec. 16, SE¼;
Sec. 19, lots 3 and 4, E½SW¼, and SE¼;
Sec. 20, S½;
Secs. 21 and 22;
Sec. 23, NW¼;
Sec. 28, N½ and SW¼;
Secs. 29 and 30;
Sec. 31, lots 1 and 2, and E½NW¼;
Sec. 32, NW¼.
T. 1 N., R. 55 E.,
Sec. 13, S½;
Sec. 14, SE¼;
Sec. 21, S½;
Sec. 22, NE¼ and S½;
Secs. 23 and 24;
Sec. 25, NW¼;
Sec. 26, N½;
Secs. 27 and 28;
Sec. 29, NE¼ and S½;
Sec. 30, SE¼;
Secs. 31 and 32;
Sec. 33, N½.
T. 1 S., R. 55 E.,
Sec. 5, lot 4 and S½NW¼;
Sec. 6;
Sec. 7, lots 1, 2, and 3, NE¼, and E½NW¼.
T. 1 N., R. 56 E., Partially Surveyed
Sec. 1;
Sec. 2, S½NE¼ and SE¼;
Sec. 9, S½;
Secs. 10 and 11;
Sec. 12, NE¼ and W½;
Sec. 13, NW¼;
Sec. 14, N½;
Secs. 15, 16, and 17;
Sec. 18, lots 3 and 4, E½, and E½SW¼;
Sec. 19, lots 1, 2, 3, NE¼, E½NW¼, NE¼SW¼, and NW¼SE¼;
Sec. 20, N½;
Sec. 21, N½.
T. 2 N., R. 56 E., Partially Surveyed
Sec. 36.
T. 1 N., R. 57 E., Partially Surveyed
Sec. 3, lots 3 and 4, and S½NW¼;
Sec. 4, lots 1 to 4, inclusive, and S½NW¼;
Sec. 5, lots 1 to 4, inclusive, S½NE¼, S½NW¼, and W½SW¼;
Sec. 6.
T. 2 N., R. 57 E.,
Sec. 13;
Sec. 14, SE¼;
Sec. 22, S½;
Secs. 23 to 28, inclusive;
Sec. 29, S½;
Sec. 31, lots 3 and 4, E½, and E½SW¼;
Secs. 32 to 35, inclusive;
Sec. 36, NE¼ and W½.
T. 2 N., R. 58 E.,
Sec. 2, lots 3 and 4, and S½NW¼;
Secs. 3 and 4;
Sec. 5, S½;
Sec. 7, lot 4, E½SW¼, and E½;
Sec. 8;
Sec. 9, NE¼ and W½;
Sec. 10, NW¼;
Sec. 13, SW¼ and S½SE¼;
Sec. 17, NE¼ and W½;
Sec. 18;
Sec. 19, lots 1 and 2, and E½NW¼;
Sec. 20, S½;
Sec. 21, S½;
Sec. 22, NE¼ and S½;
Secs. 23 and 24;
Sec. 25, N½;
Sec. 26, N½;
Secs. 27 to 30, inclusive;
Sec. 31, lots 1 and 2, NE¼, and E½NW¼;
Sec. 32, N½.
T. 3 N., R. 58 E.,
Sec. 24, SE¼;
Sec. 25;
Sec. 26, NE¼ and S½;
Sec. 33, SE¼;
Secs. 34 and 35;
Sec. 36, N½ and SW¼.
T. 2 N., R. 59 E.,
Sec. 2, lots 2, 3, and 4, and S½NW¼;
Sec. 3, lots 1 to 4, inclusive, S½NE¼, and S½NW¼;
Sec. 4;
Sec. 8, NE¼ and S½;
Sec. 9;
Sec. 16, N½ and SW¼;
Secs. 17, 18, and 19;
Sec. 20, NW¼.
T. 3 N., R. 59 E.,
Sec. 12, E½ and SW¼;
Sec. 13;
Sec. 14, SE¼;
Sec. 19, lots 3 and 4, NE¼, E½SW¼, and SE¼;
Sec. 20;
Sec. 21, S½SW¼ and SE¼;
Sec. 22, NE¼ and S½;
Secs. 23 to 28, inclusive;
Sec. 29, N½;
Sec. 30;
Sec. 33, SE¼;
Secs. 34, 35, and 36.
T. 2 N., R. 60 E., Unsurveyed
Sec. 1.
T. 3 N., R. 60 E., Unsurveyed
Secs. 5 to 8, inclusive, Secs. 18 to 22, inclusive, Secs. 25 to 31, inclusive, Secs. 34, 35, and 36.
T. 4 N., R. 60 E.,
Sec. 20, SE¼;
Sec. 21, S½;
Secs. 22, 23, and 24;
Sec. 25, N½;
Sec. 26, N½;
Sec. 27, E½NE¼ and W½;
Secs. 28 and 29;
Sec. 30, SE¼;

Sec. 31, lots 3 and 4, E½, and E½SW¼;
Sec. 32;
Sec. 33, NW¼.
T. 2 N., R. 61 E., Unsurveyed
Sec. 6.
T. 3 N., R. 61 E., Unsurveyed
Secs. 2, 3, 4, and Secs. 9 to 15, inclusive;
Sec. 22, SE¼;
Secs. 23 and 24;
Sec. 25 (excluding Weepah Spring Wilderness Area);
Secs. 26 to 33, inclusive.
Secs. 34, 35, and 36 (excluding Weepah Spring Wilderness Area).
T. 4 N., R. 61 E.,
Sec. 19, lots 2, 3, and 4, E½SW¼, and SE¼;
Sec. 20, SW¼;
Sec. 28, SW¼;
Secs. 29 and 30;
Sec. 31, NE¼;
Secs. 32 and 33;
Sec. 34, S½.
T. 1 N., R. 62 E., Unsurveyed
Sec. 1, E½;
Sec. 12, E½;
Sec. 13.
T. 2 N., R. 62 E., Unsurveyed
Secs. 1 to 4, inclusive;
Sec. 5, N½;
Secs. 10 to 14, inclusive;
Sec. 15, NE¼;
Secs. 24 and 25;
Sec. 36, E½.
T. 3 N., R. 62 E.,
Sec. 18, lots 2, 3, and 4, E½SW¼, and SE¼;
Sec. 19;
Sec. 20, W½ and SE¼;
Sec. 28, W½ and SE¼;
Secs. 29 and 30;
Sec. 31 (excluding Weepah Spring Wilderness Area);
Secs. 32, 33, and 34, inclusive;
Sec. 35, SW¼.
T 1 N., R. 63 E., Unsurveyed
Secs. 6, 7, 8, Secs. 17 to 21, inclusive, and Secs. 26 to 30, inclusive;
Secs. 32 and 35, inclusive.
T. 1 S., R. 63 E., Unsurveyed
Secs. 1, 2, 11, 12, and 13.
T. 2 N., R. 63 E.,
Sec. 7, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and SE¼;
Secs. 18, 19, 30, and 31.
T. 1 S., R. 64 E.,
Sec. 7, lots 2, 3, and 4, E½NW¼, E½SW¼, and SE¼;
Sec. 15, SW¼;
Sec. 16, S½;
Secs. 17 and 18;
Sec. 19, NE¼ and E½NW¼;
Secs. 20 to 23, inclusive;
Sec. 24, NW¼ and S½;
Sec. 25;
Sec. 26, N½;
Sec. 27, N½.
T. 1 S., R. 65 E.,
Sec. 19, lots 3 and 4, E½SW¼, and SE¼;
Sec. 20, SW¼;
Sec. 27, W½ and SE¼;
Secs. 28, 29, and 30;
Sec. 32, N½;
Sec. 33, N½ and SE¼;
Sec. 34;
Sec. 35, NW¼ and S½.
T. 2 S., R. 65 E.,
Sec. 1, S½NW¼ and SW¼;
Sec. 2;
Sec. 3, lots 1, 2, and 3, S½NE¼, S½NW¼, and SE¼;
Secs. 11, 12, and 13;
Sec. 14, NE¼.
T. 2 S., R. 66 E., Unsurveyed
Secs. 1 to 5, inclusive, Secs. 7 to 14, inclusive, Secs. 16, 17, 18, 20, and 24;
Secs. 16 to 18, inclusive.
T. 2 S., R. 67 E.,
Sec. 7, E½SE¼;
Sec. 8, S½;
Sec. 9, SW¼;
Sec. 14, SW¼ and W½SE¼;
Sec. 15, NW¼ and S½;
Secs. 16 to 20, inclusive;
Sec. 21, N½ and SE¼;
Sec. 22;
Sec. 23, NE¼NE¼, W½NE¼, W½, and SE¼;
Sec. 24, NW¼SW¼, S½SW¼, and NW¼SE¼;
Sec. 25 NW¼NW¼;
Sec. 26, NE¼;
Sec. 29, NW¼;
Sec. 30, lots 1 and 2, NE¼, and E½NW¼;
Sec. 35, NW¼NE¼;
Sec. 36, W½NE¼, SE¼NE¼, E½NW¼, E½SW¼, SW¼SW¼, and SE¼.
T. 3 S., R. 67 E.,
Sec. 1;
Secs. 12 and 13;
Sec. 16, E½;
Sec. 20, SE¼;
Sec. 21, W½NE¼, SW¼, NW¼SE¼, and N½SW¼SE¼;
Sec. 23, E½;
Secs. 24 and 25;
Sec. 28, W½NW¼, S½SW¼, and SE¼;
Sec. 29, NE¼, SW¼, N½SE¼, and SE¼SE¼;
Sec. 32, E½NE¼, NW¼, W½SW¼, NE¼SW¼, and E½SE¼;
Sec. 33, lots 2 and 3, and NW¼;
Sec. 35, E½;
Sec. 36.
T. 4 S., R. 67 E.,
Sec. 1;
Sec. 2, lots 1 and 2, S½NE¼, and SE¼;
Sec. 4, lots 3 and 4, S½NW¼, and SW¼;
Sec. 5, lots 1 and 4, SE¼NE¼, SW¼NW¼, NW¼SW¼, NE¼SE¼, and S½SE¼;
Sec. 6, lot 1, S½NE¼, and SE¼;
Sec. 7, lot 5;
Sec. 8, S½SE¼;
Sec. 9, N½NW¼ and SW¼;
Sec. 12, NE¼, N½NW¼, SE¼NW¼, and SE¼.
T. 2 S., R. 68 E.,
Sec. 23, S½;
Secs. 25 to 29, inclusive;
Sec. 30, E½, SE¼NW¼, and E½SW¼;
Sec. 31, NE¼ and E½NW¼;
Sec. 32, N½;
Sec. 33, N½;
Sec. 34, N½;
Sec. 35, N½;
Sec. 36.
T. 3 S., R. 68 E.,
Sec. 1;
Sec. 12, NE¼;
Sec. 19, lots 3 and 4, and E½SW¼;
Sec. 30, lots 1 to 4, inclusive, E½NW¼, and E½SW¼;
Sec. 31, lots 1 and 2, and E½NW¼.
T. 4 S., R. 68 E.,
Sec. 6, lots 5, 6, and 7, SE¼NW¼, E½SW¼, and SE¼;
Sec. 7, lots 2, 3, and 4, NE¼, E½SW¼, and SE¼;
Sec. 8, W½;
Sec. 17, NW¼;
Sec. 18, lot 1, NE¼, E½NW¼.
T. 2 S., R. 69 E.,
Sec. 30, lots 3 and 4, and E½SW¼;
Sec. 31, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and SE¼;
Sec. 32, S½;
Sec. 33, S½.
T. 3 S., R. 69 E.,
Sec. 3, lot 4, S½NW¼, SW¼, and SE¼;
Secs. 4 to 7, inclusive;
Sec. 8, W½;
Sec. 9, E½ and NW¼;
Sec. 10;
Sec. 11, SW¼;
Sec. 13, S½;
Secs. 14 and 15;
Sec. 22, NE¼;
Secs. 23 and 24;
Sec. 25, N½.
T. 3 S., R. 70 E.,
Sec. 8, S½;
Sec. 9, S½;
Sec. 10, S½;
Sec. 11, S½;
Sec. 12, S½;
Secs. 13 to 17, inclusive;
Sec. 18; lots 8 to 12, inclusive, and E½;
Sec. 19; sec. 20, N½;
Sec. 22, NE¼;
Sec. 23, N½;
Sec. 24, NW¼.

2. This order does not authorize the construction, operation, or maintenance of a rail line to transport spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository.

3. All public lands included in this withdrawal will be managed in accordance with applicable Bureau of Land Management land use plans, laws, regulations, and policy. The actions of the Department of Energy in evaluation of the lands covered by this withdrawal will meet the Bureau of Land Management's definition of "casual use" as set forth at 43 CFR 2801.5. The withdrawal made by this order does not alter the applicability of those public land laws governing the use of the lands under lease, license, or permit, or governing the disposal of their mineral or vegetative resources other than under the mining laws.

4. This withdrawal will expire 10 years from the effective date of this order unless, as a result of a review conducted before the expiration date pursuant to section 204(f) of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1714(f) (2000), the Secretary determines that the withdrawal shall be extended.

(Authority: 43 U.S.C. 1714(a); 43 CFR 2310.3–3(b)(1))

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Dated: December 21, 2005.

Mark Limbaugh,

Assistant Secretary of the Interior.

[FR Doc. 05–24579 Filed 12–27–05; 8:45 am]

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A.9 71 *FR* 60484, October 13, 2006

60484 Federal Register / Vol. 71, No. 198 / Friday, October 13, 2006 / Notices

DEPARTMENT OF ENERGY

Amended Notice of Intent To Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV

AGENCY: Department of Energy.

ACTION: Amended notice of intent.

SUMMARY: The Department of Energy (DOE or the Department) is providing this Amended Notice of Intent to expand the scope of the ongoing Environmental Impact Statement for the Alignment, Construction and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, Nevada (DOE/EIS–0369, Rail Alignment EIS, Notice of Intent, April 8, 2004, 69 FR 18565). In the ongoing Rail Alignment EIS, DOE has undertaken an analysis of alternative rail alignments in which to construct and operate a rail line within what is referred to as the Caliente corridor. Based on new information, DOE now plans to expand the Rail Alignment EIS to incorporate analysis of a new rail corridor alternative. This additional analysis will supplement the corridor analyses in the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (DOE/EIS–0250F, Yucca Mountain Final EIS, February 2002). The expanded analysis will consider the potential environmental impacts of a newly proposed Mina rail corridor at the same level of corridor analysis as is contained in the Yucca Mountain Final EIS, and will review the rail corridor analyses of that Final EIS, and update, as appropriate. The expanded scope will then proceed to include a detailed analysis of alternative alignments within the Mina corridor at the same level of analysis of the ongoing alignment analysis for the Caliente corridor. The result will be to provide the public with information concerning both the potential corridor and alignment impacts of the Mina corridor at the same time DOE presents the potential impacts for the construction and operation of a rail line within the Caliente corridor. The expanded EIS will be entitled the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS (DOE/EIS–0250F–S2 and DOE/EIS–0369).

On April 8, 2004 (69 FR 18557), the Department issued a Record of Decision announcing its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Yucca Mountain Final EIS. This decision will ultimately require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada for the shipment of spent nuclear fuel and high-level radioactive waste. To that end, the Department also selected the Caliente rail corridor in which to examine possible alignments for construction of that rail line. On April 8, 2004 (69 FR 18565), DOE issued a Notice of Intent to prepare an EIS under the National Environmental Policy Act (NEPA) for the alignment, construction, and operation of a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Nevada, to a geologic repository at Yucca Mountain, Nevada (the Rail Alignment EIS).

During subsequent public scoping, DOE received comments that offered preferences for various rail corridors analyzed in detail in the Yucca Mountain Final EIS, and identified other rail corridors for consideration. In particular, commenters recommended that DOE consider the Mina route, which would include use of an existing rail line from Hazen, Nevada, to the Thorne siding in Hawthorne, Nevada, and the construction of new rail line that would follow an abandoned rail line nearly to Yucca Mountain.

In the Yucca Mountain Final EIS, DOE considered, but eliminated from detailed study, several potential rail routes. One of those potential rail routes, the Mina route, could only connect to an existing rail line by crossing the Walker River Paiute Tribe Reservation northwest of Hawthorne, Nevada, and the Tribe had informed DOE that it would refuse to allow nuclear waste to be transported across its reservation (letter dated December 6, 1991). For this reason, the Department considered the Mina route to pose an unavoidable land use conflict and thus to be unavailable for further consideration.

Following review of the scoping comments for the Rail Alignment EIS, DOE held discussions with the Walker River Paiute Tribe regarding the availability of the Mina route. Subsequently, in May 2006, the Walker River Paiute Tribe informed DOE that the Tribal Council had withdrawn its objection to the completion of an EIS studying the transportation of nuclear waste across its reservation. The Tribe stated that its Tribal Council had not decided to allow such shipments, but indicated that inclusion of the Mina route in an EIS would allow the Tribe

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to make a more informed, final decision about the matter.

In view of the Tribal Council's decision, DOE initiated a study to determine the feasibility of the Mina route, and to identify a specific corridor (Mina corridor) and associated preliminary alternative alignments (described below under Mina Alternative Alignments). Based on DOE's preliminary analysis, in comparison with other rail corridors, the Mina corridor appears to offer potential advantages to the extent it would cross fewer mountain ranges, utilize existing rail bed, and also be a shorter distance. These potential advantages would simplify design and construction of a rail line, and therefore would be less costly to construct. The Mina corridor also would appear to have fewer land use conflicts, and would involve less land disturbance, which tends to result in lower adverse environmental impacts overall.

For these reasons, DOE has concluded that the Mina corridor warrants further detailed study. Accordingly, DOE is announcing its intent to expand the scope of the Rail Alignment EIS to supplement the rail corridor analyses of the Yucca Mountain Final EIS, and analyze the Mina corridor. This Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS[1] also will consider, in detail, alignments for the construction and operation of a rail line within the Caliente and Mina rail corridors.

DATES: The Department invites comments on the scope of the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS to ensure that all relevant environmental issues and reasonable alternatives are addressed. Public scoping meetings are discussed below in the **SUPPLEMENTARY INFORMATION** section. DOE will consider all comments received during the 45-day public scoping period, which starts with publication of this Amended Notice of Intent and ends November 27, 2006. Comments received after this date will be considered to the extent practicable.

ADDRESSES: Requests for additional information on the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS or transportation planning in general should be directed to: Mr. M. Lee Bishop, EIS Document Manager, Office of Logistics Management, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, Telephone 1–800–967–3477. Written comments on the scope of the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS may be submitted to Mr. M. Lee Bishop at this address, by facsimile to 1–800–967–0739, or via the Internet at *http://www.ocrwm.doe.gov* under the caption, What's New.

FOR FURTHER INFORMATION CONTACT: For general information regarding the DOE NEPA process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone 202–586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Background

On July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. Subsequently, the Department issued a Record of Decision (April 8, 2004) to announce its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Yucca Mountain Final EIS as the mode of transportation for spent nuclear fuel and high-level radioactive waste to the repository. Under the mostly rail scenario, the Department would rely on a combination of rail, truck and possibly barge to transport to the repository site at Yucca Mountain up to 70,000 metric tons of heavy metal of spent nuclear fuel and high-level radioactive waste. Most of the spent nuclear fuel and high-level radioactive waste, however, would be transported by rail.

The Department's decision to select the mostly rail scenario in Nevada ultimately will require the construction of a rail line[2] to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada for the shipment of spent nuclear fuel and high-level radioactive waste in the event the Nuclear Regulatory Commission authorizes construction of the repository, and receipt and possession of these materials at Yucca Mountain. To that end, in the same Record of Decision, the Department also decided to select the Caliente rail corridor[3] to study possible alignments for this proposed rail line. The Caliente rail corridor originates at an existing siding to the Union Pacific railroad near Caliente, Nevada, and extends in a westerly direction to the northwest corner of the Nevada Test and Training Range, before turning south-southeast to the repository at Yucca Mountain. The Caliente corridor ranges between 512 kilometers (318 miles) and 553 kilometers (344 miles) in length, depending on the alternative alignments considered.

On April 8, 2004, DOE issued a Notice of Intent to prepare an EIS under NEPA for the alignment, construction, and operation of a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials[4] from a site near Caliente, Nevada to a geologic repository at Yucca Mountain, Nevada. During subsequent public scoping, DOE received comments that offered preferences for various rail corridors analyzed in detail in the Yucca Mountain Final EIS, and identified other rail corridors for consideration. In particular, commenters recommended that DOE consider "the Mina route," which would include use of an existing rail line from Hazen, Nevada, to the Thorne siding at Hawthorne, Nevada, and the construction of new rail line that would follow an abandoned rail line nearly to Yucca Mountain.

In the Yucca Mountain Final EIS, DOE considered, but eliminated from detailed study, the Mina route and several other potential rail routes (see Section 2.3.3.1). These other potential rail routes were identified in a series of three transportation studies—"Preliminary Rail Access Study" (January, 1990), the "Nevada Potential Repository Preliminary Transportation Strategy, Study 1" (February, 1995), and the "Nevada Potential Repository Preliminary Transportation Strategy, Study 2" (February, 1996). Based on the latter (1996) study and public scoping, five potential rail corridors were considered in detail in the Yucca Mountain Final EIS.

In the 1996 study, the Mina route was not recommended for further study, because a rail line within the Mina route could only connect to an existing rail line by crossing the Walker River Paiute

[1] Coincident with this Amended Notice of Intent, DOE is publishing a Notice of Intent to prepare a Supplemental Yucca Mountain EIS (DOE/EIS–0250F–S1). That Supplement will consider the current repository design and plans for its construction and operation, and the transportation of spent nuclear fuel and high-level radioactive waste from sites around the United States to the repository at Yucca Mountain.

[2] Rail line means the railroad track and underlying earthworks.

[3] A corridor is a strip of land 400 meters (0.25 mile) wide through which DOE would identify an alignment for the construction of a rail line.

[4] Other materials are those related to the construction and operation of the repository.

Tribe Reservation, and the Tribe had informed DOE that it would refuse to allow nuclear waste to be transported across its reservation (letter dated December 6, 1991). For this reason, the Department considered the Mina route to pose an unavoidable land use conflict and thus to be unavailable for further consideration (see Section 2.3.3.1 in the Yucca Mountain Final EIS).

Following review of the scoping comments for the Rail Alignment EIS, DOE held discussions with the Walker River Paiute Tribe regarding the availability of the Mina route. Subsequently, in May 2006, the Walker River Paiute Tribe informed DOE that the Tribal Council had withdrawn its objection to the completion of an EIS studying the transportation of nuclear waste across its reservation. The Tribe stated that its Tribal Council had not decided to allow such shipments, but indicated that inclusion of the Mina route in an EIS would allow the Tribe to make a more informed, final decision about the matter.

In view of the Tribal Council's decision, DOE initiated a study to determine the feasibility of the Mina route, and to identify a specific corridor (the Mina corridor) and associated preliminary alternative alignments. Based on DOE's preliminary analysis, in comparison with other rail corridors, the Mina corridor appears to offer potential advantages to the extent it would cross fewer mountain ranges, utilize existing rail bed, and also be a shorter distance. These potential advantages would simplify design and construction of the rail line, and therefore would be less costly to construct. The Mina corridor also would appear to have fewer land use conflicts, and would involve less land disturbance, which tends to result in lower adverse environmental impacts overall.

For these reasons, DOE has concluded that the Mina corridor warrants further detailed study. Accordingly, DOE is announcing its intent to expand the scope of the Rail Alignment EIS to prepare a Supplemental EIS that will supplement the rail corridor analyses of the Yucca Mountain Final EIS. In the Yucca Mountain Final EIS, DOE evaluated the construction and operation of a rail line within five corridors—Caliente, Caliente-Chalk Mountain, Carlin, Jean and Valley Modified. In the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS, DOE will review the environmental information and analyses for these corridors, and update, as appropriate[5]; DOE also plans to consider the Mina corridor at a level of detail commensurate with that of the Yucca Mountain Final EIS. In addition, the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will consider, in detail, alignments for the construction and operation of a rail line within the Caliente and Mina corridors.

The Mina corridor originates at an existing rail line near Wabuska, Nevada, where it proceeds southeasterly through Hawthorne to Blair Junction, and then on to Lida Junction. At that point, it becomes coincident with the Caliente corridor trending southeasterly through Oasis Valley before turning north-northeast to Yucca Mountain. The Mina corridor is about 450 kilometers (280 miles) in length; however, construction of new rail line would range between about 386 kilometers (240 miles) and 409 kilometers (254 miles) because the corridor includes the existing Department of Defense rail line from Wabuska to the Hawthorne Army Depot in Hawthorne.

Previous Public Scoping Comments

The Department received more than 4,100 comments during the public scoping period for the Rail Alignment EIS that ended June 1, 2004. In general, many of these comments offered preferences for various rail corridors or requested DOE to evaluate rail corridors other than Caliente, and suggested new alternative alignments or criteria (*e.g.*, avoid wilderness study areas) that could be used to modify the preliminary alignments proposed by DOE or to create new alternative alignments. These comments helped inform DOE's decision to expand the scope of the Rail Alignment EIS as discussed under Background above, and to identify the range of reasonable alternative alignments as discussed under Caliente Alternative Alignments below.

Commenters also requested that DOE allow other commodities to be shipped on the rail line by private entities (referred to herein as shared use). As described under Proposed Action below, the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will evaluate shipments of commercial commodities, in addition to shipments of DOE materials.

DOE also received comments regarding analytical methods for various environmental resources such as cultural resources and water use, treatment of cumulative impacts and Native American concerns, the nature of the evaluation of potential accidents and sabotage, and the identification of mitigation measures. These comments and associated issues will be addressed in the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS.

Proposed Action

Under the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS, the Proposed Action is to determine a rail alignment[6] (within a rail corridor) in which to construct and operate a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from an existing railroad in Nevada to a geologic repository at Yucca Mountain, Nye County, Nevada. DOE now plans to review the environmental information and analyses for four rail corridors, and update, as appropriate (Caliente, Carlin, Jean and Valley Modified), include and analyze the Mina corridor, and evaluate in detail two alternatives that would implement the Proposed Action—the Mina Alternative and the Caliente Alternative. Under each implementing alternative, DOE will evaluate the potential environmental impacts from the construction and operation of a rail line along various alternative alignments[7] and common segments.[8] As part of rail line operations, DOE also will evaluate, as an option to the Mina and Caliente implementing alternatives, the shipment of commercial commodities by private entities (shared use).

Preliminary Alternatives

As required by the Council on Environmental Quality and Departmental regulations that implement NEPA, the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will analyze and present the environmental impacts associated with the range of reasonable alternatives to meet DOE's purpose and need for a rail line, and a no-action alternative. The preliminary alternative alignments for the Caliente and Mina rail alignments comprise a series of common segments and alternatives (maps may be obtained as described above in

[5] In a letter to the U.S. Air Force (dated December 1, 2004), DOE eliminated from detailed study alignments that would intersect the Nevada Test and Training Range because of concerns regarding military readiness testing and training activities. This letter was in response to a May 28, 2004 letter from the U.S. Air Force. For the same reasons cited in these letters, DOE does not intend to consider further the Caliente-Chalk Mountain rail corridor.

[6] A strip of land less than 400 meters (0.25 mile) wide through which the location of a rail line would be identified.

[7] A geographic region of the rail alignment for which multiple routes for the rail line have been identified.

[8] A geographic region of the rail alignment for which a single route for the rail line has been identified.

ADDRESSES). The Department is interested in identifying and subsequently evaluating any additional reasonable alternative alignments within the Caliente or Mina corridors that would reduce or avoid known or potential adverse environmental impacts, features having aesthetic values, and land-use conflicts, or alternatives that should be eliminated from detailed consideration. This could include identifying alternative alignments that could avoid environmentally sensitive areas or other land use conflicts.

Caliente Alternative Alignments

DOE's Notice of Intent (April 8, 2004) identified preliminary alternative alignments and common segments to be evaluated in the Rail Alignment EIS. The Notice of Intent also indicated that DOE would consider other potential alternatives if they would minimize, avoid or otherwise mitigate adverse environmental impacts.

Following scoping, DOE evaluated all public comments, as well as information from other sources, that could affect the preliminary alternative alignments and common segments identified in the Notice of Intent. Based on this information, DOE identified additional alternative alignments, and modified the preliminary alignments and common segments identified in the Notice of Intent to create a suite of potential alternatives. This suite was then evaluated using environmental features and engineering and design factors to determine, preliminarily, the range of reasonable alternative alignments. As an example, commenters identified alternative alignments that would avoid Garden Valley by identifying routes through Coal Valley that cross the Golden Gate Range. However, DOE found these alignments are not reasonable alternatives because they would either exceed engineering and design factors or would be far more costly to construct than other alignments that pass through Garden Valley.

On this basis, DOE has identified, preliminarily, alternative alignments at the interface with the Union Pacific Railroad near Caliente, in Garden Valley, near the Reveille Range and the Town of Goldfield, north of Scottys Junction (referred to as Bonnie Claire), and in Oasis Valley. These alternative alignments, which are described below, will be considered in detail in the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS.

Interface With Union Pacific Railroad

DOE has identified two alternative alignments, Caliente and Eccles, either of which alternative alignment would connect the proposed rail line to the existing Union Pacific Railroad in or near the City of Caliente. The Caliente alternative alignment would begin in Caliente, enter Meadow Valley Wash at Indian Cove, and extend generally north through Meadow Valley Wash and along U.S. 93. This alternative alignment would then cross U.S. 93 about 5 kilometers (3 miles) southwest of Panaca and connect to Common Segment 1 about 1 kilometer (0.6 mile) northwest of U.S. 93 and 18 kilometers (11 miles) south of Pioche. The Caliente alternative alignment would be approximately 18 kilometers (11 miles) long.

The Eccles alternative alignment would begin along Clover Creek about 8 kilometers (5 miles) east of Caliente and trend generally north to enter Meadow Valley Wash from the southeast. This alternative alignment would then cross U.S. 93 about 5 kilometers (3 miles) southwest of Panaca and connect to Common Segment 1 about 1 kilometer (0.6 mile) northwest of U.S. 93 and 18 kilometers (11 miles) south of Pioche. The Eccles alternative alignment would be about 18 kilometers (11 miles) long.

Garden Valley

DOE is considering four alternative alignments in the Garden Valley area, referred to as Garden Valley 1, 2, 3, and 8. Garden Valley 1 would run due west through the Golden Gate Range for about 7 kilometers (4 miles), trend in a southwesterly direction through Garden Valley, cross the Lincoln and Nye County line, and connect to Common Segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area, and 3 kilometers (2 miles) east of the Humboldt Toiyabe National Forest. The Garden Valley 1 alternative alignment would be approximately 35 kilometers (22 miles) long.

Garden Valley 2 would run to the south of Garden Valley 1 and Garden Valley 3, crossing the Lincoln and Nye County line. Garden Valley 2 would continue southwesterly through the Golden Gate Range at Water Gap, turn westward through Garden Valley, and continue southwesterly to connect to Common Segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area and 3 kilometers (2 miles) east of the Humboldt Toiyabe National Forest. The Garden Valley 2 alternative alignment would be about 37 kilometers (23 miles) long.

Garden Valley 3 would run due west through the Golden Gate Range and then in a northwesterly direction until turning southwest to run along the southeast base of the Quinn Canyon Range. Continuing in a southwesterly direction, it would run through Garden Valley, cross the Lincoln and Nye County line, and connect to Common Segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area and 3 kilometers (2 miles) east of the Humboldt Toiyabe National Forest. The Garden Valley 3 alternative alignment would be approximately 36 kilometers (22 miles) long.

Garden Valley 8 would run to the south of Garden Valley 1 and Garden Valley 3, crossing the Lincoln and Nye County line. It would continue southwesterly through the Golden Gate Range at Water Gap, would turn westward through Garden Valley, and run in a southwesterly direction before turning sharply westward. Garden Valley 8 would proceed westward and connect to Common Segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area and 3 kilometers (2 miles) east of the Humboldt Toiyabe National Forest. The Garden Valley 8 alternative alignment would be about 38 kilometers (23 miles) long, 8 kilometers (5 miles) of which parallels Garden Valley Road.

South Reveille

South Reveille 2 and South Reveille 3 alternative alignments would begin 5 kilometers (3 miles) south of the South Reveille Wilderness Study Area. South Reveille 2 would trend to the northwest along the border of the South Reveille Wilderness Study Area. South Reveille 3 would trend northwest a few kilometers to the west and roughly parallel to South Reveille 2. South Reveille 2 or South Reveille 3 would connect to Common Segment 3 in Reveille Valley about 14 kilometers (9 miles) west of State Route 375. South Reveille 2 would be approximately 19 kilometers (12 miles) long and South Reveille 3 would be approximately 20 kilometers (12 miles) long.

Goldfield

DOE is considering three alternative alignments in the Goldfield area, referred to as Goldfield 1, 3, and 4. Goldfield 1 would extend south into the Goldfield Hills area, passing east of Black Butte. It would turn east near Espina Hill and head south to the east of Blackcap Mountain. It would wind around a series of hills and valleys to maintain an acceptable grade. Goldfield 1 would run for approximately 11 kilometers (7 miles) along an abandoned rail line before joining Common Segment 4 about 1 kilometer (0.6 mile) northeast of Ralston. In total, the Goldfield 1 alternative alignment would be 47 kilometers (29 miles) long.

Goldfield 3 would extend south and farther to the east than the other Goldfield alternative alignments. Like Goldfield 1, Goldfield 3 would wind around a series of hills and valleys to maintain an acceptable grade. Also like Goldfield 1, Goldfield 3 would run for approximately 11 kilometers (7 miles) along an abandoned rail line before joining common Segment 4 about 1 kilometer (0.6 mile) northeast of Ralston. In total, the Goldfield 3 alternative alignment would be about 50 kilometers (31 miles) long.

The western Goldfield alternative alignment, Goldfield 4, would depart from Common Segment 3 to the north of Black Butte and trend southwest. It would then cross U.S. 95 and turn south toward Goldfield. After passing through the southwestern edge of Goldfield and crossing U.S. 95 again, Goldfield 4 would turn south to connect with Common Segment 4. Goldfield 4 would be about 53 kilometers (33 miles) long.

Bonnie Claire

DOE is considering two alternative alignments, Bonnie Claire 2 and 3. Bonnie Claire 2 would depart Common Segment 4 about 8 kilometers (5 miles) north of Stonewall Pass and would trend east toward the Nevada Test and Training Range for about 5 kilometers (3 miles) before turning south for an additional 17 kilometers (11 miles). Bonnie Claire 2 generally would follow the Nevada Test and Training Range boundary and would join Common Segment 5 in Sarcobatus Flats to the north of Scottys Junction near the intersection of State Route 267 and U.S. 95. Bonnie Claire 2 would be approximately 20 kilometers long.

Bonnie Claire 3 would depart Common Segment 4 about 8 kilometers (5 miles) north of Stonewall Pass. Bonnie Claire 3 would trend generally south, paralleling U.S. 95 to the east. After approximately 10 kilometers (6 miles), Bonnie Claire 3 would turn southeast and continue for an additional 10 kilometers (6 miles) through Sarcobatus Flats. It would then join Common Segment 5 approximately 4 kilometers (2 miles) north of Scottys Junction near the intersection of State Route 267 and U.S. 95. Bonnie Claire 3 would be approximately 20 kilometers (12 miles) long.

Oasis Valley

DOE is considering two alternative alignments, referred to as Oasis Valley 1 and Oasis Valley 3. Oasis Valley 1 would depart Common Segment 5 about 3 kilometers (2 miles) north of Oasis Mountain and would run southeast and connect to Common Segment 6. Oasis Valley 1 would be approximately 10 kilometers (6 miles) long.

Oasis Valley 3 would also depart Common Segment 5 about 3 kilometers (2 miles) north of Oasis Mountain and would run generally east and then south before crossing Oasis Valley farther to the east than Oasis Valley 1, and then connecting to Common Segment 6. Oasis Valley 3 would be 14 kilometers (9 miles) long.

Mina Alternative Alignments

Following receipt of the letter regarding the Walker River Paiute Tribal Council decision (May, 2006), the Department initiated a study to consider the feasibility of the Mina route, and to identify a specific corridor (Mina corridor) and associated preliminary alternative alignments. The process used to identify the preliminary alternative alignments within the Mina corridor is consistent with that described under Caliente Alternative Alignments. Alternative alignments were identified near the Town of Schurz, around the Montezuma Range, north of Scottys Junction (referred to as Bonnie Claire), and in Oasis Valley. These are described below.

Town of Schurz

DOE has identified three alternative alignments that would bypass the Town of Schurz, Nevada. Schurz Bypass 1 would depart from the existing rail line about 30 kilometers (18 miles) northwest of the Town of Schurz passing along the eastern side of the valley (Sunshine Flat). From there, the alignment passes east of Weber Reservoir and crosses U.S. 95 about 8 kilometers (5 miles) north of the intersection of U.S. 95 and Alternate U.S. 95. Schurz Bypass 1 then trends southeast remaining on the far side of the valley to where it rejoins the existing rail line about 13 kilometers (8 miles) south of Schurz. Schurz Bypass 1 would be 51 kilometers (32 miles) long.

Schurz Bypass 2 also would depart the existing line at the same point of departure as Schurz Bypass 1 and would pass along the eastern side of Sunshine Flat. From there, the alignment passes east of Weber Reservoir and crosses U.S. 95 about 7 kilometers (4 miles) north of the intersection of U.S. 95 and Alternate U.S. 95. From there, the alignment trends to the southeast but staying to the east of Schurz and west of Schurz Bypass 1 until it rejoins the existing rail line about 13 kilometers (8 miles) south of Schurz. Schurz Bypass 2 would be 50 kilometers (31 miles) long.

Schurz Bypass 3 would depart the existing rail line about 9 kilometers (6 miles) northwest of the Town of Schurz where it would cross the Walker River. The alignment then crosses U.S. 95 about 8 kilometers (5 miles) north of the intersection of U.S. 95 and Alternate U.S. 95 at which point it continues southeasterly to a point where it rejoins the existing rail line about 13 kilometers (8 miles) south of Schurz, on the east side of the valley.

Montezuma Range

DOE identified two alternative alignments that depart near Blair Junction at the intersection of U.S. 95 and U.S. 6 to avoid the Montezuma Range; they rejoin at a point just east of Lida Junction. The first alignment, Montezuma Range 1, would depart Blair Junction paralleling State Route 265 to the Town of Silver Peak where it would proceed north to follow the western side of Clayton Ridge. The alignment would then turn south approximately 16 kilometers (10 miles) before Railroad Pass at which point it would turn east between the southern end of the Goldfield Hills and the Cuprite Hills. The alignment would then cross U.S. 95 about 7 kilometers (5 miles) north of Lida Junction and, paralleling U.S. 95, then head south to a point just east of Lida Junction. Montezuma Range 1 would be about 134 kilometers (83 miles) long.

Montezuma Range 2, after departing from the intersection of U.S. 95 and U.S. 6, would follow the abandoned Tonopah and Goldfield rail roadbed east to the north of Lone Mountain, at which point the alignment would head south following the abandoned roadbed. The alignment would traverse Montezuma Valley south to Klondike and would then parallel U.S. 95 as it approaches the Town of Goldfield. Montezuma Range 2 would stay west of Goldfield and then trend southeasterly to a point just east of Lida Junction where it would reconnect with Montezuma Range 1. Montezuma Range 2 would be about 135 kilometers (84 miles) long.

Bonnie Claire and Oasis Valley

The Bonnie Claire and Oasis Valley alternative alignments are as described above under Caliente Alternative Alignments.

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No Action Alternative

The Council on Environmental Quality and Departmental regulations that implement NEPA require consideration of the alternative of no action. Under the No Action Alternative, DOE would not select a rail alignment within the Caliente or Mina rail corridors for the construction and operation of a rail line. As such, the No Action Alternative provides a basis for comparison to the Proposed Action.

In the event that DOE were not to select a rail alignment in the Caliente or Mina corridors, the future course that it would pursue is uncertain. DOE recognizes that other possibilities could be pursued, including identifying and evaluating alignments in other corridors considered in the Yucca Mountain Final EIS.

Potential Environmental Issues and Resources To be Examined

The Council on Environmental Quality regulations direct Federal agencies preparing an EIS to focus on significant environmental issues (40 CFR 1502.1) and discuss impacts in proportion to their significance (40 CFR 1502.2). Accordingly, the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will analyze issues and impacts with the amount of detail commensurate with their importance.

To facilitate the scoping process, DOE has identified a preliminary list of issues and environmental resources that it may consider in the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS. The list is not intended to be all-inclusive or to predetermine the scope or alternatives of the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS, but should be used as a starting point from which the public can help DOE define the scope of the EIS.

- Potential impacts to the concept of multiple use as it applies to public land use planning and management specified by the Federal Land Policy and Management Act of 1976.
- Potential impacts to land use and ownership.
- Potential impacts to plants, animals and their habitats, including impacts to wetlands, and threatened and endangered and other sensitive species.
- Potential impacts to cultural resources.
- Potential impacts to American Indian resources.
- Potential impacts to paleontological resources.
- Potential impacts to the public from noise and vibration.
- Potential impacts to the general public and workers from radiological exposures during incident-free operations of the railroad.
- Potential impacts to the general public and workers from radiological exposures from potential accidents during operations of the railroad.
- Potential impacts to water resources and floodplains.
- Potential impacts to aesthetic values.
- Potential disproportionately high and adverse impacts to low-income and minority populations (environmental justice).
- Irretrievable and irreversible commitment of resources.
- Compliance with applicable Federal, state and local requirements.

The Department specifically invites comments on the following relative to the Mina corridor and its alternative alignments:

1. Should additional alternative alignments be considered that might minimize, avoid or mitigate adverse environmental impacts (for example, looking beyond the 0.25 mile wide Mina corridor, avoiding environmentally sensitive areas)?
2. Should any of the preliminary alternatives be eliminated from detailed consideration?
3. Should additional environmental resources be considered?
4. What mitigation measures should be considered?

In addition, the Department is interested in identifying any significant changes to, or new information relevant to, the rail corridors analyzed in the Yucca Mountain Final EIS.

Schedule

The DOE intends to issue the Draft Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS in 2007 at which time its availability will be announced in the **Federal Register** and local media. A public comment period will start upon publication of the Environmental Protection Agency's Notice of Availability in the **Federal Register**. The Department will consider and respond to comments received on the Draft in preparing the Final Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS.

Other Agency Involvement

Currently, the U.S. Bureau of Land Management, U.S. Air Force and the U.S. Surface Transportation Board are cooperating agencies in the preparation of the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS. The Department also expects to invite the following to be cooperating agencies: Walker River Paiute Tribe, U.S. Bureau of Indian Affairs, and the U.S. Army. The Tribe and these agencies have management and regulatory authority over lands traversed by alternative rail alignments within the Mina and Caliente rail corridors, or special expertise germane to the construction and operation of a rail line. DOE will consult with the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. Nuclear Regulatory Commission, Native American Tribal organizations, the State of Nevada, and Nye, Lincoln, Esmeralda, Mineral, Churchill and Lyon Counties regarding the environmental and regulatory issues germane to the Proposed Action. DOE invites comments on its identification of cooperating and consulting agencies and organizations.

Public Scoping Meetings

DOE will hold public scoping meetings on the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS. The meetings will be held at the following locations and times:

- Amargosa Valley, Nevada, Longstreet Hotel Casino, Nevada State Highway 373, November 1, 2006 from 4–7 p.m.[9]
- Caliente, Nevada, Caliente Youth Center, U.S. 93 North, November 8, 2006 from 6–8 p.m.
- Goldfield, Nevada, Goldfield School Gymnasium, Hall and Euclid, November 13, 2006 from 4–7 p.m.
- Hawthorne, Nevada, Hawthorne Convention Center, 932 E. Street, November 14, 2006 from 4–7 p.m.
- Fallon, Nevada, Fallon Convention Center, 100 Campus Way, November 15, 2006 from 4–7 p.m.

The public scoping meetings will be an open meeting format without a formal presentation by DOE. Members of the public are invited to attend the meetings at their convenience any time during meeting hours and submit their comments in writing at the meeting, or in person to a court reporter who will be available throughout the meeting. This open meeting format increases the opportunity for public comment and provides for one-on-one discussions with DOE representatives involved with

[9] DOE will hold a joint public scoping meeting on the Supplemental Yucca Mountain EIS (DOE/EIS–0250F–S1) and Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS (DOE/EIS–0250F–S2 and DOE/EIS–0369) in Amargosa Valley, Longstreet Hotel Casino, Nevada State Highway 373, November 1 from 4–7 pm. Additional public scoping meetings on the Supplemental Yucca Mountain EIS will be held in Washington, DC, L'Enfant Plaza Hotel, 480 L'Enfant Plaza, SW, October 30 from 4–7 pm; and Las Vegas, Cashman Center, 850 North Las Vegas Blvd., November 2 from 4–7 pm.

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the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS, and transportation planning in general.

The public scoping meetings will be held during the public scoping comment period. The comment period begins with publication of this Amended Notice of Intent in the **Federal Register** and closes November 27, 2006. Comments received after this date will be considered to the extent practicable. Written comments may be provided in writing, facsimfle, or by the Internet to Mr. Lee Bishop, EIS Document Manager (see **ADDRESSES** above).

Public Reading Rooms

Documents referenced in this Amended Notice of Intent and related information are available at the following locations: Beatty Yucca Mountain Information Center, 100 North E. Avenue, Beatty, NV 89003, (775) 553–2130; Esmeralda County Yucca Mountain Oversight Office, 274 E. Crook Avenue, Goldfield, NV 89013, (775) 485–3419; Las Vegas Yucca Mountain Information Center, 4101–B Meadows Lane, Las Vegas, NV 89107, (702) 295–1312; Lincoln County Nuclear Waste Project Office, 100 Depot Avenue, Caliente, NV 89008, (775) 726–3511; Nye County Department of Natural Resources and Federal Facilities, 1210 E. Basin Road, Suite #6, Pahrump, NV 89060 (775) 727–7727; Pahrump Yucca Mountain Information Center, 2341 Postal Drive, Pahrump, NV 89048, (775) 571–5817; University of Nevada, Reno, The University of Nevada Libraries, Business and Government Information Center, M/S 322, 1664 N. Virginia Street, Reno, NV 89557, (775) 784–6500, Ext. 309; and the U.S. Department of Energy Headquarters Office Public Reading Room, 1000 Independence Avenue SW., Room 1E–190 (ME–74) FORS, Washington, DC 20585, 202–586–3142.

Issued in Washington, DC, October 10, 2006.

David R. Hill,

General Counsel.

[FR Doc. 06–8675 Filed 10–10–06; 4:15 pm]

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A.10 71 *FR* 60490, October 13, 2006

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DEPARTMENT OF ENERGY

Supplement to the Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV

AGENCY: U.S. Department of Energy.

ACTION: Notice of intent.

SUMMARY: The U.S. Department of Energy (DOE or the Department) is announcing its intent to prepare a Supplement to the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (DOE/EIS–0250F, February 2002) (Yucca Mountain Final EIS). The Proposed Action addressed in the Yucca Mountain Final EIS is to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain in southern Nevada for the disposal of spent nuclear fuel and high-level radioactive waste.

The Yucca Mountain Final EIS considered the potential environmental impacts of a repository design for surface and subsurface facilities, a range of canister packaging scenarios and repository thermal operating modes, and plans for the construction, operation and monitoring, and eventual closure of the repository. The Yucca Mountain Final EIS also considered the environmental impacts of the transportation of spent nuclear fuel and high-level radioactive waste from commercial and DOE sites to the repository by two principal modes—mostly truck and mostly rail. In the Yucca Mountain Final EIS DOE recognized that these repository design concepts and operational plans would continue to develop during the design and engineering process.

Since publication of the Yucca Mountain Final EIS, DOE has continued to develop the repository design and associated plans. As now planned, the proposed surface and subsurface facilities would allow DOE to operate the repository following a primarily canistered approach in which most commercial spent nuclear fuel would be packaged at the commercial sites in multipurpose transport, aging and disposal canisters (TADs), and all DOE materials would be packaged in disposable canisters at the DOE sites. Waste packages would be arrayed in the repository underground to achieve what is referred to as a higher-thermal operating mode, and most spent nuclear fuel and high-level radioactive waste would arrive at the repository by rail.

To evaluate the potential environmental impacts of the current repository design and operational plans, DOE has decided to prepare a Supplement to the Yucca Mountain Final EIS [1], consistent with the National Environmental Policy Act (NEPA) and the Nuclear Waste Policy Act, as amended (Pub. L. 97–425) (NWPA). This Supplemental Yucca Mountain EIS (DOE/EIS–0250–S1) is being prepared to assist the U.S. Nuclear Regulatory Commission (NRC) in satisfying its NEPA responsibilities pursuant to the NWPA (Section 114(f)(4)) [2].

DATES: The Department invites comments on the scope of the Supplemental Yucca Mountain EIS to ensure that all relevant environmental issues are addressed. Public scoping meetings are discussed below in the **SUPPLEMENTARY INFORMATION** section. DOE will consider all comments received during the 45-day public scoping period, which starts with publication of this Notice of Intent and ends November 27, 2006. Comments received after this date will be considered to the extent practicable.

ADDRESSES: Requests for additional information on the Supplemental Yucca Mountain EIS or on the repository program in general, should be directed to: Dr. Jane Summerson, EIS Document Manager, Regulatory Authority Office, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 010, Las Vegas, NV 89134, Telephone 1–800–967–3477. Written comments on the scope of the Supplemental Yucca Mountain EIS may be submitted to Dr. Jane Summerson at this address, or by facsimile to 1–800–967–0739, or via the Internet at *http://www.ocrwm.doe.gov* under the caption What's New.

FOR FURTHER INFORMATION CONTACT: For general information regarding the DOE NEPA process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone 202–586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

[1] Coincident with this Notice of Intent, DOE is publishing an Amended Notice of Intent to prepare a Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS (DOE/EIS–0250F–S2 and DOE/EIS–0369). That EIS will review the rail corridor analyses of the Yucca Mountain Final EIS, and update, as appropriate, and will analyze the proposed Mina corridor; it also will include detailed analyses of alternative alignments for the construction and operation of a rail line within the Mina corridor, as well as the Caliente corridor.

[2] Section 114(f)(4) of the NWPA provides that any environmental impact statement "prepared in connection with a repository * * * shall, to the extent practicable, be adopted by the Commission [NRC] in connection with the issuance by the Commission of a construction authorization and license for such repository. To the extent such statement is adopted by the Commission, such adoption shall be deemed to also satisfy the responsibilities of the Commission under the National Environmental Policy Act of 1969 * * *."

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Background

Section 111(a)(4) of the NWPA states that the Federal government has the: "responsibility to provide for the permanent disposal of high-level radioactive waste and such spent nuclear fuel as may be disposed of in order to protect the public health and safety and the environment."

The NWPA directs the Secretary of Energy, if the Secretary decides to recommend approval of the Yucca Mountain site for development of a repository, to submit a final environmental impact statement with any recommendation to the President. The Department prepared the Yucca Mountain Final EIS to fulfill that requirement.

On February 14, 2002, the Secretary, in accordance with the NWPA, transmitted his recommendation (including the Yucca Mountain Final EIS) to the President for approval of the Yucca Mountain site for development of a geologic repository. The President considered the site qualified for application to the NRC for a construction authorization and recommended the site to the U.S. Congress. Subsequently, on July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. The Department is now preparing a license application for submittal to the NRC seeking authorization to construct the repository, as required by the NWPA (Section 114(b)).

In the Yucca Mountain Final EIS, DOE considered the potential environmental impacts of a repository design for surface and subsurface facilities, a range of canister packaging scenarios and repository thermal operating modes, and plans for the construction, operation and monitoring, and eventual closure of the repository. The Yucca Mountain Final EIS also described and evaluated the transportation of spent nuclear fuel and high-level radioactive waste from commercial and DOE sites to the repository by two principal modes—mostly truck and mostly rail. DOE recognized at that time that these repository design concepts and operational plans would continue to develop during the design and engineering process.

More specifically, the Yucca Mountain Final EIS included evaluations of separate canistered and uncanistered packaging scenarios for commercial spent nuclear fuel, and a repository design comprised of three primary surface operations areas (North Portal Operations Area, South Portal Development Area, Ventilation Shaft Operations Area) in which spent nuclear fuel and high-level radioactive waste would be handled in two principal facilities (Carrier Preparation Building, Waste Handling Building). The Yucca Mountain Final EIS also evaluated a range of underground thermal operating modes (referred to as lower- and higher-temperature modes) in which heat from the waste packages would raise the temperature of the adjacent rock to a range of temperatures from below the boiling point of water to above the boiling point. Two scenarios, mostly truck and mostly rail, were analyzed for the transportation of spent nuclear fuel and high-level radioactive waste from the commercial and DOE sites to the repository.

Since publication of the Yucca Mountain Final EIS, DOE has continued to develop the repository design and associated plans. As now planned (and described in greater detail in the Proposed Action below), the proposed surface and subsurface facilities would allow DOE to operate the repository following a primarily canistered approach in which most commercial spent nuclear fuel would be packaged at the commercial sites in TADs, and all DOE materials would be packaged in disposable canisters at the DOE sites. These TADs and disposable canisters then would be transported mostly by rail [3] to the repository where they would be placed on aging (or staging) [4] pads prior to disposal, or inserted into waste packages and disposed of in the repository underground.

At the repository site, spent nuclear fuel and high-level radioactive waste would now be handled in up to six principal facilities located within three primary surface operations areas. A fourth operations area would be developed to support excavation of the underground repository. A higher-thermal (temperature) operating mode would be employed.

Based on the current planning, the Department does not believe that any of the developments to the repository design or operational plans would have a significant impact on the environmental effects considered in the Yucca Mountain Final EIS. Nevertheless, to assist NRC in satisfying its NEPA responsibilities pursuant to the NWPA (Section 114(f)(4)), DOE has decided to prepare this Supplemental EIS.

Proposed Action

Under the Proposed Action, DOE would construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain for the disposal of up to 70,000 metric tons of heavy metal (MTHM) of commercial and DOE-owned spent nuclear fuel and high-level radioactive waste.[5] DOE would dispose of these materials in the repository using the inherent, natural geologic features of the mountain and engineered barriers to ensure long-term isolation of the spent nuclear fuel and high-level radioactive waste from the human environment. These materials would be emplaced underground at least 200 meters (660 feet) below the surface and at least 160 meters (530 feet) above the water table. The NRC, through its licensing process, would regulate repository construction, operation and monitoring, and closure.

Under the Proposed Action, most spent nuclear fuel and high-level radioactive waste would be shipped from 72 commercial and 4 DOE sites [6] to the repository in NRC-certified transportation casks placed on trains dedicated only to these shipments. Some shipments, however, would arrive at the repository by truck.

Under the Proposed Action, all DOE spent nuclear fuel and high-level radioactive waste would be placed in disposable canisters at the DOE sites, and as much as 90 percent of the commercial spent nuclear fuel would be placed in TADs at the commercial sites prior to shipment. Upon arrival at the repository, both types of canisters (DOE disposable and TADs) would be placed into corrosion-resistant overpacks

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[4] On April 8, 2004 (69 FR 18557), the Department issued a Record of Decision selecting, both nationally and in the State of Nevada, the mostly rail scenario analyzed in the Yucca Mountain Final EIS. This decision will ultimately require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada.

[4] The terminology refers to retaining commercial spent nuclear fuel on the surface at the repository to meet waste package thermal limits (aging), or to provide a surge capacity to maintain flexibility in waste handling operations (staging).

[5] The 70,000 MTHM includes 63,000 MTHM of commercial spent nuclear fuel, about 2,333 MTHM of DOE fuel (includes about 65 MTHM of naval fuel), and about 4,667 MTHM of DOE high-level radioactive waste.

[6] In 2002, fifty-four additional sites, primarily domestic research reactors, were expected to ship spent nuclear fuel to two DOE sites prior to disposal at the repository (see Records of Decision June 1, 1995 at 60 FR 28680, and March 8, 1996 at 61 FR 9441). Also, the Yucca Mountain Final EIS analyzed fuel shipments from 5 DOE sites, including Fort St. Vrain, to the repository. Presently, it is anticipated that fuel from Fort St. Vrain will be shipped to Idaho National Laboratory prior to being shipped to the repository.

(waste packages) prior to emplacement in the repository underground.

The remaining commercial spent nuclear fuel (about 10 percent) would be transported to the repository in dual-purpose canisters (canisters suitable for storage and transportation), or would be uncanistered. At the repository, uncanistered spent nuclear fuel would be placed directly into TADs and then waste packages for disposal. Commercial spent nuclear fuel arriving in dual-purpose canisters would first be removed from the canisters, placed into TADs and then into waste packages for disposal.

Handling of spent nuclear fuel and high-level radioactive waste would take place in the geologic repository operations area, which includes the North Portal area, the South Portal development area, a North Construction Portal development area, and the surface shaft areas. The surface portion of the geologic repository operations area also would include the facilities necessary to receive, package, and support emplacement of spent nuclear fuel and high-level radioactive waste in the repository. Waste transfer operations would be conducted inside reinforced concrete and metal frame buildings designed and constructed to withstand earthquakes and other phenomena. Workers and the public would be protected from radiation by shielded transfer equipment and walls, exhaust filtering systems, and the use of remotely controlled equipment to remove the waste forms from the transportation casks for insertion into waste packages.

The primary surface waste handling facilities include a wet handling facility, a receipt facility, and three separate canister receipt and closure facilities. DOE also is considering an initial handling facility. These facilities would allow the various types of materials received at the repository to be prepared for disposal.

The wet handling facility would receive commercial spent nuclear fuel as bare fuel assemblies (uncanistered) or in dual-purpose canisters, either in truck or rail transportation casks. Commercial spent nuclear fuel would be transferred underwater from the transportation casks or dual-purpose canisters into TADs. The wet handling facility would include provisions for opening transportation casks and dual-purpose canisters, and for drying and closing the loaded TADs. Loaded TADs either would be placed into overpacks for placement on aging/staging pads, or would be transferred to the canister receipt and closure facilities for loading into waste packages for disposal.

The receipt facility would receive TADs and dual-purpose canisters in rail transportation casks. The TADs and dual-purpose canisters would be transferred (dry) from the transportation casks either to overpacks for placement on the aging/staging pads, or to shielded transfer casks for transfer to the canister receipt and closure facilities. Shielded transfer casks also would transfer dual-purpose canisters to the wet handling facility, as necessary.

The canister receipt and closure facilities would receive DOE disposable canisters and TADs in rail transportation casks, shielded transfer casks and aging/staging overpacks. These facilities also could receive truck casks. There, TADs and DOE disposable canisters would be placed into waste packages for disposal.

If constructed, the initial handling facility would receive DOE high-level radioactive waste canisters and naval spent nuclear fuel canisters in truck and rail transportation casks. These canisters would be removed from the transportation casks and transferred to waste packages for disposal.

Waste packages containing TADs, naval nuclear spent fuel, or DOE disposable canisters would be placed on pallets and loaded onto shielded waste package transporters. The shielded waste package transporters would transfer the waste packages to the underground for emplacement in dedicated tunnels (drifts). In these drifts, waste packages would be aligned end-to-end. Emplacement drifts would be excavated in a series of panels, phased to match the anticipated throughput rate of the surface waste handling facilities.

The repository also would have other underground excavations. These would include, for example, main drifts to provide access to the surface and the emplacement drifts, and exhaust mains to exhaust ventilation air from the emplacement drifts.

Under the Proposed Action, thermal output of the waste packages would heat the adjacent rock in excess of the boiling temperature of water (i.e., higher-thermal operating mode). In this higher-thermal mode, the repository emplacement drifts would remain open and ventilated for a nominal period of 50 years after emplacement of the spent nuclear fuel and high-level radioactive waste; ventilation would remove much of the heat and humidity from the emplacement drifts during this period. The higher thermal operating mode would be achieved by a combination of closely spaced waste packages, a nominal ventilation period of 50 years, and managing waste package thermal output by mixing lower heat output waste packages with higher heat output packages in the drifts (for example).

After the repository is closed and sealed, the rock around the emplacement drifts would dry, minimizing the amount of water that might contact the waste packages for hundreds of years. However, a substantial portion of the rock between the drifts would remain at temperatures below boiling, and this would promote drainage of water through the central portions of the rock, rather than into the emplacement drifts.

The surface and subsurface facilities and associated infrastructure,[7] such as the on-site road and water distribution networks and emergency response facilities, would be constructed in phases to accommodate the expected receipt rates of spent nuclear fuel and high-level radioactive waste. Emplacement (disposal) operations, which would last up to 50 years, would be followed by a preclosure monitoring period of 50 years. Towards the end of the preclosure monitoring period, titanium drip shields would be installed over the waste packages. The drip shields would divert moisture that might drip from the drift walls, as well as condensed water vapor around the waste packages, to the drift floor thereby increasing the life expectancy of the waste packages. Drip shields also would protect the waste packages from rock falls.

Under the Proposed Action, emplaced waste packages could be retrieved at any time prior to 100 years after the start of emplacement. Following waste emplacement, surface facilities would be decommissioned and after the monitoring period the repository would be closed. Closure would involve sealing the shafts, ramps, exploratory boreholes and other repository openings. The main drifts would be filled with crushed rock and surface caps would be installed to discourage human intrusion. A network of monuments and markers would be erected around the site surface to warn

[7] DOE published a "Draft Environmental Assessment for the Proposed Infrastructure Improvements for the Yucca Mountain Project, Nevada" on July 6, 2006 (71 FR 38391). DOE proposes to repair, replace, or improve certain infrastructure at the site to enhance safety and to safely continue operations, scientific testing, and maintenance until such time as NRC decides whether to authorize construction of a repository. To the extent that activities proposed by DOE in its environmental assessment, such as construction of a new access road or new power lines, may not be undertaken in the timeframe considered in the environmental assessment, they will be considered in this Supplemental Yucca Mountain EIS (DOE/EIS–0250F–S1).

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future generations of the presence and nature of the buried radioactive waste.

No Action Alternative

Under the No Action Alternative, DOE would terminate activities at Yucca Mountain and undertake site reclamation to mitigate any significant adverse environmental impacts. Commercial nuclear power utilities and DOE would continue to manage spent nuclear fuel and high-level radioactive waste at sites throughout the United States. The No Action Alternative was analyzed in the Yucca Mountain Final EIS as a basis for comparison with the Proposed Action.

Since completion of the Yucca Mountain Final EIS, DOE has not identified any relevant changes in circumstances or information bearing on environmental concerns regarding the No Action Alternative. For this reason, DOE anticipates that the Supplemental Yucca Mountain EIS will incorporate by reference the information describing and analyzing the No Action Alternative presented in the Yucca Mountain Final EIS (pursuant to Council on Environmental Quality (CEQ) regulations at 40 Code of Federal Regulations (CFR) 1502.21).

Potential Environmental Issues and Resources To Be Examined

The CEQ regulations direct Federal agencies preparing an EIS to focus on significant environmental issues (40 CFR 1502.1) and discuss impacts in proportion to their significance (40 CFR 1502.2). Accordingly, the Supplemental Yucca Mountain EIS will analyze issues and impacts with the amount of detail commensurate with their importance. Under these guidelines, aspects of the Proposed Action with clearly small environmental impacts usually would require less depth and breadth of analysis. To the degree that the Proposed Action would affect public health or safety, however, the potential impacts generally are a matter of public interest, regardless of their significance. Therefore, DOE plans to pay particular attention to worker and public health and safety associated with the handling and disposal, and transportation of spent nuclear fuel and high-level radioactive waste, even where such impacts would not be significant.

To facilitate the scoping process, DOE has identified a preliminary list of issues and environmental resources that it may consider in the Supplemental Yucca Mountain EIS. The list is not intended to be all-inclusive, but should be used as a starting point for public input on the scope of the Supplemental Yucca Mountain EIS.

- Radiological releases. The potential impacts (i.e., latent cancer fatalities) to the public and workers from potential radiological releases during routine loading of canisters and transportation casks at the commercial sites, and from handling and disposal operations at the repository.
- Worker safety and health. Potential health and safety impacts (i.e., injuries and fatalities) to workers during handling and disposal operations at the commercial and DOE sites and the repository.
- Transportation. The potential radiological and non-radiological impacts (i.e., traffic injuries and fatalities) to the public and workers associated with the shipment of materials to the repository under the mostly rail scenario.
- Accidents. The potential radiological impacts to workers and the public from reasonably foreseeable accidents during loading of canisters at the sites, transportation and repository operations, including any accidents with low probability but high potential consequences.
- Sabotage. The potential radiological impacts to workers and the public from sabotage of transportation and repository operations.
- Waste isolation. Potential radiological and non-radiological impacts (e.g., chemically toxic materials) associated with the long-term performance of the repository.
- Socioeconomic conditions. Potential local regional socioeconomic impacts to the surrounding communities from construction, operation and closure of the repository.
- Water and air resources. Potential impacts to air resources, and water quality and use.
- Cultural resources. Potential impacts to archaeological and historic resources and American Indian issues of concern.
- Biological resources. Potential impacts to plants, animals and their habitats, including impacts to endangered and threatened species.
- Cumulative impacts from the Proposed Action and other past, present and reasonably foreseeable future actions.
- Environmental justice. Potential for disproportionately high and adverse impacts on minority or low-income populations.

Schedule

The DOE intends to issue the Draft Supplemental Yucca Mountain EIS in 2007, at which time its availability will be announced in the **Federal Register** and in media in Nevada. A public comment period will start upon publication of the Environmental Protection Agency's Notice of Availability in the **Federal Register**. DOE will hold public hearings during the comment period. The Department will consider and respond to comments received on the Draft Supplemental Yucca Mountain EIS in preparing the Final Supplemental Yucca Mountain EIS.

Other Agency Involvement

The Department intends to consult with Federal agencies, such as the U.S. Army Corps of Engineers, U.S. Bureau of Land Management, U.S. Air Force, and the U.S. Department of the Navy, and with state agencies, such as the Nevada Department of Transportation and the Nevada Division of Environmental Protection, during preparation of the Supplemental Yucca Mountain EIS.

Public Scoping Meetings

DOE will hold public scoping meetings on the Supplemental Yucca Mountain EIS. The meetings will be held at the following locations and times:

- Washington, District of Columbia, L'Enfant Plaza Hotel, 480 L'Enfant Plaza, SW., October 30 from 4–7 p.m.
- Amargosa Valley, Nevada. Longstreet Hotel Casino, Nevada State Highway 373, November 1 from 4–7 p.m.[8]
- Las Vegas, Nevada, Cashman Center, 850 North Las Vegas Blvd., November 2 from 4–7 p.m.

The public scoping meetings will be an open meeting format without a formal presentation by DOE. Members of the public are invited to attend the meetings at their convenience any time during meeting hours and submit their comments in writing at the meeting, or in person to a court reporter who will be available throughout the meeting. This open meeting format increases the opportunity for public comment and provides for one-on-one discussions with DOE representatives involved with

[8] DOE will hold a joint public scoping meeting on the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS (DOE/EIS–0250F–S2 and DOE/EIS–0369) and on the Supplemental Yucca Mountain EIS (DOE/EIS–0250F–S1) in Amargosa Valley, Longstreet Hotel Casino, Nevada State Highway 373, November 1 from 4–7 pm. Additional public scoping meetings on the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will be held in Caliente, Caliente Youth Center, U.S. 93 North, November 8 from 6–8 pm; Goldfield, Goldfield School Gymnasium, Hall and Euclid, November 13 from 4–7 pm; Hawthorne, Hawthorne Convention Center, 932 E. Street, November 14 from 4–7 pm; and Fallon, Fallon Convention Center, 100 Campus Way, November 15, from 4–7 pm.

the Supplemental Yucca Mountain EIS and the repository program.

The public scoping meetings will be held during the public scoping comment period. The comment period begins with publication of this Notice of Intent in the **Federal Register** and closes November 27, 2006. Comments received after this date will be considered to the extent practicable. Written comments may be provided in writing, by facsimile, or via the Internet to Dr. Jane Summerson, EIS Document Manager (see **ADDRESSES** above).

Public Reading Rooms

Documents referenced in this Notice of Intent and related information are available at the following locations: Beatty Yucca Mountain Information Center, 100 North E. Avenue, Beatty, NV 89003, (775) 553–2130; Esmeralda County Yucca Mountain Oversight Office, 274 E. Crook Avenue, Goldfield, NV 89013, (775) 485–3419; Las Vegas Yucca Mountain Information Center, 4101–B Meadows Lane, Las Vegas, NV 89107, (702) 295–1312; Lincoln County Nuclear Waste Project Office, 100 Depot Avenue, Caliente, NV 89008, (775) 726–3511; Nye County Department of Natural Resources and Federal Facilities, 1210 E. Basin Road, Suite #6, Pahrump, NV 89060 (775) 727–7727; Pahrump Yucca Mountain Information Center, 2341 Postal Drive, Pahrump, NV 89048, (775) 571–5817; University of Nevada, Reno, The University of Nevada Libraries, Business and Government Information Center, M/S 322, 1664 N. Virginia Street, Reno, NV 89557, (775) 784–6500, Ext. 309; and the U.S. Department of Energy Headquarters Office Public Reading Room, 1000 Independence Avenue, SW., Room 1E–190 (ME–74) FORS, Washington, DC, 20585, 202–586–3142.

Issued in Washington, DC, October 10, 2006.

David R. Hill,

General Counsel.

[FR Doc. 06–8676 Filed 10–10–06; 4:15 pm]

BILLING CODE 6450–01–P

A.11 72 *FR* 1235, January 10, 2007

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DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[NV–930–1920–ET–4662; NVN 82752; 7–08807]

Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice.

SUMMARY: The Department of Energy (DOE) has filed an application with the Bureau of Land Management (BLM) requesting the Secretary of the Interior to withdraw 208,037 acres of public lands from surface entry and mining through December 27, 2015, to evaluate the lands for the potential construction, operation, and maintenance of a rail line for the transportation of spent nuclear fuel and high-level radioactive waste in the event the Nuclear Regulatory Commission authorizes a geologic repository at Yucca Mountain as provided for under the Nuclear Waste Policy Act of 1982, as amended. This notice segregates the lands from surface entry and mining for up to 2 years while various studies and analyses are made to support a final decision on the withdrawal application.

DATES: Comments and requests for a public meeting should be received on April 10, 2007.

ADDRESSES: Comments and meeting requests should be sent to the Nevada State Director, BLM, P.O. Box 12000, Reno, Nevada 89520–0006.

FOR FURTHER INFORMATION CONTACT: Dennis J. Samuelson, BLM Nevada State Office, 775–861–6532.

SUPPLEMENTARY INFORMATION: The DOE has filed an application with the BLM requesting the Secretary of the Interior to withdraw the following described public lands from settlement, sale, location, or entry under the general land laws, including the United States mining laws, but not from leasing under the mineral leasing laws, subject to valid existing rights:

Mount Diablo Meridian

A corridor 1-mile in width that contains a portion of, or is wholly encompassed within the following sections and/or quarter sections and government lots:

Caliente Rail Corridor (additional lands)

T. 1 S., R. 42 E.,
Sec. 36, E½SE¼.
T. 2 S., R. 42 E.,
Sec. 1;
Sec. 2, SE¼;
Sec. 10, SE¼;
Sec. 11;
Sec. 12, N½ and SW¼;
Sec. 13, NW¼NW¼;
Secs. 14 and 15 (except patented land);
Sec. 22 (except patented land);
Sec. 23, W½NW¼ and W½SW¼ (except patented land);
Sec. 26, W½NW¼ and W½SW¼ (except patented land);
Secs. 27 and 34 (except patented land);
Sec. 35, W½ (except patented land).
T. 3 S., R. 42 E.,
Sec. 3 (except patented land);
Sec. 10, E½ and NE¼NW¼;
Secs. 11 and 12 (except patented land);
Sec. 13, N½ and N½SE¼;
Sec. 14, NE¼ and NE¼NW¼.
T. 1 N., R. 43 E.,
Sec. 33, SE¼SW¼ and SE¼.
T. 1 S., R. 43 E.,
Sec. 4, W½;
Sec. 5, SE¼NE¼ and SE¼;
Sec. 8, E½;
Sec. 9, W½;
Sec. 13, SW¼SW¼;
Sec. 14, SW¼;
Sec. 16, W½;
Sec. 17, E½;
Sec. 20;
Sec. 22, SE¼;
Sec. 23, W½ and SE¼;
Sec. 24, W½NW¼;
Sec. 26;
Sec. 27, E½;
Sec. 29;
Sec. 30, E½ and SE¼SW¼;
Sec. 31;
Sec. 32, NW¼NE¼ and W½;
Sec. 34, E½;
Sec. 35;
Sec. 36, W½ and W½SE¼.
T. 2 S., R. 43 E.,
Sec. 1;
Sec. 2, E½ and SE¼SW¼;
Sec. 6;
Sec. 7, NW¼NW¼;
Sec. 8, E½SE¼;
Sec. 11;
Sec. 12, NW¼NE¼, NW¼, and W½SW¼;
Sec. 13, W½;
Sec. 14;
Sec. 17, SE¼SE¼ (except patented land);
Sec. 20, NE¼ and SE¼SW¼ (except patented land);
Sec. 23, E½ and E½NW¼;
Sec. 24, NW¼NE¼, W½, and W½SE¼;
Sec. 25;
Sec. 26, NE¼ and E½SE¼ (except patented land);
Sec. 29, E½NW¼ and E½SW¼ (except patented land);
Sec. 32, NE¼NW¼ (except patented land);
Sec. 35, NE¼;
Sec. 36, E½ and NW¼.
T. 3 S., R. 43 E.,
Sec. 4, SE¼ (except patented land);
Sec. 7, (except patented land);
Sec. 8, S½ (except patented land);
Sec. 9, NE¼NE¼ (except patented land);
Sec. 13, SE¼;
Sec. 16, W½NW¼ and W½SW¼;
Sec. 17 (except patented land);
Sec. 18, lots 1, 2, and 3, NE¼, E½NW¼, NE¼SW¼, and N½SE¼ (except patented land);
Sec. 19, E½ and SE¼SW¼;
Sec. 20;

Sec. 21, NW¼NW¼;
Sec. 27, SW¼;
Sec. 28, S½NW¼ and S½;
Sec. 29;
Sec. 30, E½, E½NW¼, and NE¼SW¼;
Sec. 31, NE¼NE¼;
Sec. 32, N½;
Sec. 33, N½, NE¼SW¼, and N½SE¼;
Sec. 34, W½.
T. 4 S., R. 43 E.,
Sec. 3, lot 3 and SE¼NW¼;
Sec. 13, W½NW¼ and W½SW¼;
Sec. 21, SE¼SE¼;
Sec. 23, E½;
Sec. 24, NW¼NW¼;
Sec. 28, SE¼SW¼;
Sec. 32, SE¼SE¼.
T. 5 S., R. 43 E.,
Sec. 20, E½NE¼ and E½SE¼;
Sec. 29, NE¼NE¼.
T. 6 S., R. 44 E., Unsurveyed
Sec. 7;
Sec. 18, E½, E½NW¼, and E½SW¼;
Sec. 19, E½ and E½NW¼;
Sec. 20;
Secs. 28 and 29;
Sec. 30, E½NE¼;
Sec. 32, NE¼NE¼;
Sec. 33.
T. 7 S., R. 44 E., Partially Surveyed
Sec. 3, W½NW¼ and W½SW¼;
Sec. 4;
Sec. 5, S½SW¼ and SE¼SE¼;
Secs. 8 and 9;
Sec. 10, SW¼NW¼ and SW¼;
Secs. 15, 16, and 22;
Sec. 23, W½ and SW¼SE¼;
Sec. 25, SW¼SW¼;
Sec. 26;
Sec. 34, NE¼NE¼;
Sec. 35;
Sec. 36, W½ and SW¼SE¼.
T. 8 S., R. 44 E.,
Sec. 1;
Sec. 13, E½;
Sec. 24, NE¼NE¼.
T. 8 S., R. 45 E.,
Sec. 6, W½SW¼;
Sec. 7, W½ and SW¼SE¼;
Sec. 17, SW¼SW¼;
Sec. 19;
Sec. 20, W½.
T. 1 N., R 46 E.,
Sec. 30, lot 3.
T. 9 S., R. 46 E.,
Sec. 8, SW¼SW¼;
Sec. 16, SW¼ and SW¼SE¼;
Sec. 22, NW¼ and SE¼;
Sec. 23, S½SW¼.
T. 10 S., R. 46 E.,
Sec. 11, NE¼.
T. 1 N., R. 47 E.,
Sec. 9, SE¼SE¼;
Sec. 31, NE¼SW¼.
T. 2 N., R. 47 E.,
Sec. 24, SE¼SE¼;
Sec. 35, SE¼SW¼.
T. 10 S., R. 47 E.,
Sec. 9, SE¼;
Sec. 10, S½ and SE¼NE¼;
Sec. 11, S½NE¼, S½NW¼, and S½;
Sec. 13, W½;
Sec. 14 (except patented land);
Sec. 15, NE¼;
Sec. 22, W½NE¼ (except patented land);
Sec. 23, E½ and N½NW¼ (except patented land);
Sec. 24, W½NW¼;
Sec. 26, W½NE¼ and NW¼SE¼.
T. 11 S., R. 47 E.,
Sec. 10, NE¼NE¼;
Sec. 23, NE¼NE¼;
Sec. 24, E½SW¼;
Sec. 25, NE¼SE¼;
Sec. 36, E½NE¼.
T. 2 N., R. 48 E.,
Sec. 8, SE¼SW¼;
Sec. 19, SE¼NW¼.
T. 3 N., R. 48 E.,
Sec. 23, SE¼SW¼;
Sec. 33, SE¼SE¼.
T. 3 N., R. 49 E.,
Sec. 7, SE¼NE¼.
T. 3 N., R. 50 E.,
Sec. 22, E½SE¼.
T. 1 S., R. 51 E.,
Sec. 10, E½NE¼;
Sec. 14, E½NW¼;
Sec. 23, NE¼NE¼;
Sec. 25, W½;
Sec. 36, E½NW¼ and E½SW¼.
T. 2 N., R. 51 E.,
Sec. 18, lot 2.
T. 2 S., R. 52 E.,
Sec. 24, N½NE¼ and N½NW¼.
T. 1 S., R. 53 E.,
Sec. 26, SE¼SE¼;
Sec. 35, SE¼NW¼.
T. 1 S., R. 54 E.,
Sec. 1, lot 1;
Sec. 13, NW¼SW¼;
Sec. 16, SE¼SW¼;
Sec. 20, NE¼ and SE¼NW¼;
Sec. 23, NW¼NE¼.
T. 1 N., R. 55 E.,
Sec. 22, SE¼NW¼;
Sec. 29, S½NW¼.
T. 1 N., R. 56 E.,
Sec. 12, NW¼SE¼;
Sec. 14, NW¼SW¼;
Sec. 18, SE¼NW¼.
T. 1 N., R. 57 E.,
Sec. 2, lots 1 to 4, inclusive, and S½NW¼;
Sec. 3, NE¼;
Sec. 4, S½NE¼;
Sec. 5, NE¼SW¼ and NW¼SE¼;
Sec. 7, lot 1.
T. 2 N., R. 57 E.,
Sec. 1, lots 1 to 4, inclusive, S½NE¼, S½NW¼, and SW¼;
Sec. 2;
Sec. 3, SE¼NE¼ and SE¼;
Sec. 9, SE¼SE¼;
Sec. 10;
Sec. 11, N½ and SW¼;
Sec. 14, NW¼NW¼;
Sec. 15;
Sec. 16, E½ and S½SW¼;
Sec. 20, E½ and SW¼;
Sec. 21;
Sec. 22, NW¼NE¼ and NW¼;
Sec. 29, N½;
Sec. 30, E½ and SE¼SW¼;
Sec. 31, lots 1 and 2, and E½NW¼;
Sec. 36, SE¼.
T. 3 N., R. 57 E.,
Sec. 25, SE¼SE¼;
Sec. 35, SE¼;
Sec. 36.
T. 2 N., R. 58 E.,
Sec. 6, lot 4;
Sec. 25, S½;
Sec. 26, S½;
Sec. 31, lots 3 and 4, E½SW¼, and SE¼;
Sec. 32, S½;
Secs. 33 and 34;
Sec. 35, N½, SW¼, and NW¼SE¼;
Sec. 36, NW¼NW¼.
T. 3, N., R. 58 E.,
Sec. 13, S½NE¼, S½NW¼, and S½;
Sec. 14, S½NE¼, S½NW¼, and S½;
Sec. 15, S½;
Sec. 16, SE¼SE¼;
Sec. 20, SE¼SW¼ and SE¼;
Secs. 21 and 22;
Sec. 23, N½;
Sec. 24, N½;
Sec. 27, NW¼NW¼;
Sec. 28, N½ and SW¼;
Sec. 29;
Sec. 30, lots 3 and 4, S½NE¼, E½SW¼, and SE¼;
Sec. 31;
Sec. 32, NW¼NE¼ and NW¼.
T. 2 N., R. 59 E.,
Sec. 5, SE¼SE¼;
Sec. 7, SE¼SE¼;
Sec. 20, NW¼NE¼;
Sec. 30, lots 1 and 2, and E½NW¼.
T. 3 N., R. 59 E.,
Sec. 14, NE¼ and SW¼;
Sec. 17, SW¼SW¼;
Sec. 18, lots 2, 3, and 4, E½SW¼, and SE¼;
Sec. 19, lots 1 and 2, and W½NE¼;
Sec. 33, NE¼ and E½SW¼.
T. 4 N., R. 60 E.,
Sec. 21, S½NE¼ and SE¼NW¼;
Sec. 31, SE¼NW¼.
T. 4. N., R. 61 E.,
Sec. 19, S½NE¼ and SE¼NW¼;
Sec. 20, SW¼SE¼.
T. 2 N., R. 62 E.,
Sec. 9, NE¼NE¼;
Sec. 15, NE¼SE¼;
Sec. 23, E½ and NE¼NW¼.
T. 1 N., R. 63 E.,
Sec. 22, SW¼SW¼.
T. 1 S., R. 64 E.,
Sec. 19, lot 1.
T 2 S., R. 65 E.,
Sec. 1, lots 3 and 4, and S½NW¼.
T. 1 S., R. 66 E.,
Sec. 35, S½SW¼ and S½SE¼.
T. 2 S., R. 67 E.,
Sec. 21, E½SW¼;
Sec. 24, NE¼SW¼.
T. 3 S., R. 67 E.,
Sec. 21, SE¼NW¼ and S½SW¼SE¼;
Sec. 26, E½NE¼.
T. 4 S., R. 68 E.,
Sec. 7, E½NW¼;
Sec. 8, W½SE¼;
Sec. 17, NW¼NE¼.

The additional lands for the Caliente Corridor aggregate 68,646 acres in Esmeralda, Lincoln, and Nye Counties.

Mina Rail Corridor

T. 15 N., R. 26 E.,
Sec. 26, S½SE¼;
Sec. 35, lots 2, 3, and 4, E½NW¼, NE¼, and SE¼;
Sec. 36.
T. 9 N., R. 31 E.,
Sec. 32, lots 1 to 4, inclusive, N½SW¼, and N½SE¼.
T. 8 N., R. 32 E.,
Sec. 7, lots 3 and 4, E½SW¼;

Sec. 13, S½SW¼ and S½SE¼;
Sec. 14, S½SW¼ and S½SE¼;
Sec. 15, SW¼ and S½SE¼;
Sec. 16, S½NE¼, W½, and SE ¼;
Sec. 17, SE¼SW¼;
Sec. 19, N½NE¼ and N½NW¼;
Sec. 20, NE¼ and N½NW¼;
Sec. 21, N½ and N½SE¼ (except patented land);
Sec. 22, N½, N½SW¼, and SE¼;
Secs. 23 and 24.

T. 8 N., R. 33 E.,
Sec. 17, S½SW¼ and S½SE¼;
Sec. 18, lot 4, SE¼SW¼, and S½SE¼;
Secs. 19 to 24, inclusive;
Sec. 25, N½;
Sec. 26, N½;
Sec. 27, N½NE¼ and N½NW¼;
Sec. 28, N½NE¼ and N½NW¼;
Sec. 29, N½NE ¼ and N½NW ¼.

T. 7 N., R. 34 E.,
Sec. 1, lot 1 and SE¼NE¼.

T. 8 N., R. 34 E.,
Sec. 19, lots 2, 3, and 4, S½NE¼, SE¼NW¼, W½SW¼, and SE¼;
Sec. 20, S½NE¼, S½NW¼, and S½;
Sec. 21, S½NE¼, S½NW¼, and S½;
Sec. 22, S½;
Sec. 23, S½;
Sec. 24, S½ (except patented land);
Sec. 25;
Sec. 26, N½, N½SW¼, and N½SE¼;
Sec. 27, N½, N½SW¼, and N½SE¼;
Sec. 28, N½ and N½SE¼;
Sec. 29, N½;
Sec. 30, lots 1 and 2, NE¼, and E½NW¼;
Sec. 36, E½ and N½NW¼.

T. 4 N., R. 35 E.,
Sec. 1, N½ and SE¼;
Sec. 2, NE¼;
Sec. 12, N½NE¼.

T. 5 N., R. 35 E.,
Sec. 1, S½NE¼, S½NW¼, and S½;
Sec. 2;
Sec. 3, lots 1, 2, and 3, S½NE¼, and SE¼;
Sec. 11, NE¼ and N½NW¼;
Sec. 12, E½, NW¼, and E½SW¼;
Sec. 13, NE¼ and E½SE¼;
Sec. 24, E½;
Sec. 25, E½, E½NW¼, and SW¼;
Sec. 36.

T. 6 N., R. 35 E.,
Sec. 4, lot 4, SW¼NW¼, SW¼, and S½SE¼;
Sec. 5;
Sec. 8 (except patented lands);
Sec. 9;
Sec. 10, S½NW¼ and SW¼;
Sec. 15, W½ and W½SE¼;
Sec. 16, E½, NW¼, and E½SW¼;
Sec. 21, E½;
Sec. 22, W½NE¼, W½, and W½SE¼;
Sec. 27, W½NE¼, W½, and W½SE¼;
Sec. 28, NE¼ and N½SW¼;
Sec. 33, E½ (except patented land);
Sec. 34;
Sec. 35, S½SW¼.

T. 7 N., R. 35 E.,
Sec. 5, lot 4, S½NW¼, and SW¼;
Sec. 6;
Sec. 7, N½NE¼, E½NW¼, and SE¼;
Sec. 8, W½NE¼, W½, and SE¼;
Sec. 16, W½NW¼ and SW¼;
Sec. 17;
Sec. 18, E½NE¼;
Sec. 20;
Sec. 21, W½;
Sec. 28, NW¼ and W½SW¼;
Sec. 29;
Sec. 30, S½SE¼;
Sec. 31, E½NE¼;
Sec. 32;
Sec. 33, W½SW¼.

T. 8 N., R. 35 E.,
Sec. 30, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and W½SE¼ (except patented land);
Sec. 31 (except patented land).

T. 3 N., R. 36 E.,
Sec. 1;
Sec. 12, E½, E½NW¼, and E½SW¼;
Sec. 13, E½;
Sec. 24, E½;
Sec. 25, N½NE¼.

T. 4 N., R. 36 E., Unsurveyed
Sec. 5, SW¼;
Sec. 6;
Sec. 7, N½ and SE¼;
Sec. 8, W½ and SE¼;
Sec. 9, S½SW¼;
Sec. 15, SW¼;
Sec. 16, W½ and SE¼;
Sec. 17;
Sec. 18, NE¼;
Sec. 20, NE¼;
Sec. 21, N½ and SE¼;
Sec. 22;
Sec. 23, S½;
Sec. 25, W½;
Sec. 26;
Sec. 27, N½;
Sec. 35, N½ and SE¼;
Sec. 36.

T. 5 N., R. 36 E., Unsurveyed
Sec. 6, SW¼;
Sec. 7, W½;
Sec. 18, W½;
Sec. 19, W½;
Sec. 30, W½;
Sec. 31, W½.

T. 2 N., R. 37 E.,
Sec. 4, W½SW¼;
Sec. 5;
Sec. 6, lots 1 and 2, S½NE¼, and E½SE¼;
Sec. 8;
Sec. 9, W½NW¼, SW¼, and S½SE¼;
Sec. 13, S½NE¼, S½NW¼, and S½;
Sec. 14, S½NE¼ and S½;
Sec. 15, NW¼ and S½;
Sec. 16;
Sec. 17, N½NE¼, SE¼NE¼, E½NW¼, and E½SE¼;
Sec. 21, NE¼;
Sec. 22, N½, N½SW¼, and N½SE¼;
Sec. 23, N½ and N½SW¼;
Sec. 24, N½.

T. 3 N., R. 37 E., Unsurveyed
Sec. 6, W½;
Sec. 7, W½ and E½SE¼;
Sec. 18, W½NE¼, W½, and W½SE¼;
Sec. 19;
Sec. 29, W½;
Sec. 30;
Sec. 31, E½ and E½NW¼;
Sec. 32, W½NE¼, W½, and W½SE¼.

T. 4 N., R. 37 E., Unsurveyed
Sec. 31, S½SW¼.

T. 1 N., R. 38 E., Unsurveyed
Sec. 3, W½NW¼ and SW¼;
Sec. 4;
Sec. 5, E½NE¼;
Sec. 9, E½ and E½NW¼;
Sec. 10;
Sec. 11, SW¼;
Sec. 14, W½NE¼, W½, and SE¼;
Sec. 15, E½ , NW¼, and N½SW¼;
Sec. 16, N½NE¼;
Sec. 22, NE¼;
Sec. 23;
Sec. 24, W½ and W½SE¼;
Sec. 25;
Sec. 26, NE¼ and E½SE¼;
Sec. 36, NE¼ and N½NW¼.

T. 2 N., R. 38 E., Unsurveyed
Sec. 13, S½SW¼ and SE¼;
Sec. 16, S½NW¼ and SW¼;
Secs. 17 and 18;
Sec. 19, N½;
Sec. 20, E½ and NW¼;
Sec. 21, W½ and SE¼;
Sec. 22, S½;
Sec. 23, NE¼, S½NW¼, and S½;
Sec. 24;
Sec. 25, N½NW¼;
Sec. 26, N½;
Sec. 27, N½;
Sec. 28;
Sec. 29, E½;
Sec. 32, E½;
Sec. 33.

T. 1 N., R. 38.2 E., Unsurveyed
Sec. 30, S½NW¼, SW¼, and S½SE¼;
Sec. 31, N½, N½SW¼, and SE¼;
Sec. 32, W½ and SE¼.

T. 2 N., R. 38.2 E.,
Sec. 4;
Sec. 5, S½SE¼;
Sec. 7, S½SE¼;
Sec. 8, E½, S½NW¼, and SW¼;
Sec. 9;
Sec. 16, N½NW¼;
Sec. 17, N½, SW¼, and N½SE¼;
Sec. 18;
Sec. 19, N½ and N½SW¼;
Sec. 20, N½NW¼.

T. 1 S., R. 39 E.,
Sec. 4, lots 3 and 4, S½NW¼, and S½;
Sec. 5;
Sec. 6, lots 1 and 2, and S½NE¼;
Sec. 8, NE¼;
Sec. 9;
Sec. 10, W½NW¼ and SW¼;
Sec. 14, W½SW¼;
Sec. 15;
Sec. 16, E½ and E½NW¼;
Sec. 21, N½NE¼;
Sec. 22;
Sec. 23, W½NW¼ and W½SW¼;
Sec. 26, W½NW¼ and W½SW¼;
Sec. 27, E½, E½NW¼, and E½SW¼;
Sec. 34, E½, E½NW¼, and SW¼;
Sec. 35, W½.

T. 2 N., R. 39 E., Unsurveyed
Sec. 4, NW¼;
Sec. 5, N½ and SW¼;
Sec. 6;
Sec. 7, N½ and SW¼.

T. 2 S., R. 39 E.,
Sec. 2, lot 4, S½NW¼, and SW¼;
Sec. 3, lots 1 to 4, inclusive, S½NE¼, S½NW¼, E½SW¼, and SE¼;
Sec. 10, E½, E½NW¼, and E½SW¼;
Sec. 11, W½;
Sec. 14, W½NE¼, W½, and W½SE¼;
Sec. 15, E½ and E½NW¼;
Sec. 22 (except patented land);
Sec. 23, W½NE¼, W½, and W½SE¼;
Sec. 25, S½SW¼;

Sec. 26;
Sec. 27, E½;
Sec. 34, N½NE¼;
Sec. 35;
Sec. 36, W½ and SE¼.
T. 3 N., R. 39 E.,
Sec. 13, S½SE¼;
Sec. 22, S½SE¼;
Sec. 23, S½NE¼ and S½;
Sec. 24;
Sec. 25, N½ and N½SW¼;
Secs. 26 and 27;
Sec. 28, S½NE¼ and S½;
Sec. 29, S½SE¼;
Sec. 31, S½SW¼ and SE¼;
Secs. 32 and 33;
Sec. 34, N½ and N½SW¼;
Sec. 35, N½NW¼.
T. 3 S., R. 39 E.,
Sec. 1;
Sec. 2, lots 1 and 2, S½NE¼, and E½SE¼;
Sec. 12, NE¼.
T. 2 S., R. 40 E.,
Sec. 22, S½SW¼ and SE¼;
Sec. 23, S½ and S½NE¼;
Sec. 24, NE¼, S½NW¼, and S½;
Sec. 25, N½;
Sec. 26, N½, N½SW¼, and N½SE¼;
Sec. 27;
Sec. 28, lot 1 and lots 3 to 8, inclusive, and SW¼;
Sec. 29, S½SE¼;
Sec. 31, E½SW¼ and SE¼;
Sec. 32;
Sec. 33, N½, SW¼, and N½SE¼;
Sec. 34, NW¼.
T. 3 N., R. 40 E.,
Sec. 8, S½SE¼;
Sec. 9, S½NE¼ and S½;
Sec. 10 (except patented land);
Sec. 11 (except patented land);
Sec. 12, S½NE¼, S½NW¼, and S½;
Sec. 13, N½ and N½SE¼;
Sec. 14, N½ (except patented land);
Sec. 15, N½ and N½SW¼;
Secs. 16 and 17;
Sec. 18, lot 4, S½NE¼, E½SW¼, and SE¼;
Sec. 19;
Sec. 20, N½ and N½SW¼;
Sec. 21, N½NW¼;
Sec. 30, lot 1 and E½NW¼.
T. 3 S., R. 40 E.,
Sec. 4, lot 4;
Sec. 5, lots 1 to 4, inclusive, S½NE¼, S½NW¼, and SW¼;
Sec. 6;
Sec. 7, lot 1, E½NW¼, and N½NE¼.
T. 2 S., R. 40.2 E., Unsurveyed
Sec. 4, S½SE¼;
Sec. 8, E½ and SW¼;
Sec. 9;
Sec. 16, N½;
Sec. 17;
Sec. 18, S½NE¼, S½SW¼, and SE¼;
Sec. 19;
Sec. 20, NE¼ and W½;
Sec. 30, N½.
T. 1 N., R. 41 E.,
Sec. 1;
Sec. 2, lots 1 and 2, S½NE¼, and E½SE¼;
Sec. 12, N½, E½SW¼, and SE¼;
Sec. 13, E½.
T. 2 N., R. 41 E.,
Sec. 3, lots 2, 3, and 4, S½NE¼, S½NW¼, and S½;
Sec. 4, lots 1, 2, and 3, S½NE¼, S½NW¼, and SE¼;
Sec. 9, NE¼;
Sec. 10;
Sec. 11, W½;
Sec. 14;
Sec. 15, E½ and E½NW¼;
Sec. 22, N½NE¼;
Sec. 23;
Sec. 24, W½NW¼ and W½SW¼;
Sec. 25, W½;
Sec. 26, E½, NW¼, and E½SW¼;
Sec. 35, E½ and E½NW¼;
Sec. 36, W½NE¼, W½, and SE¼.
T. 2 S., R. 41 E.,
Sec. 3, W½SW¼;
Sec. 4, S½NE¼, S½NW¼, and S½;
Sec. 5, S½NE¼ and S½;
Sec. 6, lots 10 to 16, inclusive, and S½SE¼;
Secs. 7, 8, and 9;
Sec. 10, W½NW¼ and W½SW¼;
Sec. 15, W½NW¼;
Sec. 16;
Sec. 17, E½ and SW¼;
Sec. 18, N½NE¼;
Sec. 19, E½NE¼ and E½SE¼;
Sec. 20;
Sec. 21, NW¼ and N½SW¼;
Sec. 29, NE¼, W½, and W½SE¼;
Sec. 30, E½;
Sec. 31, lots 8 to 11, inclusive, and E½;
Sec. 32, N½NE¼ and W½.
T. 3 N., R. 41 E.,
Sec. 7, lots 3 and 4, E½SW¼, and SE¼;
Sec. 8, SW¼;
Sec. 16, S½SW¼; secs. 17 and 18;
Sec. 19, N½NE¼;
Sec. 20;
Sec. 21, W½ and W½SE¼;
Sec. 27, S½SW¼;
Sec. 28;
Sec. 29, E½;
Sec. 32, N½NE¼;
Sec. 33;
Sec. 34, W½ and S½SE¼.
T. 3 S., R. 41 E.,
Sec. 4, lot 4 and S½NW¼;
Sec. 5;
Sec. 6, lot 1, SE¼NE¼, and SE¼;
Sec. 7, E½;
Sec. 8, W½NE¼, W½, and W½SE¼;
Sec. 16, SW¼ and S½SE¼ (except patented land);
Sec. 17;
Sec. 18, E½;
Sec. 19, N½NE¼;
Sec. 20, N½ and SE¼;
Sec. 21;
Sec. 22, S½NE¼, W½, and SE¼;
Sec. 23, S½;
Sec. 24, S½;
Sec. 25;
Sec. 26, N½, N½SW¼, and N½SE¼;
Sec. 27, N½;
Sec. 28, NE ¼.
T. 1 N., R. 42 E.,
Sec. 6, lots 6 and 7, and E½SW¼;
Sec. 7, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and W½SE¼;
Sec. 17, SW¼;
Sec. 18;
Sec. 19, lot 1, E½NW¼, and E½;
Sec. 20;
Sec. 21, SW¼;
Sec. 28, W½NE¼, W½, and SE¼;
Sec. 29;
Sec. 30, N½NE¼;
Sec. 32, NE¼;
Sec. 33;
Sec. 34, W½ and W½SE¼.
T. 1 S., R. 42 E.,
Sec. 3;
Sec. 4, lots 1 and 2, S½NE¼, and SE¼;
Sec. 9, E½NE¼;
Sec. 10;
Sec. 11, W½SW¼;
Sec. 14, W½NW¼ and W½SW¼;
Secs. 15 and 22;
Sec. 23, W½;
Sec. 26, W½;
Sec. 27, E½, E½NW¼, and E½SW¼;
Sec. 34, E½, E½NW¼, and E½SW¼;
Sec. 35, W½.
T. 2 S., R. 42 E.,
Sec. 2, lots 3 and 4, S½NW¼, and W½SW¼;
Sec. 3, lots 1, 2, and 3, S½NE¼, S½NW¼, E½SW¼, and SE¼;
Sec. 10;
Sec. 11, W½NW¼ and W½SW¼;
Sec. 14, W½NW¼ and W½SW¼ (except patented land);
Secs. 15 and 22 (except patented land);
Sec. 23, W½NW¼ and W½SW¼ (except patented land);
Sec. 26, W½NW¼ and W½SW¼ (except patented land);
Secs. 27 and 34 (except patented land);
Sec. 35, W½NW¼ and W½SW¼ (except patented land).
T. 3 S., R. 42 E.,
Sec. 3, lots 1, 2, and 3, S½NE¼, S½NW¼, E½SW¼, and SE¼ (except patented land);
Sec. 10, NE¼ and E½SE¼ (except patented land);
Secs. 11 and 12 (except patented land);
Sec. 13, N½ (except patented land);
Sec. 14, N½NE¼ (except patented land);
Sec. 19, lots 4 to 9 inclusive, and S½SE¼;
Sec. 20, S½SW¼ and S½SE¼;
Sec. 28, W½NE¼, W½, and SE¼;
Secs. 29 and 30;
Sec. 32, N½NE¼ and S½SE¼;
Sec. 33.
T. 4 S., R. 42 E.,
Sec. 4;
Sec. 5, lot 1, S½NE¼, and SE¼;
Sec. 8, E½, E½NW¼, and E½SW¼;
Sec. 9, W½NE¼ and W½;
Sec. 16, W½;
Sec. 17;
Sec. 18, S½SE¼;
Sec. 19, E½NE¼ and E½SE¼;
Sec. 20;
Sec. 23, S½SW¼ and S½SE¼;
Sec. 24, S½SW¼ and S½SE¼;
Secs. 25 and 26;
Sec. 27, NE¼ and S½;
Sec. 28, W½NW¼, W½SW¼, and SE¼;
Secs. 29, 32, and 33;
Sec. 34, N½, SW¼, and N½SE¼;
Sec. 35, N½NE¼ and NW¼.
T. 5 S., R. 42 E., Unsurveyed
Sec. 4, N½NE¼ and N½NW¼;
Sec. 5, N½NE¼.
T. 3 S., R. 43 E.,
Sec. 7 (except patented land);
Sec. 8, S½ (except patented land);
Sec. 16, W½NW¼ and W½SW¼;
Secs. 17 and 18 (except patented land);

Sec. 19, E½ and E½SW¼;
Sec. 20;
Sec. 21, N½NW¼;
Sec. 27, S½;
Sec. 28, S½NE¼, S½NW¼, and S½;
Sec. 29;
Sec. 30, E½ and E½NW¼;
Sec. 31, N½NE¼;
Sec. 32, N½;
Sec. 33, N½ and SE¼;
Sec. 34;
Sec. 35, E½NW¼ and E½SW¼.
T. 5 S., R. 43 E., Unsurveyed
Sec. 6;
Sec. 7, E½ and E½NW¼;
Sec. 18, N½NE¼.

The lands in the Mina Corridor aggregate 139,391 acres in Esmeralda, Lyon, and Mineral Counties.

Public Land Order (PLO) No. 7653, 70 FR 76854–76858 (December 28, 2005), withdrew approximately 308,600 acres of public lands from surface entry and mining for the purpose of evaluating a suite of alternative rail alignments along the Caliente Corridor, as described in the DOE's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, February 2002. The evaluation is for the potential construction, operation, and maintenance of a rail line which would be used to transport spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository as part of the DOE's responsibility under the Nuclear Waste Policy Act, as amended, 42 U.S.C. 10101 *et seq.*

The DOE has identified an additional 68,646 acres of public lands for evaluation along the Caliente Corridor. Since PLO No. 7653 can not be amended to add lands, the DOE has filed this new withdrawal application for those additional lands.

The DOE's withdrawal application also includes 139,391 acres of public lands for the purpose of evaluating the potential construction, operation, and maintenance of a rail line along a suite of alternative rail alignments referred to by the DOE as the "Mina Route." The width of the withdrawal is 1 mile.

The expiration date for this proposed withdrawal would be the same as the expiration date for PLO No. 7653, which is December 27, 2015.

The use of a right-of-way, interagency agreement, or cooperative agreement would not adequately constrain non-discretionary uses that could irrevocably affect the evaluation of these lands for a potential rail line alignment.

There are no suitable alternative sites, since the lands described identify the alternative alignments that need to be evaluated.

No water rights will be needed to fulfill the purpose of the withdrawal.

Possible mineral deposits present in the above-described land areas include some locatable and salable minerals.

For a period of 90 days from the date of publication of this notice, all persons who wish to submit comments, suggestions, or objections in connection with the proposed withdrawal may present their views in writing to the BLM Nevada State Director.

Comments, including names and street addresses of respondents, will be available for public review at the BLM Nevada State Office, 1340 Financial Blvd., Reno, Nevada, during regular business hours, 7:30 a.m. to 4:30 p.m., Monday through Friday, except holidays. Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your comments. Such requests will be honored to the extent allowed by the law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

Notice is hereby given that in addition and subsequent to the 90-day public comment period mentioned above, there will be at least one public meeting in connection with the proposed withdrawal to be announced at a later date. A notice of the time, place, and date will be published in the **Federal Register** and a local newspaper at least 30 days before the scheduled date of a meeting.

This withdrawal proposal will be processed in accordance with the regulations set forth in 43 CFR part 2300.

For a period of 2 years from the date of publication of this notice in the **Federal Register,** the lands described above will be segregated as specified above unless the application is denied or cancelled or the withdrawal is approved prior to that date.

Licenses, permits, cooperative agreements, or discretionary land use authorizations of a temporary nature which will not significantly impact the purpose of the proposed withdrawal may be allowed with the approval of the authorized officer of the BLM during the segregative period.

(Authority: 43 CFR 2310.3–1(a))

Dated: October 30, 2006.

Margaret L. Jensen,

Deputy State Director, Natural Resources, Lands, and Planning.

[FR Doc. E7–84 Filed 1–9–07; 8:45 am]

BILLING CODE 4310–HC–P

A.12 72 *FR* 40139, July 23, 2007

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DEPARTMENT OF ENERGY

Office of Civilian Radioactive Waste Management; Safe Routine Transportation and Emergency Response Training; Technical Assistance and Funding

AGENCY: Department of Energy.

ACTION: Notice of revised proposed policy and request for comments.

SUMMARY: The Department of Energy (DOE) is publishing this notice of revised proposed policy to set forth its revised plans for implementing Section 180(c) of the Nuclear Waste Policy Act of 1982 (the NWPA). Under Section 180(c) of the NWPA, DOE shall provide technical and financial assistance for training of local public safety officials to States and Indian Tribes through whose jurisdictions the DOE plans to transport spent nuclear fuel or high-level

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radioactive waste to a facility authorized under Subtitle A or C of the NWPA (NWPA-authorized facility). The training is to cover both safe routine transportation and emergency response procedures. The purpose of this notice is to communicate to stakeholders the revised proposed policy of DOE regarding Section 180(c) issues and request comments on this revised proposed policy and the questions specified herein. Written and electronic comments may be submitted to DOE on this document.

DATES: Comments must be received by DOE on or before October 22, 2007.

ADDRESSES: Written comments should be directed to Ms. Corinne Macaluso, U.S. Department of Energy, c/o Patricia Temple, Bechtel SAIC Company, LLC, 955 N. L'Enfant Plaza, SW., Suite 8000, Washington, DC 20024. The revised proposed policy and electronic comment forms are also available at *http://www.ocrwm.doe.gov*. Fill out the form and click "submit" to send your comments in through the Web site. Persons submitting comments should include their name and address. Receipt of written comments in response to this notice will be acknowledged if a stamped, self-addressed postal card or envelope is enclosed. Electronic comments will receive an electronic notice of receipt.

FOR FURTHER INFORMATION CONTACT: For further information on the transportation of spent nuclear fuel and high-level radioactive waste under the NWPA, please contact: Ms. Corinne Macaluso, Office of Logistics Management, Office of Civilian Radioactive Waste Management (RW–10), U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC, 20585, Telephone: 202–586–2837.

General program information is available on the Office of Civilian Radioactive Waste Management (OCRWM) Web site located at *www.ocrwm.doe.gov*.

Copies of comments received will be posted on the OCRWM Web site. Please allow up to two weeks after DOE receives comments to view them on the Web site.

Request for Comments: DOE will consider all comments submitted by the closing date. Comments received after that date will be considered to the extent practicable. DOE requests that commenters pay particular attention to the questions at the end of this revised proposed policy.

SUPPLEMENTARY INFORMATION:

I. Purpose and Need for Agency Action

Under the NWPA, DOE is responsible for the transportation of spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility. In particular, under Section 180(c) of the NWPA, DOE is responsible for providing technical and financial assistance for training of local public safety officials to States and Indian Tribes through whose jurisdiction the Secretary plans to transport spent nuclear fuel or high-level radioactive waste to an NWPA-authorized facility. Section 180(c) further provides that such training cover procedures required for both safe routine transportation of these materials and for dealing with emergency response situations. Section 180(c) identifies the Nuclear Waste Fund as the source of funds for this assistance.

DOE has announced a schedule to begin shipping spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility in 2017.[1] Subject to the availability of appropriated funds, DOE plans to conduct a pilot program for 180(c) grants beginning in fiscal year 2008. DOE will evaluate public comments received on this revised proposed policy prior to implementing the pilot program. After review of the comments received on this revised proposed policy and completion of the pilot program, DOE plans to issue a new revised proposed policy for public comment and thereafter to issue a final policy prior to awarding the first 180(c) grants. The first grants are planned to be issued approximately four years prior to the commencement of shipments through a State or Tribe's jurisdiction to support assessing the need for and planning for training.

The *Office of Civilian Radioactive Waste Management, Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions* calls for DOE to work closely with State Regional Groups and individual impacted States and Tribes as it makes operational decisions regarding shipments to an NWPA-authorized facility. The DOE's practice of involving States, Tribes, industry, utilities, and other interested parties in transportation planning has contributed to a decades-long record of safely transporting such material. This revised proposed policy supports the DOE's OCRWM objective to develop and begin implementation of a comprehensive national spent fuel transportation plan that accommodates State, local, and Tribal concerns and input to the greatest extent practicable.

II. Background

On January 3, 1995, DOE issued a proposed policy on how it would implement Section 180(c) of the NWPA (60 FR 99). DOE subsequently issued several notices relating to its proposed 180(c) policy in the **Federal Register** on July 18, 1995 (60 FR 36793), May 16, 1996 (61 FR 24772), July 17, 1997 (62 FR 38272), and April 30, 1998 (63 FR 23753). DOE is publishing this Notice of Revised Proposed Policy to set forth and communicate to stakeholders the revised policy by which DOE currently intends to implement Section 180(c). DOE previously requested comments on the 1998 Notice of Revised Proposed Policy and Procedures. Those comments were reviewed and considered during the development of this revised proposed policy.

As part of its longstanding commitment to work with stakeholders on transportation matters, DOE has engaged in ongoing discussions on how to implement Section 180(c). Such discussions have taken place in the context of the Transportation External Coordination (TEC) Working Group, which is comprised of representatives of State, Tribal, and local governments, and professional, technical, and industry associations, and which meets biannually to identify and discuss issues related to the transport of radioactive materials. In 2004, DOE formed a TEC Topic Group specifically to discuss Section 180(c) issues, and the Topic Group met at least monthly from June 2004 through November 2005. In addition, DOE has discussed Section 180(c) issues with the six national and regional organizations with which DOE has cooperative agreements. These agreements enable DOE to exchange information and solicit input regarding the planned transportation activities of OCRWM, including Section 180(c) activities. These organizations comprise the four State Regional Groups (the Southern States Energy Board, Western Interstate Energy Board, Council of State Governments Midwestern Office, and Council of State Governments Eastern Regional Conference), the Commercial Vehicle Safety Alliance, and the

[1] The schedule for the proposed Yucca Mountain repository is based on factors within the control of DOE, appropriations consistent with optimum Project execution, issuance of an Nuclear Regulatory Commission (NRC) Construction Authorization consistent with the three year period specified in the Nuclear Waste Policy Act, and the timely issuance by the NRC of a Receive and Possess license. This schedule also is dependent on the timely issuance of all necessary other authorizations and permits, the absence of litigation related delays, and the enactment of legislation proposed by the Administration.

National Conference of State Legislatures.

Through the TEC Section 180(c) Topic Group, discussions with the national and regional organizations described above, and other stakeholder interactions, DOE received valuable comments and views on 180(c) issues which have been considered in the development of this revised proposed policy. The Topic Group reached significant agreement on eligibility requirements and timing of the grants and allowable uses of the funding.

This policy is intended to be consistent with Homeland Security Presidential Directives Number 5, "Management of Domestic Incidents," issued February 28, 2003, and Number 8, "National Preparedness," issued December 17, 2003; the Department of Homeland Security's National Preparedness Goal, issued December 2005; the National Preparedness Guidance issued April 27, 2005; the National Incident Management System, issued March 1, 2004; and the National Response Plan, issued December 2004.

III. Policy

Policy Statement

Section 180(c) of the NWPA states:

> The Secretary [of DOE] shall provide technical assistance and funds to States for training for public safety officials of appropriate units of local government and Indian tribes through whose jurisdiction the Secretary plans to transport spent nuclear fuel or high-level radioactive waste under subtitle A or under subtitle C. Training shall cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations.

This proposed policy addresses the provision of technical and financial assistance for training, both for normal transportation operations and for potential incidents that may require emergency response during shipments of spent nuclear fuel or high-level radioactive waste to an NWPA-authorized facility. Technical assistance to support 180(c) activities will consist of non-monetary assistance that the Secretary of Energy can provide from DOE's specific knowledge, expertise, and existing resources to aid training of public safety officials on procedures for safe routine transportation and for emergency response situations during the transport of spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility. Technical assistance includes, but is not limited to, access to DOE's regional and Headquarters representatives involved in the planning and operation of NWPA transportation or emergency preparedness activities, provision of information packets that include materials about the OCRWM Program and shipments, and provision of other training materials and information. Financial assistance will consist of assessment and planning grants and annual training grants. The provision of grants will be subject to the criteria described herein, as well as the availability of appropriated funds.

This revised proposed policy is consistent with DOE's longstanding commitment to meet or exceed requirements and standards applicable to the transport of spent nuclear fuel and high-level radioactive waste; to cooperate with States, Tribes, and local governments; and to make use of the existing expertise of States, Tribes, and local governments to the maximum extent practicable.

Section 180(c) funds are intended to be used for training specific to shipments of spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility. DOE will work with States and Tribes to evaluate current preparedness for safe routine transportation and emergency response capability and will provide funding as appropriate to ensure that State, Tribal, and local officials are prepared for OCRWM shipments. Section 180(c) funds and related training are intended to supplement but not duplicate existing training for safe routine transportation and emergency preparedness. DOE will work with States and Tribes to coordinate and integrate Section 180(c) activities with existing training programs designed for State, Tribal, and local public safety officials. Equipment purchased with Section 180(c) funds is intended to be used for training to prepare for the specific hazards presented by shipments to an NWPA-authorized facility. If necessary, such equipment could then be used for inspections and for responding to emergencies. Since State and Tribal governments have primary responsibility to protect the public health and safety in their jurisdictions, they will have flexibility to decide which allowable activities to request Section 180(c) assistance to meet their unique needs within the limits of the NWPA and DOE and other Federal financial assistance regulations and restrictions.

Training with Section 180(c) funds should be to the level of detail and to the degree necessary to prepare for shipments to an NWPA-authorized facility. When necessary or appropriate, training should be consistent with the Occupational Safety and Health Administration (OSHA) awareness or operations levels, as those terms are defined in 29 CFR 1910.120, and the jurisdiction's emergency response plans. Any deficiency in basic emergency response capability may be addressed through consultation and technical assistance.

Funding Mechanism

DOE will implement Section 180(c) by funding direct grants to eligible States and Tribes. The grants program will be administered in accordance with the DOE Financial Assistance rules (10 CFR part 600), which implement applicable Office of Management and Budget circulars, and applicable law. The grant application process will require States and Tribes to describe and justify their proposed work in the format of a five-year project with a more detailed two-year work plan. Applications will only be accepted through the Federal government's electronic grant application system at *www.grants.gov*.

Basis for Cost Estimate/Grant Funding Allocation to States

DOE anticipates providing funds to States in accordance with the approach described below. Specifically, DOE expects to make two grants available to States: An assessment and planning grant and an annual training grant.[2]

The assessment and planning grant to each eligible State will support an initial needs assessment to identify training needs that might be addressed in future training grants to that State. The amount of the assessment and planning grant is not expected to exceed $200,000, adjusted annually for inflation, for each eligible State based on appropriated funds available for that purpose in a particular fiscal year. The annual training grant to each eligible State will support allowable activities as specified in the grant. The annual training grant for each eligible State will consist of a base amount not expected to exceed $100,000, adjusted annually for inflation, as well as a variable amount. The base amount for each grant depends on Congressional appropriations. DOE selected the amounts of the base grants based on experience with similar training programs and discussions with State and emergency response officials about the scope of work likely for each grant.

The variable amount of the training grant will be determined through a risk-based formula using the factors of population along routes, route miles,

[2] DOE has recently begun meeting with Indian Tribes to discuss the funding allocation options for grants to Tribes. The proposed funding allocation approach described herein applies only to States.

number of shipments, and shipping sites. The population figure, calculated from U.S. Census Bureau data, acts as a surrogate for either the number of responders requiring training or the number of jurisdictions requiring training. Total route miles (for all shipping modes) acts as a surrogate for the accident risk. The number of shipments addresses the additional burden placed on States that are heavily impacted by shipments. Finally, the number of shipping sites will factor in the additional training burden placed on States that must prepare for point-of-origin inspections of both the package and the vehicle. Shipping sites will include commercial nuclear power plants, DOE sites, and any other entity shipping spent nuclear fuel or high-level radioactive waste to an NWPA-authorized facility.

The amount of the annual training grants will be based on the appropriated funds available for that purpose in a particular fiscal year. Available funds will be first used to fund the base portion of the grant, which would be the same for each eligible State. Remaining available funds will be used to fund the variable portion of the grant for each eligible State on the basis of the following five-step formula.

The steps are as follows:

Step 1: Collect raw data with respect to the factors of population along routes, route miles, number of shipments, and shipping sites for each State.

Step 2: Divide the raw State data for each factor by the national total for each factor. The result is each State's percentage of the national total for each factor.

Step 3: Multiply each State's percentage of each factor by the correspondent weighting for each factor as specified below; the result would be summed to reach a total for each State, as follows:

0.3 × Percentage of Population Along Route Corridors
+ 0.3 × Percentage of Route Miles
+ 0.3 × Percentage of Number of Shipments
+ 0.1 × Percentage of Shipping Sites
= Total for Each State

Step 4: Sum the total for each State to obtain a national total.

Step 5: Divide each State's total by the national total to reach each State's percentage of available funds for the year.

DOE will work with applicants to ensure consistent sources are used to estimate the raw data for each factor of the formula. All factors are specific to the shipping year. The specific sources DOE will use for the raw data are as follows:

• The population factor will be calculated using the population within 2,500 meters of the route as calculated by the Transportation Routing Analysis Geographic Information System (TRAGIS), DOE's routing model. TRAGIS uses U.S. Census Bureau data as its source for population.

• For route miles, DOE will calculate the national total using TRAGIS to estimate the route miles for each year's projected shipments.

• The number of shipments annually through a State will be estimated based on DOE's projected shipments for each year.

• The number of shipping sites will be based on the number of defense and civilian sites originating a shipment within the State for the year for which an applicant is applying for funding.

Eligibility and Timing of the Grants Program

DOE will provide grants and technical assistance to those States and Tribes through whose jurisdictions the Secretary of Energy plans to transport spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility. Where a route constitutes a border between two States, a State and a Tribal reservation, or two Tribal reservations, every jurisdiction with emergency response responsibility and inspection authority over the route will be eligible for Section 180(c) assistance. If a State or Tribe will *not* have shipments but has cross-deputization or mutual aid agreements with a jurisdiction that *will* have shipments, the non-shipment jurisdiction may work with DOE to receive funding.

DOE will send a letter to the Governor or Tribal leader's office notifying them of their State or Tribe's eligibility to apply for Section 180(c) grants approximately five years before shipments are scheduled through that State or Tribe's jurisdiction. Each State or Tribe shall designate which agency or staff member of the State or Tribe will administer its Section 180(c) grants. Subsequently, DOE will communicate with the State or Tribe's designated agency or staff person regarding Section 180(c) grants.

Subject to the availability of appropriated funds, DOE expects to begin making assessment and planning grants available to a State or Tribe approximately four years prior to the first shipment to an NWPA-authorized facility through that State or Tribe's jurisdiction.

DOE intends to issue training grants in each of the three years prior to a scheduled shipment through a State or Tribe's jurisdiction and every year that shipments are scheduled.

Allowable Activities

DOE intends to allow a broad array of eligible planning and training activities, thus providing the recipients flexibility to direct funds toward their individual needs. DOE will require applicants to describe and justify the need for proposed activities, training, and purchases in the application package for review and approval by DOE.

Under Section 180(c) of the NWPA, DOE shall provide technical and financial assistance to States and Indian Tribes through whose jurisdictions the DOE plans to transport spent nuclear fuel or high-level radioactive waste to an NWPA-authorized facility. States and Tribes should describe in their grant applications how the grants will be used to provide training to local public safety officials. States and Tribes are expected to coordinate with local public safety officials during the assessment and planning phase and in developing their applications for the annual training grants. DOE recognizes that, depending on the State or Tribe, the role of local public safety officials in responding to incidents involving radioactive materials varies from a minimal role of crowd and traffic control to the primary role of incident command. Therefore, the benefit to local public safety officials should be consistent with established State, Tribal, and local roles in dealing with routine transportation and in responding to an incident involving NWPA shipments.

Potential activities for the Assessment and Planning Grant include:

• Assessment of the jurisdiction's needs for training on procedures related to safe routine transportation and emergency response situations.
• Development of mutual aid agreements among neighboring jurisdictions and with Federal agencies.
• Planning for how to provide needed training for public safety officials.
• Participation in DOE, regional, and national transportation planning meetings.
• Intra- and interstate and Tribal planning and coordination.
• Support for exercises to test plans and training.
• Review of DOE transportation, emergency management, communications, and security plans, including threat assessments and civil disobedience/law enforcement planning.
• Obtaining access to DOE data and systems, such as the Transportation Tracking and Communications system

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(TRANSCOM) for information and shipment tracking.

• Evaluation and identification of alternative routes for DOE non-classified radioactive materials shipments according to 49 CFR 397, *Transportation of Hazardous Materials' Driving and Parking Rules* (referred to as HM–164).

• Risk assessments.

• Participation in DOE's Transportation Emergency Preparedness Program (TEPP).[3]

• Coordination with DOE's Radiological Assistance Program (RAP) training, exercises, and planning activities.[4]

• Planning activities using Transportation Routing Analysis Geographic Information System (TRAGIS) or other DOE route or risk assessment models.

• Participation in carrier evaluation programs that may be implemented through other agencies or organizations.

• Staff costs related to planning and needs assessments.

The Training Grant has two categories of allowable activities: Activities related to safe routine transportation and activities related to emergency response.

Activities for the safe routine transportation aspects of the Training Grant may include:

• Continuation of the activities initiated under the Assessment and Planning Grant, such as coordination with agencies within the State or Tribe, assessment of training needs, and assessment of technical assistance needs.

• Training and staff costs associated with the Department of Transportation's State Rail Safety Participation Program. The Federal Railroad Administration will provide informal outreach and training opportunities to Tribal nations, since there is no statutory authority for participation by Indian Tribes in the State Safety Participation Program as outlined in 49 CFR 212.

• Training for public safety officials in safety and enforcement inspections of highway shipments (drivers, vehicles, and shipping containers).

• Training related to accident prevention (e.g., for safe parking, bad weather, and road conditions).

• Training for appropriate local, State, and Tribal officials on the proper handling of information and documents, including secure and confidential shipments.

• Training for radiological inspections, both rail and truck.

• Training on a satellite tracking system.

• Equipment purchases, calibration, and maintenance for training purposes.[5]

• Staff costs related to training.

Activities for the emergency response aspects of the Training Grant may include:

• Continuation of planning activities begun under the Assessment and Planning Grant.

• Training in implementation of mutual aid agreements among neighboring jurisdictions and agreements with Federal agencies.

• Training for public safety officials in hazardous materials emergency response procedures. When necessary or appropriate, training should be consistent with OSHA awareness or operations levels, as those terms are defined in 29 CFR 1910.120, and the jurisdiction's emergency response plans.

• Participation in DOE's TEPP.

• Equipment purchases, calibration, and maintenance for training purposes.

• Training for emergency medical personnel, including hospital emergency medical personnel.

• Designing, conducting, and evaluating drills and exercises, including the implementation of mutual aid agreements and emergency response plans and procedures.

• Staff costs related to training.

IV. Merit Review Criteria

States and Tribes will have flexibility to decide for which allowable activities to request Section 180(c) assistance to meet their unique needs within the limits of the NWPA and DOE and other Federal financial assistance regulations and restrictions. Grant applications will be reviewed in accordance with 10 CFR 600.13, *Merit Review.*

The merit review process consists of a board of technically qualified reviewers who evaluate each grant application on pre-established criteria. The merit review board advises the DOE's selection officials as to the merits of each proposed activity and the overall quality of the application. The DOE's selection officials will make final funding determinations and notify successful applicants of their award in accordance with standard grant procedures.

The proposed criteria, which the merit review board will use for its review, are described below in *Table 1, Assessment and Planning Grant and Table 2, Training Grant.* The applicant's narrative should address each of these criteria in accordance with the instructions provided.

TABLE 1.—ASSESSMENT AND PLANNING GRANT

Criteria	Instructions
Conduct a needs assessment and develop a training plan to prepare for NWPA shipments through the applicant's jurisdiction.	In the grant application narrative, make sure the scope of the assessment and plan development is clear and thorough: a. Describe how the State or Tribe will assess needs, including how the State or Tribe will determine what additional planning, training, equipment, and exercises may be needed. b. Describe the technical assistance that will be requested from DOE or other Federal agencies in order to conduct the needs assessment. c. Describe the cost and timeframe of each proposed assessment and planning activity. d. Describe what planning will occur within the State or Tribe and with local jurisdictions. e. Identify all mutual aid agencies that will be contacted to complete the needs assessment and training plan. f. Describe how the proposed grant funding does not supplant or duplicate existing funding from Federal or State sources.

[3] DOE's TEPP integrates transportation emergency preparedness activities for DOE non-classified shipments of radioactive materials to address the emergency response concerns of State, Tribal, and local officials affected by such shipments. TEPP is implemented on a regional basis, with a TEPP Coordinator for each region. TEPP ensures responders have access to the model plans and procedures, training, and technical assistance necessary to respond safely, efficiently, and effectively to transportation incidents.

[4] DOE's RAP is a team of DOE and DOE contractor personnel specifically trained to perform radiological emergency response activities. The RAP teams may deploy at the request of DOE sites; other Federal agencies; State, Tribal or local governments; or from any private organization or individual. Teams are located at eight sites around the Nation.

[5] Grant funds can be used to purchase equipment for training purposes. They can also be used to calibrate and maintain equipment as long as the equipment is training-related and specific to the needs created by the NWPA shipments.

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TABLE 1.—ASSESSMENT AND PLANNING GRANT—Continued

Criteria	Instructions
Prepare public safety officials of appropriate units of local government.	The narrative should completely and accurately describe: a. How local public safety officials were involved in developing the grant application. b. How local public safety officials will be involved in the needs assessment consistent with their role in radioactive/hazardous materials transportation as defined by the State.
Prepare sufficiently to reassure the public of adequate preparedness.	The narrative should accurately and completely describe: a. How the applicant will assess what is needed to respond to inquiries from the public and the media. b. What activities and measures, if any, are needed to reassure the public of adequate preparedness.
Train for the increment of need specific to NWPA shipments.	The narrative should accurately and completely describe: a. What the applicant is already doing to prepare for radioactive materials shipments. b. How each proposed needs assessment activity is specific to the NWPA shipments.

TABLE 2.—TRAINING GRANT

Criteria	Instructions
Conduct training on procedures for safe routine transportation to help prevent accidents and respond in a timely and appropriate fashion to incidents involving NWPA shipments.	The narrative should accurately and completely describe: a. How many public safety officials will be trained and what training they will receive, based on the needs assessment conducted under the Assessment and Planning Grant. b. List the equipment the applicant proposes to purchase, describe why this equipment is necessary for training for these shipments, and how it is consistent with the training level to which the responders will be trained. c. How the proposed grant funding does not supplant or duplicate existing funding from Federal or State sources. d. How the actions listed in this section help the applicant increase its capability to prevent accidents and respond appropriately to accidents. e. The technical assistance that will be requested from DOE, either from OCRWM, RAP teams, TEPP coordinators, or other Federal agencies. f. How the training and technical assistance will be integrated with assistance received from other Federal Government sources.
Help prepare public safety officials of appropriate units of local government.	The narrative should accurately and completely describe: a. How local public safety officials will benefit from the proposed activities. b. Whether those local public safety officials support the activities proposed in this application and how their level of support is determined.
Prepare sufficiently to reassure the public of adequate preparedness.	The narrative should accurately and completely describe: a. How the applicant will train to respond to inquiries from the public and the media. b. What activities and measures, if any, will be taken to reassure the public of adequate preparedness.
Train in the increment of need specific to NWPA shipments.	The narrative should accurately and completely describe: a. How each proposed activity is specific to the NWPA shipments. b. How the training will be integrated with assistance received from other DOE programs or Federal agencies for radioactive materials transportation preparedness.
Assess level of preparedness after training, exercises, and technical assistance.	The narrative should accurately and completely describe: a. How the applicant will assess their level of preparedness after conducting the proposed activities. The proposed assessment should measure readiness against the objectives described in the applicant's project narrative. b. How the applicant will assess how well it utilized the technical assistance requested.

V. Request for Comments

DOE requests that interested parties comment on this notice of revised proposed policy, including the specific questions identified below:

Question 1

(a) Would $200,000 be an appropriate amount for the assessment and planning grant to conduct an initial needs assessment?

(b) Should the amount be the same for each eligible State and Tribe?

(c) Would there be a need to update the initial needs assessment and, if so, at what intervals and should funding be made available for this purpose and in what amount?

Question 2

(a) Would $100,000 be an appropriate amount for the annual training grant?

(b) Recognizing that, after commencement of shipments through an eligible State or Tribe, training to maintain capability may become less costly with increased expertise and efficiency, should the base amount of subsequent annual training grants be adjusted downward to reflect the number of years that annual training grants have been received?

(c) What should be the allocation of available appropriated funds for a fiscal year between the base amount and the variable amount of the annual training grants?

(d) Should the entire training grant be variable based on the funding allocation formula described herein?

Question 3

(a) Should the amount of funding be adjusted where a route forms a border between two States, a State and a Tribal reservation, or two Tribal reservations?

(b) Should States or Tribes with mutual aid responsibilities along a route outside their borders be eligible for

180(c) grants on the basis of the mutual aid agreement?

(c) If so, how should the amount of funding be calculated, and should the calculation take into account whether or not the State or Tribe would otherwise be eligible for a grant?

(d) Should the State or Tribe that received notification of eligibility from DOE indicate in their grant application that a neighboring State or Tribe has a mutual aid agreement along a particular route, whereupon DOE would then notify the neighboring State or Tribe of its eligibility?

Question 4

(a) Do assessment and planning grants need to be undertaken four years prior to an initial scheduled shipment through a State or Tribe's jurisdiction?

(b) Do training grants need to commence three years prior to a scheduled shipment through a State or Tribe's jurisdiction?

(c) Do training grants need to be provided every year that shipments are scheduled?

Question 5

(a) Should the Section 180(c) grants be adjusted to account for fees levied by States or Tribes on the transportation of spent nuclear fuel or high-level radioactive waste through their jurisdiction?

(b) How should DOE determine if a fee covers all or part of the cost of activities allowed under Section 180(c) grants?

(c) Is the language in this policy, requiring States and Tribes to explain in their grant application how the fees and Section 180(c) grant awards are separate and distinct, sufficient to prevent DOE from paying twice for the same activity?

Question 6

(a) How should Section 180(c) grants be adjusted to reflect other funding or technical assistance from DOE or other Federal agencies for training for safe routine transportation and emergency response procedures?

(b) In particular, how should DOE account for TEPP and other similar programs that provide funding and/or technical assistance related to transportation of radioactive materials?

(c) To what extent is Section 180(c) funding necessary where funding and/or technical assistance are being or have been provided for other DOE shipping campaigns such as to DOE's Waste Isolation Pilot Plant?

Issued in Washington, DC, on July 18, 2007.

Edward F. Sproat III,

Director, Office of Civilian Radioactive Waste Management.

[FR Doc. E7–14181 Filed 7–20–07; 8:45 am]

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APPENDIX B

INTERAGENCY AND INTERGOVERNMENTAL INTERACTIONS

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APPENDIX B

INTERAGENCY AND INTERGOVERNMENTAL INTERACTIONS

This appendix describes DOE interagency and intergovernmental interactions during the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS.

During the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS, the U.S. Department of Energy (DOE or the Department) has interacted with a number of government agencies and other organizations. These interaction efforts have several purposes, as follows:

- To discuss issues of concern with organizations having an interest in or authority over land that the Proposed Action would directly affect, or organizations having other interests that some aspect of the Proposed Action could affect
- To obtain information pertinent to the environmental impacts analyses
- To initiate consultations or permitting processes, including providing data to agencies with oversight, review, or approval authority over some aspect of the Proposed Action

Sections B.1 through B.7 describe agency and organization interests in the proposed railroad project and DOE consultations and interactions with those agencies and organizations.

B.1 Cooperating Agencies

The Bureau of Land Management (BLM or the Bureau), the Surface Transportation Board (STB), and the U.S. Air Force are cooperating agencies in the preparation of the Rail Corridor SEIS and the Rail Alignment EIS, pursuant to Council on Environmental Quality regulations at 40 Code of Federal Regulations 1501.6.

B.1.1 BUREAU OF LAND MANAGEMENT

DOE met routinely with the BLM to discuss project direction and coordination. DOE has held numerous briefings and working meetings with the BLM, including staff from the Tonopah, Ely, Battle Mountain, Las Vegas, Reno, and Carson City BLM field offices, regarding the status of the National Environmental Policy Act (NEPA) analyses. Table B-1 summarizes major DOE interactions with the BLM. In addition, a BLM staff member resided in DOE offices during the development of the Nevada Rail Corridor SEIS and the Rail Alignment EIS to facilitate communications and interactions between DOE and the BLM.

B.1.2 SURFACE TRANSPORTATION BOARD

The U.S. Department of Transportation has the authority to regulate several aspects of the transportation of spent nuclear fuel and high-level radioactive waste to the repository. The general authority of the U.S. Department of Transportation to regulate carriers and shippers of hazardous materials includes packaging procedures and practices, shipping of hazardous materials, routing, carrier operations, shipping container instruction, and receipt of hazardous material.

Table B-1. Summary of DOE interactions with the BLM[a] (page 1 of 2).

Date	Office	Summary of interaction
07/14/04	DOE Las Vegas	Discussed the schedule for preparation of the Rail Alignment EIS and reviewed the preliminary scope and outline for the EIS
12/02/04	DOE Las Vegas	Reviewed the nature of the Proposed Action and alternatives (including alternative segments) and the locations of railroad construction and operations support facilities for purposes of analysis
12/14/04	BLM Ely	• Obtained initial information for biological surveys and physical setting • Discussed unique natural features; soil surveys; BLM special status species; fencing; grazing allotments; wetlands; and various wildlife species
12/15/04	BLM Tonopah	• Obtained initial information for biological surveys and physical setting • Discussed soil surveys; invasive species; wetlands; BLM special status species; fencing; grazing allotments; wetlands; and various wildlife species
01/03/05	BLM Las Vegas	Obtained and discussed BLM input on key observation points for aesthetics analysis
01/04/05	BLM Ely	Obtained and discussed BLM input on key observation points for aesthetics analysis
01/06/05	BLM Battle Mountain	Obtained and discussed BLM input on key observation points for aesthetics analysis
02/08/05	BLM Tonopah	• Discussed fencing, land segregation, invasive species, and land-use conflicts • Identified potential activities to be considered in the Shared-Use Option and the cumulative impact analysis
02/16/05	BLM Las Vegas	• Provided an overview of proposed rail alignment and alternative actions for BLM • Learned of BLM concerns
03/17/05	DOE Las Vegas	Discussed the approach for addressing mitigation measures
04/06/05	BLM Ely	Discussed caves, paleontology, and unique natural features
04/06/05	BLM Las Vegas	Formal presentation to BLM on the Rail Alignment EIS to review historical perspective; discuss decisions supported by the EIS; the Proposed Action and alternatives; use of conceptual design information; approaches to analyzing resources; land acquisition; and schedule
04/12/05	DOE Las Vegas	Discussed the approach for addressing mitigation measures and a preferred alignment
04/21/05	BLM Las Vegas	Reviewed the approach for land acquisition; discussed economic or value assessment of mineral resources and ore bodies
05/18/05	BLM Las Vegas	• Provided an update regarding the Rail Alignment EIS • Discussed BLM concerns • Presented and discussed approach to analysis of cumulative impacts
05/24/05	BLM Ely	• Discussed availability of mapping of visual resource management classifications, and the record of decision for Caliente Management Framework • Planned for and discussed the upcoming Resource Management Plan for the Garden Valley area

Table B-1. Summary of DOE interactions with the BLM[a] (page 2 of 2).

Date	Office	Summary of interaction
05/26/05	BLM Battle Mountain	• Coordinated use of BLM geographical information system data
06/07/05	BLM Ely	• Provided an update regarding the Rail Alignment EIS • Learned of BLM Resource Management Plan update and identified projects that should be included in the Rail Alignment EIS • Discussed Rail Alignment EIS cumulative impact analysis
06/22/05	BLM Tonopah	• Provided an update regarding the Rail Alignment EIS
06/29/05	BLM Battle Mountain	• Provided an update regarding the Rail Alignment EIS
02/07/06-02/08/06	DOE Las Vegas	• Presented the DOE preferred alternative segments and received input from cooperating agencies
03/14/06-3/16/06	BLM Ely	• Draft EIS workshop to discuss Proposed Action and potential impacts
11/28/06	BLM Reno	• Provided an update regarding the Nevada Rail Corridor SEIS and the Rail Alignment EIS
2/13/07	BLM Carson City	• Provided an update regarding the Nevada Rail Corridor SEIS and the Rail Alignment EIS

a. BLM = Bureau of Land Management; DOE = U.S. Department of Energy; EIS = environmental impact statement; SEIS = supplemental environmental impact statement.

During the preparation of the NEPA analyses, DOE met routinely with the STB to discuss project direction and coordination. The STB:

- Participated in a meeting on July 14, 2004, to discuss the Rail Alignment EIS preparation schedule and to review the preliminary scope and outline of the EIS
- Participated in a meeting on December 2, 2004, to review the nature of the Proposed Action and alternatives (including alternative segments) and to review the proposed locations of construction and operations support facilities for purposes of analysis
- Received a formal presentation from DOE on March 16, 2005, to review the proposed Caliente rail alignment alternative segments, use of conceptual design information, framework of the Shared-Use Option, and approaches to analyzing various environmental resources
- Participated in a meeting on April 12, 2005, to discuss the approach for addressing mitigation measures and a preferred alignment along the Caliente rail corridor and to review the approach for acquiring land
- Provided, on April 19, 2005, input regarding the extent to which truck traffic carrying general commodities should be evaluated under the No-Action Alternative
- Participated in a 2-day meeting on February 7 and 8, 2006, to discuss the DOE preferred alternative segments along the Caliente rail alignment

B.1.3 U.S. AIR FORCE

The U.S. Air Force participated in a meeting on July 14, 2004, to discuss the NEPA document preparation schedule and to review the preliminary scope and outline of the Rail Alignment EIS, and a 2-day meeting on February 7 and 8, 2006, to discuss the DOE preferred alternative segments along the Caliente rail alignment.

B.1.4 U.S. ARMY

The U.S. Army has participated in the following meetings:

- December 23, 2006, to discuss the status of document preparation, and the inclusion of the Mina rail alignment as part of the NEPA analysis
- January 8, 2007, to discuss rail alignment infrastructure in relation to the U.S. Army-established safety zones around munitions storage areas
- February 19, 2007, to discuss the location and use of switching yards from the existing U.S. Department of Defense Branchline

B.2 Other Federal Agencies

B.2.1 U.S. DEPARTMENT OF THE INTERIOR

The U.S. Department of the Interior is responsible for most federally owned public lands and natural resources. Department of the Interior activities potentially affected by the Proposed Action include managing lands and resources, conducting scientific research and investigations, developing resources, and carrying out trust responsibilities of the U.S. Government with respect to American Indians. The Department of the Interior oversees various bureaus with jurisdictional responsibilities or interests that would be affected by the proposed railroad, including the Bureau of Indian Affairs, the Bureau of Land Management, and the U.S. Fish and Wildlife Service.

The Bureau of Indian Affairs is responsible for administering and managing land held in trust by the United States for American Indians, Indian tribes, and Alaska Natives. The Bureau of Indian Affairs is responsible for developing forestlands, leasing assets on these lands, directing agricultural programs, protecting water and land rights, developing and maintaining infrastructure, and economic development.

On September 20, 2004, DOE responded to a letter from the Bureau of Indian Affairs, indicating that the Department had eliminated one Caliente alternative segment from further consideration based on the Bureau's concern that it would cross lands held in trust for the Timbisha Shoshone Tribe (DIRS 174558-Sweeney 2004, all).

Under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*), as amended, the U.S. Fish and Wildlife Service, a bureau of the U.S. Department of the Interior, has responsibility to determine if projects such as the proposed railroad would have an adverse impact on endangered or threatened species, on species proposed for listing as endangered or threatened, or on designated critical habitat.

- DOE met with staff from the U.S. Fish and Wildlife Service on January 27, 2005, March 2, 2006, and December 13, 2006, to introduce the project; discuss compliance with the Endangered Species Act; and consider potential impacts to threatened and endangered species.
- On April 12, 2006, representatives of the U.S. Fish and Wildlife Service and DOE visited the Caliente area to evaluate habitat for southwestern willow flycatchers and discuss impacts to that endangered species.

- On March 18, 2005, the U.S. Fish and Wildlife Service sent DOE a list of threatened and endangered species and candidate species that occur in the region of influence of the Caliente rail alignment (DIRS 174439-Williams 2005, all).
- On December 13, 2006, and April 11, 2007, DOE met with staff from the U.S. Fish and Wildlife Service Reno Office to discuss compliance with the Endangered Species Act and requested a list of endangered species that occur in the Mina rail alignment region of influence.
- On March 8, 2007, the Fish and Wildlife Service sent DOE a species list for the Mina rail alignment and an updated list for the Caliente rail alignment.

B.2.2 U.S. ARMY CORPS OF ENGINEERS

The Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) gives the U.S. Army Corps of Engineers permitting authority over activities that discharge dredge or fill material into Waters of the United States. If DOE activities associated with the proposed railroad would discharge dredge or fill into any such waters, the Department might need to obtain a permit from the U.S. Army Corps of Engineers.

On November 4, 2004, March 7, 2006, November 27, 2006, and March 5, 2007, DOE met with the U.S. Army Corps of Engineers to provide an overview of the plans for constructing a rail line to Yucca Mountain along the Caliente rail alignment and to obtain initial information from the U.S. Army Corps of Engineers on the permitting process for Section 404 of the Clean Water Act. At these meetings, DOE and the Corps of Engineers discussed the required state permits; Corps of Engineers jurisdiction over isolated waters; the type of permit DOE would have to obtain; content and timing of the permit application; potential mitigation; the addition of the Mina rail alignment and related construction plans; and compliance with the National Environmental Policy Act.

B.2.3 U.S. DEPARTMENT OF AGRICULTURE

The U.S. Department of Agriculture is responsible for ensuring that the potential for federal programs to contribute to unnecessary and irreversible conversion of farmlands to nonagricultural uses is kept to a minimum.

On March 9, 2007, DOE sent a letter to the Natural Resources Conservation Service requesting that the Service identify prime farmland along the Caliente and Mina rail alignments.

B.3 State of Nevada

If DOE decided to construct the proposed railroad along the Caliente rail alignment or the Mina rail alignment, the Department would need to obtain a range of permits and approvals from the State of Nevada (Rail Alignment EIS, Chapter 6, Statutory, Regulatory, and Other Applicable Requirements).

- On March 23, 2005, DOE met with personnel from the Nevada Department of Wildlife to identify information that they had regarding wildlife and sensitive animal species that could be included in the Rail Alignment EIS. Various species were discussed, as was fencing along the Caliente rail alignment. DOE had numerous informal follow-up meetings and conversations with the Nevada Department of Wildlife occurred to coordinate sharing of wildlife information.
- On March 23, 2005, DOE met with personnel from the Nevada Division of Forestry to identify pertinent information to be used in the Rail Alignment EIS. The Division of Forestry provided direction regarding where to obtain pertinent information.

- On December 20, 2005, DOE met with personnel from the Nevada Department of Transportation to introduce DOE plans for constructing a rail line to Yucca Mountain along the Caliente rail alignment and to inquire about standards or requirements for road upgrades/improvements, requirements for grade-crossing protection, anticipated improvement projects, and other related topics.
- On January 10, 2006, DOE met with the Nevada Bureau of Air Quality concerning air quality permits and the Rail Alignment EIS. The purpose of the meeting was to present to the Bureau a general overview of the Nevada Rail Project, and a description of air quality permitting that will be included in this EIS.
- On November 31, 2006, and December 18, 2006, DOE met with the Nevada Division of Water Resources to discuss water appropriations for construction and operation of the proposed railroad along the Caliente rail alignment and the process for developing and submitting permit applications.

B.4 Federal and State Agencies Consulted Jointly

DOE, the Advisory Council on Historic Preservation, the Nevada State Office of Historic Preservation, the BLM, and the STB held numerous meetings during 2005 and 2006 to develop a Programmatic Agreement (see Appendix M) to address DOE responsibilities under Sections 106 and 110 of the National Historic Preservation Act and the Council's implementation regulations. The Programmatic Agreement provides that an appropriate level of field investigation, including on-the-ground intensive surveys, evaluations of all recorded resources in the *National Register of Historic Places*, assessments of adverse effects, and applicable mitigation of identified impacts, be completed prior to commencement of any ground-disturbing construction activities (DIRS 176912-Wenker et al. 2006, all). Cultural resource requirements for the segment of the rail alignment and the Rail Equipment Maintenance Yard and geologic repository operations area interface inside the Yucca Mountain Site boundary are covered by the existing programmatic agreement for *Development for the Nuclear Waste Deep Geologic Repository at Yucca Mountain, Nevada* (DIRS 104558-DOE 1988, all) between the DOE Office of Civilian Radioactive Waste Management, the Advisory Council on Historic Preservation, and the Nevada State Office of Historic Preservation.

Although not a formal signatory, the Nevada State Historic Preservation Officer has the right at any time, on request, to participate in monitoring DOE compliance with the Programmatic Agreement. In addition, DOE must provide opportunities for consultations with the Advisory Council on Historic Preservation, the Nevada State Historic Preservation Officer, the BLM, the STB, and American Indian tribes as appropriate throughout the process of implementing the Programmatic Agreement. DOE will submit an annual report to the Advisory Council, the Nevada State Historic Preservation Officer, the BLM, and the STB describing the activities it conducts each year to implement the stipulations of the Programmatic Agreement. DOE will continue to seek input from the Advisory Council on Historic Preservation, the Nevada State Historic Preservation Officer, the BLM, and the STB and will interact appropriately to meet the reporting and other stipulations of the Programmatic Agreement.

B.5 Local Agencies

Units of local government that would be affected by construction and operation of the proposed railroad along the Caliente rail alignment include Lincoln, Nye, and Esmeralda. These counties and the City of Caliente have formed the Central Nevada Community Protection working group to address, in a collaborative effort, issues of concern to their communities related to the Proposed Action.

Under a Cooperative Agreement with DOE, Nye County conducted a mail survey to property owners along or near the Caliente rail alignment to obtain their concerns and thoughts on potential mitigation measures (DIRS 182923-DOE 2003, all). Also under the Cooperative Agreement with DOE, the Nye County Department of Natural Resources and Federal Facilities conducted an assessment of the potential economic benefits of the proposed railroad to Lincoln, Nye, and Esmeralda Counties (DIRS 174090-Wilbur Smith Associates 2005, all).

DOE has interacted with Esmeralda, Lincoln, and Nye Counties and the City of Caliente on a regular basis throughout the preparation of this Nevada Rail Corridor SEIS and the Rail Alignment EIS. For example:

- On March 23, 2005, DOE conducted an all-day project status meeting with the affected units of government, which includes Inyo, Churchill, Esmeralda, Nye, Mineral, White Pine, Lincoln, Clark, Lander, and Eureka Counties. Each county provided an oversight activity report.
- On May 24, 2005, DOE provided an annual program update to the Lander County Commissioners.
- On January 9, 2007, DOE met with Nye County to provide an update on the Nevada Rail Corridor SEIS and the Rail Alignment EIS.
- On January 12, 2007, DOE met with Mineral, Churchill, Esmeralda, and Nye Counties to discuss potential economic opportunities that would be associated with the Shared-Use Option.
- On February 2, 2007, DOE met with the Nye County Economic Development representatives to discuss the potential location of an industrial park the county is considering building near the Yucca Mountain Repository.
- On February 26, 2007, DOE met with Lincoln, Mineral, Nye, and Esmeralda Counties to discuss potential water appropriations applications that would be required to construct and operate the proposed railroad.

B.6 American Indian Tribes

In 1987, DOE initiated the Native American Interaction Program to solicit input from and interact with tribes and organizations on the characterization of the Yucca Mountain site and the possible construction and operation of a repository. These tribes and organizations - Southern Paiute; Western Shoshone; and Owens Valley Paiute and Shoshone people from Arizona, California, Nevada, and Utah - have cultural and historic ties to both the Yucca Mountain area and to the larger region that includes portions of the Caliente and Mina rail alignments.

The Native American Interaction Program concentrates on the protection of cultural resources at Yucca Mountain and contributes to a government-to-government relationship with the tribes and organizations. Its purpose is to help DOE comply with various federal laws and regulations, including the American Indian Religious Freedom Act (42 U.S.C. 1996); the Archaeological Resources Protection Act (16 U.S.C. 470aa *et seq.*); the National Historic Preservation Act (16 U.S.C. 470 *et seq.*); the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001); the American Indian and Alaska Native Tribal Government Policy; DOE Order 1230.2, *American Indian and Tribal Government Policy*; Executive Order 13007, *Indian Sacred Sites*; and Executive Order 13084, *Consultation and Coordination with Indian Tribal Governments*. These regulations and Executive Orders mandate the protection of archaeological sites and cultural items and require agencies to include American Indians and federally recognized tribes in discussions and interactions on major federal actions.

Initial ethnographic studies identified three tribal groups – the Southern Paiute, the Western Shoshone, and the Owens Valley Paiute and Shoshone – whose cultural heritage includes the Yucca Mountain region. Additional ethnographic efforts eventually led to the involvement of 17 tribes and organizations in the Yucca Mountain Project American Indian and cultural resource studies.

The 17 tribes and organizations have formed the Consolidated Group of Tribes and Organizations (an informal coalition), which consists of officially appointed tribal representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. A major priority of this group has been the protection of cultural resources and environmental restoration at Yucca Mountain. Members of the group have participated in many ethnographic interviews and have provided DOE valuable insights into American Indian cultural and religious values and beliefs. These interactions have produced several reports that record the regional history of American Indian people and the interpretation of American Indian cultural resources in the Yucca Mountain region.

On June 2, 2004, DOE met with the Consolidated Group of Tribes and Organizations to introduce the rail alignment project and learn of their concerns. In October 2004, a small group of designated tribal representatives participated in a field reconnaissance trip along the proposed rail alignment, followed by a meeting with the larger consolidated group in late November 2004.

Based on these efforts, these tribal representatives known as the American Indian Writers Subgroup, a subgroup of the Consolidated Group of Tribes and Organizations, prepared *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy Yucca Mountain Project* (DIRS 174205-Kane et al. 2005, all). This document provides insight into American Indian viewpoints and concerns regarding cultural resources along the Caliente rail alignment and long-term impacts of DOE selection of a rail system to transport spent nuclear fuel and high-level radioactive waste to a geologic repository at Yucca Mountain, Nevada. This document is a supplement to the American Indian Writers Subgroup document produced in 1998 titled *American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement* (DIRS 102043-AIWS 1998, all).

- In July 2005, DOE held a tribal update meeting with the Consolidated Group of Tribes and Organizations. The rail alignment project and the document prepared by the American Indian Writers Subgroup were topics of discussion.
- In September 2005, DOE held a special meeting with the Consolidated Group of Tribes and Organizations for discussions on the Environmental Assessment associated with the DOE request for a Public Land Order to prevent new mining claims along the Caliente rail corridor study area.
- In April 2006, DOE again met with the American Indian Writers Subgroup for continued discussions and updates on the Caliente rail alignment. After each meeting between DOE and the Consolidated Group of Tribes and Organizations or the designated American Indian Writers Subgroup, the tribal representatives prepared a series of recommendations for DOE consideration.
- On November 29, 2006, DOE met with the Consolidated Group of Tribes and Organization to discuss the inclusion of the Mina rail alignment for analysis in the Nevada Rail Corridor SEIS and the Rail Alignment EIS and to provide an update on analysis of the Caliente rail alignment.

DOE recognized that the Walker River Paiute Tribe, as a sovereign nation, would play a prominent role in the preparation and review of the Nevada Rail Corridor SEIS and the Rail Alignment EIS, because the Mina rail alignment would cross the Walker River Reservation through one of four alternative segments. Before withdrawing from the EIS process in April 2007, the Walker River Paiute Tribe served as a cooperating agency, and participated in several status meetings to discuss the Proposed Action and environmental analyses and document preparation.

B.7 Government Organization Having Oversight of DOE Activities Related to the Proposed Railroad, Nuclear Waste Technical Review Board

The Nuclear Waste Policy Amendments Act of 1987 (42 U.S.C. 10101 *et seq.*) created the 11-member Nuclear Waste Technical Review Board to evaluate DOE scientific and technical activities related to the management and disposal of the Nation's commercial spent nuclear fuel. The Technical Review Board's primary responsibility is to evaluate (1) the site characterization phase of the Yucca Mountain Project and the activities associated with determining whether the Yucca Mountain Site is suitable for further development as a geologic repository, and (2) the packaging and transportation of spent nuclear fuel and high-level radioactive waste.

The mandate of the Nuclear Waste Technical Review Board is to evaluate the scientific and technical work DOE is performing in its commercial nuclear waste disposal program. The Technical Review Board makes scientific and technical recommendations to DOE.

B.8 REFERENCES

102043	AIWS 1998	AIWS (American Indian Writers Subgroup) 1998. American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement. Las Vegas, Nevada: Consolidated Group of Tribes and Organizations. ACC: MOL.19980420.0041.
104558	DOE 1988	DOE (U.S. Department of Energy) 1988. Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation for the Nuclear Waste Deep Geologic Repository Program Yucca Mountain, Nevada. Washington, D.C.: U.S. Department of Energy. ACC: HQX.19890426.0057.
182923	DOE 2003	DOE 2003. Proposed New Cooperative Agreement Number DE-FC28-03RW12223 for Yucca Mountain Transportation Issues and Concerns Unique to the Destination County Memorandum w/enclosures ACC: MOL.20030922.0177.
174205	Kane et al. 2005	Kane, G.; Cornelius, B.; Charles, J.; Moose, G.; Frank-Churchill, M.; and Arnold, R. 2005. American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project. [Las Vegas, Nevada]: American Indian Writers Subgroup, Consolidated Group of Tribes and Organizations. ACC: ESU.20050707.0001.
174558	Sweeney 2004	Sweeney, R.L. 2004. Response to Bureau of Indian Affairs Letter dated June 18, 2004 Concerning Timbisha Shoshone Tribe and Rail Alignment, Environmental Impact Statement. Correspondence from R.L. Sweeney (DOE/ORD) to A.L. Dutschke (Bureau of Indian Affairs), September 20, 2004, 0921043296, MFR:OSPD:RLS-1755. ACC: MOL.20041129.0011.

176912	Wenker et al. 2006	Wenker, R.; Lanthum, J.G.; Baldrica, A.M.; and Rutson, V. 2006. Programmatic Agreement Among the U.S. Department of Interior Bureau of Land Management, Nevada (BLM); the U.S. Department of Energy (DOE); Surface Transportation Board (STB); and the Nevada State Historic Preservation Office (SHPO) Regarding the Nevada Rail Project (NRP). Agreement that Construction of the NRP Shall be Administered in Accordance with Stipulations in the Agreement to Ensure that Historic Properties Will be Treated to Avoid or Mitigate Effects to the Extent Practicable, Regardless of Surface Ownership, and to Satisfy DOE and BLM Section 106 Responsibilities for All Aspects of the Undertaking. ACC: MOL.20060531.0087.
174090	Wilbur Smith Associates 2005	Wilbur Smith Associates 2005. Final Report, Rail Transportation Economic Impact Evaluation & Planning. Nye County, Nevada: Nye County, Department of Natural Resources and Federal Facilities. TIC: 257526.
174439	Williams 2005	Williams, R.D. 2005. “Species List for U.S. Department of Energy Rail Line from near Caliente, Lincoln County, Nevada to Yucca Mountain, Nye County, Nevada.” Letter from R.D. Williams (Nevada Fish and Wildlife Service) to R. Sweeney (DOE), March 18, 2005, File No. 1-5-05-SP-439. ACC: MOL.20050714.0434.

APPENDIX C

EVOLUTION OF ALTERNATIVE SEGMENTS AND COMMON SEGMENTS

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APPENDIX C

EVOLUTION OF COMMON SEGMENTS AND ALTERNATIVE SEGMENTS

This appendix describes the process the DOE used to evaluate and determine the range of alternative segments considered in the Rail Alignment EIS and the results of that process.

Section C.7 defines terms shown in ***bold italics***.

Section C.1 of this appendix describes how the U.S. Department of Energy (DOE or the Department) developed the preliminary range of ***alternative segments***. Section C.2 describes the public scoping process and the comments DOE received and used as input to development of the sets of alternative segments and ***common segments*** analyzed in detail in the Rail Alignment EIS. Section C.3 describes the alignment identification and analysis process. Section C.4 describes alternative segments eliminated from detailed analysis. Section C.5 describes the process DOE used to refine the alternative segments.

C.1 Development of the Range of Alternative Segments

To develop the range of alternative segments for evaluation in the Rail Alignment EIS, DOE evaluated a suite of potential alternative segments for the Caliente Implementing Alternative and the Mina Implementing Alternative to determine whether they would be practical or feasible from a technical, environmental, and economic standpoint. To develop the range of alternative segments, DOE:

Alternative segments are portions of the rail alignments for which DOE is considering two or more routes for the rail line.

Common segments are portions of the rail alignments for which DOE has identified a single route for the rail line.

- Identified public comments related to alternative segments; considered comments that suggested specific alternative segments, and comments that could be construed as criteria to modify the preliminary alternative segments and common segments described in the Notices of Intent (69 *FR* 18565, April 18, 2004; and *FR* 60484, October 13, 2006, or as criteria to identify new alternative segments.
- Identified engineering factors relevant to the design and construction of a rail line; considered factors consistent with those of railroad-industry standards and practices.
- Identified environmental features to determine whether they would be directly affected by potential alternative segments and common segments; considered features such as springs, wetlands, and Wilderness Study Areas.
- Identified potential conflicts with land uses, including American Indian lands, private lands, and mineral resources.
- Evaluated then-currently available information, such as U.S. Geological Survey topographic maps and associated databases.

- Evaluated the suite of potential alternative segments to determine whether they could be constructed to satisfy the engineering factors and avoid environmental features.
- Estimated costs to construct each potential alternative segment.

The process involved a number of steps for each rail corridor, as depicted on Figure C-1. Sections C.2.1 through C.5 describe the evaluative process and results in more detail.

C.1.1 DEVELOPMENT OF THE RANGE OF ALTERNATIVE SEGMENTS WITHIN THE CALIENTE RAIL CORRIDOR

In the *Notice of Intent to Prepare an EIS for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (69 *Federal Register* [*FR*] 18565, April 8, 2004) (Notice of Intent), DOE identified preliminary alternative segments and common segments to be evaluated in the Rail Alignment EIS (Figure C-2).

The Department estimated that about 55 percent of the length of the Caliente rail corridor would not have alternative segments and these areas would be referred to as common segments. In the Notice of Intent, DOE indicated it would consider potential alternative segments outside the 0.4-kilometer (0.25-mile)-wide Caliente rail corridor that might minimize, avoid, or otherwise mitigate adverse environmental ***impacts***. More specifically, DOE invited comment on the following:

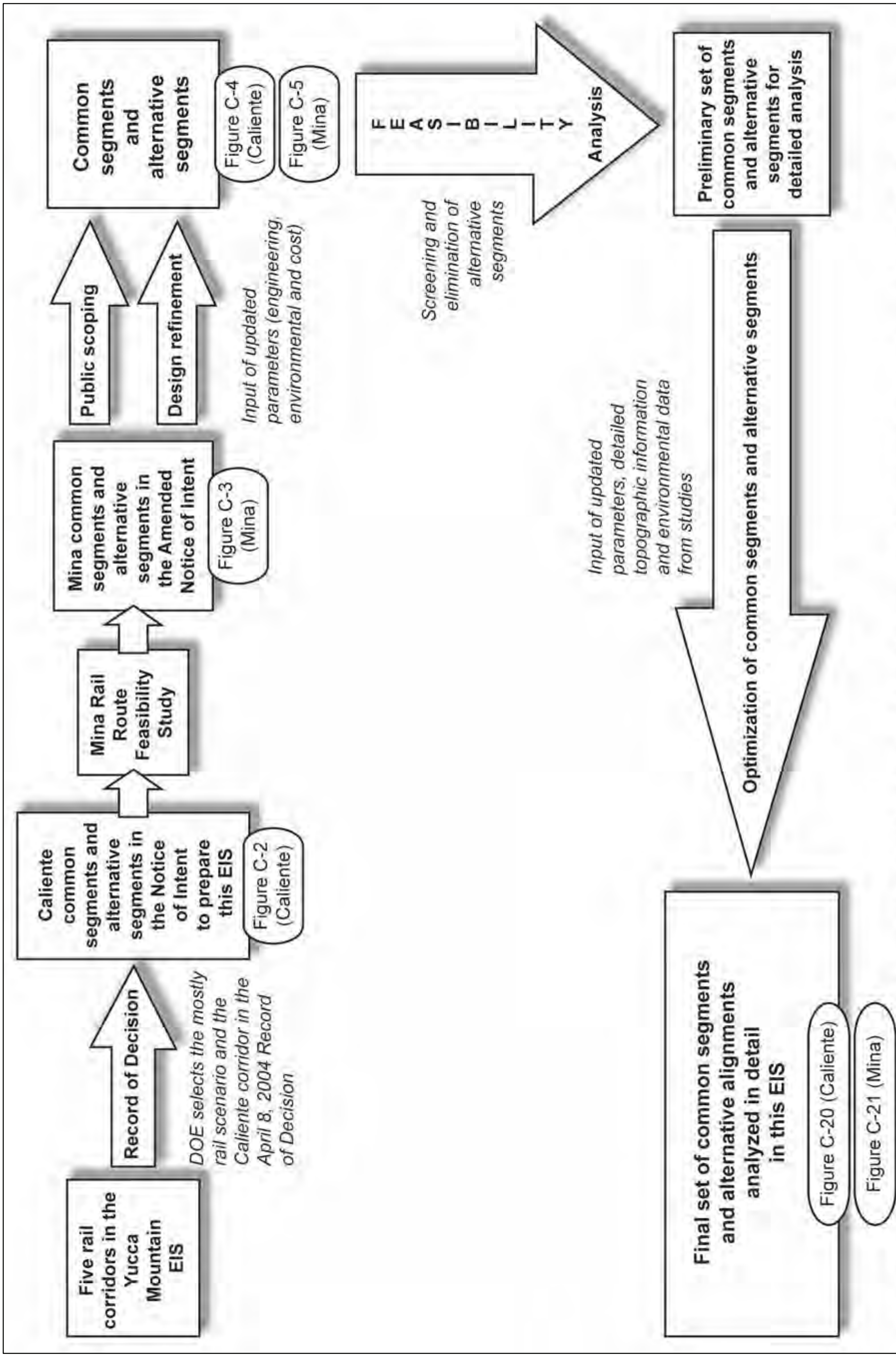
- Should additional alternative segments be considered that might minimize, avoid, or mitigate adverse environmental impacts, such as avoiding Wilderness Study Areas, American Indian Trust Lands, or encroachment on the Nevada Test and Training Range?
- Should any of the preliminary alternative segments be eliminated from detailed study?

C.1.2 DEVELOPMENT OF THE RANGE OF ALTERNATIVE SEGMENTS WITHIN THE MINA RAIL CORRIDOR

In the *Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV* (71 *FR* 60484, October 13, 2006) (Notice of Intent), DOE announced that it had identified preliminary alternative segments and common segments for the Mina rail corridor to be evaluated in the Rail Alignment EIS (Figure C-3). In response to communications with the Walker River Paiute Tribe, DOE initiated a study to determine the feasibility of a rail line in the Mina rail corridor and to identify preliminary alternative segments (DIRS 180222-BSC 2006, all).

Based on this preliminary feasibility study, and the resultant alternative segments and common segments, DOE determined that the Mina rail corridor did warrant further detailed study.

The resulting alternative segments and common segments were presented in the Amended Notice of Intent. Through the Notice, DOE solicited input from the public regarding either the elimination of alternative segments, or identification and evaluation of any additional alternative segments within the Caliente rail corridor or Mina rail corridor that would reduce or avoid potential adverse environmental impacts.



Note: Although the same process and series of steps applies to both the Mina and Caliente rail corridors, these processes and steps occurred during different time periods.

Figure C-1. Process used to evaluate the Caliente and Mina rail corridors.

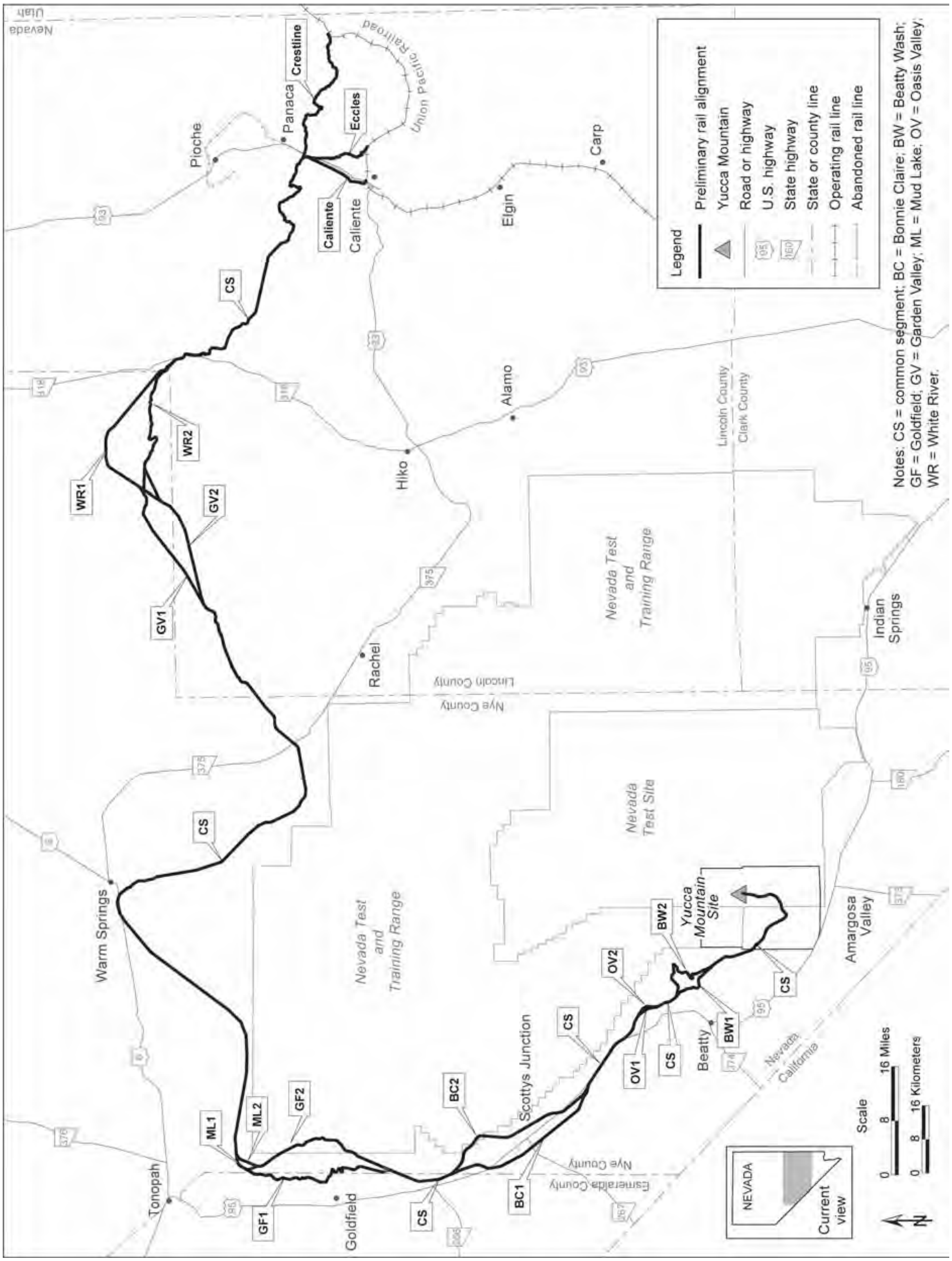


Figure C-2. Caliente rail corridor preliminary alternative segments and common segments as identified in the Notice of Intent.

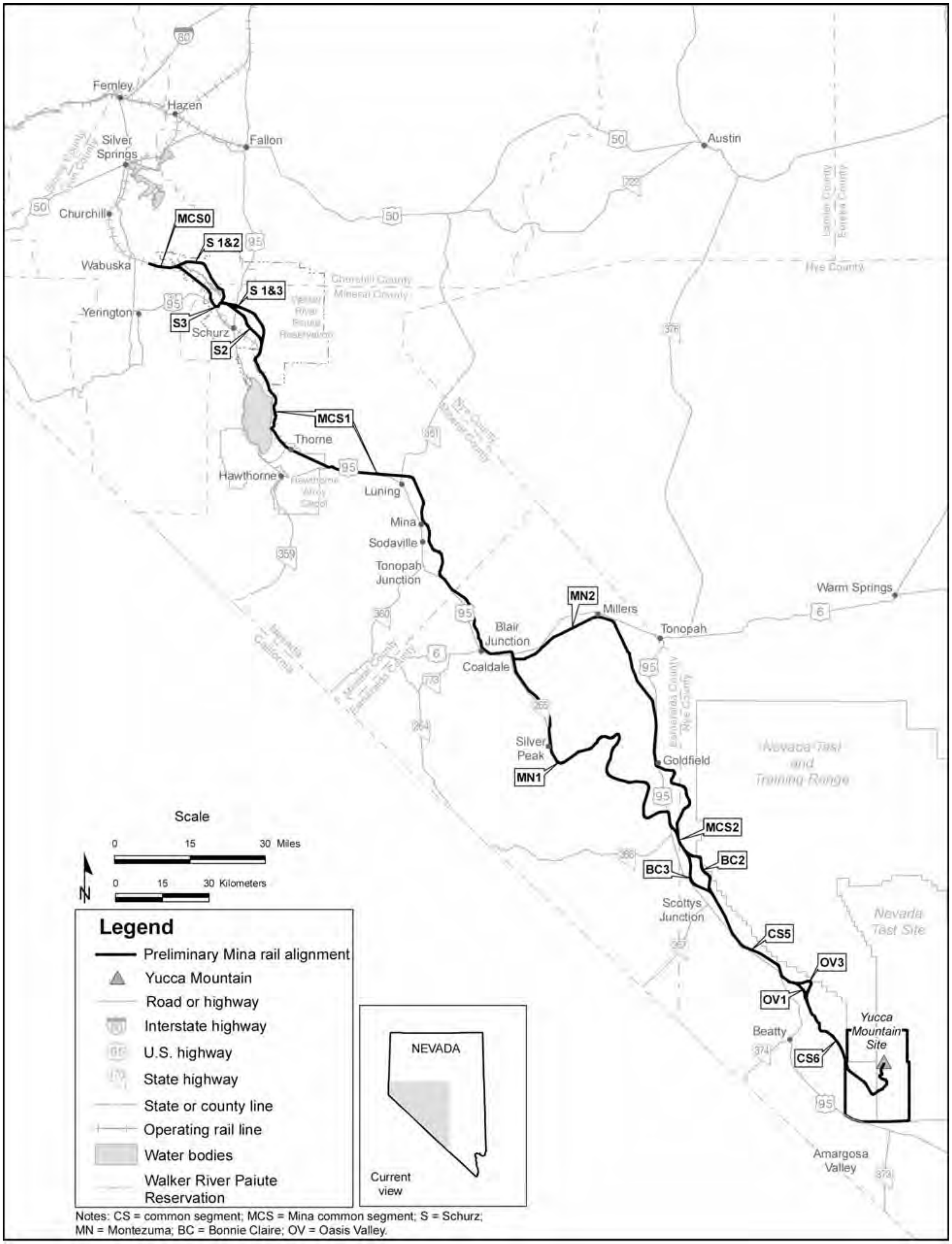


Figure C-3. Mina rail corridor preliminary alternative segments and common segments as identified in the Amended Notice of Intent.

C.2 Public Scoping

C.2.1 CALIENTE RAIL ALIGNMENT PUBLIC SCOPING

The Notice of Intent identified preliminary alternative segments to be evaluated in the Rail Alignment EIS. DOE evaluated all public comments received as a result of the public scoping process.

The Department considered comments the Bureau of Land Management (BLM) received during its public meetings on the DOE proposed land ***withdrawal*** from surface and mining entry for the Caliente rail corridor (see Chapter 1 of the Rail Alignment EIS) and information from interviews conducted by Lincoln and Nye Counties.

From these sources, DOE identified and evaluated all comments that could affect the preliminary alternative segments identified in the Notice of Intent and common segments. Some commenters offered specific recommendations or alternative segments, such as:

- Establish the interface with the Union Pacific Railroad near Elgin, Nevada.
- Start in Caliente, Nevada, and follow U.S. Highway 93 and State Route 375 to avoid Garden Valley.
- Cross south of the Weepah Springs Wilderness and pass through Seaman Narrows to Murphy Gap and then north to avoid Garden Valley.
- Bypass Goldfield to the west to avoid the town and its historic mining district.

Commenters also suggested that DOE use various criteria to modify the preliminary alternative segments and to identify new alternative segments. For example, commenters suggested that DOE avoid conflicts with, or impacts to, sensitive biological and cultural resources, mineral resources, mining operations, American Indian Trust Lands, the Nevada Test and Training Range, ranching and grazing land uses, and private lands.

C.2.2 MINA RAIL ALIGNMENT PUBLIC SCOPING

In the Amended Notice of Intent, DOE invited public comments concerning the evaluation of the Mina rail alignment in the Rail Alignment EIS. DOE developed a range of alternative segments for the Mina rail corridor to be evaluated in the EIS. The initial alternative segments and common segments were documented in the *Mina Rail Route Feasibility Study* (DIRS 180222-BSC 2006, all). DOE presented the preliminary alternative segments at public scoping meetings and through information provided at reading rooms in various towns in the general vicinity of the Mina rail corridor (see Chapter 1 of the Rail Alignment EIS).

DOE considered comments that suggested specific alternative segments and comments that could be construed as criteria to modify the preliminary alternative segments and common segments described in the Amended Notice of Intent, or as criteria to identify new alternative segments. Some commenters offered specific recommendations or alternative segments, for example:

- Follow the existing (unused) rail roadbed through Tonopah to minimize impacts.
- Follow the existing rail roadbed where feasible.
- Move Mina rail alignment Montezuma alternative segment 2/Caliente rail alignment Goldfield alternative segment 4 as far west as possible to avoid mining claims in the area.
- Avoid all communities.

DOE considered all comments and in some cases identified alternative segments that warranted further investigation. Commenters also suggested that DOE use various criteria to modify the preliminary alternative segments and to identify new alternative segments.

C.3 Alignment Identification and Analysis

C.3.1 CALIENTE RAIL CORRIDOR ALIGNMENT IDENTIFICATION AND ANALYSIS

Following the public scoping process, DOE identified additional alternative segments for the Caliente rail alignment, and modified the preliminary alternative segments and common segments identified in the Notice of Intent. To do so, DOE used a computer-based modeling system that allowed the Department to consider multiple alternative segments within the geographic area of the Caliente rail corridor.

First, DOE used the computer modeling system to evaluate topographic data to determine whether common segments and alternative segments would be relatively linear, or whether they would need to curve to avoid or reduce conflicts with areas having greater topographic relief, such as mountain ranges or associated foothills. Topographic data were based on U.S. Geological Survey maps compiled from two sets of information: (1) year 2003 roads, streams, and other landmarks and (2) year 2000 (or more recent) contour data. The system integrated topographic data with engineering factors, specifically the project-specific design elements and the associated standard. Table C-1 lists the primary engineering factors and standards DOE considered.

Table C-1. Primary engineering factors considered in the identification and analysis of Caliente and Mina alternative segments and common segments[a] (page 1 of 2).

Design element	Standard	Refinement software input
Civil works design speed	60 miles per hour[b]	Included in curvature and grade specifications
Operating train speed	Maximum 50 miles per hour	Included in curvature and grade specifications
Construction right-of-way width	1,000 feet[c] (nominal)	Defined 1,000-foot-wide right-of-way
Operations right-of-way width (minimum)	200 feet (nominal); expected to be narrower than the construction right-of-way in most cases. In some areas it could be the same width as the construction right-of-way. Actual operations right-of-way would be defined during final design.	Addressed by setting cut bench width
Vertical curves: rate of change between track gradients	Comply with American Railway Engineering and Maintenance-of-Way Association speed-based criteria	Defined in network data settings
Rail roadbed section		
Roadbed width (fill)	15 feet 6 inches[d] from centerline, 31 feet total	Generalized cross sections addressed through settings of cut bench width and geotypes
Roadbed width (cut)	62 feet total	
Subballast depth	Minimum 6 inches	

Table C-1. Primary engineering factors considered in the identification and analysis of Caliente and Mina alternative segments and common segments[a] (page 2 of 2).

Design element	Standard	Refinement software input
Vertical grades		
Maximum (allowable)	2 percent (curve-compensated)	Network data set so that grades on curves had to be compensated at 0.04 percent per degree of curve
Horizontal curve	6°–00" (mainline); radius = 955 feet	Defined in network data settings
Maximum degree of curve for yards and sidings	10°–00"; radius = 574 feet	
Minimum length of spiral per 0.5 inch of superelevation	30 feet	
Tangent lengths (between horizontal reverse curves)	300 feet 150 feet (yards, sidings, and back tracks)	Approximated with stiffness parameter in network data settings
Clearances for highway overpass		
Vertical	24 feet minimum	Vertical clearances requirements set as linear feature crossing rule

a. Source: DIRS 176584-Nevada Rail Partners 2006, all.
b. To convert miles per hour to kilometers per hour, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert inches to centimeters, multiply by 2.54.

DOE considered the following environmental and land-use features:

- Springs
- Wilderness Areas, Wilderness Study Areas, and wildlife preserves
- Locations of sensitive biological species
- Cultural resources
- Private lands, including patented mining claims
- Native American Trust Lands
- Federally managed lands, including the Nevada Test and Training Range, U.S. Forest Service lands, and National Parks

With this integrated information, the computer modeling system identified and evaluated several million routes within the geographic limits defined by the input of start and stop points. The system, however, identified the 20 to 50 potential routes (for each start/stop point set) that came closest to, or most satisfied, engineering factors, and minimized or avoided conflicts with environmental and land-use features at the lowest cost to construct. Based on this information, DOE selected one route, known as the Caliente rail alignment, for further evaluation (DIRS 176584-Nevada Rail Partners 2006, all). This rail alignment consists of alternative segments and common segments.

For each alternative segment and common segment, the computer modeling system provided information and data in a number of ways, including plan and profile, horizontal and vertical curvatures, and grade profiles. DOE used this information and data to estimate construction-related items such as earthworks (***cuts***, ***fills***, and haulage) and rail roadbeds (***subballast***, ***ballast***, track, and ties), and to identify design features such as bridges, overpasses, and underpasses. DOE also used the computer modeling system to develop preliminary construction-cost estimates by considering cost factors for construction-related items and design features. In general, the avoidance of environmental and land-use features typically resulted in alternative segments and common that were longer, which tended to increase earthworks, length of rail roadbeds, the number of structures, and, thus, construction costs (DIRS 176584-Nevada Rail Partners 2006, all).

Figure C-4 shows the full suite of common segments and potential alternative segments DOE produced for the Caliente rail corridor as a result of its analyses and public scoping comments.

C.3.2 MINA RAIL CORRIDOR ALIGNMENT IDENTIFICATION AND ANALYSIS

DOE developed the *Mina Rail Route Feasibility Study* (DIRS 180222-BSC 2006, all) to determine the feasibility of identifying a 0.4-kilometer (0.25-mile)-wide corridor in which to engineer a rail alignment that meets specific engineering criteria. As with the Caliente rail alignment, DOE employed software (using data from the feasibility study) to determine the feasibility of new alternative segments and common segments and realign existing alternative segments and common segments based on comments received during the scoping period. The software computes each segment's horizontal and vertical geometry and the cut and fill (earthwork) needed to construct each. The software then computes the segment geometries, incorporating topographic information, location-specific information, cross-section templates, and engineering criteria (as listed in Table C-1). Also addressed within the system were environmental and land-use features to be considered including:

- Springs
- Wilderness Areas, Wilderness Study Areas and wildlife preserves
- Locations of sensitive biological species
- Cultural resources
- Private lands, including patented mining claims
- American Indian Trust Lands
- Federally managed lands, including the Hawthorne Army Depot, U.S. Forest Service Lands, and national parks

The modeling software derived alternative segments and common segments that met the applicable design criteria while addressing the need to minimize or avoid potentially adverse environmental impacts.

For each alternative segment and common segment, the software provided information and data in a number of ways, including plan and profile, horizontal and vertical curvatures, and grade profiles. DOE used this information and data for each alternative segment and common segment to estimate construction-related items such as earthworks (cuts, fills, and haulage) and rail roadbeds (subballast, ballast, track, and ties), and to identify design features such as bridges, overpasses, and underpasses.

DOE also used the software to develop preliminary construction cost estimates by considering cost factors for construction-related items and design features. In general, the avoidance of environmental features typically resulted in longer common segments and alternative segments, which tended to increase earthworks, length of rail roadbeds, and the number of structures, and thus construction costs (DIRS 176584-Nevada Rail Partners 2006, all).

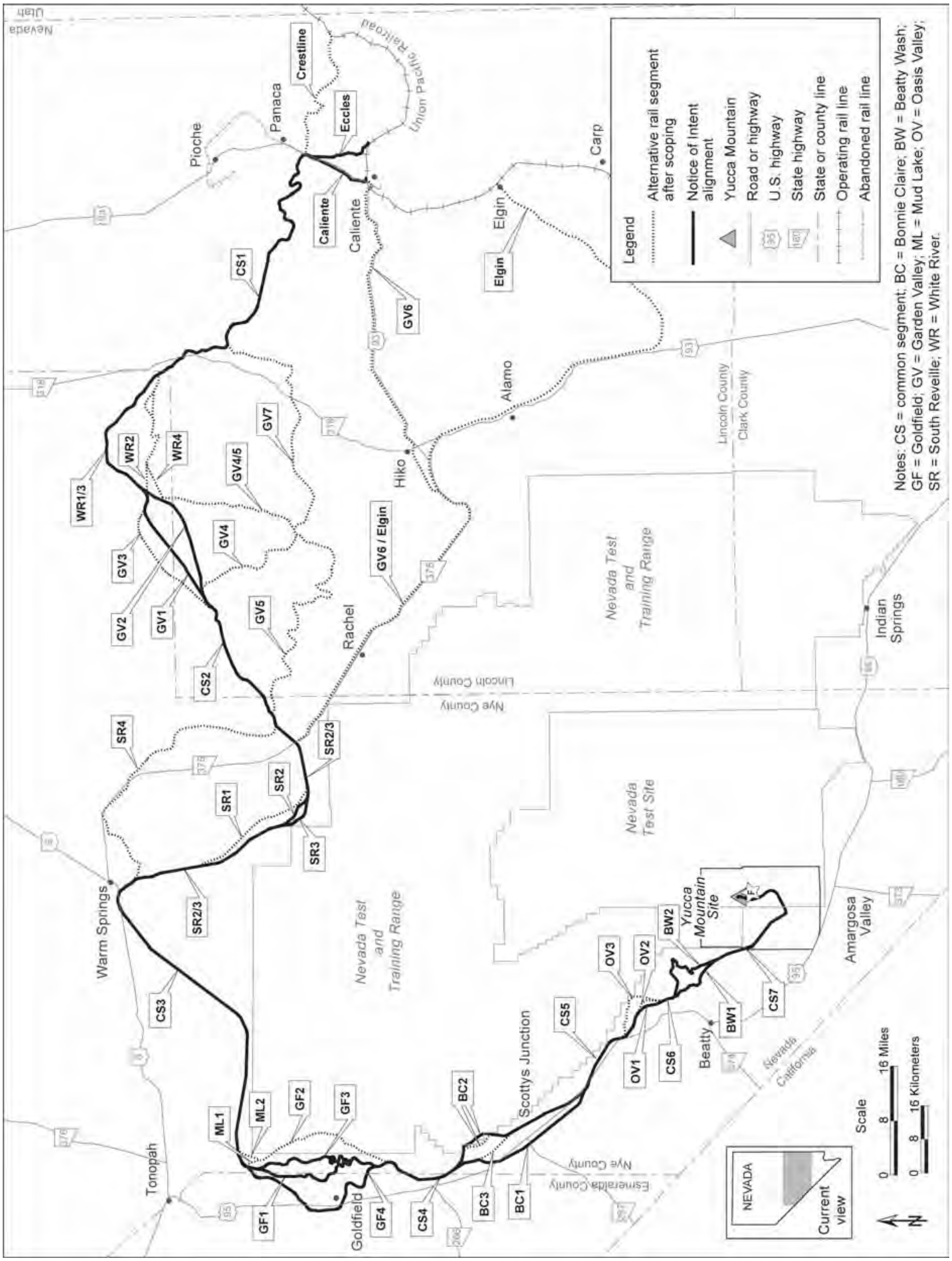


Figure C-4. Suite of potential alternative segments for the Caliente rail corridor.

As a result of the scoping process and subsequent analyses, DOE made several changes to the Mina rail alignment, as follows:

- At the request of the Walker River Paiute Tribe, eliminated two of the initial Schurz alternative segments and added three others.
- Made a slight modification to Mina common segment 1 in the Redlich area.
- Added a new alternative segment called Montezuma 3, which combined the northern section of Montezuma 2 and the southern section of Montezuma 1 with a crossover along the alluvial fans north of the Montezuma Range. The result was a new alignment that would avoid the communities of Goldfield and Silver Peak.

Figure C-5 shows the full suite of alternative segments and common segments DOE produced for the Mina rail corridor as a result of its analyses and public scoping comments.

C.4 Alternative Segments Eliminated from Detailed Analysis

Council on Environmental Quality regulations that implement the procedural requirements of NEPA (40 CFR 1502.14) and DOE regulations (10 CFR Part 1021) require the identification and evaluation of a range of alternatives that might accomplish the objectives of the Proposed Action. In accordance with these regulations, this section briefly describes the alternative segments DOE eliminated from detailed study and the reasons for their elimination. Alternative segments and common segments DOE did not eliminate are those that are practical or feasible from a technical, environmental, and economic standpoint.

DOE adjusted alternative segments and common segments described in Section 2.2 of the Rail Alignment EIS from those identified in the Notice of Intent and the Amended Notice of Intent. In some cases, the lengths of the common segments have changed as alternative segments have been eliminated. The primary reasons for eliminating or adjusting an alternative segment include:

- Environmental constraints, such as impacts to Wilderness Areas or wildlife preserves
- Avoidance of private lands, mineral resources, or oil resources
- Engineering considerations, such as steep, heavy grades; tight curvature; tunneling; or excessive excavation or placement of fill materials
- Public safety and national security issues associated with the Nevada Test and Training Range

C.4.1 CALIENTE RAIL ALIGNMENT ALTERNATIVE SEGMENTS ELIMINATED FROM DETAILED ANALYSIS

Figure C-6 shows the Caliente rail alignment alternative segments DOE eliminated from detailed analysis. Table C-2 lists the alternative segments DOE identified in its Notice of Intent (69 *FR* 18565, April 8, 2004) and added for consideration based on public comments received during the EIS scoping process. The table also summarizes the reasons DOE eliminated certain of these alternative segments from detailed analysis in the Rail Alignment EIS.

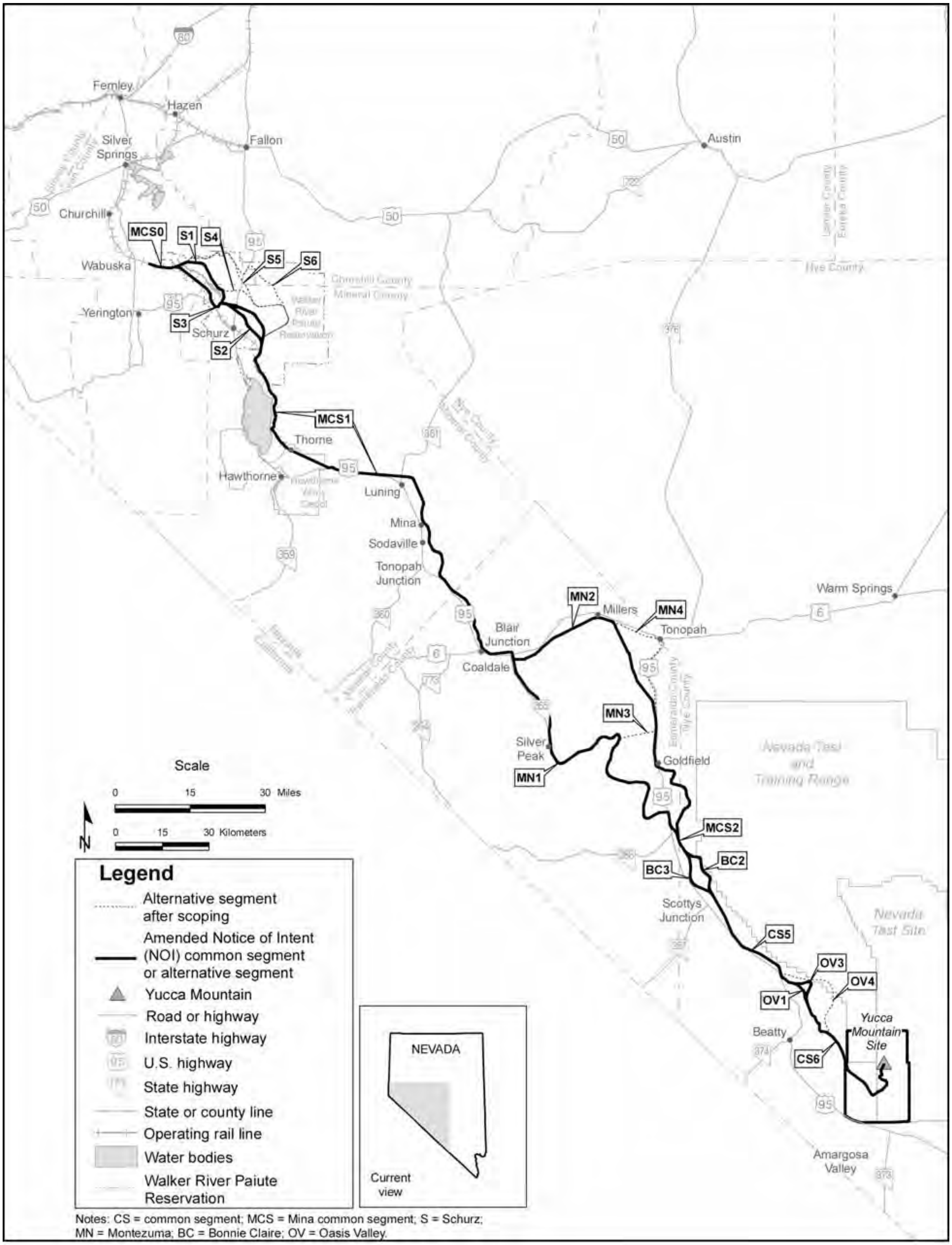


Figure C-5. Suite of potential alternative segments for the Mina rail corridor.

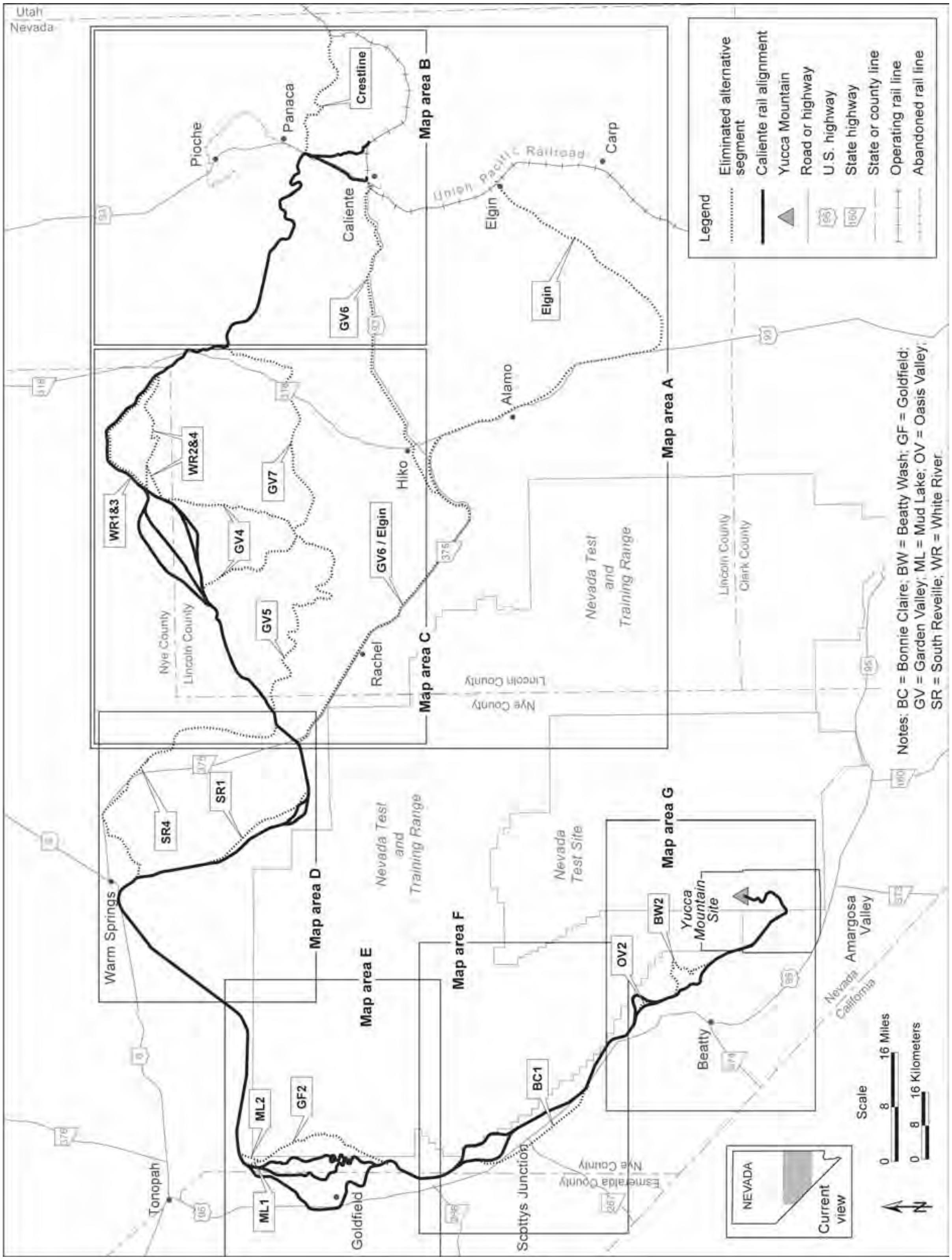


Figure C-6. Caliente rail alignment alternative segments DOE eliminated from detailed analysis.

Table C-2. Caliente rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 1 of 3).

Map area	Alternative segment	Notice of Intent	Scoping	Analyzed in detail or eliminated
Interface with the Union Pacific Railroad Mainline	Caliente	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Eccles	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Crestline	Alternative segment identified		Eliminated because engineering criteria not met.
	Elgin		Alternative segment identified	Eliminated because it would exceed maximum allowable grade.
White River Valley Area	White River 1	Alternative segment identified		With the elimination of White River 2 and 3, White River 1 became part of common segment 1.
	White River 2	Alternative segment identified		Eliminated because engineering criteria not met and possible requirement for tunnel through Timber Mountains.
	White River 3		Alternative segment identified	When White River 2 and 3 were eliminated, White River 3 became part of common segment 1.
	White River 4		Alternative segment identified	Eliminated because engineering criteria not met and possible requirement for tunnel through Timber Mountains.
Garden Valley Area	Garden Valley 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Garden Valley 2	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Garden Valley 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Garden Valley 4		Alternative segment identified	Eliminated because of operational issues.
	Garden Valley 5		Alternative segment identified	Eliminated because engineering criteria not met.
	Garden Valley 6		Alternative segment identified	Eliminated because engineering criteria not met.
	Garden Valley 7		Alternative segment identified	Eliminated because engineering criteria not met.
	Garden Valley 8		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.

Table C-2. Caliente rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 2 of 3).

Map area	Alternative segment	Notice of Intent	Scoping	Analyzed in detail or eliminated
South Reveille Area	South Reveille 1	Alternative segment identified		Eliminated because it would cross into the South Reveille Wilderness Study Area.
	South Reveille 2		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	South Reveille 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	South Reveille 4		Alternative segment identified	Eliminated because engineering criteria not met.
Mud Lake Area	Mud Lake 1	Alternative segment identified		Eliminated because it links to Goldfield 2, which was also eliminated.
	Mud Lake 2	Alternative segment identified		Eliminated because it links to Goldfield 2, which was also eliminated.
Goldfield Area	Goldfield 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Goldfield 2	Alternative segment identified		Eliminated because it would enter the Nevada Test and Training Range.
	Goldfield 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Goldfield 4		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
Bonnie Claire Area	Bonnie Claire 1	Alternative segment identified		Eliminated because it would enter Timbisha Shoshone Trust Lands.
	Bonnie Claire 2	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Bonnie Claire 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
Oasis Valley Area	Oasis Valley 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Oasis Valley 2	Alternative segment identified		Eliminated during the public scoping process because engineering factors and land use features are similar to Oasis Valley 1.
	Oasis Valley 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.

Table C-2. Caliente rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 3 of 3).

Map area	Alternative segment	Notice of Intent	Scoping	Analyzed in detail or eliminated
Beatty Wash Area	Beatty Wash 1	Alternative segment identified		When Beatty Wash 2 was eliminated, Beatty Wash 1 became part of common segment 6.
	Beatty Wash 2	Alternative segment identified		Eliminated because engineering criteria not met.

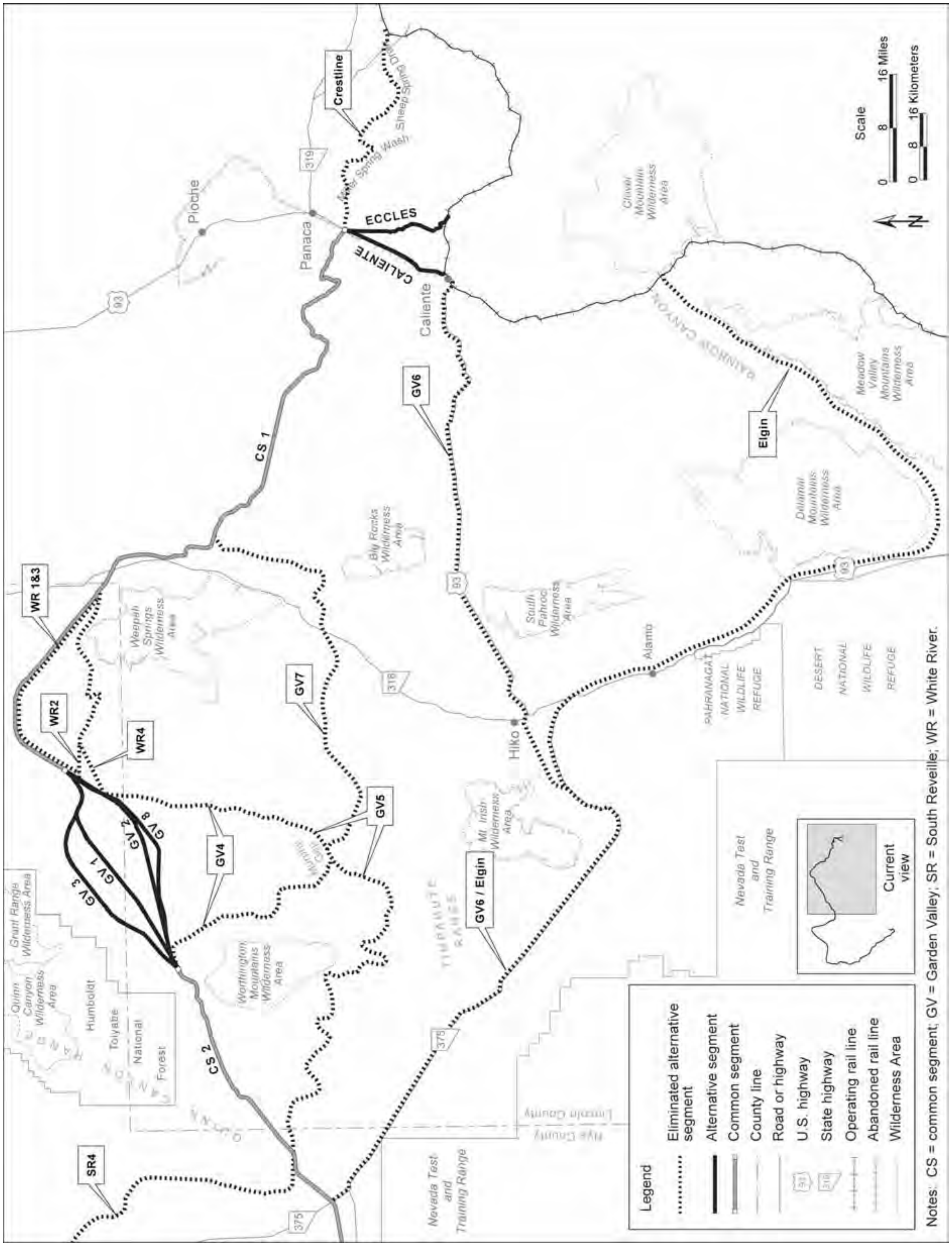
C.4.1.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline

DOE identified four alternative segments to connect the rail line to the existing mainline railroad in eastern Nevada (Figures C-7 and C-8). The Notice of Intent identified Caliente, Eccles, and Crestline as possible interface locations near Caliente, Nevada. In response to public scoping comments suggesting an interface location near the town of Elgin, Nevada, DOE identified Elgin as a fourth alternative segment. The Department then evaluated whether these four alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. The terrain around Crestline rendered it technically infeasible and Elgin would exceed the maximum allowable grade. Based on this analysis, DOE eliminated Crestline and Elgin from detailed analysis in the Rail Alignment EIS. The Department found the Caliente and Eccles alternative segments to be feasible from a technical and economic standpoint. Table C-3 provides a comparison of the key factors the Department used in this determination.

Table C-3. Comparison of possible alternative segments for the Interface with the Union Pacific Railroad Mainline.[a]

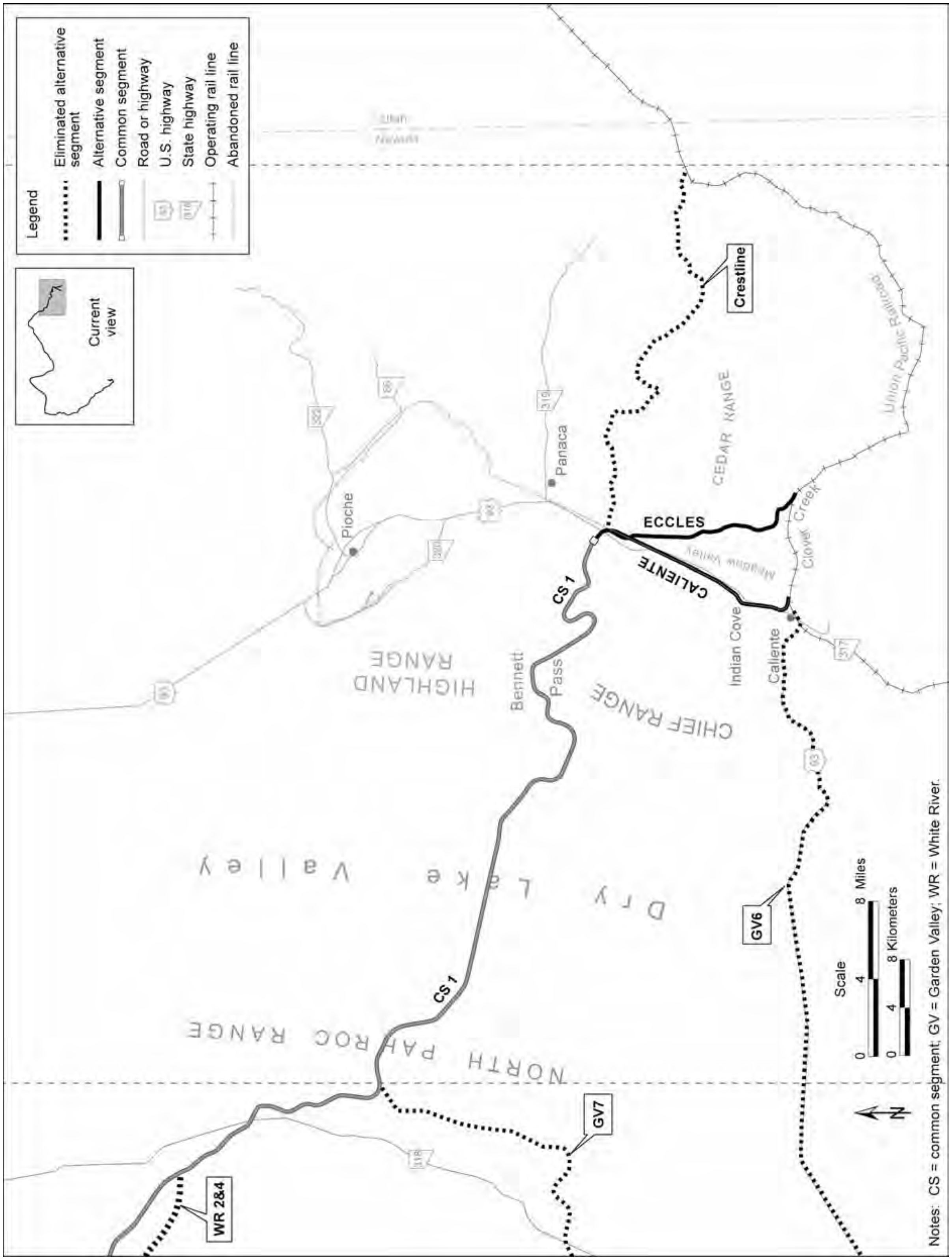
Attribute	**Crestline**	Eccles	Caliente	**Elgin**
Length (kilometers)[b]	39	18	18	225[c]
Construction cost ($ millions)	140	148	71.6	1,500[c]
Engineering factors	Rugged terrain and insufficient flat land to accommodate rail yard and associated facilities at the interchange with the Union Pacific Railroad mainline	Meets engineering design criteria	Meets engineering design criteria	Would exceed maximum allowable grade
Key environmental and land-use features	No notable environmental or land-use constraints	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	No notable environmental or land-use constraints

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.
c. Elgin interface does not share a common end point with the other interface alternative segments.



Notes: CS = common segment; GV = Garden Valley; SR = South Reveille; WR = White River.

Figure C-7. Eliminated segments within Caliente map area A.



Notes: CS = common segment; GV = Garden Valley; WR = White River.

Figure C-8. Eliminated segments within Caliente map area B.

C.4.1.2 White River Valley Alternative Segments

DOE identified four possible alternative segments in the White River Valley area (Figures C-7 and C-9). The Notice of Intent identified White River 1 and White River 2. Later, DOE identified alternative segments White River 3 and White River 4 to avoid the Weepah Springs Wilderness. The Department then evaluated whether these four alternative segments would be technically feasible according to the engineering design criteria, estimated the cost to construct each alternative segment, and considered the environmental and land-use features associated with each. White River 2 and White River 4 would have required long stretches at the maximum allowable grade, might have required a tunnel through the Timber Mountains, and would be three times as costly as White River 1 and White River 3. Based on this analysis, DOE eliminated White River 2 and White River 4 from detailed analysis in the Rail Alignment EIS. DOE found White River 1 and 3 to be feasible from a technical and economic standpoint. Table C-4 provides a comparison of the key factors used in this determination.

Because DOE eliminated White River 2 and White River 4 from consideration, it was no longer necessary to maintain a distinction between White River 1 and White River 3. Although White River 3 was slightly longer than White River 1, elimination of White River 2 and White River 4 allowed DOE to establish a common end for White River 1 and White River 3, and then made the two alternative segments part of Caliente common segment 1.

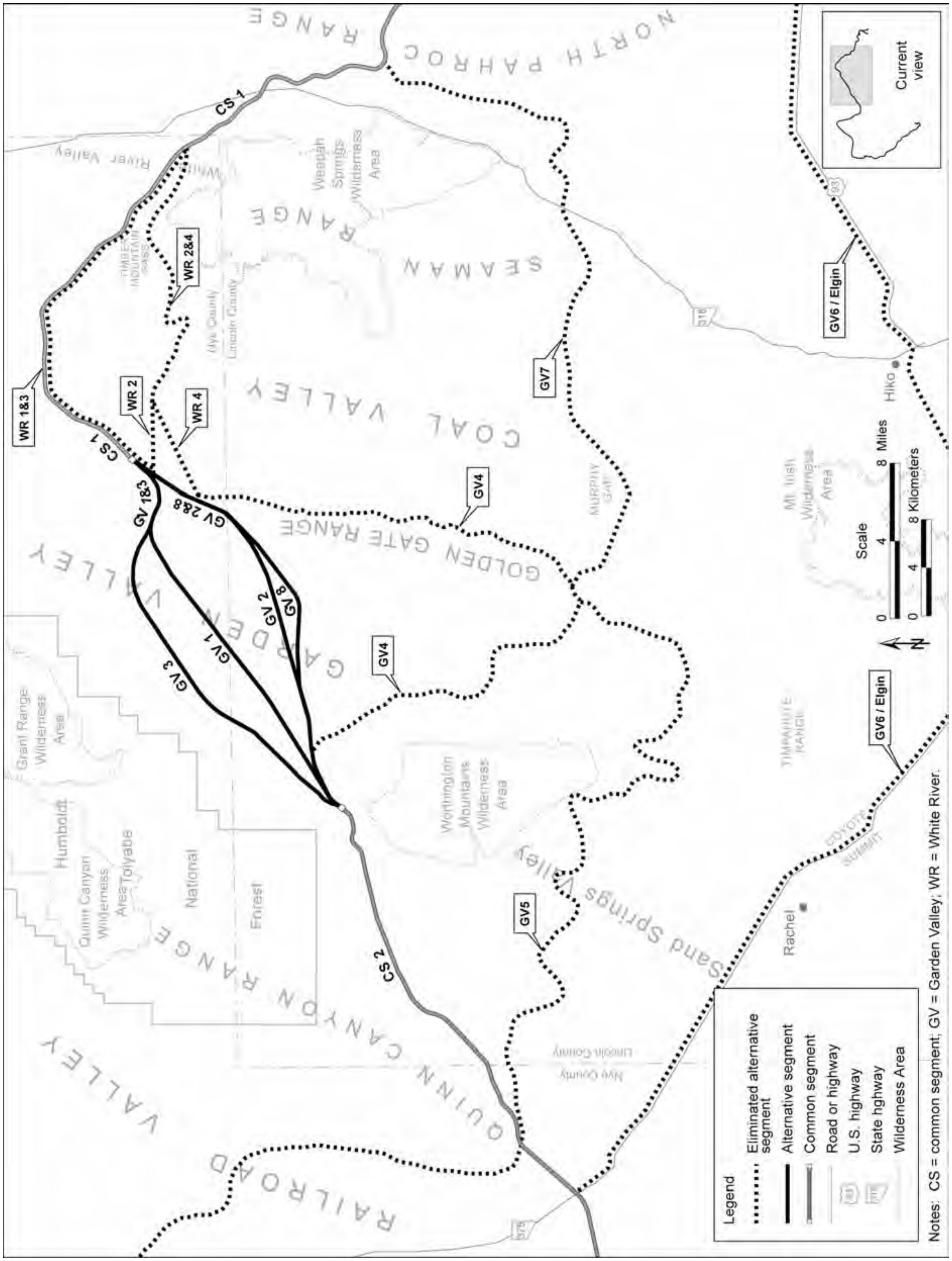
Table C-4. Comparison of possible alternative segments in the White River Valley area.[a]

Attribute	White River 1	**White River 2**	White River 3	**White River 4**
Length (kilometers)[b]	47	42	48	42
Construction cost ($ millions)	46	160	46	140
Engineering factors	Would include a short stretch at maximum allowable grade	Would require long stretches at maximum allowable grade and/or a potential tunnel through the Timber Mountains	Would include a short stretch at maximum allowable grade	Would require long stretches at maximum allowable grade and/or a potential tunnel through the Timber Mountains
Key environmental and land-use features	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints

a. Eliminated alternative segments are shown in bold.
b. To convert kilometers to miles, multiply by 0.62137.

C.4.1.3 Garden Valley Alternative Segments

DOE identified eight alternative segments in the Garden Valley area (Figures C-7 and C-9). The Notice of Intent identified Garden Valley 1 and Garden Valley 2. In response to public scoping comments regarding Garden Valley and perceived noise and visual impacts to an earthworks sculpture, *City*, DOE identified six additional alternative segments in the area (Garden Valley 3 through Garden Valley 8). The Department then evaluated whether the eight alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. Garden Valley 4, 5, 6, and 7 would either exceed maximum allowable grade or require significant earthwork or construction of tunnels. Also, these alternative segments would have been longer than other available alternative segments in Garden Valley. For these reasons, construction costs for Garden Valley 4, 5, 6, and 7 would have been significantly greater than for any of the other Garden Valley alternative segments. Therefore, DOE eliminated Garden Valley 4, 5, 6, and 7 from detailed analysis in the Rail Alignment EIS. Garden Valley 1, 2, 3, and 8 would be feasible from a technical, environmental, land-use, and economic standpoint. Table C-5 provides a comparison of the key factors DOE used in this determination.



Notes: CS = common segment; GV = Garden Valley; WR = White River.

Figure C-9. Eliminated segments within Caliente map area C.

Table C-5. Comparison of possible alternative segments in Garden Valley.[a]

Attribute	Garden Valley 1	Garden Valley 2	Garden Valley 3	**Garden Valley 4**	**Garden Valley 5**	**Garden Valley 6**	**Garden Valley 7**	Garden Valley 8
Length (kilometers)[b]	35	36	38	68[c]	100[c]	160[c]	100[c]	37
Construction cost ($ millions)	126	120	109	170	160[d]	1,600[d]	380[d]	154
Engineering factors	Meets engineering design criteria	Meets engineering design criteria	Meets engineering design criteria	Would require more than 10 miles of continuous maximum allowable grade through Murphy Gap	Would exceed maximum allowable grade and there would be more than 10 miles of continuous maximum grade	Would require extensive tunneling to exit Caliente and then through each of the three passes to the west	Would require more than 10 miles of continuous maximum allowable grade through Murphy Gap	Meets engineering design criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.
c. Garden Valley 4, 5, 6, and 7 do not share common starting and ending points with the other Garden Valley alternative segments.
d. Cost is approximate because the computer-based modeling system could not identify a feasible alignment for which construction costs could be estimated.

C.4.1.4 South Reveille Alternative Segments

DOE identified four alternative segments in the South Reveille area, South Reveille 1 through South Reveille 4 (Figure C-10). South Reveille 1 was originally considered a common segment in the Notice of Intent, but became an alternative segment with the addition of South Reveille 2, South Reveille 3, and South Reveille 4. DOE developed these alternative segments in response to public scoping comments to avoid the South Reveille Wilderness Study Area, which the original common segment (South Reveille 1) would intersect. The Department then evaluated whether these four alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the potential environmental and land-use features associated with each. DOE concluded that South Reveille 1 would be incompatible with the current uses of the South Reveille Wilderness Study Area, and that South Reveille 4 would exceed the maximum allowable grade. Based on this analysis, the Department eliminated South Reveille 1 and South Reveille 4 from detailed analysis in the Rail Alignment EIS. Though there could be impacts to cultural resources along South Reveille 2 and land-uses along South Reveille 2 and 3 might be affected in the absence of mitigation, these constraints did not warrant elimination of South Reveille 2 and South Reveille 3. The DOE analysis found that South Reveille alternative segments 1 and 3 appear to be feasible from a technical and economic standpoint. Table C-6 provides a comparison of the key factors DOE used in this determination.

Table C-6. Comparison of possible alternative segments in Reveille Valley.[a]

Attribute	**South Reveille 1**	South Reveille 2	South Reveille 3	**South Reveille 4**
Length (kilometers)[b]	Alternative segment not evaluated because it would cross into the South Reveille Wilderness Study Area	19	20	84
Construction cost ($ millions)		82.6	80.3	126
Engineering factors		Meets engineering design criteria	Meets engineering design criteria	Would exceed maximum allowable grade
Key environmental and land-use features		Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

C.4.1.5 Mud Lake Alternative Segments

The Notice of Intent identified two alternative segments in the Mud Lake area, Mud Lake 1 and Mud Lake 2 (Figure C-11). Mud Lake alternative segments 1 and 2 would begin near the northwest corner of the Nevada Test and Training Range. Mud Lake 1 would pass about 2 kilometers (1 mile) northwest of Mud Lake, avoiding its western shore, and would extend south to connect with Goldfield alternative segment 2. Mud Lake 2 would depart Caliente common segment 3 and run farther to the east before connecting with Goldfield alternative segment 2. Due to this arrangement, both Mud Lake alternative segments were dependent on Goldfield 2 as a viable alternative segment. Therefore, when DOE eliminated Goldfield 2 from further analysis, as described below, both Mud Lake 1 and Mud Lake 2 were also eliminated.

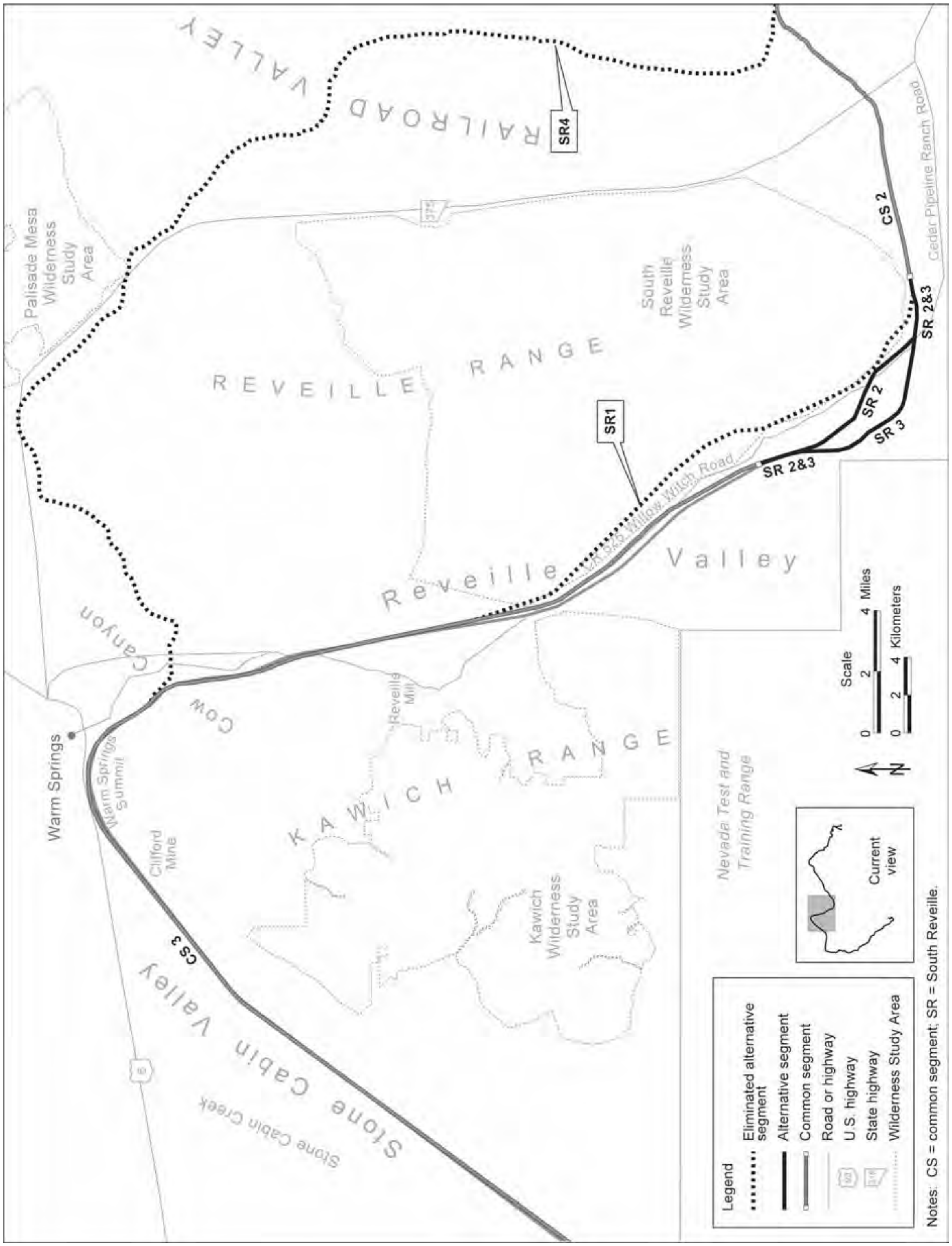


Figure C-10. Eliminated segments within Caliente map area D.

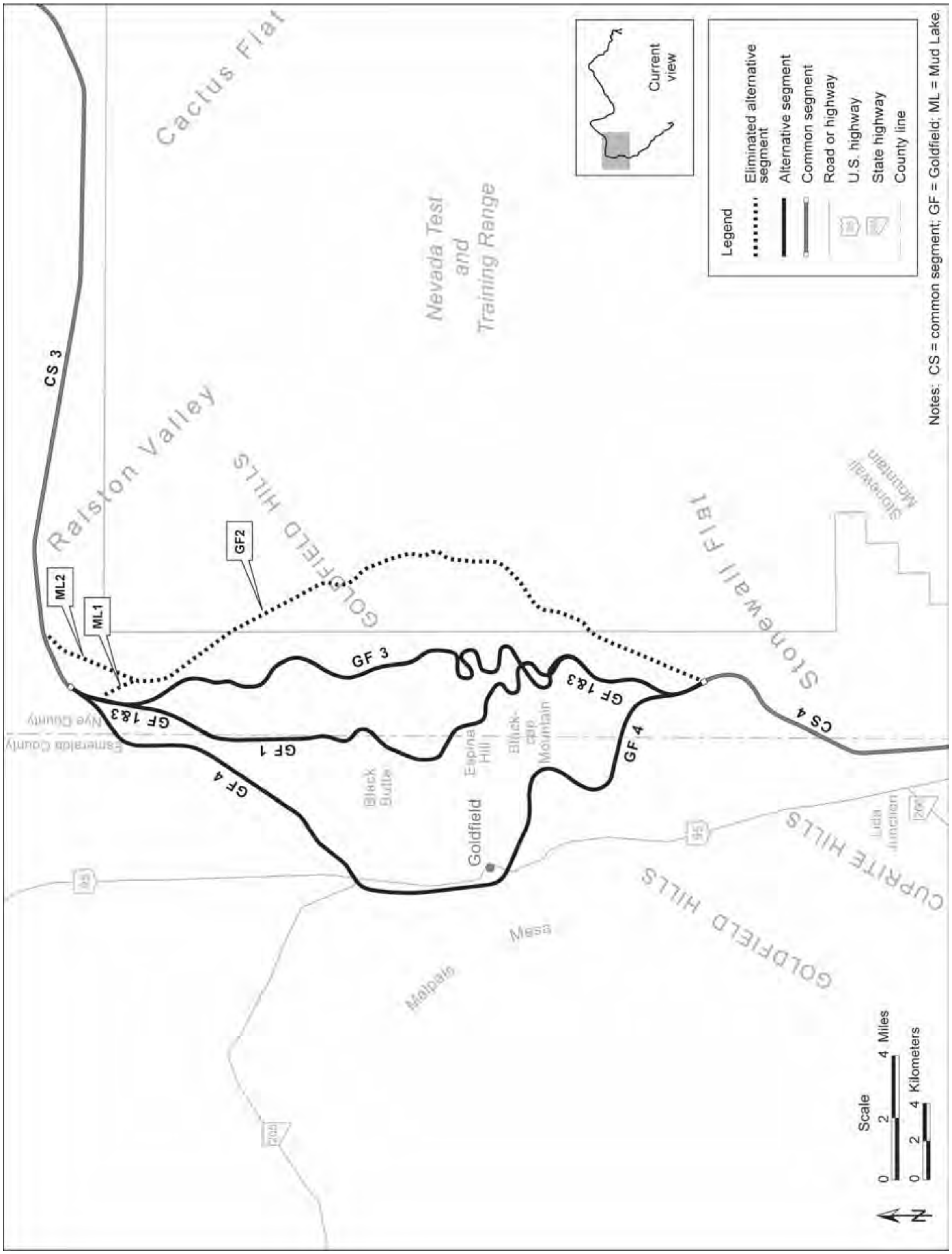


Figure C-11. Eliminated segments within Caliente map area E.

C.4.1.6 Goldfield Alternative Segments

DOE identified four alternative segments in the Goldfield area, Goldfield 1 through Goldfield 4 (Figure C-11). The Notice of Intent identified Goldfield 1 and Goldfield 2. DOE added Goldfield 3 and Goldfield 4 as a result of public scoping comments to avoid mineral resource areas to the north and east of Goldfield. The U.S. Air Force stated that a rail line would be incompatible with current uses of the Nevada Test and Training Range. Therefore, DOE eliminated Goldfield 2, which would enter the Nevada Test and Training Range, from detailed analysis. DOE then evaluated whether the remaining three Goldfield alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. Table C-7 provides a comparison of the key factors DOE used in this determination.

Table C-7. Comparison of possible alternative segments in the Goldfield area.[a]

Attribute	Goldfield 1	**Goldfield 2**	Goldfield 3	Goldfield 4
Length (kilometers)[b]	47	Alternative segment not evaluated because it would enter the Nevada Test and Training Range	50	53
Construction cost ($ millions)	203		231	249
Engineering factors	Would cut through complex, steep terrain. Meets engineering design criteria.		Would cut through complex, steep terrain. Meets engineering design criteria.	Would require short stretch at maximum allowable grade. Meets engineering design criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination		Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

DOE found Goldfield alternative segments 1, 3, and 4 to have various construction and design complexities, such as grade-separated crossings, that would increase construction costs. Absent consideration of mitigation measures, each Goldfield alternative segment could also have the potential to impact mining interests and cultural resources. However, each alternative segment is feasible from a technical and economic standpoint and the environmental and land-use constraints do not warrant elimination of Goldfield 1, Goldfield 3, and Goldfield 4 from detailed analysis in the Rail Alignment EIS.

C.4.1.7 Bonnie Claire Alternative Segments

DOE identified three alternative segments in the Bonnie Claire area, Bonnie Claire 1 through Bonnie Claire 3 (Figure C-12). The Notice of Intent identified Bonnie Claire 1 and Bonnie Claire 2. As a result of public scoping comments that suggested avoiding the Nevada Test and Training Range and the Timbisha Shoshone Trust Lands near Scottys Junction, the Department modified Bonnie Claire 2 and identified a new alternative segment, Bonnie Claire 3. Additionally, based on comments from the Timbisha Shoshone Tribe that the rail line crossing their lands would be incompatible with their current and planned land uses, the Department eliminated Bonnie Claire 1 from detailed analysis in the Rail Alignment EIS. DOE then determined whether Bonnie Claire 2 and Bonnie Claire 3 would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and

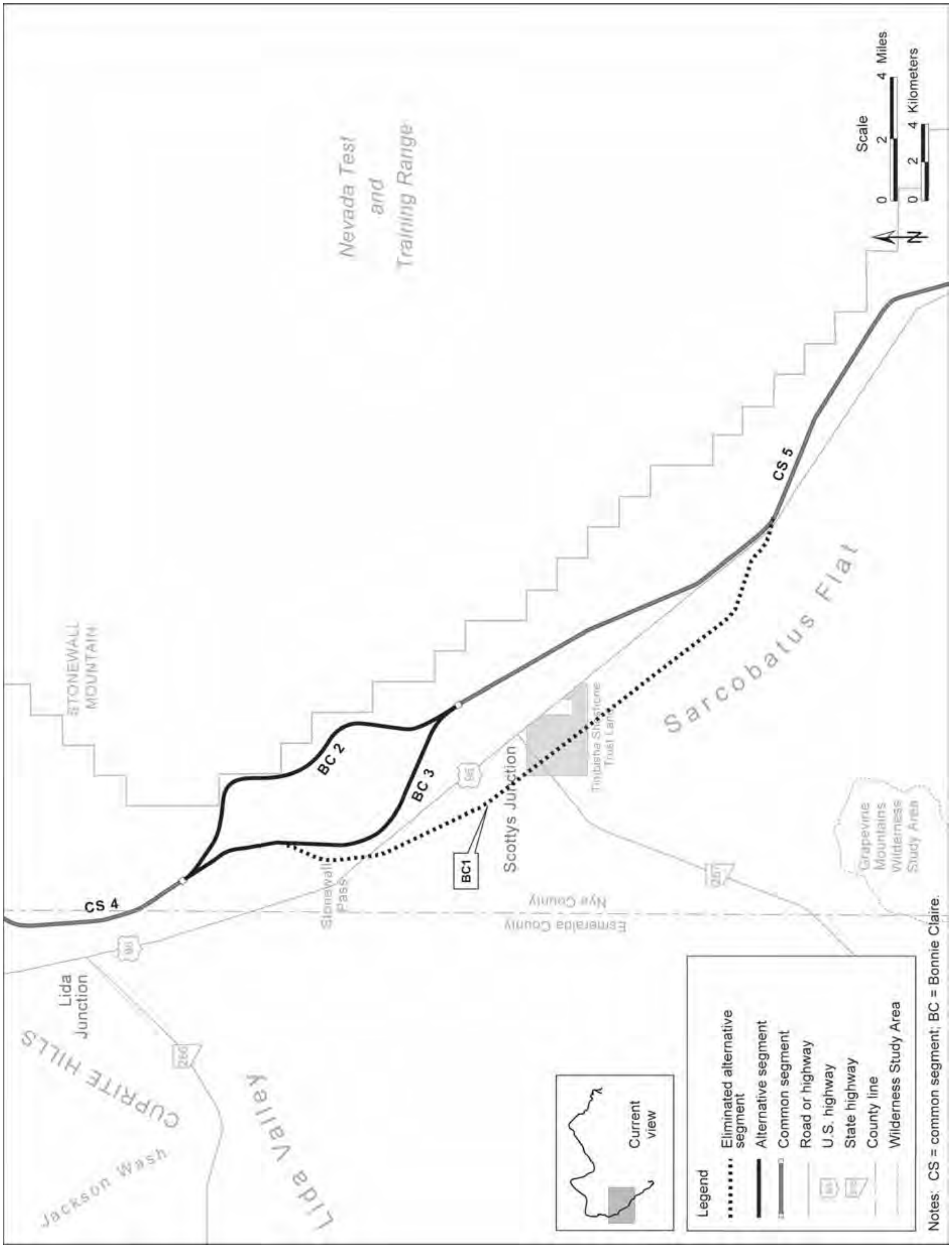


Figure C-12. Eliminated segments within Caliente map area F.

considered the environmental and land-use features associated with each. Based on this analysis, neither alternative segment was eliminated from detailed analysis in the Rail Alignment EIS. Table C-8 provides a comparison of the key factors DOE used in this determination.

Table C-8. Comparison of possible alternative segments in the Bonnie Claire area.a

Attribute	**Bonnie Claire 1**	Bonnie Claire 2	Bonnie Claire 3
Length (kilometers)[b]	Alternative segment not evaluated because it would cross Timbisha Shoshone Trust Lands.	20	20
Construction cost ($ millions)		96.9	74.9
Engineering factors		Meets engineering design criteria	Meets engineering design criteria
Key environmental and land-use features		Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

Bonnie Claire alternative segments 2 and 3 would have various construction and design complexities. Both alternative segments would require bridges and near maximum allowable grade that would increase construction costs. In addition, absent consideration of mitigation, both alternative segments would have the potential to impact various environmental resources, such as access to mining operations. However, each alternative segment appears to be feasible from a technical and economic standpoint.

C.4.1.8 Oasis Valley Alternative Segments

DOE identified three alternative segments in the Oasis Valley area, Oasis Valley 1, Oasis Valley 2, and Oasis Valley 3 (Figure C-13). The Notice of Intent identified Oasis Valley 1 and Oasis Valley 2. Oasis Valley 1 would cross less private land, but Oasis Valley 2 would be further from springs in the vicinity. In response to public scoping comments to avoid or minimize intrusion on certain parcels of land, DOE added Oasis Valley 3 for consideration. The Department then determined whether these three alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. Oasis Valley alternative segments 1, 2, and 3 appear to be feasible from a technical and economic standpoint. Oasis Valley 1 and 2 are immediately adjacent to one another and their engineering and construction factors would be similar. Both have similar land-use constraints, which do not warrant elimination of the alternative segments from detailed analysis. Because Oasis Valley 1 and Oasis Valley 2 have such similarities, DOE eliminated Oasis Valley 2 from detailed analysis. Table C-9 provides a comparison of the key factors DOE used in this determination.

Table C-9. Comparison of possible alternative segments in the Oasis Valley area.[a]

Attribute	Oasis Valley 1	**Oasis Valley 2**	Oasis Valley 3
Length (kilometers)[b]	10	Alternative segment not evaluated because engineering factors and environmental and land-use features similar to Oasis Valley 1	14
Construction cost ($ millions)	43.2		58.6
Engineering factors	Meets engineering design criteria		Meets engineering design criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination		Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

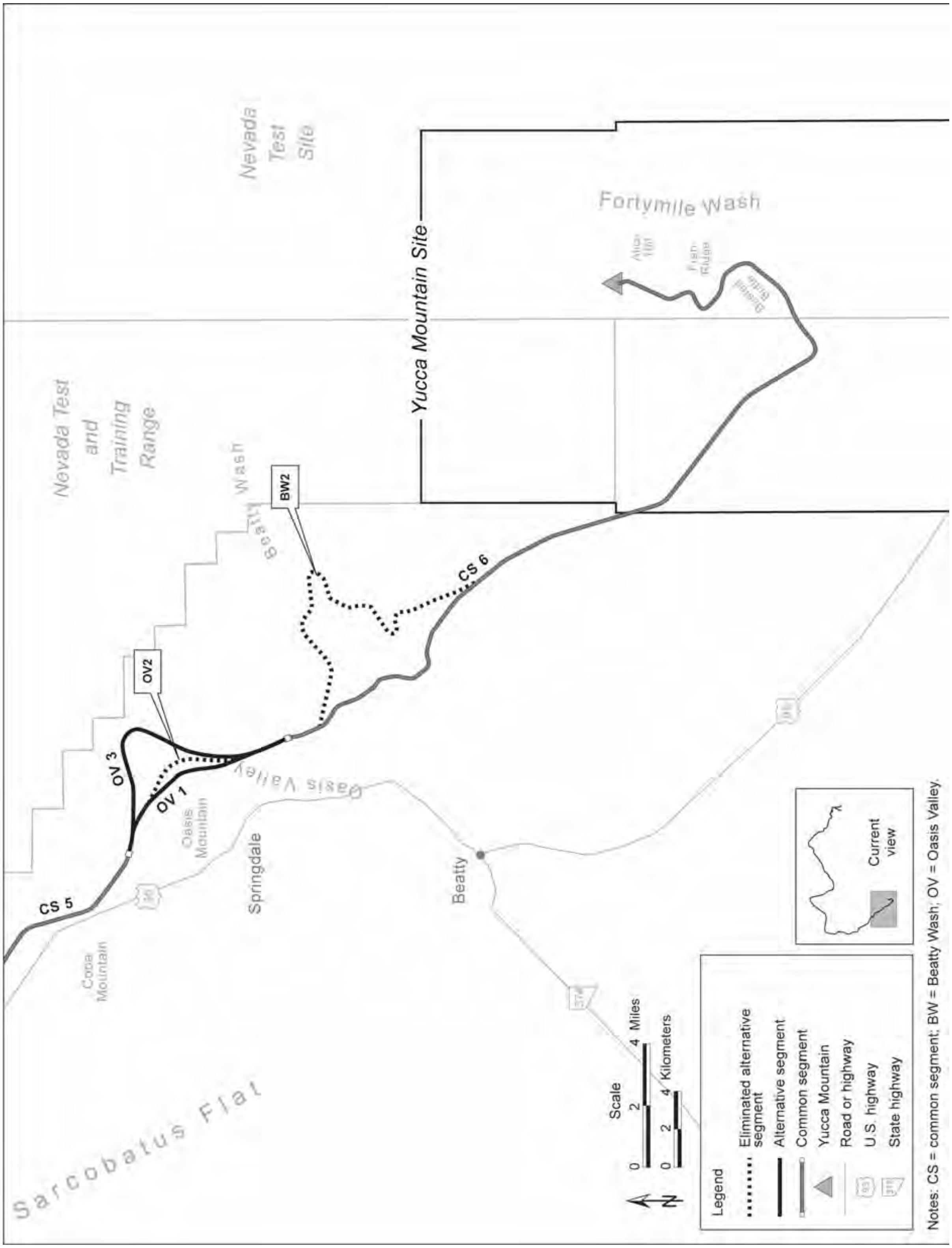


Figure C-13. Eliminated segments within Caliente map area G.

C.4.1.9 Beatty Wash Alternative Segments

In the Notice of Intent to prepare the Rail Alignment EIS (69 *FR* 18565, April 8, 2004), DOE identified two alternative segments in the Beatty Wash area, Beatty Wash 1 and Beatty Wash 2 (Figure C-13). DOE determined whether these two alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. Beatty Wash 2 would exceed design criteria for horizontal and vertical curvature. Therefore, DOE eliminated Beatty Wash 2 from detailed analysis in the Rail Alignment EIS. Table C-10 provides a comparison of the key factors DOE used in this determination. Eliminating Beatty Wash 2 resulted in only one Beatty Wash alternative segment for detailed analysis; thus, Beatty Wash 1 became an addition to common segment 6.

Table C-10. Comparison of possible alternative segments in the Beatty Wash area.[a]

Attribute	Beatty Wash 1	**Beatty Wash 2**
Length (kilometers)[b]	13	21
Construction cost ($ millions)	36	More than 60[c]
Engineering factors	Meets engineering design criteria	Exceeds design criteria for horizontal and vertical curvature
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.
c. Cost is listed as approximate because the computer based modeling system could not identify a viable alignment for construction estimating.

C.4.2 MINA RAIL ALIGNMENT ALTERNATIVE SEGMENTS ELIMINATED FROM DETAILED ANALYSIS

Figure C-14 shows the alternative segments DOE eliminated from consideration for the Mina rail corridor. Table C-11 identifies the alternative segments DOE identified in its Amended Notice of Intent (71 *FR* 60484, October 13, 2006) and alternative segments the Department added for consideration based on public comments. The table also summarizes the reasons DOE eliminated certain alternative segments from detailed analysis in the Rail Alignment EIS.

Table C-11. Mina rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 1 of 2).

Map area	Alternative segments	Amended Notice of Intent	Scoping	Analyzed in detail or eliminated
Walker River Paiute Reservation area	Schurz 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Schurz 2	Alternative segment identified		Eliminated based on input from the Walker River Paiute Tribe.
	Schurz 3	Alternative segment identified		Eliminated based on input from the Walker River Paiute Tribe.

Table C-11. Mina rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 2 of 2)

Map area	Alternative segments	Amended Notice of Intent	Scoping	Analyzed in detail or eliminated
Walker River Paiute Reservation area (continued)	Schurz 4		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Schurz 5		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Schurz 6		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
Montezuma Range area	Montezuma 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Montezuma 2	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Montezuma 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Montezuma 4		Alternative segment identified	Eliminated because engineering criteria not met.
Bonnie Claire	Alternative segments and all factors are unchanged from Caliente analysis.			
Oasis Valley area	Oasis Valley 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Oasis Valley 3	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Oasis Valley 4		Alternative segment identified	Eliminated because of land-use constraints and because engineering criteria not met.

C.4.2.1 Schurz Alternative Segments

The Amended Notice of Intent identified three alternative segments near Schurz, Schurz 1, Schurz 2, and Schurz 3 (Figure C-15). Feedback from the Walker River Paiute Tribe suggested that Schurz 2 and Schurz 3 not be considered viable alternatives to provide a bypass around Schurz, and DOE eliminated those alternative segments from detailed analysis in the Rail Alignment EIS. The Walker River Paiute Tribe identified several additional alternative segments where the rail line would cross Walker River Paiute Reservation lands. DOE determined whether the alternative segments would be technically feasible according to the design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. The results of these analyses indicated

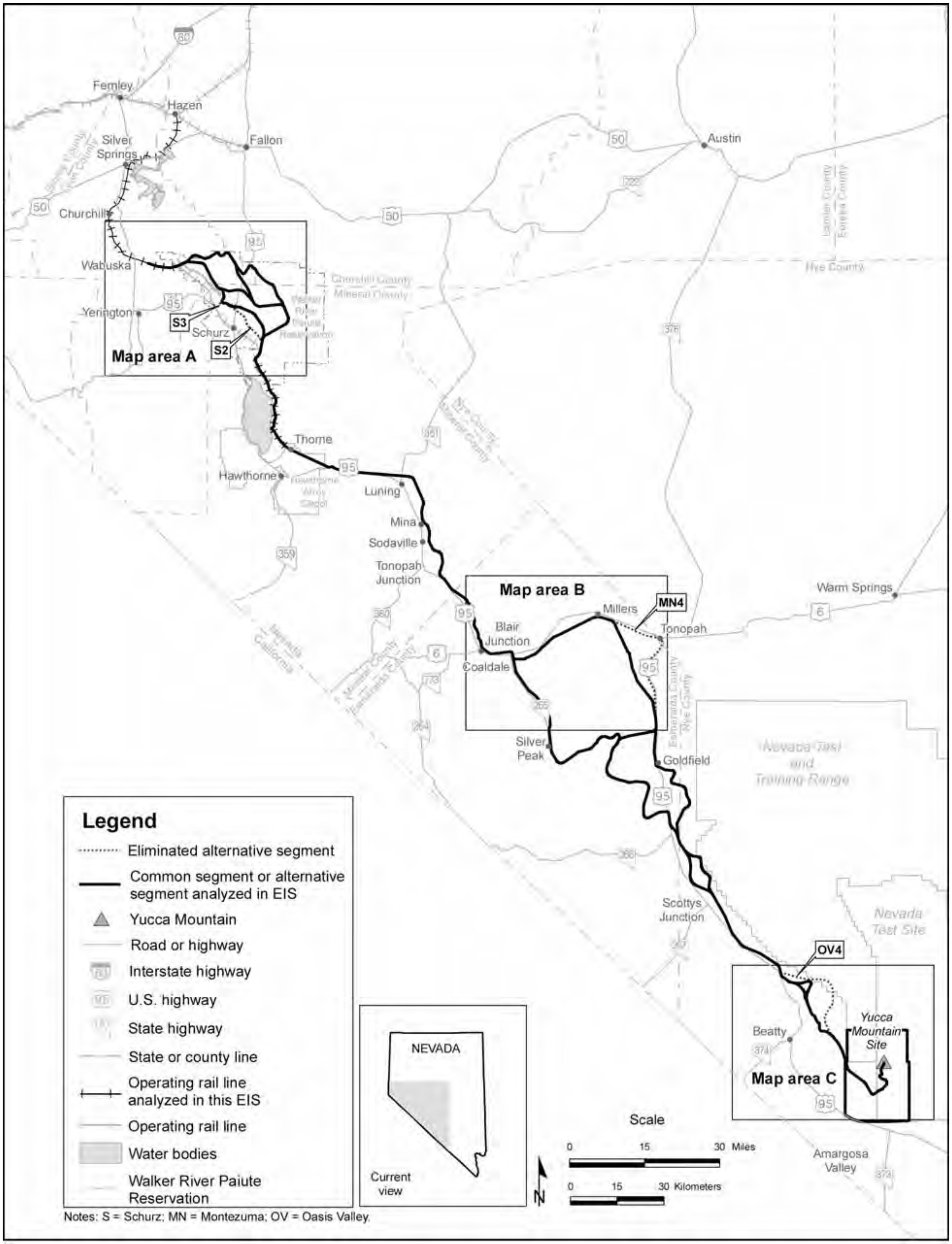


Figure C-14. Mina map key.

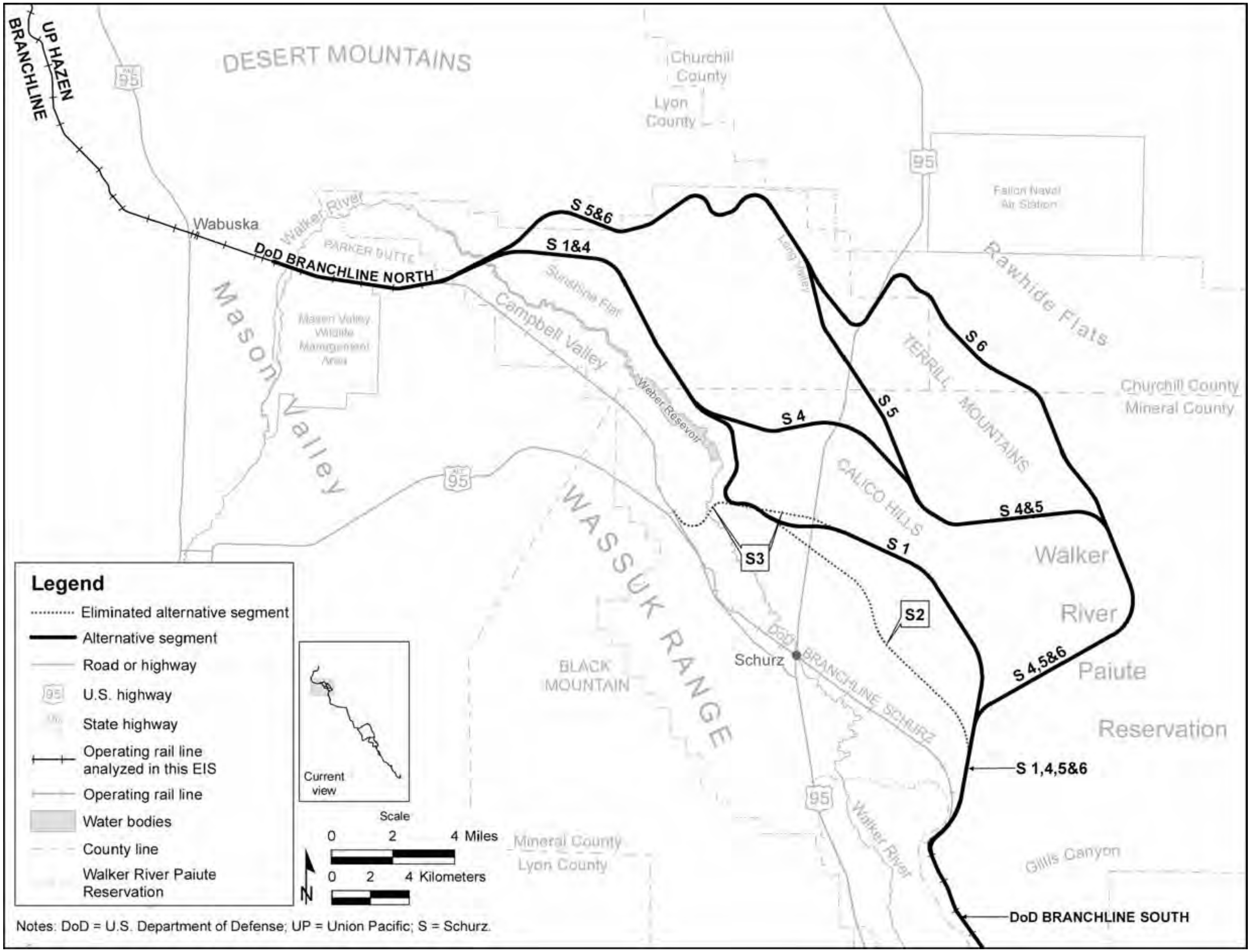


Figure C-15. Eliminated segments within Mina map area A.

that, while Schurz 4, Schurz 5, and Schurz 6 would each add additional length to the overall route and would present engineering challenges in several areas, each would meet engineering design criteria and present a viable alternative segment. Therefore, DOE added Schurz 4, 5, and 6 to the suite of alternative segments to be considered for detailed analysis in the EIS. Table C-12 lists the alternative segments considered.

Table C-12. Comparison of possible alternative segments in the Schurz area.[a]

<table>
<tr><th>Attribute</th><th>Schurz 1</th><th>Schurz 2</th><th>Schurz 3</th><th>Schurz 4</th><th>Schurz 5</th><th>Schurz 6</th></tr>
<tr><td>Length (kilometers)[b]</td><td>51.8</td><td>48.4</td><td>49.7</td><td>63.6</td><td>69</td><td>70.5</td></tr>
<tr><td>Construction cost (millions of $)</td><td>168</td><td>137</td><td>168</td><td>238</td><td>335</td><td>347</td></tr>
<tr><td>Engineering factors</td><td>Meets engineering design criteria</td><td rowspan="2" colspan="2">Eliminated due to input from the Walker River Paiute Tribe</td><td>Meets engineering design criteria</td><td>Meets engineering design criteria</td><td>Meets engineering design criteria</td></tr>
<tr><td>Key environmental and land-use features</td><td>Environmental and land-use constraints do not warrant elimination</td><td>No notable environmental or land-use constraints</td><td>No notable environmental or land-use constraints</td><td>Environmental and land-use constraints do not warrant elimination</td></tr>
</table>

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

C.4.2.2 Montezuma Alternative Segments

DOE considered four alternative segments in the Montezuma area (Figure C-16). The Amended Notice of Intent identified two alternative segments in the Montezuma Range area, Montezuma 1 and 2. Based on a public scoping comment to avoid communities along the Mina rail alignment, DOE added Montezuma alternative segment 3, which would avoid the communities of Goldfield and Silver Peak. Additionally, based on a comment received during public scoping, DOE examined Montezuma 4 as an alternative to constructing Montezuma 2. DOE determined whether the alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. DOE determined that Montezuma 4 would impact private lands and that an alternative segment that meets the intent of the public scoping comment while meeting engineering and environmental criteria could not be derived. Therefore, DOE eliminated Montezuma 4 from detailed analysis in the Rail Alignment EIS. Table C-13 displays a comparison of the alternative segments considered.

Table C-13. Comparison of possible alternative segments in the Montezuma area.[a]

Attribute	Montezuma 1	Montezuma 2	Montezuma 3	**Montezuma 4**
Length (kilometers)[b]	118	119	140	145
Construction cost (in millions of $)	485	383	475	Not calculated because eliminated from consideration
Engineering factors	Meets engineering design criteria	Meets engineering design criteria, utilizes existing rail roadbed	Meets engineering design criteria, utilizes existing rail roadbed	Exceeds grade criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

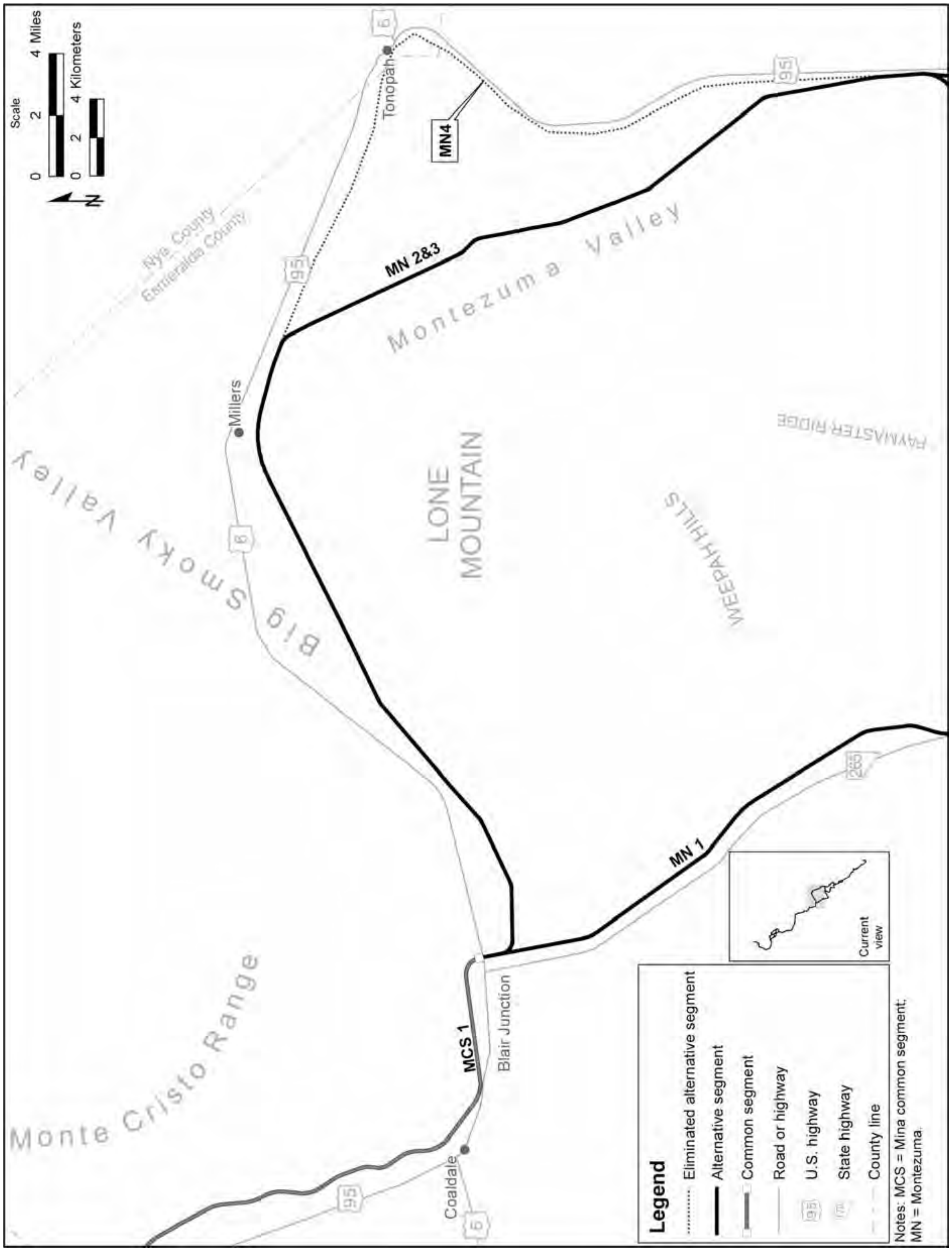


Figure C-16. Eliminated segments within Mina map area B.

C.4.2.3 Oasis Valley Alternative Segments

In total, DOE considered four alternative segments in Oasis Valley (Figure C-17). DOE identified Oasis Valley 1 and Oasis Valley 2 in its Notice of Intent. As discussed in Section C.5.1.8, during the Caliente rail alignment scoping process, DOE added Oasis Valley 3 to and eliminated Oasis Valley 2 from detailed analysis in the Rail Alignment EIS. The Amended Notice of Intent incorporated Oasis Valley 1 and Oasis Valley 3 by reference. Then, during scoping for the Mina rail alignment, one commenter suggested that DOE create an alternative segment in Oasis Valley to avoid private lands and eliminate perceived noise and vibration impacts. Based on this comment, DOE attempted to identify a feasible alternative segment, but could not without crossing onto the Nevada Test and Training Range. Table C-14 compares the Oasis Valley alternative segments DOE considered.

Table C-14. Comparison of possible alternative segments in the Oasis Valley area.[a]

Alternative segment	Oasis Valley 1	Oasis Valley 3	**Oasis Valley 4**
Length (kilometers)[b]	17.4	20.9	Alternative segment not included in the Rail Alignment EIS as it would enter the Nevada Test and Training Range
Construction cost (millions of $)	43.2	58.6	
Engineering factors	Meets engineering design criteria	Meets engineering design criteria	
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

C.5 Rail Alignment Refinement Process

DOE continued with development of alternative segments and common segments that were identified for detailed analysis, as described above. DOE used Caliente- and Mina-specific information from the computer models to refine and adjust common segment and alternative segment geometry to reflect rail design and engineering criteria. The Department transferred the information developed by the computer modeling system to a computer-aided-design (commonly called CAD) platform, and to alignment-specialty software. DOE used the CAD platform to create engineered drawings and used the software to develop each segment's horizontal and vertical geometry and estimate earthwork volumes such as cuts and fills. In developing this geometry, DOE considered U.S. Geological Survey topographic information, specific location information, cross-section templates, and engineering criteria (DIRS 176584-Nevada Rail Partners 2006, all).

DOE reviewed the alternative segments and common segments generated by software to identify the potential for further refinements. Further refinements were undertaken to improve operational functionality using industry standard practices recommended by the American Railway Engineering and Maintenance-of-Way Association and the Association of American Railroads.

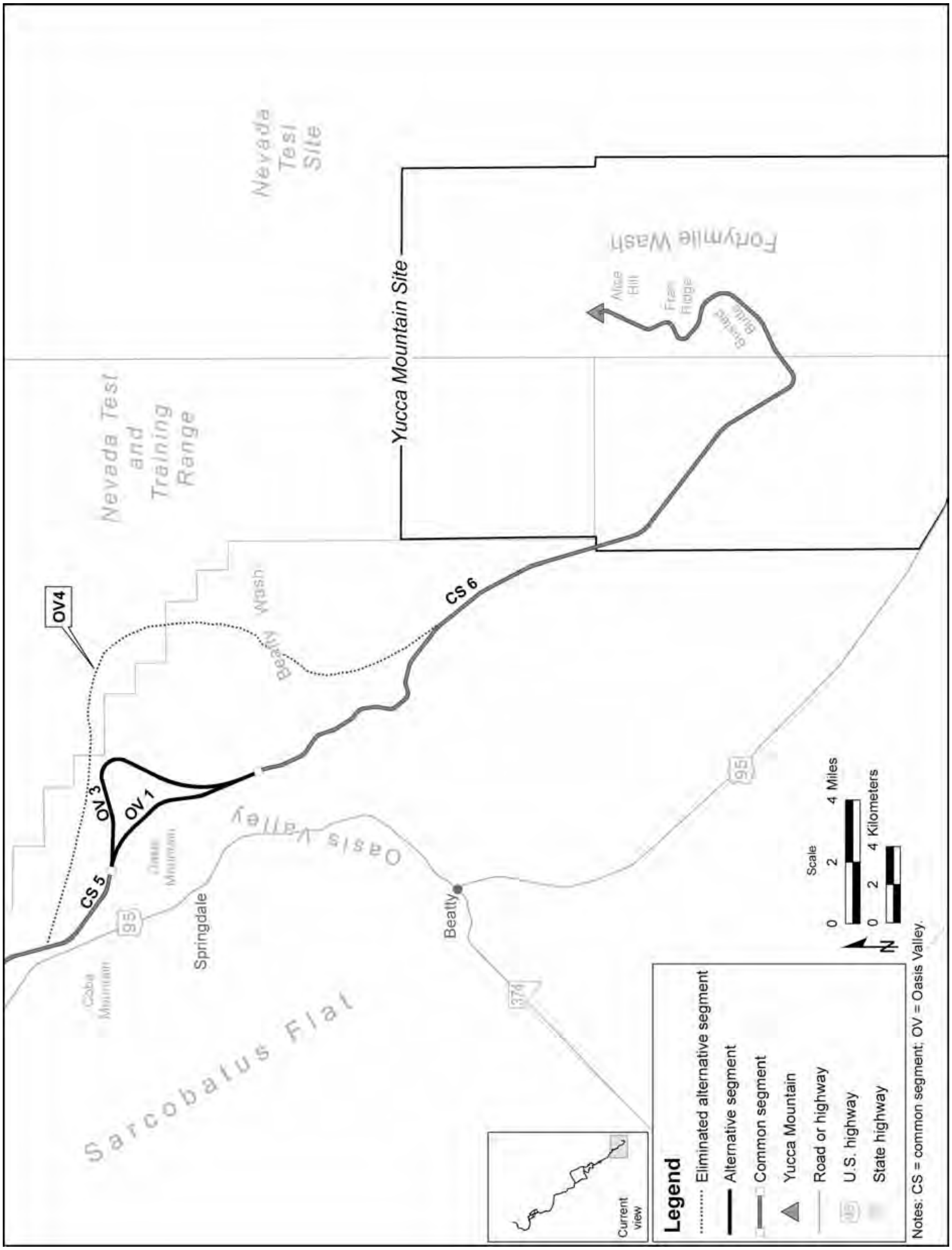


Figure C-17. Eliminated segments within Mina map area C.

C.5.1 CALIENTE RAIL ALIGNMENT REFINEMENT PROCESS

Caliente rail alignment refinements were limited in geographic extent and mostly consisted of shifting the track centerline. Figures C-18 and C-19 illustrate the alternative segment DOE refined the most, Oasis Valley 3. Figure C-18 illustrates the alternative segment before the conceptual design process, and Figure C-19 illustrates the results of this initial process. Figure C-20 shows the resulting conceptual alternative segments and common segments.

Following receipt of new aerial mapping and terrain models for the Caliente rail alignment, DOE again used computer-based modeling software to evaluate and refine the alternative segments and common segments in light of the new topographic data. The second refinement, called the Revision 1 alignment, typically altered the centerline location (compare to Revision 0) by several hundred feet, and occasionally a greater distance if environmental impacts would be reduced, thereby improving the feasibility of the rail alignment.

Water availability is the major issue determining the location and design of the rail alignment. It simultaneously affects engineering design, environmental effects, permitting constraints, and project costs. The principal factor affecting water demand is earthwork. Ninety percent of the water DOE would need for the project would be used to provide for compaction of embankment fill materials, and to control dust during excavation and other earth-moving activities. In the first refinement (Revision 0), DOE prepared the track profile with the objective of trying to balance earthwork quantities (that is, keeping the total excavation [cut] approximately equal to the placement of embankment [fill]). However, the conceptual design approach used during Revision 1 was to adjust the profile so that cut and fill would be reduced. By reducing fill, the water demand for embankment compaction would also be reduced (DIRS 176584-Nevada Rail Partners 2006, all).

DOE considered additional environmental and land-use factors in deriving the alternative segments and common segments that make up the Caliente rail alignment. This information included the identification of known areas of potential cultural resources impacts based on cultural resources surveys, and DOE adjusted the alternative segments and common segments to decrease or eliminate impacts in these areas.

C.5.2 MINA RAIL ALIGNMENT REFINEMENT PROCESS

DOE developed a conceptual Mina rail alignment and refined it using the modeling program and the process described in Section C.5. Figure C-21 shows the resulting conceptual alternative segments and common segments that make up the Mina rail alignment.

Following the receipt of new aerial mapping and terrain models, DOE again used software to evaluate the Mina alternative segments and common segments in light of the new topographic data, utilizing the same process and factors described for the Caliente rail alignment refinement process in C.5.1.

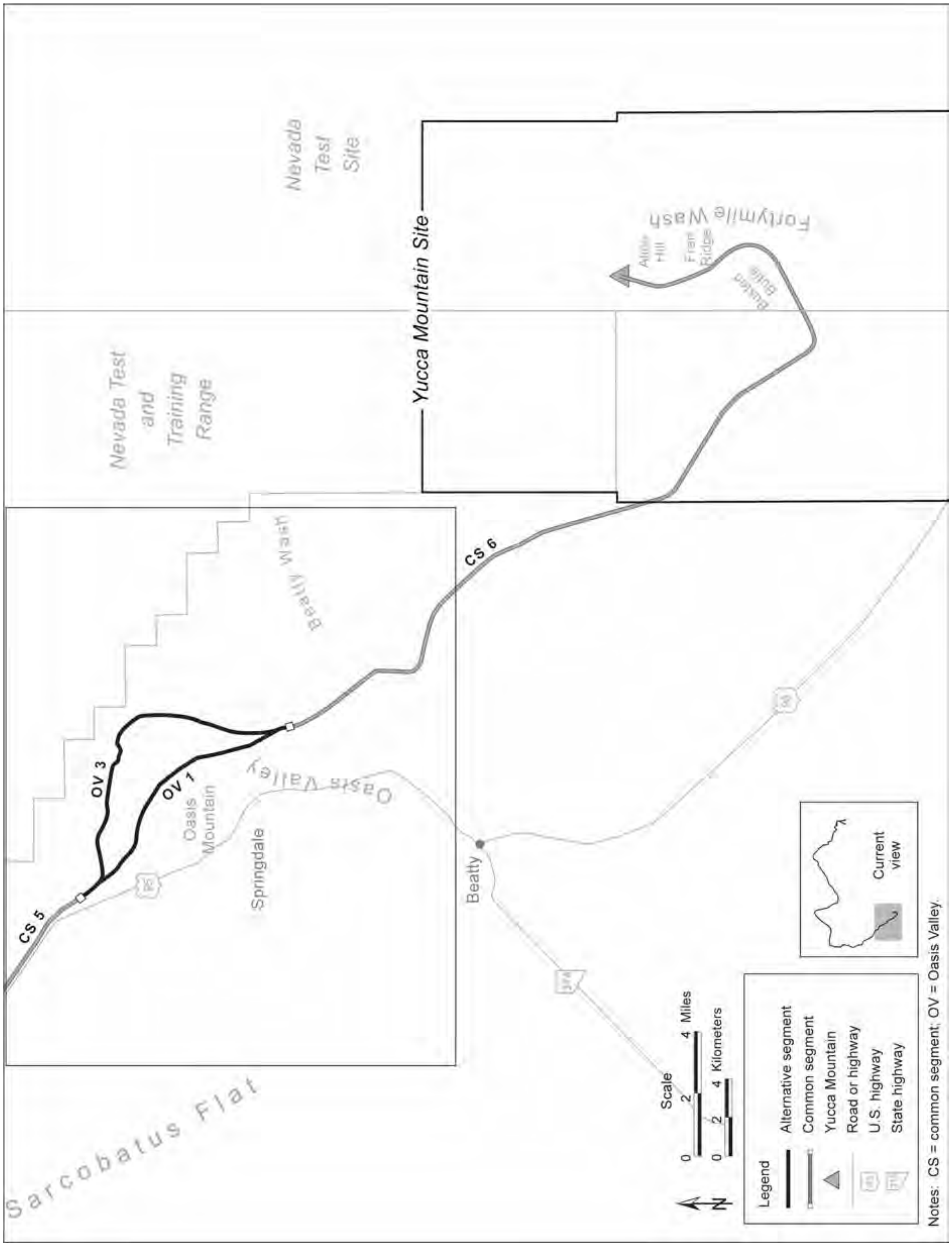


Figure C-18. The Oasis Valley alternative segments before the conceptual design process.

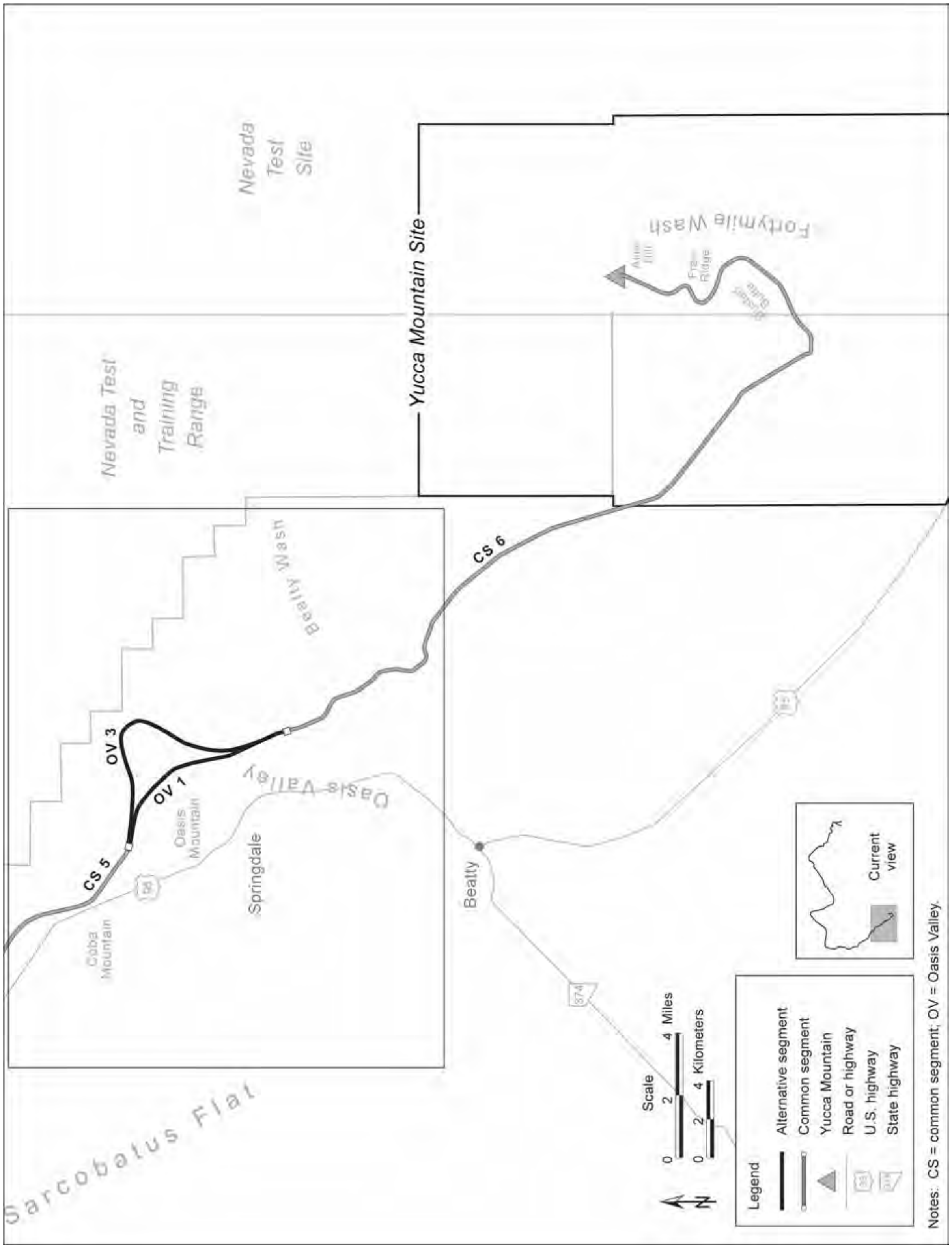


Figure C-19. The Oasis Valley alternative segments refined as a result of the conceptual design process.

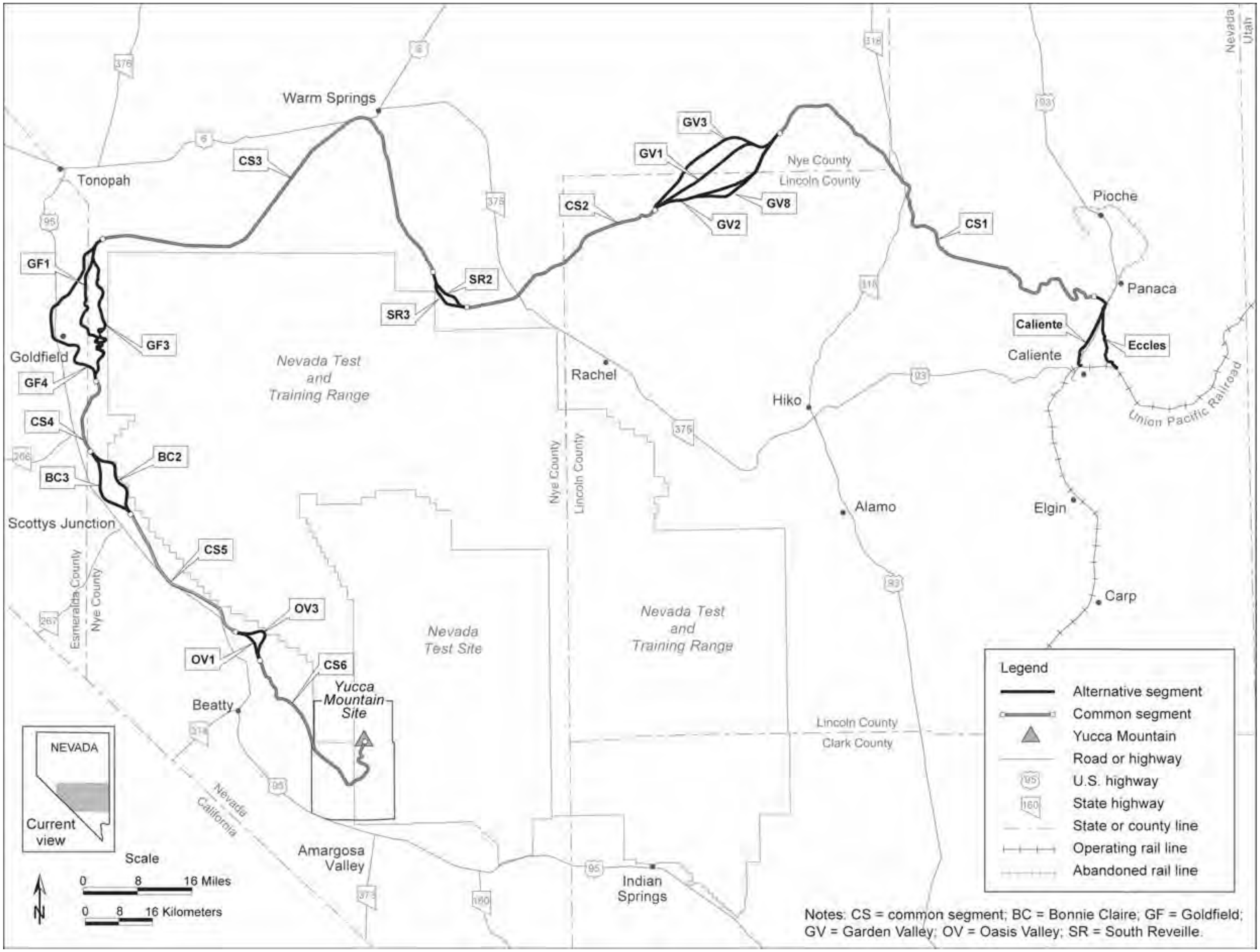


Figure C-20. Final alternative segments and common segments for analysis in the Rail Alignment EIS – Caliente rail alignment.

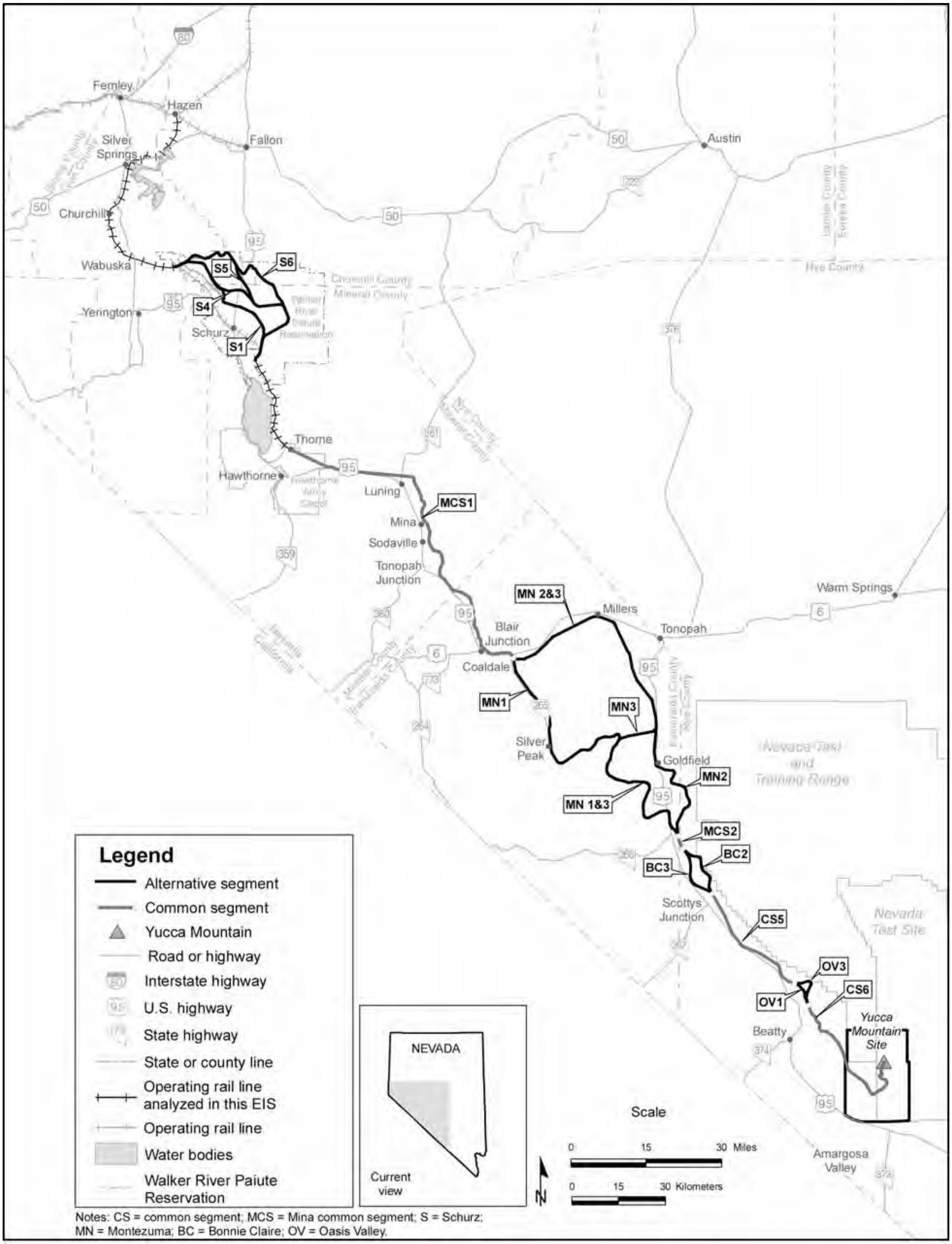


Figure C-21. Final alternative segments and common segments for analysis in the Rail Alignment EIS – Mina rail alignment.

C.6 Glossary

accessible environment — For this ***environmental impact statement*** (EIS), all points on Earth outside the surface and subsurface area controlled over the long term for the ***repository***, including the atmosphere above the controlled area.

accident — An unplanned sequence of events that results in undesirable consequences. Examples in this Rail Alignment EIS include an inadvertent release of radiation from the casks or hazardous materials from their containers; train derailments; vehicular accidents; and construction-related accidents that could affect workers.

air quality — A measure of the concentrations of pollutants, measured individually in the air.

alpha particle — A positively charged particle ejected spontaneously from the nuclei of some ***radioactive*** elements. It is identical to a helium nucleus and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See ***ionizing radiation.***

alternative — One of two or more actions, processes, or propositions, from which a decisionmaker will determine the course to be followed. The National Environmental Policy Act, as amended, states that in preparing an EIS, an agency "shall … (s)tudy, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" [42 U.S.C. 4321, Title I, Section 102(E)]. The regulations of the Council on Environmental Quality that implement the National Environmental Policy Act indicate that the alternatives section is "the heart of the environmental impact statement (40 CFR 1502.14), and include rules for presentation of the alternatives, including no action, and their estimated impacts.

The Rail Alignment EIS analyzes one alternative to the ***Proposed Action*** – the ***No-Action Alternative*** – and two implementing alternatives under the Proposed Action – the Caliente Implementing Alternative and the Mina Implementing Alternative – for constructing, operating, and possibly abandoning a ***railroad*** for the shipment of ***spent nuclear fuel*** and ***high-level radioactive waste*** for long-term ***disposal*** in a ***geologic repository*** at Yucca Mountain. Under the No-Action Alternative, the DOE would not construct the proposed railroad along the Caliente ***rail alignment*** or the Mina rail alignment.

alternative segment — Geographic region of the ***rail alignment*** for which multiple routes for the ***rail line*** have been identified. In the Rail Alignment EIS, there are different alignments identified within the Caliente ***rail corridor*** and the Mina rail corridor that could minimize or avoid environmental ***impacts*** and reduce construction complexities.

atomic mass	The mass of a neutral atom, based on a relative scale, usually expressed in atomic mass units. See ***atomic weight.***
atomic nucleus	See ***nucleus***.
atomic number	The number of ***protons*** in an atom's ***nucleus***.
atomic weight	The relative mass of an atom based on a scale in which a specific carbon atom (carbon-12) is assigned a mass value of 12. Also known as relative ***atomic mass***.
ballast	The coarse rock that is placed under the ***railroad*** tracks to support the railroad ties and improve drainage along the ***rail line***.
beta particle	A negatively charged ***electron*** or positively charged positron emitted from a ***nucleus*** during ***decay***. Beta decay usually refers to a radioactive transformation of a ***nuclide*** by electron emission, in which the ***atomic number*** increases by 1 and the mass number remains unchanged. In positron emission, the atomic number decreases by 1 and the mass number remains unchanged. See ***ionizing radiation.***
boiling-water reactor (BWR)	A ***nuclear reactor*** that uses boiling water to produce steam to drive a turbine.
common segment	Geographic region of the ***rail alignments*** for which a single route for the ***rail line*** has been identified.
cut	Cutting away from the top of a slope to fill in at the bottom, thereby providing a suitable grade for the rail ***roadbed***. See ***fill***.
decay (radioactive)	The process in which one ***radionuclide*** spontaneously transforms into one or more different radionuclides called decay products.
disposal (of spent nuclear fuel and high-level radioactive waste)	The ***emplacement*** in a ***repository*** of ***spent nuclear fuel***, ***high-level radioactive waste***, or other highly ***radioactive*** material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste, and the ***isolation*** of such waste from the ***accessible environment***.
dose (radioactive)	The amount of ***radioactive*** energy taken into (absorbed by) living tissues. See ***effective dose equivalent***.
effective dose equivalent	Often referred to simply as ***dose***, it is an expression of the ***radiation*** dose received by an individual from external radiation and from ***radionuclides*** internally deposited in the body.
electron	A stable elementary particle that is the negatively charged constituent of ordinary matter.
emplacement	The placement and positioning of ***waste packages*** in the ***repository***.

environment	(1) Includes water, air, and land and all plants and humans and other animals living therein, and the interrelationship existing among these. (2) The sum of all external conditions affecting the life, development, and survival of an organism.
environmental impact statement (EIS)	A detailed written statement that describes: "...the environmental impact of the ***proposed action***; any adverse environmental effects which cannot be avoided should the proposal be implemented; ***alternatives*** to the proposed action; the relationship between local short-term uses of man's ***environment*** and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Preparation of an EIS requires a public process that includes public meetings, reviews, and comments, as well as agency responses to the public comments.
exposure (to radiation)	The condition of being subject to the effects of or potentially acquiring a ***dose*** of ***radiation***. The incidence of radiation on living or inanimate material by ***accident*** or intent. Background exposure is the exposure to natural ionizing radiation. Occupational exposure is the exposure to ionizing radiation that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.
fill	The material used to fill the bottom of a slope with material cut away from the top of a slope, thereby providing a suitable grade for the rail ***roadbed***. (See ***cut***.)
fission products	***Radioactive*** or nonradioactive atoms produced by the ***fission*** of heavy atoms, such as uranium.
fuel assembly	A number of fuel elements held together by structural materials, used in a ***nuclear reactor***; sometimes called a fuel bundle.
gamma ray	The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. See ***ionizing radiation.***
geologic repository	A system for the ***disposal*** of ***radioactive*** waste in excavated geologic media, including surface and subsurface areas of operation, and the adjacent part of the geologic setting that provides ***isolation*** of the radioactive waste in a controlled area.
high-level radioactive waste	The highly ***radioactive*** material that resulted from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains ***fission products*** in sufficient concentrations.

impact	For an EIS, the positive or negative effect of an action (past, present, or future) on the natural ***environment*** (land use, ***air quality***, water resources, geological resources, ecological resources, aesthetic and scenic resources) and the human environment (***infrastructure***, economics, social, and cultural).
infrastructure	Basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communication systems.
ionizing radiation	(1) ***Alpha particles***, ***beta particles***, ***gamma rays***, ***X-rays***, ***neutrons***, high-speed ***electrons***, high-speed ***protons***, and other particles capable of producing ions. (2) Any ***radiation*** capable of displacing electrons from an atom or molecule, thereby producing ions.
irradiation	***Exposure*** to ***radiation***.
isolation	Inhibiting the transport of ***radioactive*** material so that the amounts and concentrations of this material entering the ***accessible environment*** stay within prescribed limits.
neutron	An atomic particle with no charge and an ***atomic mass*** of 1; a component of all atoms except hydrogen; frequently released as ***radiation***.
No-Action Alternative	Under the No-Action Alternative in the Rail Alignment EIS, DOE would not implement the ***Proposed Action*** in the Caliente rail corridor or the Mina rail corridor.
nuclear reactor	A device in which a nuclear fission chain reaction can be initiated, sustained, and controlled to generate heat or to produce useful ***radiation***.
nucleus	The central, positively charged, dense portion of an atom. Also known as ***atomic nucleus***.
nuclide	An atomic ***nucleus*** specified by its ***atomic weight***, ***atomic number***, and energy state; a ***radionuclide*** is a ***radioactive*** nuclide.
pressurized-water reactor (PWR)	A nuclear power ***reactor*** that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.
Proposed Action	The activity proposed to accomplish a federal agency's purpose and need. An EIS analyzes the environmental ***impacts*** of a proposed action, which includes the project and its related support activities. The Proposed Action in the Rail Alignment EIS, is to determine an alignment (within a corridor) and construct, operate, and potentially abandon a railroad in Nevada to transport spent nuclear fuel, high-level radioactive waste, and other Yucca Mountain project materials to a repository at Yucca Mountain.

proton	An elementary particle that is the positively charged component of ordinary matter and, together with the ***neutron***, is a building block of all atomic ***nuclei***.
radiation	Energy traveling through space. Radiation can be non-ionizing, like radio waves, ultraviolet radiation, or visible light, or ionizing, depending on its effect on atomic matter. As used in this Rail Alignment EIS "radiation" refers to ***ionizing radiation***. Ionizing radiation has enough energy to ionize atoms or molecules while non-ionizing radiation does not. Radioactive material is a physical material that emits ionizing radiation.
radioactive	Emitting ***radioactivity***.
radioactivity	(1) The spontaneous transformation of unstable atomic ***nuclei***, usually accompanied by the emission of ionizing ***radiation*** (e.g., such as ***alpha***, ***beta***, ***or gamma rays***). (2) The property of unstable nuclei in certain atoms (of elements such as uranium) to spontaneously emit ionizing radiation during nuclear transformations.
radionuclide	See ***nuclide***.
rail alignment	(1) A strip of land less than 400 meters (0.25 mile) wide through which the location of a rail line would be identified. (2) In this Rail Alignment EIS, the location of a ***rail line*** within a ***rail corridor***.
rail corridor	As used in this Rail Alignment EIS, a strip of land, 400 meters (0.25 mile) wide through which DOE would identify an alignment (***rail alignment***) for the construction of a ***rail line*** in Nevada to a ***geologic repository*** at Yucca Mountain.
rail line	An engineered feature incorporating the track, ties, ***ballast***, and ***subballast*** at a specific location.
railroad	A transportation system incorporating the rail line, operations support facilities, railcars, locomotives, and other related property and infrastructure.
reactor	See ***nuclear reactor***.
repository	See ***geologic repository***.
roadbed	The earthwork foundation upon which the track, ties, ***ballast***, and ***subballast*** of a ***rail line*** are lain.

spent nuclear fuel	Fuel that has been withdrawn from a ***nuclear reactor*** following ***irradiation***, the component elements of which have not been separated by reprocessing. For this project, this refers to (1) intact, nondefective ***fuel assemblies***, (2) failed fuel assemblies in ***canisters***, (3) fuel assemblies in canisters, (4) consolidated fuel rods in canisters, (5) nonfuel assembly hardware inserted in ***pressurized-water reactor*** fuel assemblies, (6) fuel channels attached to ***boiling-water reactor*** fuel assemblies, and (7) nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in canisters.
subballast	A layer of crushed gravel that is used to separate the ***ballast*** and ***roadbed*** for the purpose of load distribution and drainage.
waste packages	Two thick metal cylinders, one nested within the other. The inner cylinder would be made of stainless steel to provide structural strength. The outer cylinder would be made of a nickel alloy that is highly resistant to corrosion.
withdrawal	Related to land use: Withholding an area of federal land from settlement, sale, location, or surface entry, under some or all of the general land laws, for the purpose of limiting activities under those laws to maintain other public values in the area or reserving the area for a particular public purpose or program. Related to water resources: Water diverted from the ground or diverted from a surface-water source for use.
X-rays	Penetrating electromagnetic ***radiation*** having a wavelength much shorter than that of visible light. X-rays are identical to ***gamma rays*** but originate outside the ***nucleus***, either when the inner orbital ***electrons*** of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.

C.7 References

180222	BSC 2006	BSC (Bechtel SAIC Company) 2006. Mina Rail Route Feasibility Study. Rev. 01. Las Vegas, Nevada: Bechtel SAIC Company. ACC: MOL.20070108.0027.
176584	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Alignment Development Report Caliente Rail Corridor, Task 6: Route Alignment Definition, REV. 01A. Document No. NRP-R-SYSW-DA-0001-01A. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060302.0017.

APPENDIX D

AESTHETIC RESOURCES

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APPENDIX D

AESTHETIC RESOURCES

This appendix supports the DOE analyses of potential impacts to aesthetic resources described in Sections 4.2.3 and 4.3.3 of *the* Rail Alignment EIS.

The U.S. Department of Energy (DOE) used U.S. Department of the Interior, Bureau of Land Management (BLM) methodologies to evaluate visual values along the Caliente and Mina rail alignments. The BLM considers visual resources when addressing aesthetic issues during BLM planning. These resources include natural or manmade physical features that give a landscape its character and value as an environmental factor. The BLM uses a visual resource management system to classify the aesthetic value of its lands and to set management objectives (DIRS 173052-BLM 1984, all).

Scenic quality is a measure of the visual appeal of a tract of land. Areas are rated based on key factors including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications (DIRS 101505-BLM 1986, Section II).

Sensitivity levels are a measure of public concern for scenic quality. Areas are ranked high, medium, or low based on types of users, amount of use, public interest, adjacent land uses, and whether they are special areas (DIRS 101505-BLM 1986, Section III).

The BLM classification of visual resource value, the visual resource inventory, involves assessing visual resources and assigning them to one of four visual resource management classes based on three factors: ***scenic quality***, visual sensitivity (***sensitivity levels***), and distance from travel or observation points (DIRS 101505-BLM 1986, all). The BLM uses a combination of the ratings of these three factors to assign a visual resource inventory class to a piece of land, ranging from Class I to Class IV, with Class I representing the highest visual values. Each visual resource class is subsequently associated with a management objective, defining the way the land may be developed or used. Each BLM district assigns visual resource management classes to its lands during the resource management planning process. Table D-1 lists the BLM management objectives for visual resource classes.

The BLM uses visual resource contrast ratings to assess the visual impacts of proposed projects and activities on the existing landscape (DIRS 173053-BLM 1986, all). The Bureau looks at basic elements of design to determine levels of contrast created between a proposed project and the existing ***viewshed.*** Depending on the visual resource management objective for a particular location, varying levels of contrast are acceptable.

Contrast ratings are determined from locations called key observation points, which are usually along commonly traveled routes such as highways or frequently used county roads or in communities. To identify key observation points along the Caliente and Mina rail alignments, DOE considered the following factors: angle of observation, number of viewers, how long the project would be in view, relative project size, season of use, and light conditions. BLM guidance (DIRS 173053-BLM 1986, Section IIC) recommends that key observation points for linear projects, such as the proposed railroad, include the following:

- Most-critical viewpoints (for example, views from communities at road crossings)
- Typical views encountered in representative landscapes, if not covered by critical viewpoints
- Any special project or landscape features such as river crossings and substations

Table D-1. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity.
		Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer.
		Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer.
		Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention.
		An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

D.1 Caliente Rail Alignment

This section provides photographs taken from key observation points along the Caliente rail alignment. For some views, DOE has added simulations to the baseline photographs to show how track, trains, or facilities would appear. Figure D-1 shows the locations of the key observation points and the BLM visual resource management classifications of the lands in the viewsheds. Figures D-2 through D-83 are photographs along the Caliente rail alignment.

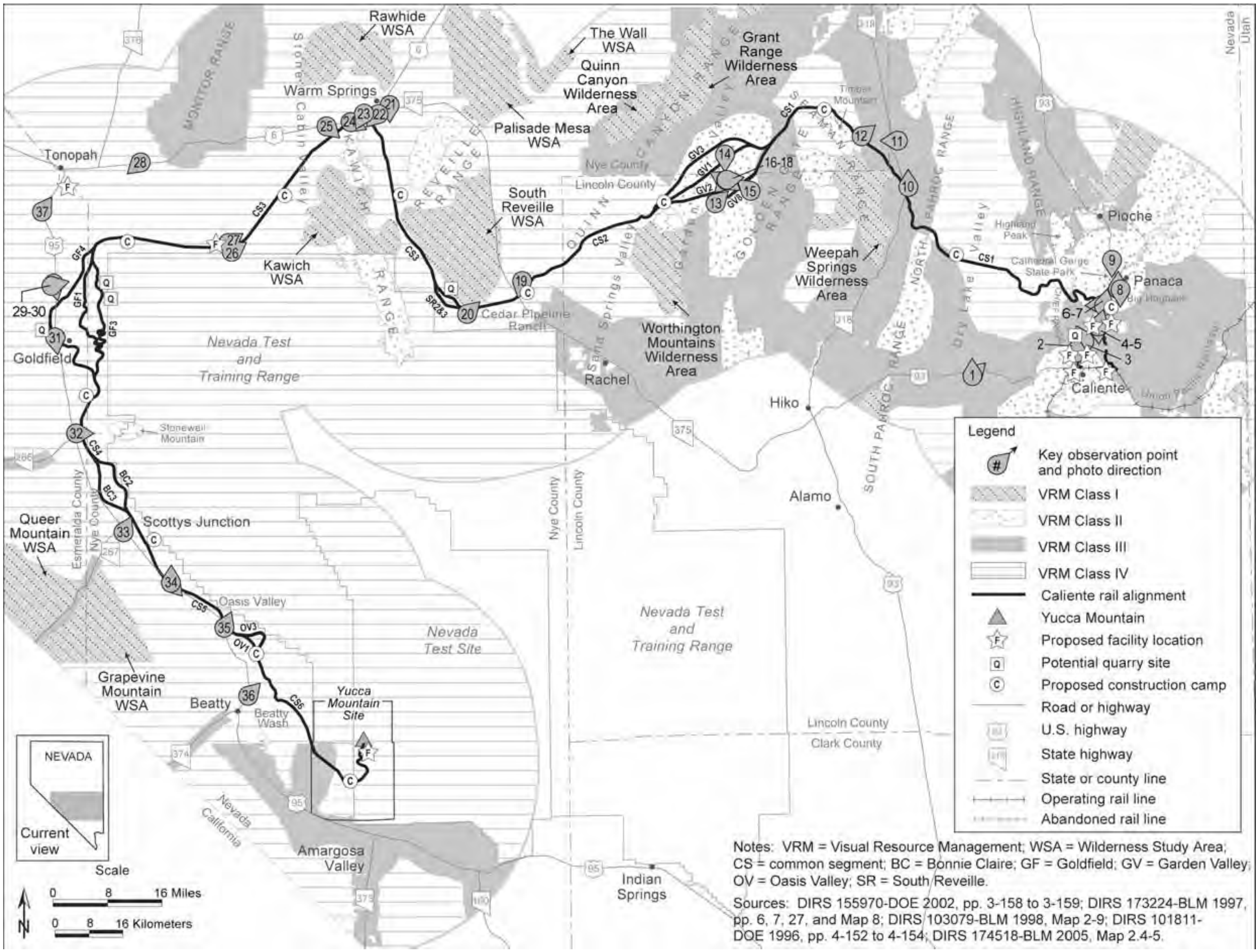

Figure D-1. Visual resource management classifications and key observation points along the Caliente rail alignment.

Figure D-2. View northeast from key observation point 1 at U.S. Highway 93 in Dry Lake Valley toward the Burnt Springs and Chief Ranges. Rail line would not be visible because it would be screened by Burnt Springs Range.

Figure D-3. View north from key observation point 1 on U.S. Highway 93 in Dry Lake Valley. Highland Range on right. Rail line would not be visible in valley because of distance.

Figure D-4. View north from key observation point 2 on U.S. Highway 93 toward location of Staging Yard Caliente-Indian Cove option.

Figure D-5. Simulation of Staging Yard Caliente-Indian Cove option in view north from key observation point 2. Office buildings would be visible in background.

Figure D-6. Simulation of train approaching Staging Yard Caliente-Indian Cove option in view north from key observation point 2.

Figure D-7. View north-northwest from key observation point 3 on U.S. Highway 93. Rock conveyor to deliver ballast to Staging Yard Caliente-Indian Cove option would cross over highway here. (See Figure D-9 for a simulation of conveyor appearance.)

Figure D-8. View south-southwest from key observation point 4 on U.S. Highway 93. Rock conveyor to deliver ballast to Staging Yard Caliente-Upland option would cross over highway here.

Figure D-9. Simulation of rock conveyor in view south-southwest from key observation point 4.

Figure D-10. View north-northeast from key observation point 5 on U.S. Highway 93 over location of Staging Yard Caliente-Upland option. Note existing buildings.

Figure D-11. Simulation of Staging Yard Caliente-Upland option in view north-northeast from key observation point 5.

Figure D-12. View north-northeast from key observation point 6 on U.S. Highway 93 at location where rail line would cross highway.

Figure D-13. Simulation of U.S. Highway 93 crossing over rail line in view north-northeast from key observation point 6.

Figure D-14. Simulation of train on rail line at U.S. Highway 93 crossing over rail line in view north-northeast from key observation point 6.

Figure D-15. View west from key observation point 7 on U.S. Highway 93 just north of rail line crossing, toward Highland Range and Bennett Pass.

Figure D-16. Simulation of track in view west from key observation point 7.

Figure D-17. Simulation of train close to U.S. Highway 93 in view west from key observation point 7.

Figure D-18. View south from key observation point 8 along U.S. Highway 93 at intersection with State Route 319, toward Big Hogback. Rail line would not be visible in this view.

Figure D-19. View north from key observation point 8 along U.S. Highway 93 at intersection with State Route 319. Photograph taken to show that Cathedral Gorge is not visible from highway here.

Figure D-20. View south from key observation point 9 at Miller Point in Cathedral Gorge Park toward rail alignment location. Rail line would be barely discernible, if visible at all.

Figure D-21. Panorama from northwest to northeast from key observation point 10 on State Route 318, toward location of rail line crossing.

Figure D-22. Simulation of crossing structure and train on rail line in view northwest to northeast from key observation point 10.

Figure D-23. View west toward Timber Mountain and northern Seaman Range from key observation point 11 off county road west of State Route 318 north of rail line crossing. White River visible in foreground.

Figure D-24. Simulation of track in view west from key observation point 11.

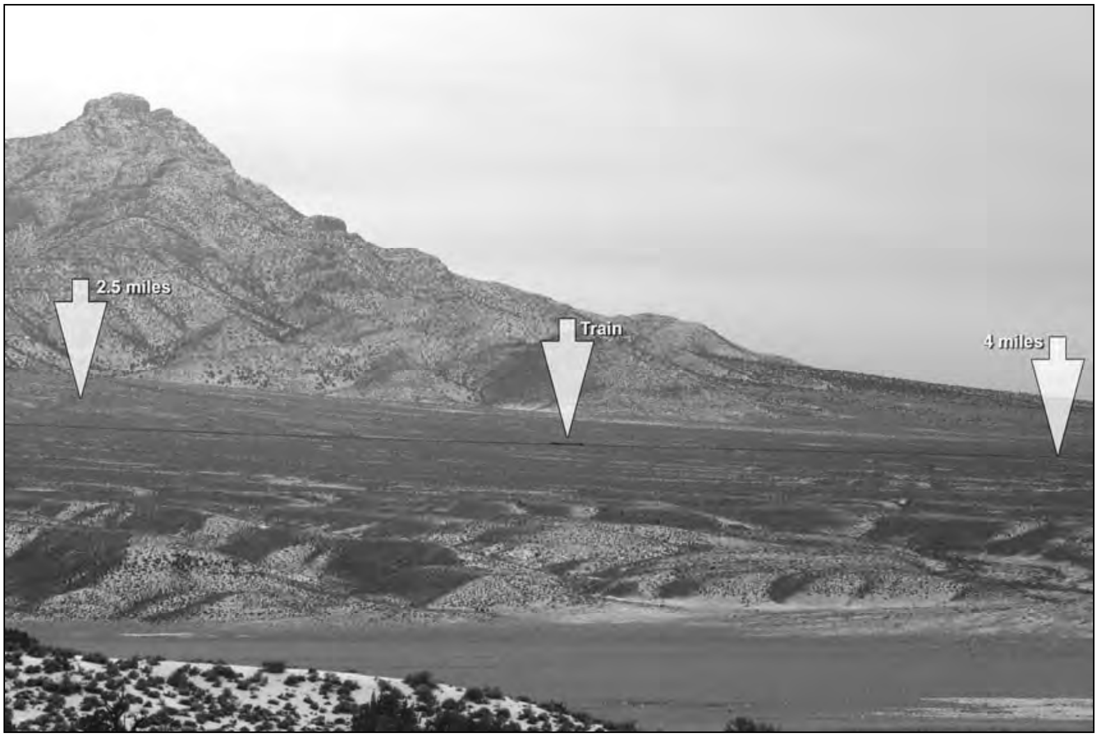

Figure D-25. Simulation of track and train in view west from key observation point 11.

Figure D-26. View east-northeast from key observation point 12 on Timber Mountain Pass Road toward location of rail line crossing. White River visible in right midground.

Figure D-27. Simulation of track and signals at rail line crossing of Timber Mountain Pass Road in view east-northeast from key observation point 12.

Figure D-28. Simulation of train at rail line crossing of Timber Mountain Pass Road in view east-northeast from key observation point 12.

Figure D-29. View northeast from key observation point 13 on a county road in south Garden Valley. Modifications associated with *City* sculpture visible as light band across midground, with trees on a ranch at right.

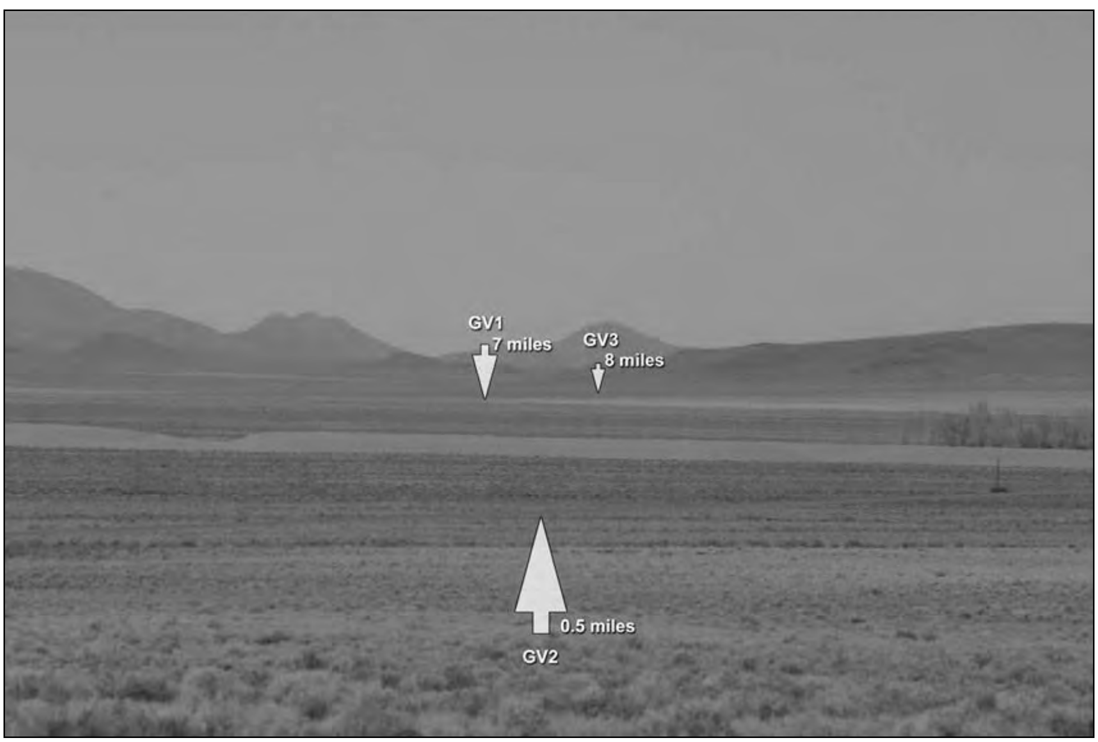

Figure D-30. Simulation from key observation point 13 of track on Garden Valley alternative segment 2 in foreground, Garden Valley alternative segments 1 and 3 in background, coming from east entry to valley. Note simulation of communications tower in right midground along Garden Valley alternative segment 2. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley alternative segment 2.

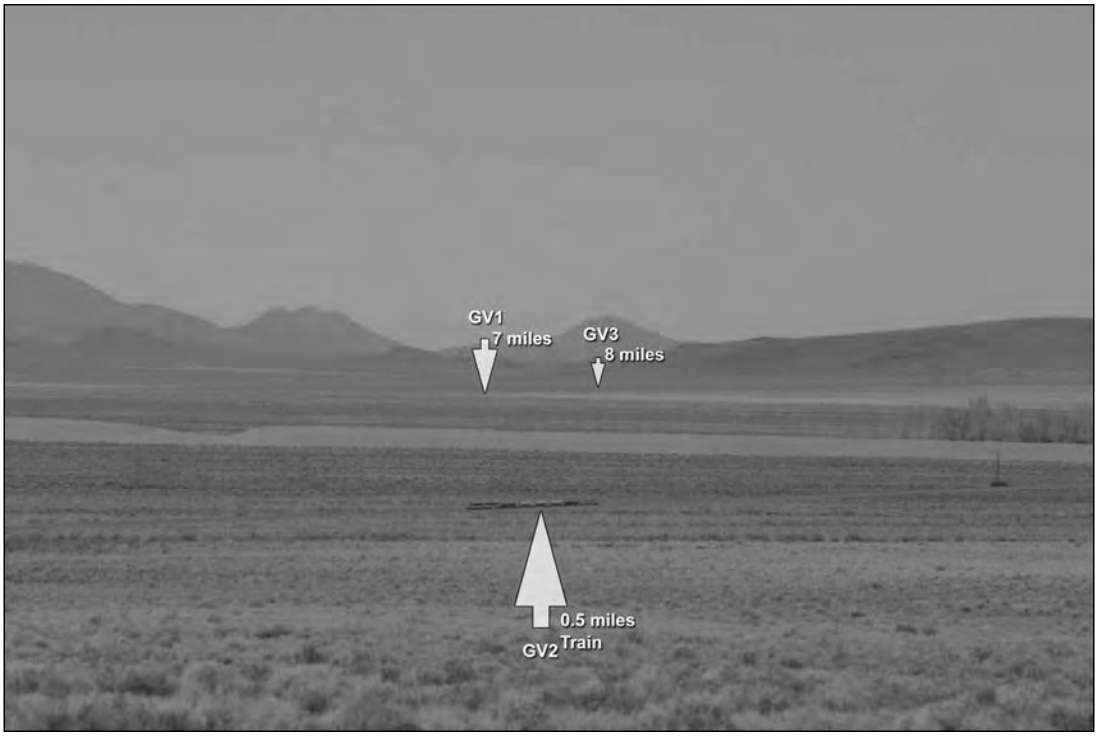

Figure D-31. Simulation of train on Garden Valley alternative segment 2 in view northeast from key observation point 13. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley alternative segment 2.

Figure D-32. View south from key observation point 14 on county road in middle of Garden Valley toward south end of the Golden Gate Range. Tops of some *City* sculpture mounds and ranch visible at left midground.

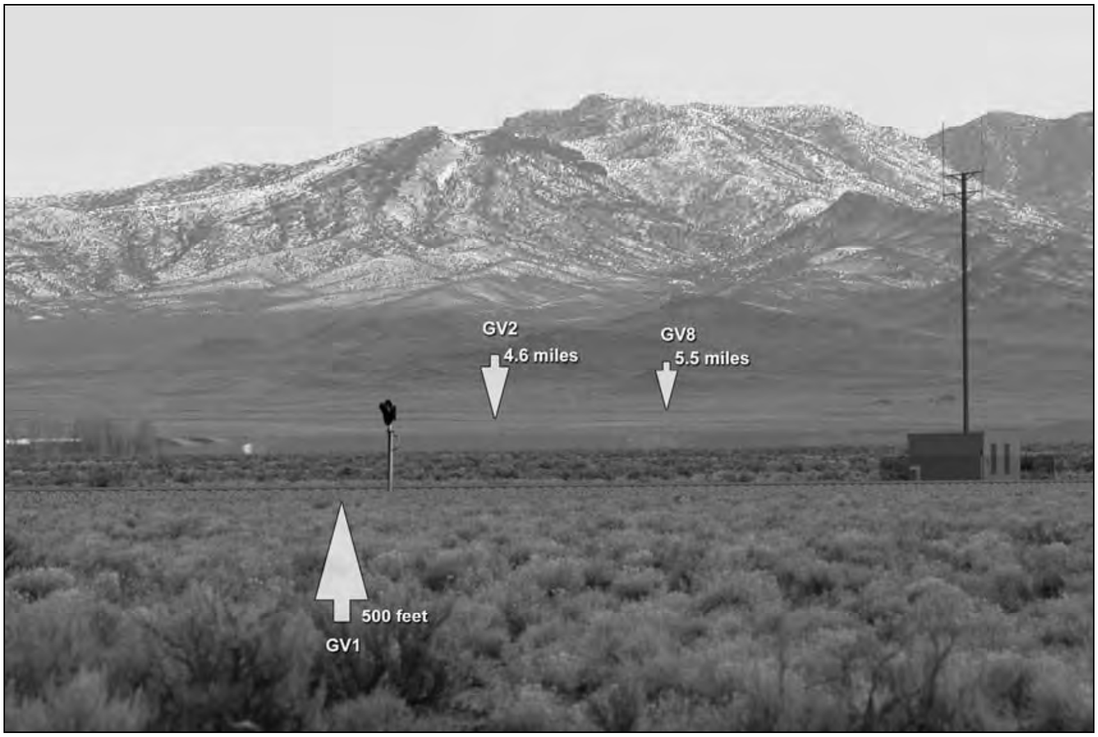

Figure D-33. Simulation from key observation point 14 of track on nearby Garden Valley alternative segment 1, distant Garden Valley alternative segment 2, and more distant Garden Valley alternative segment 8. Note simulation of signal and communication tower along Garden Valley alternative segment 1. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 1.

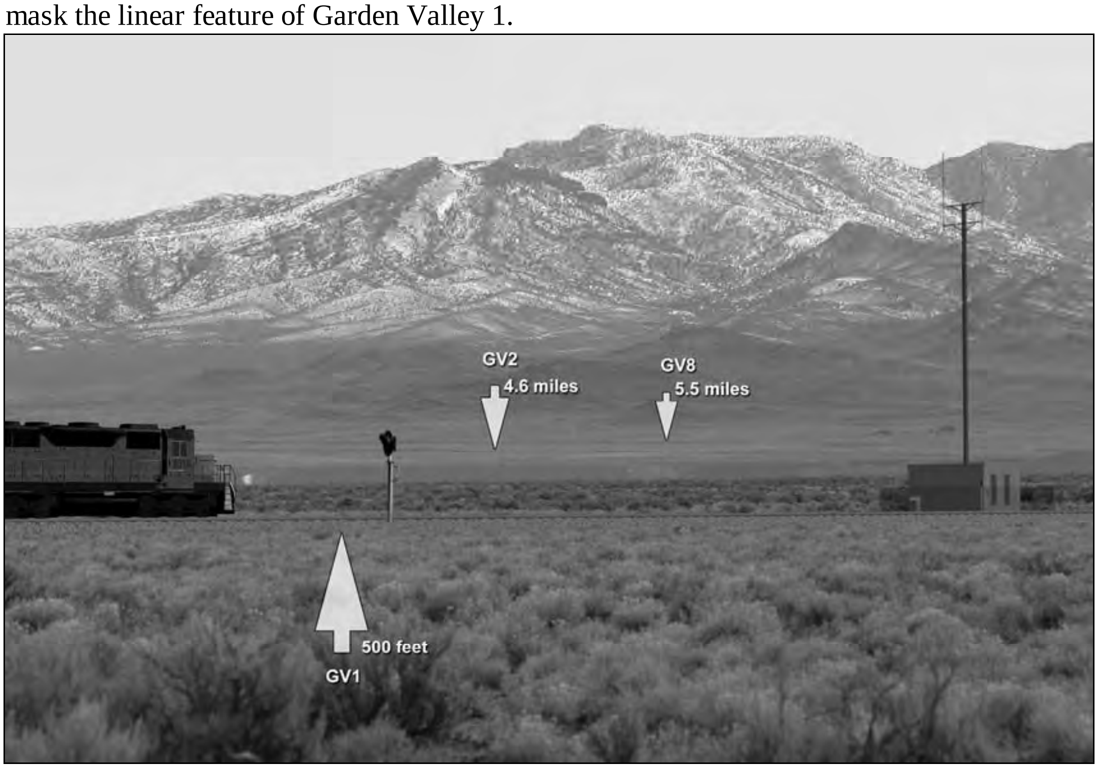

Figure D-34. Simulation of train on Garden Valley alternative segment 1 in view south from key observation point 14. Garden Valley alternative segment 2 and Garden Valley alternative segment 8 in distant midground. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 1.

Figure D-35. View northwest toward Quinn Canyon Range from key observation point 15 on county road south of Garden Valley. Tops of some *City* sculpture mounds visible in midground, ranch in right midground.

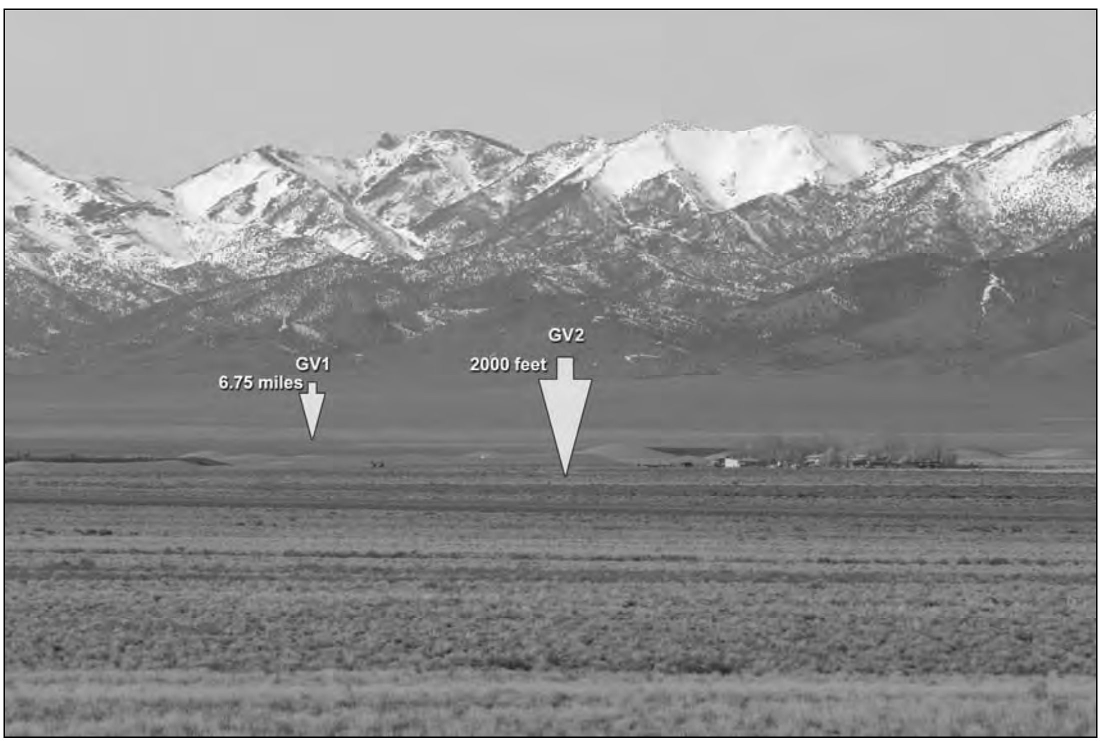

Figure D-36. Simulation of track on Garden Valley alternative segment 1 (background) and Garden Valley alternative segment 2 in view northwest from key observation point 15. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 2.

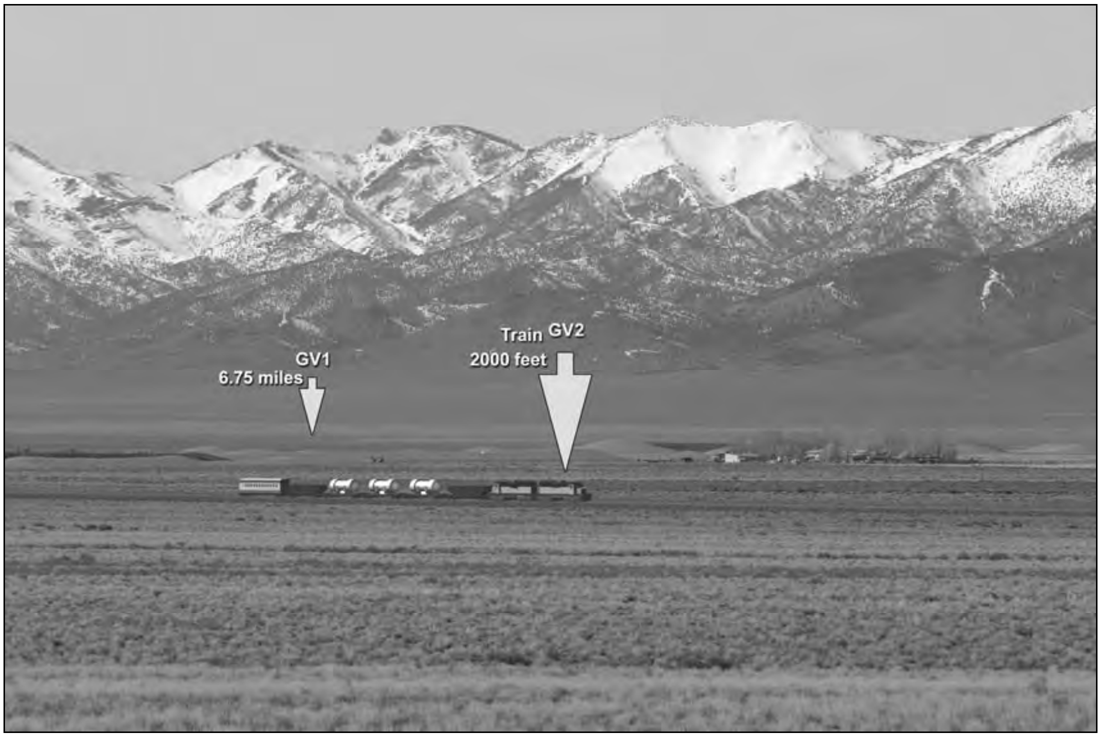

Figure D-37. Simulation of trains on Garden Valley alternative segment 2 (closest to viewer) and Garden Valley alternative segment 1 in view northwest from key observation point 15. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 2.

Figure D-38. View northwest toward the Quinn Canyon Range from key observation point 16 on top of a *City* mound.

Figure D-39. Simulation of track on Garden Valley alternative segment 1 (midground) and Garden Valley alternative segment 3 (background) in view northwest from key observation point 16.

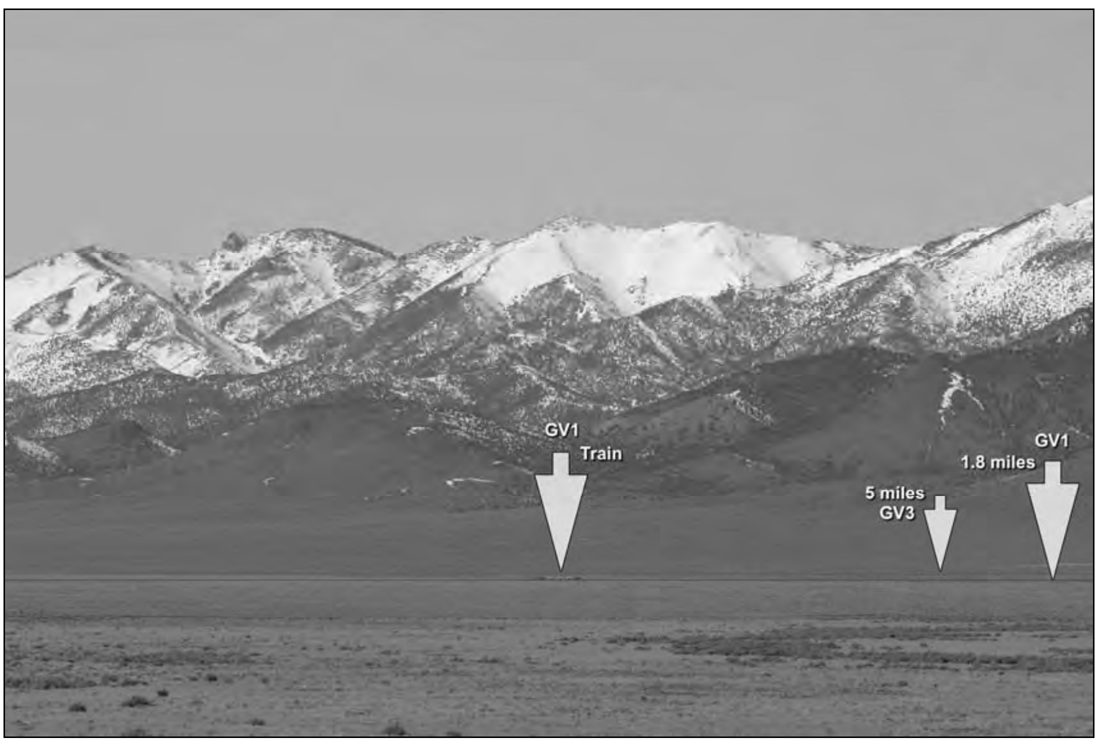

Figure D-40. Simulation of trains on Garden Valley alternative segment 1 and Garden Valley alternative segment 3 in view northwest from key observation point 16.

Figure D-41. View west-southwest from key observation point 16 on top of a *City* mound over Garden Valley between the Worthington and Quinn Canyon Ranges.

Figure D-42. Simulation of track on Garden Valley alternative segment 1 across midground of view, Garden Valley alternative segment 3 more distant, in view west-southwest from key observation point 16. Construction camp would be at greater distance from viewer, off photo on left.

Figure D-43. View southwest toward the Worthington Range from key observation point 17 on top of a *City* mound.

Figure D-44. Simulation of track on Garden Valley alternative segments 2 and 8 in view southwest from key observation point 17. On west side Garden Valley alternative segments 2 and 8 are approximately 1 mile apart; the two simulated tracks are not visible as distinct lines because of the distance and local topography. Instead, the visible line is slightly thicker than it would be if only one alternative segment were shown. The alternative segments merge into a single segment at about the center of the picture.

Figure D-45. View southeast from key observation point 18 on top of a *City* mound toward the Golden Gate Range.

Figure D-46. Simulation of track on Garden Valley alternative segment 2 and Garden Valley alternative segment 8 (more distant) in view southeast from key observation point 18.

Figure D-47. Simulation of train on Garden Valley alternative segment 2 and track on Garden Valley alternative segment 8 (more distant), in view southeast from key observation point 18.

Figure D-48. View slightly north of east from key observation point 18 on top of a *City* mound, toward Water Gap. Note distant scar of Timber Mountain Pass Road over the Seaman Range in left midground.

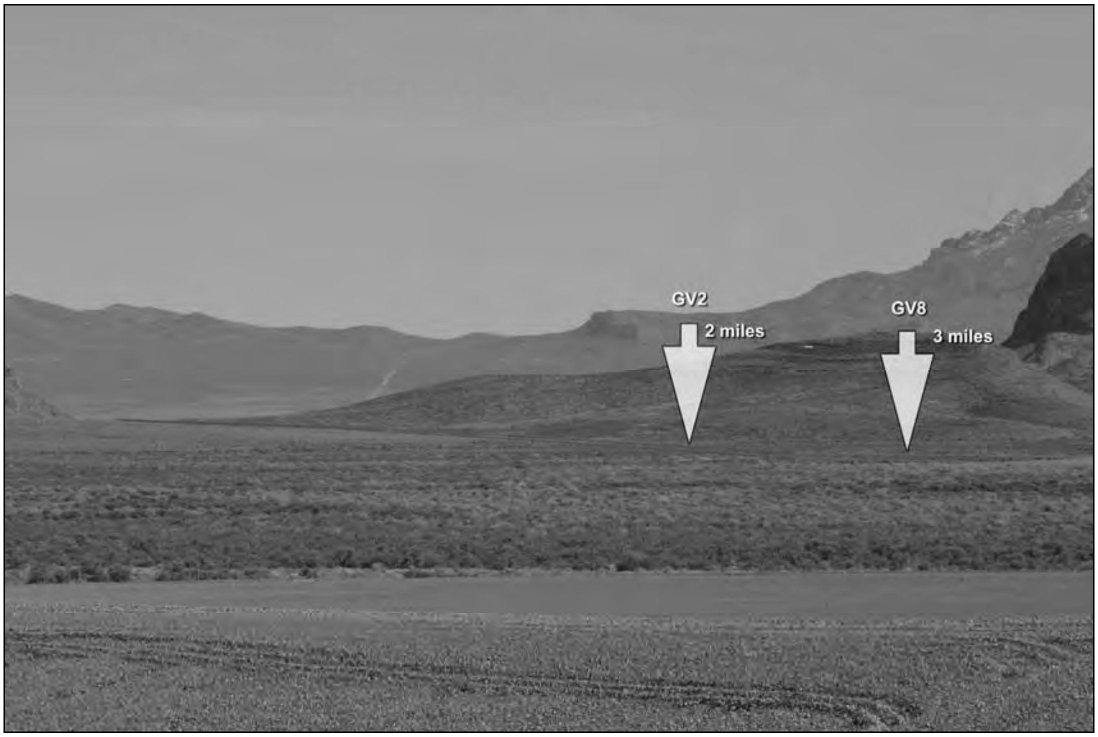

Figure D-49. Simulation of track on Garden Valley alternative segment 2 and Garden Valley alternative segment 8 (more distant) in view slightly north of east from key observation point 18.

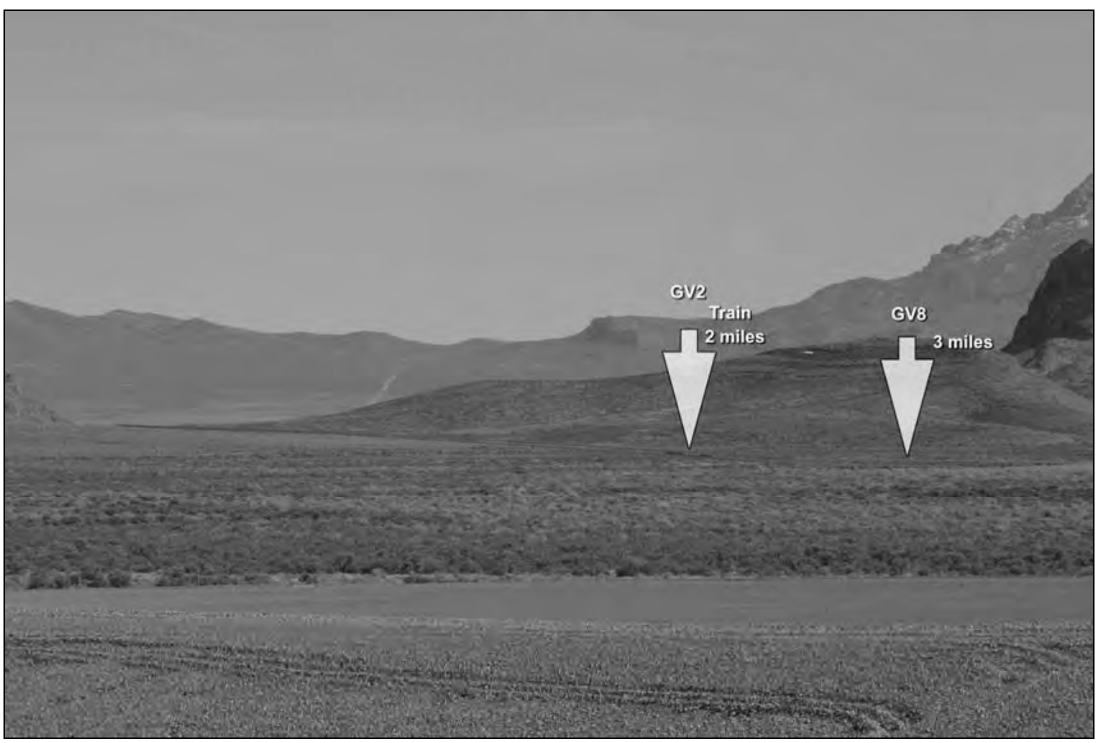

Figure D-50. Simulation of train on Garden Valley alternative segment 2 and track on Garden Valley alternative segment 8 (more distant), in view slightly north of east from key observation point 18.

Figure D-51. View south-southwest from key observation point 19 on State Route 375 near rail line crossing.

Figure D-52. Simulation of track and construction camp in view south-southwest from key observation point 19.

Figure D-53. View northeast from key observation point 20 at Cedar Pipeline Ranch. Quinn Canyon Range in center and right background; cone in center midground is Black Top.

Figure D-54. Simulation of track in view northeast from key observation point 20.

Figure D-55. View south from key observation point 21 on State Route 375 near intersection with U.S. Highway 6. View shows Reveille Valley with Kawich Range in middle ground. Rail line would be too distant to be seen in this view.

Figure D-56. View southwest from key observation point 22 on U.S. Highway 6 near intersection with State Route 375 toward the Kawich Range.

Figure D-57. Simulation of train in view from key observation point 22. As noted on photograph, much of the rail line would be obscured by topography from this viewpoint.

Figure D-58. View south-southwest from key observation point 23 on U.S. Highway 6 on east side of Warm Springs Summit.

Figure D-59. Simulation of track in view south-southwest from key observation point 23. Note simulation of signal in left midground, communications tower in right midground. Power poles are not simulations.

Figure D-60. Simulation of train in view south-southwest from key observation point 23. Note simulation of signal in left midground, communications tower in right midground. Power poles are not simulations.

Figure D-61. View east-southeast from key observation point 24 on Highway 6 toward the Kawich Range at Warm Springs Summit.

Figure D-62. Simulation of rail line in view east-southeast from key observation point 24. Track would be in a cut at this location so viewers would not see it, but the line of the cut would be discerned behind and roughly paralleling the power poles.

Figure D-63. View southeast from key observation point 25 on U.S. Highway 6 toward the Kawich Range. Highway visible on left, road to Clifford mine visible as snow track in center and right. Track would be in a cut at this location so viewers would not see it.

Figure D-64. View east-northeast toward the Kawich Range from key observation point 26 on Test and Training Range Road near location of rail line crossing.

Figure D-65. Simulation of track in view east-northeast from key observation point 26.

Figure D-66. View east-northeast toward the Kawich Range from key observation point 27 on Test and Training Range Road near location of rail line crossing. Reed's Ranch visible in center midground.

Figure D-67. View southwest toward Pilot Peak from key observation point 28 on U.S. Highway 6. Rail line would be approximately two thirds of the distance between viewer and mountains.

Figure D-68. View east-northeast from key observation point 29 north of Goldfield on U.S. Highway 95. Activities and facilities at possible quarry in hills at right side of photo could be seen but would not attract attention.

Figure D-69. View south-southeast from key observation point 30 at north end of Goldfield on U.S. Highway 95.

Figure D-70. Simulation of track on Goldfield alternative segment 4 in view from key observation point 30. Distance and topography would obscure much of the rail line.

Figure D-71. View south-southeast from key observation point 31 on U.S. Highway 95 south of Goldfield.

Figure D-72. Simulation of Goldfield alternative segment 4 crossing over U.S. Highway 95 in view south-southeast from key observation point 31.

Figure D-73. Simulation of train on Goldfield alternative segment 4 in view south-southeast from key observation point 31.

Figure D-74. View east toward Stonewall Mountain from key observation point 32 on U.S. Highway 95 at intersection with State Route 266.

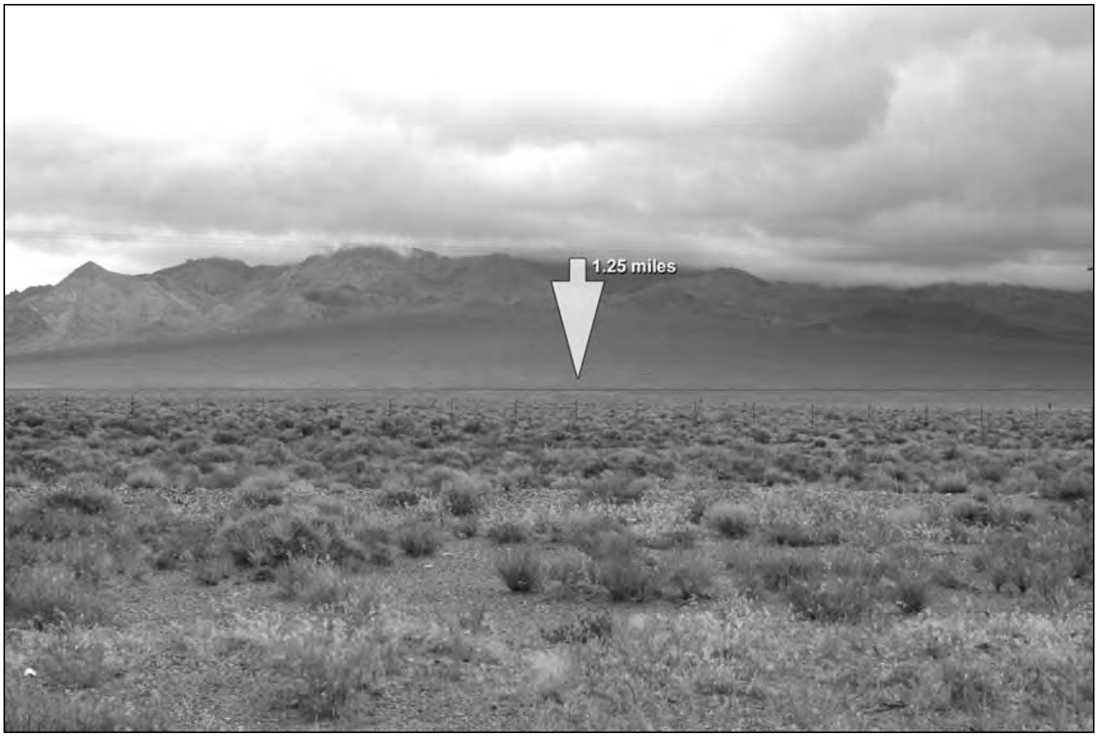

Figure D-75. Simulation of track in view east from key observation point 32. Stonewall Mountain in background.

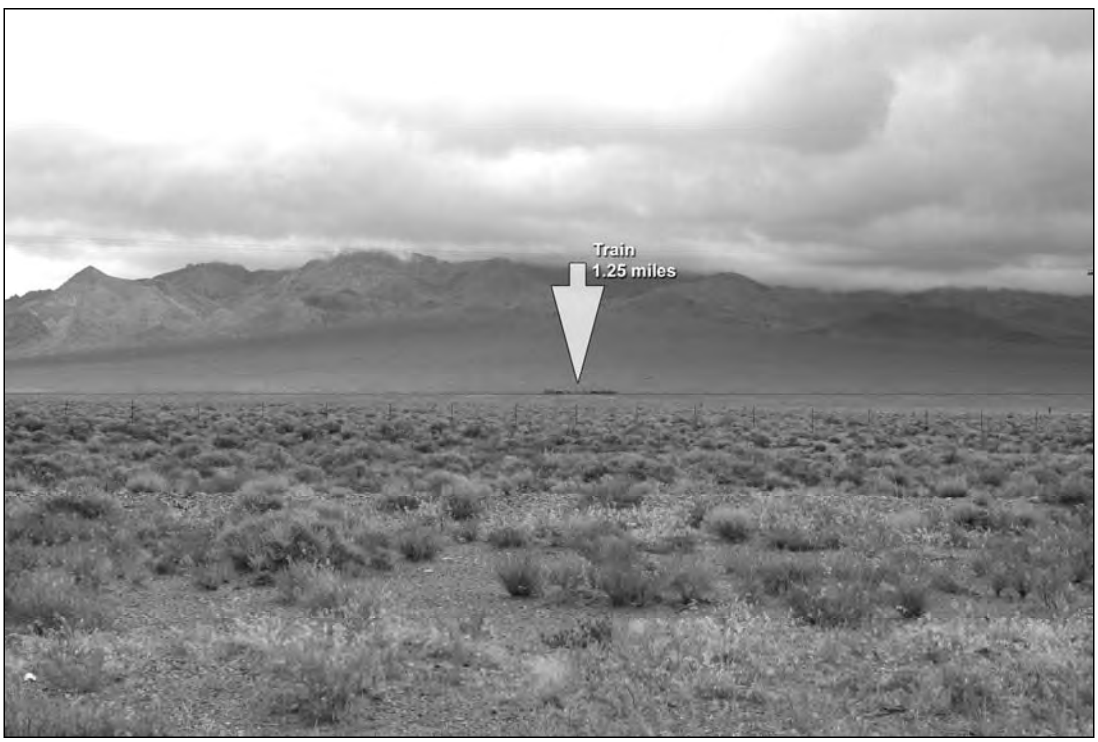

Figure D-76. Simulation of train in view east from key observation point 32. Stonewall Mountain in background.

Figure D-77. View north-northeast from key observation point 33 on U.S. Highway 95 at intersection with State Route 267. Rail line would be several miles in the distance.

Figure D-78. View southeast from key observation point 34 on U.S. Highway 95. Cut would remove lower slope at far right to keep rail line on flat grade.

Figure D-79. View north from key observation point 34 on U.S. Highway 95 toward same cut location shown in Figure D-78. Cut would remove lower slope at far left to keep rail line on flat grade.

Figure D-80. View north-northeast from key observation point 35 on U.S. Highway 95 across a typical landscape. This most northerly of views from this point across the Amargosa River Valley toward Oasis Valley is where the rail line would be closest to the highway.

Figure D-81. View northeast from key observation point 36 on U.S. Highway 95 looking across the road that would be used for construction access to Beatty Wash. Rail line, bridge, and construction camp would not be visible from this point.

Figure D-82. View northeast from key observation point 37 on U.S. Highway 95.

Figure D-83. Simulation of Maintenance-of-Way Headquarters Facility in view northeast from key observation point 37 on U.S. Highway 95.

D.2 Mina Rail Alignment

This section provides photographs taken from key observation points along the Mina rail alignment. For some views, DOE has added simulations to the baseline photographs to show how track, trains, or facilities would appear. Figure D-84 shows the locations of the key observation points and the BLM visual resource management classifications of the lands in the viewsheds. Key observation points 31 through 36 are the same as those shown in Section D.1 for the Caliente rail alignment.

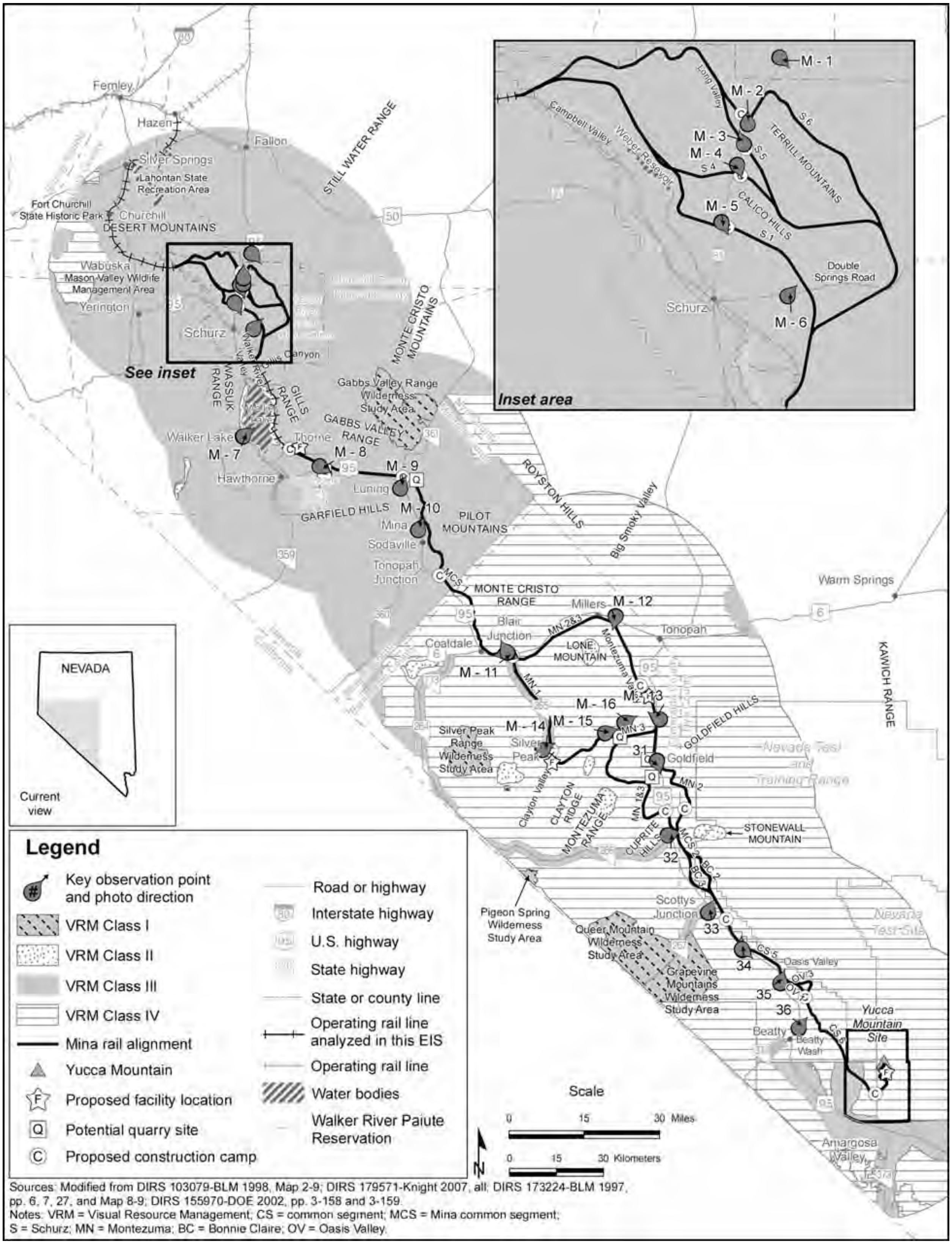

Figure D-84. Visual resource management classifications and key observation points along the Mina rail alignment.

Figure D-85. View southeast from key observation point M-1 on U.S. Highway 95 toward location of Schurz alternative segment 6 against hills.

Figure D-86. Simulation of Schurz alternative segment 6 across Rawhide Flats southeast from key observation point M-1 on U.S. Highway 95.

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Figure D-88. View northeast from key observation point M-2 on U.S. Highway 95 toward location of Schurz alternative segment 6 and rail-over-road crossing.

Figure D-89. Simulation of Schurz alternative segment 6 and grade-separated crossing of U.S Highway 95, view northeast from key observation point M-2.

Figure D-90. Simulation of train on Schurz alternative segment 6 and grade-separated crossing of U.S Highway 95, view northeast from key observation point M-2.

Figure D-91. View north in Long Valley, toward location of proposed grade-separated crossing of U.S. Highway 95 over Schurz alternative segment 5 from key observation point M-3.

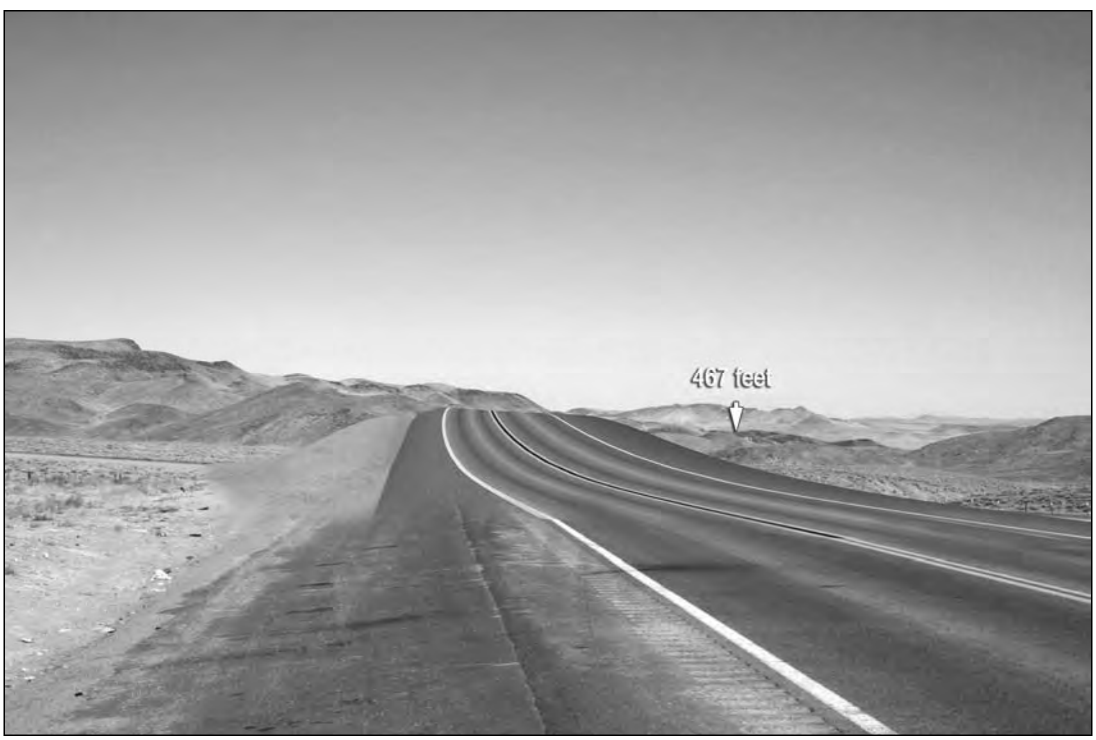

Figure D-92. U.S. Highway 95 in Long Valley, simulation of grade-separated crossing of U.S. Highway 95 over Schurz alternative segment 5 from key observation point M-3.

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Figure D-100. View east from key observation point M-7 in the town of Walker Lake across lake toward existing Department of Defense Branchline South. Photo shows the visibility of the existing line at distance of 9.3 kilometers (5.8 miles).

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Figure D-117. View east from key observation point M-15 on Silver Peak Road toward location of Montezuma alternative segment 1 and North Clayton quarry.

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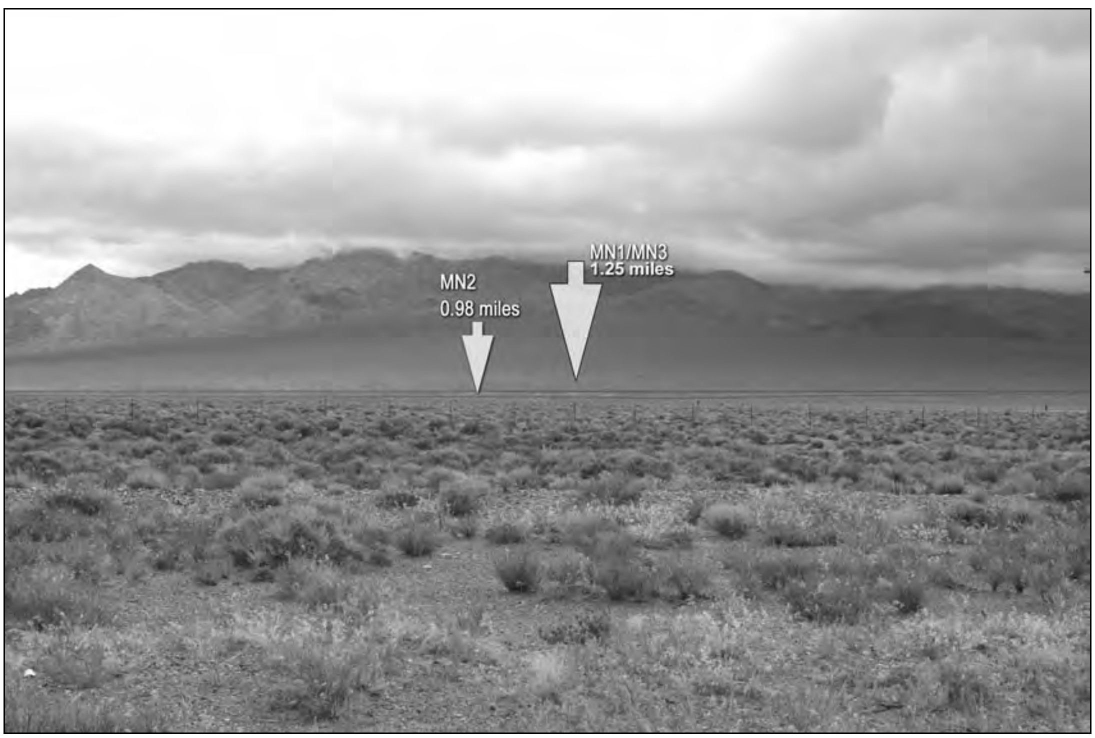

Figure D-123. Simulation of Montezuma alternative segments 1 and 3 (middleground) and Montezuma alternative segment 2 (foreground) in view east from key observation point 32. Stonewall Mountain in background.

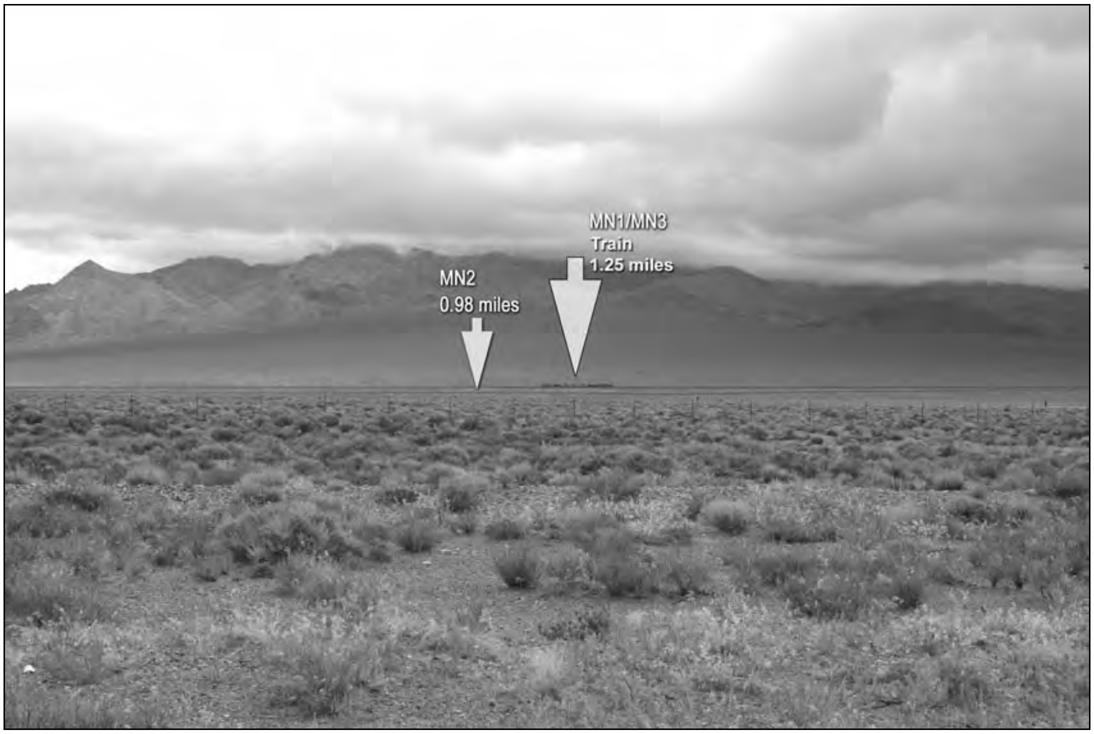

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Figure D-129. View northeast from key observation point 36 on U.S. Highway 95 looking across the road that would be used for construction access to Beatty Wash. Rail line, bridge, and construction camp would not be visible from this point.

D.3 References

173052	BLM 1984	BLM (Bureau of Land Management) 1984. 8400 - Visual Resource Management, BLM Manual. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050406.0039.
101505	BLM 1986	BLM (Bureau of Land Management) 1986. Visual Resource Inventory. BLM Manual Handbook 8410-1. Washington, D.C.: U.S. Bureau of Land Management. ACC: MOL.20010730.0378.
173053	BLM 1986	BLM (Bureau of Land Management) 1986. Visual Resource Contrast Rating, BLM Manual Handbook 8431-1. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050406.0040.

APPENDIX E

AIR QUALITY ASSESSMENT METHODOLOGY

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ACRONYMS AND ABBREVIATIONS

CO	carbon monoxide
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
PM_{10}	particulate matter with an aerodynamic diameter equal to or less than 10 micrometers
$PM_{2.5}$	particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers
SO_2	sulfur dioxide
VOCs	volatile organic compounds

APPENDIX E

AIR QUALITY ASSESSMENT METHODOLOGY

This appendix describes the methods DOE used to develop the assessments of potential impacts to air quality provided in Sections 4.2.4 and 4.3.4 of the Rail Alignment EIS.

Section **E.4** defines terms shown in ***bold italics***.

This appendix provides detail on the basis for:

- The air quality modeling methodology for construction and operation of the proposed railroad
- The emission inventory as used in the air quality modeling and for the county-level emission inventory comparison
- Site-specific details on the air quality modeling employed for each location where the U.S. Department of Energy (DOE or the Department) performed an assessment

Section E.1 is an overview of the air quality modeling methodology and assumptions; Section E.2 addresses the Caliente rail alignment; and Section E.3 addresses the Mina rail alignment.

E.1 Overview of Air Quality Modeling Methodology and Assumptions

This section describes the general approach DOE used to model potential impacts to existing ***ambient air*** quality that would result from emissions during railroad construction and operations along the Caliente rail alignment or the Mina rail alignment.

Air quality is generally a regional issue, and compliance with federal and state air quality standards is most often determined at the county level. Historic data on pollutant emissions inventories and compliance status for the State of Nevada are calculated at the county level, and these provide the best means of comparison to the potential impacts from proposed railroad construction and operations. Therefore, the air quality assessment considered impacts associated with increases in total emissions levels and compliance with regulatory standards at the county level.

However, stationary point sources (such as quarries) and mobile sources of air emissions (such as operating trains and automobiles) can subject certain locations, such as population centers (known as receptors), to higher localized levels of pollutants than a regional analysis would suggest. Therefore, DOE also selected more focused study locations within the region of influence in which to model air quality impacts to specific receptors. The Department modeled potential impacts to air quality using the U.S. Environmental Protection Agency (EPA) ***AERMOD*** Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all). Model inputs included (1) the estimated air pollutant emissions rates that would be produced by railroad construction and operations activities and (2) local meteorology, where appropriate.

DOE modeled a set of scenarios for the Caliente rail alignment and a set for the Mina rail alignment, in which each combination of location and activity represents one scenario. Generally, the methodology employed to determine potential impacts from air emissions for a scenario involved the following steps:

1. Determine the appropriate air pollutant emissions rates from all facilities in question at the given location.

2. Set up the modeling scenarios in AERMOD to accurately represent the expected layout of emissions sources and position receptors to capture the maximum expected impact from the scenario, including terrain effects on concentration.
3. Obtain at least 3 years of appropriate meteorological inputs for the modeling scenario.
4. Run the model for 3-year periods for the given scenario with unit values (1 gram per second) for emission rates from all sources.
5. Post-process the model output to adjust the unit emission rates for the actual emission rates for each pollutant from each source and determine peak concentrations for all air pollutants of concern and for all averaging periods.
6. Combine the peak and background concentrations and compare them with the applicable ***National Ambient Air Quality Standards*** (NAAQS) to determine if the scenario would have the potential to exceed the NAAQS.

DOE based the air quality modeling effort on the following:

- Emissions from all construction activities involving surface disturbance, laying track, and other processes would have a release height of 0.5 meter (1.6 feet), representing a typical exhaust height, with a initial vertical dimension of 0.46 meter (1.5 feet) to reflect surface or near-surface releases. Emissions from locomotives would have a release height of 5 meters (16 feet) (DIRS 173568-California Environmental Protection Agency 2004, Appendix G) with an initial vertical dimension of 2.3 meters (7.5 feet).
- DOE modeled construction and operations activities along the rail line and rail sidings as volume sources because those emissions would have both a horizontal and a vertical dimension associated with the train stacks and buoyant plumes. Modeling the highly linear rail line as a volume source best represents the initial shape of the plume. The Department modeled activities during quarry operations as area sources to maximize flexibility in source shape and orientation.
- DOE determined maximum air pollutant concentrations near construction and operations activities. The Department set the distance between each activity and the closest receptors on both sides of the edge of the construction right-of-way during the construction phase and on both sides of the edge of the operations right-of-way during the operations phase. The spacing between receptors averaged 25 meters along the right-of-way. All receptors were set at a standard breathing height of 1.8 meters (5.9 feet) above ground level.
- For purposes of modeling, DOE took the layout of each facility for the Caliente rail alignment from *Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 01* (DIRS 176168-Nevada Rail Partners 2006, all).
- For purposes of modeling, DOE took the layout of each facility for the Mina rail alignment from *Facilities–Design Analysis Report Mina Rail Corridor, Task 10: Facilities, Rev. 00* (DIRS 180873-Nevada Rail Partners 2007, pp. 3-1 and 3-2).
- Construction activity along the rail alignment and at all facilities would occur for 12 hours per day, 5 days each week for the duration of each activity.
- During the construction phase, quarries would operate evenly over a 250-day per year schedule (average of 5 days per week), 12 hours per day each week. DOE set receptor locations at the quarry fence line (DIRS 175945-Nevada Rail Partners 2005, pp. 3-7 and 3-8; DIRS 176182-Shannon & Wilson 2006, pp. 15 and 33). Spacing between receptors averaged 50 meters along the fence line.
- DOE determined air pollutant concentrations at all receptors for each scenario using the AERMOD dispersion modeling system version 07026 (DIRS 174202-EPA 2002, DIRS 181091-EPA 2004, all;

DIRS 181090-EPA 2007, all). This software is currently the EPA-recommended model for regulatory applications and is appropriate for this application. Meteorological and terrain inputs for AERMOD were prepared with the ***AERMET*** and ***AERMAP*** preprocessors, respectively. Both employ version 06341.

- DOE aggregated the concentration values from each air pollutant source in each scenario and adjusted from unit to actual emission rates. Generally, this procedure operated by reading the individual model output files for each source group in each scenario, summing the contribution from each source group at each receptor and outputting the receptor exhibiting the peak concentration of each air pollutant.
- DOE computed maximum concentrations (along with maximum background concentration) for all sources in each scenario for all ***criteria air pollutants*** and compared these maximums to the Nevada and National Ambient Air Quality Standards.

E.2 Caliente Rail Alignment

The Caliente rail alignment region of influence for air quality and climate consists of the air basins in three counties (Lincoln, Nye, and Esmeralda) in Nevada through which the rail line would run. DOE performed air quality modeling in four locations: the two largest population centers near the Caliente rail alignment (Caliente in Lincoln County and Goldfield in Esmeralda County), and quarry sites northwest of Caliente (CA-8B) and in South Reveille Valley (NN-9B).

For the Caliente rail alignment, the Department modeled a total of eight scenarios, as listed in Table E-1.

Table E-1. Air quality modeling scenarios for railroad construction and operations along the Caliente rail alignment.

Scenario	Activity	Location
1	Rail line construction	Near the City of Caliente (Lincoln County)
2	Facility construction	Interchange Yard in Caliente
3	Rail line construction and quarry operations	Potential quarry site CA-8B northwest of Caliente
4	Rail line construction and quarry operations	Potential quarry site NN-9B in South Reveille Valley (Nye County)
5	Rail line construction	Near Goldfield (Esmeralda County)
6	Railroad operations	Near Caliente
7	Facility operations	Interchange Yard in Caliente
8	Railroad operations	Near Goldfield

E.2.1 CONSTRUCTION IMPACT ASSESSMENT – CALIENTE RAIL ALIGNMENT

E.2.1.1 Overview

DOE assumed a total duration of the construction phase to be the shortest under consideration (4 years), with 36 months of construction and the remaining 12 months allocated to installation, testing of signal and communications equipment, and commissioning. This assumption produced conservative (high) emission estimates, because longer periods of construction would result in lower annual emission rates.

The construction impact assessment included emissions and impacts to air quality associated with the construction of the rail line, access roads, wells, quarries, construction camps, and construction-material storage piles. *Construction Plan Caliente Rail Corridor, Task 14: Construction Planning Support, Rev. 01* (DIRS 176172-Nevada Rail Partners 2006, all) provides more detail on construction and associated emissions.

The construction impact assessment also included emissions and air quality impacts associated with the construction of the Interchange Yard at the Interface with the Union Pacific Railroad Mainline in Lincoln County, which DOE expects would occur during the first year of the rail line construction phase. Details on the activity and emissions at this facility were taken from the *Air Quality Emission Factors and Socio-Economic Model Input Caliente Rail Corridor, Task 13: EIS Interface Support, Rev. 01* (DIRS 180921-Nevada Rail Partners 2007, all) (the Caliente Rail Corridor Task 13 document).

E.2.1.1.1 Exhaust Emissions

DOE based the estimated exhaust emissions associated with construction of the proposed railroad along the Caliente rail alignment on engineering estimates of activity levels for construction crews operating in either rugged or gentle terrain. The Department assumed the use of similar construction equipment in both types of terrain, but assumed that the duration of activities would be longer in rugged terrain. Rugged terrain would require significant cut-and-fill operations.

DOE estimated exhaust emissions consisting of ***nitrogen oxides*** (NO_x), ***particulate matter*** with aerodynamic diameters equal to or less than 10 micrometers (PM_{10}) and 2.5 micrometers ($PM_{2.5}$), ***sulfur dioxide*** (SO_2), ***carbon monoxide*** (CO), and ***volatile organic compounds*** (VOCs) from both non-road and on-road equipment. Non-road equipment would include bulldozers, graders, front-end and backhoe loaders, excavators, scrapers, cranes, compactors, tampers, drills, and other equipment. On-road equipment would include equipment licensed for on-road use that would be used for construction of the proposed railroad (such as pickup, dump, and water trucks).

To determine annual non-road equipment exhaust emissions, DOE used engineering estimates of equipment size, activity levels, annual hours of operation, and horsepower ratings for the construction equipment as reported in the Caliente Rail Corridor Task 13 document. This document included in its analysis an adjustment to operating hours for the cut-and-fill operations. Activity hours for locations assessed as needing considerable cut and fill operations were increased by 50 percent. Emissions factors for corresponding classes of non-road equipment used in construction were conservatively estimated from EPA Tier 1 (typically, 1997 to 2003 model-year equipment) emissions standards based on horsepower ratings from *Exhaust and Crankcase Emissions Factors for Non-road Engine Modeling—Compression-Ignition* (DIRS 174089-EPA 2004, all). Exhaust emissions of NO_x were conservatively converted to ***nitrogen dioxide*** (NO_2) at the rate of 20 percent.

To determine exhaust emissions from on-road equipment, annual operating hours from the Caliente Rail Corridor Task 13 document (DIRS 180921-Nevada Rail Partners 2007, all) were converted to annual miles traveled assuming average operating speeds of 24 kilometers (15 miles) per hour and combined with emissions factors for appropriate vehicle classifications from the EPA MOBILE 6.2 vehicle emission modeling software (DIRS 174201-EPA 2003, all; DIRS 181954-EPA 2007, all; DIRS 181955-EPA 2004, all).

E.2.1.1.2 Fugitive Dust Emissions

DOE estimated particulate-matter emissions from ***fugitive dust*** associated with construction activities along the Caliente rail alignment based on the calculations in the Caliente Rail Corridor Task 13 document (DIRS 180921-Nevada Rail Partners 2007, all). These calculations are based on EPA emission factor guidance from *AP-42, Compilation of Air Pollutant Emission Factors* (DIRS 103679-EPA 1991, Section 13.2.3) and the *WRAP Fugitive Dust Handbook* (DIRS 174081-Countess 2004, Chapters 3, 6, and 9). DOE estimated fugitive dust emissions for soil disturbance from grading, scraping, bulldozing, and other rail line construction activities; wind erosion; construction material stockpiles; construction and operation of concrete batch plants; construction camps; rail line facilities; quarry and excavation activities; and construction of new access roads or upgrades of unpaved roads.

The rail line construction right-of-way would be nominally 150 meters (500 feet) on either side of the centerline of the rail alignment (300 meters [1,000 feet] total width). In addition, the Caliente rail alignment would include:

- Two major bridges (over Beatty Wash and the White River) and a series of minor bridges.
- Twelve construction camps 0.1 square kilometer (25 acres) each.
- Sites for four railroad operations support facilities (the Interchange Yard, Staging Yard, Maintenance-of-Way Trackside Facility, and Rail Equipment Maintenance Yard) that would occupy 0.06 square kilometer, 0.2 square kilometer, 0.06 square kilometer, and 0.4 square kilometer (15, 50, 15, and 100 acres), respectively.
- A total of 23 kilometers (14 miles) of access roads to facilities, plus the access roads on either side of the rail line.
- Four hundred storage piles to be used in track construction that would be located along the rail route.

Fugitive dust emissions would also be associated with the operation of batch plants (including two coarse and fine storage piles), with new road construction or upgrades, and with quarry and excavation operations. In addition to the rail roadbed construction activity, a substantial amount of fugitive dust emissions would be related to haul trucks in the construction zone.

DOE would ensure that best management practices were implemented during construction to minimize air emissions of particulates. These measures typically would include the application of water or other dust suppressants on disturbed land, and limiting vehicle speeds on all unpaved roads. The EPA provides guidance on estimating emissions, including emissions in specific size ranges and information on watering as a dust-control method for unpaved roads (*WRAP Fugitive Dust Handbook* [DIRS 174081-Countess 2004, pp. 3-13 and 3-14] and in AP-42, Section 13.2.2 [DIRS 103679-EPA 1991, all]). The handbook provides additional guidance on the effectiveness of water in suppressing fugitive dust during construction. Emissions-control efficiency ranges from approximately 40 to 85 percent for short durations (DIRS 174084-Piechota et al. 2002, all), depending on meteorology, soil water content, soil type, and other factors. Typical effectiveness values of 70 percent are characteristic of the southwestern

United States (DIRS 174215-Maricopa County 2004) for applications on the order of hours. For realistic estimation of fugitive dust emissions, DOE assumed:

- A 74-percent best management practice reduction for most fugitive dust emission sources (DIRS 174081-Countess 2004, Executive Summary, pp. 3 and 3-14)

Based on operational guidance, DOE assumed all of the following:

- An 84-percent reduction for construction material storage piles (DIRS 174081-Countess 2004, Executive Summary, p. 3)
- A 62-percent reduction for batch plant operations (DIRS 174081-Countess 2004, Table 4-2, p. 4-5)
- A 70-percent reduction for quarry operations (DIRS 174081-Countess 2004, Executive Summary, p. 3)

E.2.1.2 Lincoln County Detail

E.2.1.2.1 Emissions Inventory

DOE based the total emissions expected to occur within Lincoln County from rail line construction along the Caliente rail alignment on the anticipated rail alignment options (common segments and alternative segments) through the county, which range from approximately 132 kilometers (82 miles) to approximately 148 kilometers (92 miles), depending on the route chosen. Lincoln County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction-material storage piles. Emissions from construction activities that would occur only in Lincoln County (for example, construction of the Interchange Yard, specific access roads, and one quarry) were allocated solely to Lincoln County. DOE estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Lincoln County, including construction of the Interchange Yard, for each of the assumed 4 years of construction. The Department determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Lincoln County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.2.1.2.2 Air Quality Modeling

E.2.1.2.2.1 Construction Activity. DOE modeled air quality to determine how construction activities would be likely to impact air pollutant concentrations at Caliente. Modeling included both the rail line and the Interchange Yard. The Department used the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all) for all model runs.

Caliente meteorological data were provided primarily by the Desert Research Institute-operated Community Environmental Monitoring Program. For missing hours in this record, DOE substituted data from the Pioche Community Environment Monitoring Program site (obtained from the Desert Research Institute) and cloud-cover data from McCarran International Airport in Las Vegas. This surface meteorological data represents the best available information for this region, for which meteorological data are sparse. Upper-air data were taken from Elko, Nevada (National Weather Service station 72582). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Elko is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record for 1999, 2000, and 2001 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

In all cases, emission rates were expressed in units of grams per second for the appropriate activity and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year.

DOE modeled the construction of a portion of the Caliente alternative segment that would begin near Caliente and extend to the northwest for 2 kilometers (1.3 miles) through an area of private property near the city. DOE chose this location for the modeling runs because it represents the closest location of the Caliente rail alignment to population centers.

Because the Department would use existing rail line, construction emissions modeled included only the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. This modeling used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). DOE assumed rail line construction would occur at a rate of 260 hours per month (nominally12 hours per day, 5 days per week). The peak result from the model runs was used to determine all averaging periods.

DOE also modeled emissions from construction of the proposed 0.06-square-kilometer (15-acre) Interchange Yard in Caliente. DOE set receptor locations surrounding the proposed Interchange Yard along the public roads that would parallel the Yard. Receptors were set at a standard breathing height of 1.8 meters (5.9 feet) and a release height of 0.5 meter (1.6 feet) was employed to reflect near surface releases from equipment and dust. Construction activities would include surface work, laying track, and building structures for the Interchange Yard. DOE assumed construction of the Interchange Yard would occur at an average rate of 260 hours per month (nominally 12 hours per day, 5 days per week).

E.2.1.2.2.2 Quarry Activity. DOE also performed air quality modeling to estimate air pollutant concentrations resulting from activity at potential quarry site CA-8B northwest of the City of Caliente (DIRS 175945-Nevada Rail Partners 2005, all). All modeling was performed using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

Caliente meteorological data was provided primarily by the Desert Research Institute-operated Community Environmental Monitoring Program. For missing hours in this record, DOE substituted data from the Pioche Community Environment Monitoring Program site (obtained from the Desert Research Institute) and cloud-cover data from McCarran International Airport in Las Vegas. This surface meteorological data represents the best available information for this region, for which meteorological data are sparse. Upper-air data were taken from Elko, Nevada (National Weather Service station 72582). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Elko is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record for 1999, 2000, and 2001 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

DOE calculated emissions for each of the assumed 3 years of quarry operation, including emissions associated with construction of the quarry facilities during the first year of the construction phase. Emissions included those from the quarry, plant, railroad siding, and access roads. All sources were taken as surface-based releases. Annual emissions were distributed evenly over a 250-day-per-year work schedule (average of 5 days per week), operating between 6:00 a.m. and 6:00 p.m. Receptor locations were set at the fence line surrounding the potential quarry and at a standard breathing height of 1.8 meters (5.9 feet).

Next DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations of each air pollutant at all receptors over all 3 years of meteorological data. Therefore, the analysis approach represents a conservative estimate of air pollutant concentrations.

E.2.1.3 Nye County Detail

E.2.1.3.1 Emissions Inventory

The total emissions expected to occur within Nye County from construction of the proposed rail line along the Caliente rail alignment was based on the proposed rail alignment options (common segments and alternative segments) through the county, which range from 342 kilometers (213 miles) to 398 kilometers (247 miles). Nye County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction material storage piles. Emissions from construction activities that would occur only in Nye County (for example, the Maintenance-of-Way Trackside Facility and construction and operation of one quarry and facility access roads) were allocated solely to Nye County. DOE estimated exhaust and fugitive dust emissions that would be attributable to rail line construction and associated facility construction activity in Nye County for each of the assumed 4 years of construction. The highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase were used in subsequent analysis.

E.2.1.3.2 Air Quality Modeling

E.2.1.3.2.1 Quarry Activity. DOE also performed modeling to determine potential impacts to air quality associated with construction-related activity at proposed quarry site NN-9B in South Reveille Valley (DIRS 175945-Nevada Rail Partners 2005, Appendix B, pp. B-11, B-12, and B-34 through B-37). All model runs were made using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090 - EPA 2007, all).

For surface meteorological data, DOE relied primarily on the nearby Tonopah Nevada National Weather Service site because of the availability of complete hourly weather data, including cloud-cover data. DOE also used matching upper-air meteorological data from the National Weather Service Mercury/Desert Rock site as model input. DOE was able to assemble a complete 4-year meteorological record for 1989, 1990, 1991, and 1992 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

DOE calculated air pollutant emissions for each of the assumed 3 years of quarry operation associated with construction of the rail line, which included emissions associated with the construction of the quarry facilities during the first year of the construction phase. DOE then modeled the peak annual emissions from activity inside the facility, including the quarry, plant, railroad siding, and access road as area sources. All sources were taken as surface-based releases. Annual emissions were distributed evenly over a 250-day-per-year work schedule (average of 5 days per week), operating between 6:00 a.m. and 6:00 p.m. Receptor locations were set at the fence line surrounding the potential quarry and at a standard breathing height of 1.8 meters (5.9 feet).

DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations of each air pollutant at all receptors over all 4 years of meteorological data. Therefore, the analysis approach represents a conservative estimate of air pollutant concentrations.

E.2.1.4 Esmeralda County Detail

E.2.1.4.1 Emissions Inventory

The total emissions expected to occur within Esmeralda County from rail line construction along the Caliente rail alignment are based on the anticipated rail alignment options (common segments and alternative segments) through the county, which range from 22 kilometers (14 miles) to 44 kilometers (27 miles). Esmeralda County was allocated the fraction of total emissions that would result from rail line construction, alignment access-road construction, well construction, and construction-material storage piles. DOE estimated exhaust and fugitive dust emissions that would be attributable to rail line construction and associated facility construction activity in Esmeralda County for each of the assumed 4 years of construction. The highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase were determined.

E.2.1.4.2 Air Quality Modeling

DOE modeled air quality to determine the impact of emissions from construction of a segment of the rail alignment (Goldfield alternative segment 4; see Figure 2-9 in Chapter 2 of this Rail Alignment EIS) passing near Goldfield extending for 4.7 kilometers (2.9 miles) near the town. DOE selected Goldfield alternative segment 4 as the most conservative alignment in relation to proximity to population and the exposure to emissions from construction of the rail line. All modeling runs were made using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE used surface meteorological data from the Tonopah Nevada National Weather Service site in the analysis because of the complete hourly weather data, including cloud-cover data. DOE used matching upper-air meteorological data from the National Weather Service Mercury/Desert Rock site in the modeling effort. DOE was able to assemble a 4-year meteorological record for 1989, 1990, 1991, and 1992 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

In all cases, an appropriate emissions rate was determined with units of grams per second or grams per second per square meter for the appropriate activity, and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year. In addition to the receptors placed alongside the construction and permanent operation rights-of-way, DOE also placed five key receptors at locations within Goldfield. These include the tanks west of Goldfield alternative segment 4, the School Bus Maintenance Facility east of the alignment, and three houses east of the alignment at the periphery of the town nearest the alignment. DOE determined pollutant concentrations at each of these locations in addition to those at the rights-of-ways to indicate potential project impact at key locations in addition to the overall maximum impact at any location along the modeling domain.

DOE modeled construction emissions in two phases. The first phase modeled the emissions associated with construction activities, including surface disturbance, laying track, and other processes with a release height of 0.5 meter (1.6 feet) to reflect surface or near-surface releases from equipment activity. This represented the initial portion of rail line construction. For the second modeling phase, DOE modeled the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. This modeling used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). For both model runs, DOE assumed rail line construction would occur at a rate of 260 hours per month. The highest year results from the two model runs were combined for the annual average to estimate the peak annual average concentration. For the shorter-term averages the higher concentration was reported from each of these phases because the track construction and the subsequent ballast deliveries would not occur simultaneously.

E.2.2 RAILROAD OPERATIONS IMPACT ASSESSMENT – CALIENTE RAIL ALIGNMENT

E.2.2.1 Overview

The operations impact assessment included estimating emissions and potential impacts to air quality associated with operation of the rail line and railroad operations support facilities.

E.2.2.1.1 Emissions from Rail line Operation

Spent nuclear fuel and high-level radioactive waste would be transported along the rail line sealed in rail casks. Each DOE cask car would have a gross weight as high as 240 metric tons (264 tons); naval cask cars would weight as much as 355 metric tons (390 tons). The railroad would operate for up to 50 years. DOE would use two to three 4,000-horsepower, diesel/electric locomotives with a maximum weight of approximately 180 metric tons (198 tons) when fully fueled and ready for use to transport the spent nuclear fuel and high-level radioactive waste.

Emissions associated with railroad operations would be related to the weight of the trains and their frequency. To conservatively estimate emissions, each train trip was assumed to operate with the nominal number of three cask cars per trip, but with the maximum number of locomotives and peak activity along the rail line. This estimate results in a total of six train cars (one escort car, three cask cars, and two buffer cars) plus the maximum number of three locomotive engines per trip, with an equal number returning unloaded each week.

DOE expects that train shipments to the repository would peak around 2013 to 2036 (DIRS 176173-Nevada Rail Partners 2006, Table 1, p. 4-2). At that time, there would be eight one-way cask train trips per week, in addition to the other trains anticipated to operate on the rail line. Other trains would include those needed for fuel-oil, repository construction, and maintenance-of-way trains. DOE expects the total rail traffic on the rail line during the peak year would average 17 one-way trips per week (DIRS 175036-BSC 2005, Table 4-2). DOE made the most conservative estimate of activity along the rail line by assuming this activity level throughout the life of the project. DOE then estimated emissions from railroad operations by combining this activity level with estimates of the weight and fuel consumption of the train and appropriate emission factors (DIRS 174085-Sierra Research 2004, pp. 6 and 18), and then dividing the emissions among the counties in which the railroad would operate. Although the level of activity would remain constant, because locomotive emission rates generally are expected to decrease throughout the life of the project due to improvement in emission control technologies, total emissions could decrease over the life of the project.

To assess the impact to air quality from railroad operations emissions near Goldfield (in Esmeralda County) and Caliente (in Lincoln County), DOE modeled air quality using the EPA AERMOD Version 07026 model (DIRS 174202 -EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all). In this assessment, a portion of the alternative segments that would pass nearest the two communities were modeled using local meteorological data. To assess the significance of potential impacts to air quality, comparisons were made with the applicable Nevada and National Ambient Air Quality Standards.

E.2.2.1.2 Emissions from Facility Operations

The operations impact assessment also included emissions and potential impacts to air quality associated with operation of the Interchange Yard in Lincoln County. Other facilities would have similar or smaller operations or would be too distant from public access; therefore, their potential to impact air quality would be low.

DOE treated operations at the Interchange Yard as continuous throughout the life of the proposed railroad. Details on the activity and emissions at these facilities were taken from the Caliente Rail Corridor Task 13 document (DIRS 180921-Nevada Rail Partners 2007, Appendix C) and *Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 01* (DIRS 176168-Nevada Rail Partners 2006, all).

E.2.2.2 Lincoln County Detail

E.2.2.2.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Lincoln County from railroad operations on the possible rail alignments through the county (common segments and alternative segments), which range from approximately 132 kilometers (82 miles) to approximately 148 kilometers (92 miles) depending on the route chosen. Lincoln County was allocated the fraction of total emissions arising from railroad operations. Emissions from facility operations that would occur only in Lincoln County (operation of the Interchange Yard) were allocated solely to Lincoln County. Exhaust emissions attributable to operation of the railroad were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Lincoln County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.2.2.2.2 Air Quality Modeling

A portion of the Caliente alternative segment begins near Caliente and extends to the northwest for 1 kilometer (0.62 mile) through an area of private property near the city. DOE performed air quality modeling of the air pollutants released from railroad operations near Caliente using the EPA AERMOD Version 07026 (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2006, all; DIRS 181090-EPA 2004, all) dispersion model.

Caliente meteorological data was provided primarily by the Desert Research Institute-operated Community Environmental Monitoring Program. For missing hours in this record, DOE substituted data from the Pioche Community Environment Monitoring Program site (obtained from the Desert Research Institute) and cloud-cover data from McCarran International Airport in Las Vegas. This surface meteorological data represents the best available information for this region, for which meteorological data are sparse. Upper-air data were taken from Elko, Nevada (National Weather Service station 72582). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Elko is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record for 1999, 2000, and 2001 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

In all cases, DOE determined an appropriate emissions rate representing the average activity of the railroad corresponding to the above-determined total emissions with units of grams per second for the appropriate activity. Operations emissions were modeled with a release height of 5 meters (16 feet) to reflect locomotive emission release height (California Environmental Protection Agency 2004 [DIRS 173568], Appendix G). DOE assumed the railroad would operate 24 hours per day, 7 days per week.

DOE also modeled emissions with AERMOD based on the operation of the Interchange Yard on a 0.06-square-kilometer (15-acre) site in Caliente. Receptor locations were set surrounding the Interchange Yard along the public roads, which would parallel the Yard. Operations activities would include locomotive switcher and truck operations. DOE assumed the facility would operate 24 hours per day, 7 days per week. Appropriate emissions rates were determined that represented this average activity profile.

DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations from all receptors for each model year.

E.2.2.3 Nye County Detail

E.2.2.3.1 Emissions Inventory

DOE estimated total emissions that would be associated with operation of the railroad through Nye County using the same procedure as previously described for Lincoln County. The anticipated routes through Nye County range from 342 kilometers (213 miles) to 398 kilometers (247 miles).

The analysis compares operations-related emissions with 2002 Nye County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.2.2.3.2 Air Quality Modeling

Because none of the Caliente rail alignment alternative segments or common segments would pass near a community in Nye County, DOE did not perform any air quality modeling for proposed railroad operations.

E.2.2.4 Esmeralda County Detail

E.2.2.4.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Esmeralda County from railroad operations on the possible rail alignments (common segments and alternative segments) through the county, which range from approximately 22 kilometers (14 miles) to 44 kilometers (27 miles) depending on route chosen. Esmeralda County was allocated the fraction of total emissions that would result from railroad operations. Exhaust emissions attributable to railroad operations were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Esmeralda County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.2.2.4.2 Air Quality Modeling

DOE performed air quality modeling of the air pollutants that would be released from railroad operations near Goldfield using the EPA AERMOD Version 07026 dispersion model (DIRS 174202 -EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090 -EPA 2007, all). DOE modeled Goldfield alternative segment 4 over a total distance of 4.7 kilometers (2.9 miles) from northwest of the town, through the town, and turning to exit southeast of the town.

As with the Caliente modeling, the general layout was selected to reflect emissions into the area of private property around Goldfield. DOE modeled railroad operations emissions with a release height of 5 meters (16 feet) (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). DOE assumed the railroad would operate 24 hours per day, 7 days per week.

DOE used surface meteorological data from the Tonopah Nevada National Weather Service site in the analysis because of the complete hourly weather data, including cloud-cover data. DOE used matching upper-air meteorological data from the National Weather Service Mercury/Desert Rock site in the modeling. DOE was able to assemble a 4-year meteorological record for 1989, 1990, 1991, and 1992 of hourly data, and these data were preprocessed by AERMET for input into AERMOD. An emissions rate expressed in grams per second was determined to represent the average operation of the trains.

The highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at any receptor were determined for each modeled year.

E.2.3 SHARED-USE OPTION – CALIENTE RAIL ALIGNMENT

Although the Shared-Use Option would require the construction of some additional sidings in Lincoln and Nye Counties, the additional sidings would be placed parallel to existing track and would not require additional roadbed foundation, only laying of track. Given that these activities would result in minimal additional construction-related emissions over those produced under the Proposed Action without shared use, it was not necessary to calculate an annual emissions inventory, or conduct additional air quality modeling to assess construction-related impacts for the Shared-Use Option beyond those already conducted for evaluation of the Proposed Action without shared use.

DOE calculated emissions for the three additional round trips per week of commercial train activity consisting of 20 cars and three locomotives in each of the three counties. The emissions for each county were determined by scaling the total emissions along the Caliente rail alignment by the anticipated range of distances associated with the various possible rail alignment options through each county.

The analysis compares operations-related emissions associated with the Shared-Use Option with each county's 2002 data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO060NEI2002D.000, all).

Emissions would increase marginally beyond those associated with railroad operations without shared use. In turn, the maximum air pollutant concentrations would increase marginally. Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for railroad operations along the Caliente rail alignment under the Shared-Use Option.

E.3 Mina Rail Alignment

The Mina rail alignment region of influence for air quality and climate consists of the five counties (Churchill, Lyon, Mineral, Esmeralda, and Nye) in Nevada through which the rail line would run. The largest population centers near the Mina rail alignment (Schurz, Hawthorne, Mina, and Silver Peak), and quarry sites (Garfield Hills and Malpais Mesa South).

DOE performed air quality modeling in seven Nevada locations along the Mina rail alignment: Schurz, Hawthorne, Garfield Hills, Mina, Silver Peak, Malpais Mesa, and Goldfield. The Department modeled a total of 14 scenarios, as listed in Table E-2.

Table E-2. Air quality modeling scenarios for railroad construction and operations along the Mina rail alignment.

Scenario	Activity	Location
1	Rail line construction	Near Schurz
2	Facility construction	Staging Yard in Hawthorne
3	Rail line construction	Near Hawthorne
4	Quarry operations	Potential quarry site at Garfield Hills
5	Rail line construction	Near Mina
6	Rail line construction	Near Silver Peak
7	Quarry operations	Potential quarry site at Malpais Mesa South
8	Rail line construction	Goldfield
9	Railroad operations	Near Schurz
10	Facility operations	Staging Yard in Hawthorne
11	Railroad operations	Near Hawthorne
12	Railroad operations	Near Mina
13	Railroad operations	Near Silver Peak
14	Railroad operations	Goldfield

E.3.1 CONSTRUCTION IMPACT ASSESSMENT – MINA RAIL ALIGNMENT

E.3.1.1 Overview

DOE assumed a total duration of the construction phase to be the shortest under consideration (4 years), with 36 months of construction and the remaining 12 months allocated to installation, testing of signal and communications equipment, and commissioning. This assumption produced conservative (high) emission estimates, because longer periods of construction would result in lower annual emission rates.

The construction impact assessment included emissions and impacts to air quality associated with construction of the rail line, access roads, wells, and construction material storage piles. *Construction Plan Mina Rail Corridor, Task 14: Construction Plan Mina Rail Corridor, Rev. 00* (DIRS 180875-Nevada Rail Partners 2007, all) provides additional detail on construction and associated emissions.

The construction impact assessment also included emissions and air quality impacts associated with the construction of a Staging Yard at Hawthorne in Mineral County, which DOE expects would occur during the first year of the construction phase. Details on the activity and emissions at this facility were taken from the *Air Quality Emission Factors and Socio-Economic Model Input Mina Rail Corridor, Task 13: EIS Interface Support, Rev. 02* (DIRS 180921-Nevada Rail Partners 2007, Chapters 2 and 3, Appendixes A through C).

E.3.1.1.1 Exhaust Emissions

DOE based the estimated exhaust emissions associated with construction of the proposed railroad along the Mina rail alignment on engineering estimates of activity levels for construction crews operating in either rugged or gentle terrain. The Department assumed the use of similar construction equipment in both types of terrain, but assumed that the duration of activities would be longer in rugged terrain. Rugged terrain would require significant cut-and-fill operations.

DOE estimated exhaust emissions (NO_x, PM_{10}, $PM_{2.5}$, SO_2, CO, VOCs) from both non-road and on-road equipment. Non-road equipment would include bulldozers, graders, front-end and backhoe loaders, excavators, scrapers, cranes, compactors, tampers, drills, and other equipment. On-road equipment would include equipment licensed for on-road use that would be used for construction of the railroad (such as pickup, dump, and water trucks).

To determine annual non-road equipment exhaust emissions, DOE used engineering estimates of equipment size, activity levels, annual hours of operation, and horsepower ratings for the construction equipment as reported in the Mina Rail Corridor Task 13 document (DIRS 180874-Nevada Rail Partners 2007, Appendix B). This document included in its analysis an adjustment to operating hours for the cut-and-fill operations. Emissions factors for corresponding classes of non-road equipment used in construction were conservatively estimated from Tier 1 (typically, 1997 to 2003 model-year equipment) emissions standards based on horsepower ratings from *Exhaust and Crankcase Emissions Factors for Non-road Engine Modeling—Compression-Ignition* (DIRS 174089-EPA 2004, all).

To determine exhaust emissions from on-road equipment, annual operating hours from the Mina Rail Corridor Task 13 document (DIRS 180874-Nevada Rail Partners 2007, Appendix B) were converted to annual miles traveled assuming average operating speeds of 24 kilometers (15 miles) per hour and combined with emissions factors for appropriate vehicle classifications from the EPA MOBILE 6.2 vehicle emission modeling software (DIRS 174201-EPA 2003, all; DIRS 181954-EPA 2007, all; DIRS 181955-EPA 2004, all).

E.3.1.1.2 Fugitive Dust Emissions

DOE estimated particulate-matter emissions from fugitive dust associated with construction activities along the Mina rail alignment based on the calculations in the Mina Rail Corridor Task 13 document (DIRS 180874-Nevada Rail Partners 2007, Appendix B). These calculations are based on EPA emission factor guidance from *AP-42, Compilation of Air Pollutant Emission Factors* (DIRS 103679-EPA 1991, Section 13.2.3) and the *WRAP Fugitive Dust Handbook* (DIRS 174081-Countess 2004, Chapters 3, 6, and 9). DOE estimated fugitive dust emissions for soil disturbance from grading, scraping, bulldozing, and other rail line construction activities; wind erosion; construction material stockpiles; construction and operation of concrete batch plants; construction camps; rail line facilities; quarry and excavation activities; and construction of new access roads or upgrades of unpaved roads.

The proposed rail line construction right-of-way would be nominally 150 meters (500 feet) on either side of the centerline of the rail alignment (300 meters [1,000 feet] total width). In addition, the Mina rail alignment would include:

- Two major bridges (over Beatty Wash and the Walker River) and a series of minor bridges
- Ten construction camps 0.1 square kilometer (25 acres) each
- Sites for three railroad operations support facilities (Hawthorne Staging Yard, Maintenance-of-Way Facility, and Rail Equipment Maintenance Yard) that would occupy 0.2 square kilometer, 0.06 square kilometer, 0.4 square kilometer (50, 15, and 100 acres), respectively
- A total of 18 kilometers (11 miles) of access roads to facilities, plus the access roads on either side of the rail line
- Three-hundred storage piles to be used in track construction that would be located along the rail route

Fugitive dust emissions would also be associated with the operation of batch plants (including two coarse and fine storage piles), with new road construction or upgrades, and with quarry and excavation operations. In addition to the rail roadbed construction activity, a substantial amount of fugitive dust emissions would be related to haul trucks in the construction zone.

DOE would ensure that best management practices were implemented during construction to minimize air emissions of particulates. These measures typically would include the application of water or other dust suppressants on disturbed land, and limiting vehicle speeds on all unpaved roads. The EPA provides guidance on estimating emissions, including emissions in specific size ranges and information on watering as a dust-control method for unpaved roads (*WRAP Fugitive Dust Handbook* [DIRS 174081-Countess 2004, pp. 3-13 and 3-14]) and in AP-42, Section 13.2.2 (DIRS 103679-EPA 1991, all). The handbook provides additional guidance on the effectiveness of water in suppressing fugitive dust during construction. Emissions-control efficiency ranges from approximately 40 to 85 percent for short durations (DIRS 174084-Piechota et al. 2002, all), depending on meteorology, soil water content, soil type, and other factors. Typical effectiveness values of 70 percent are characteristic of the southwestern United States (DIRS 174215-Maricopa County 2004) for applications on the order of hours. For realistic estimation of fugitive dust emissions, DOE assumed:

- A 74-percent best practice reduction for most fugitive-dust emission sources (DIRS 174081-Countess 2004, Executive Summary, p. 3, and p. 3-14)

Based on operational guidance, DOE assumed all of the following:

- An 84-percent reduction for construction material storage piles (DIRS 174081-Countess 2004, Executive Summary, p. 3)
- A 62-percent reduction for batch plant operations (DIRS 174081-Countess 2004, Table 4-2, p. 4-5)
- A 70-percent reduction for quarry operations (DIRS 174081-Countess 2004, Executive Summary, p. 3)

E.3.1.2 Churchill County Detail

E.3.1.2.1 Emissions Inventory

DOE based the total emissions expected to occur within Churchill County from rail line construction along the Mina rail alignment on the anticipated rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from approximately 17 kilometers (11 miles) to approximately 31 kilometers (20 miles), depending on the route chosen. Churchill County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, and construction-material storage piles. DOE estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Churchill County. DOE determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Churchill County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.1.2.2 Air Quality Modeling

Because the Department has not identified any potential quarry sites in Churchill County, and because of the relatively small amount of emissions that would be associated with construction in Churchill County, DOE did not perform any site-specific air quality modeling for that area.

E.3.1.3 Lyon County Detail

E.3.1.3.1 Emissions Inventory

DOE based the total emissions expected to occur within Lyon County from rail line construction along the Mina rail alignment on the anticipated rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from approximately 61 kilometers (38 miles) to approximately 81 kilometers (51 miles), depending on the route chosen. Lyon County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, and construction-material storage piles. DOE estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Lyon County for each of the assumed 4 years of construction. The Department determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Lyon County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.1.3.2 Air Quality Modeling

Because DOE has not identified any potential quarry sites in Lyon County, and because of the relatively limited amount of emissions that would be associated with construction in Lyon County, DOE did not conduct any site-specific air quality modeling.

E.3.1.4 Mineral County Detail

E.3.1.4.1 Emissions Inventory

DOE based the total emissions expected to occur within Mineral County from rail line construction along the Mina rail alignment on the anticipated rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from approximately 153 kilometers (95 miles) to approximately 171 kilometers (106 miles), depending on the route chosen. Mineral County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction-material storage piles. Emissions from construction activities that would occur only in Mineral County (for example, construction of the Hawthorne Interchange Yard, specific access roads, and one quarry) were allocated solely to Mineral County. The Department estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Mineral County, including construction of the Interchange Yard, for each of the assumed 4 years of construction. DOE determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Mineral County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.1.4.2 Air Quality Modeling

E.3.1.4.2.1 Construction Activity. DOE modeled air quality to determine how construction activities would be likely to affect air pollutant concentrations near Schurz, Hawthorne (including the Hawthorne Staging Yard), and Mina. Modeling included both the rail line and the Staging Yard. All modeling runs were made using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE modeled Schurz using the meteorological data collected by the Walker River Paiute Tribe in Schurz as reported through the Tribal Environmental Exchange Network. For missing hours in this record, DOE substituted data from the Fallon, Nevada, site (obtained from the Desert Research Institute) and also used cloud-cover data from Fallon because Schurz does not record cloud-cover information. This surface meteorological data represents the best available information for Schurz. Upper-air data for this location were taken from Reno, Nevada (National Weather Service station 72489). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Reno is routine in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record for 2004, 2005, and 2006 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

DOE modeled Hawthorne, the Staging Yard location, and Mina using the meteorological data collected by National Renewable Energy Laboratory at Luning 7W as reported through the Western Region Climate Center. For missing hours in this record, DOE substituted data from the Fallon and Reno, Nevada, sites (obtained from the Desert Research Institute) and also used cloud-cover data from Fallon because Luning does not record cloud-cover information. This surface meteorological data represents the best hourly meteorological information available for Hawthorne. Upper-air data for this location were taken from Reno, Nevada (National Weather Service station 72489). Thus, it was possible to assemble a 3-year meteorological record for 2004, 2005, and 2006 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

Because DOE would use existing rail line near Hawthorne, construction emissions modeled included only the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. For locations south of the Hawthorne Staging Yard, where there is no existing track, construction emissions included both surface emissions from laying track and emissions from ballast delivery. Both modeling runs used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). DOE assumed rail line construction would occur at a rate of 260 hours per month. The peak results from the modeling runs were taken to determine all averaging periods.

DOE also modeled emissions from construction of the proposed 0.2-square-kilometer (50-acre) Hawthorne Staging Yard. DOE set receptor locations surrounding the proposed Staging Yard along the public roads that would parallel the Yard. Receptors were set at a standard breathing height of 1.8 meters (5.9 feet) and a release height of 0.5 meter (1.6 feet) was employed to reflect near surface releases from construction equipment. Construction activities would include surface work, laying track, and building structures for the Staging Yard. DOE assumed construction of the Staging Yard would occur at an average rate of 260 hours per month.

DOE also modeled air quality to determine the impact of emissions from construction near Schurz and Mina. DOE selected Schurz alternative segment 1 as the most conservative alignment in relation to proximity to Schurz and the exposure to emissions from rail line construction. All modeling runs were made using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

In all cases, emission rates were expressed in units of grams per second for the appropriate activity and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year.

For Schurz and Mina, DOE modeled construction emissions in two phases. The first phase modeled the emissions associated with construction activities, including surface disturbance, laying track, and other processes with a release height of 0.5 meter (1.6 feet) to reflect surface or near-surface releases from equipment activity. This represented the initial portion of rail line construction. For the second modeling phase, DOE modeled the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. This modeling used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). For both model runs, DOE assumed rail line construction would occur at a rate of 260 hours per month. The highest year results from the two model runs were combined for the annual average to estimate the peak annual average concentration. For the shorter-term averages, the higher concentration was reported from each of these phases because the track construction and the subsequent ballast deliveries would not occur simultaneously.

E.3.1.4.2.2 Quarry Activity. DOE also performed air quality modeling to estimate air pollutant concentrations resulting from activity at the Garfield Hills quarry site east of Hawthorne (DIRS 180881-Shannon & Wilson 2007, pp. 32-37). All modeling analyses were made using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE used the same set of meteorological data as used for Hawthorne and Mina.

DOE calculated emissions for each of the assumed 3 years of quarry operation, including emissions associated with construction of the quarry facilities during the first year of the construction phase. Emissions included those from the quarry, plant, railroad siding, and access roads. All sources were taken as surface-based releases. Annual emissions were distributed evenly over a 250-day-per-year work schedule, operating between 6:00 a.m. and 6:00 p.m. Receptor locations were set at the fence line surrounding the potential quarry and at a standard breathing height of 1.8 meters (5.9 feet).

Next DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations of each air pollutant at all receptors over all 3 years of meteorological data. Therefore, the analysis approach represents a conservative estimate of air pollutant concentrations.

E.3.1.5 Esmeralda County Detail

E.3.1.5.1 Emissions Inventory

DOE based the total emissions expected to occur within Esmeralda County from rail line construction along the Mina rail alignment on the anticipated rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from approximately 134 kilometers (83 miles) to approximately 175 kilometers (109 miles), depending on the route chosen. Esmeralda County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction-material storage piles. Emissions from construction activities that would occur only in Esmeralda County (for example, specific access roads, and one quarry) were allocated solely to Esmeralda County. DOE estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Esmeralda County for each of the assumed 4 years of construction. DOE determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Esmeralda County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.1.5.2 Air Quality Modeling

E.3.1.5.2.1 Construction Activity. DOE modeled air quality to determine how construction activities would be likely to impact air pollutant concentrations near Goldfield and Silver Peak. All modeling was performed using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE modeled Silver Peak using the Tonopah Airport meteorological data collected by the National Weather Service. For missing hours in this record, DOE substituted data from the Desert Rock, Nevada, site (obtained from the Desert Research Institute). This surface meteorological data represents the best available hourly weather information for Silver Peak. Upper-air data for this location were taken from Desert Rock, Nevada. Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Desert Rock is routine in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record of hourly data for 2004, 2005, and 2006 for Silver Peak and a 4-year record for 1989, 1990, 1991, and 1992 for Goldfield. The older meteorological data were readily available for use in the Goldfield modeling. These data were preprocessed by AERMET for input into AERMOD.

DOE modeled air quality in Silver Peak to determine the impact of emissions from construction of the rail alignment. DOE modeled the alternative segment (Montezuma 1) as the most conservative segment in relation to proximity to Silver Peak and the exposure to emissions from rail line construction. DOE also modeled air quality to determine the impact of emissions from construction of a segment of the rail alignment (Goldfield alternative segment 4) passing near Goldfield extending for 4.7 kilometers (2.9 miles) near the town. DOE selected Goldfield alternative segment 4 as the most conservative segment in relation to proximity to population and the exposure to emissions from construction of the rail line. In addition to the receptors placed alongside the construction and permanent operations rights-of-way, DOE also placed five receptors at key locations within Goldfield. These include the tanks west of Goldfield alternative segment 4, the School Bus Maintenance Facility east of the segment, and three houses east of the segment at the periphery of the town nearest the alignment. DOE determined pollutant concentrations at each of these locations in addition to those at the rights-of-ways to indicate potential project impacts at key locations in addition to the overall maximum impact at any location along the modeling domain. All modeling was performed using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2006, all; DIRS 181090-EPA 2007, all).

In all cases, emission rates were expressed in units of grams per second or grams per second per square meter for the appropriate activity and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year.

DOE modeled the Silver Peak and Goldfield construction emissions in two phases. The first phase modeled the emissions associated with construction activities, including surface disturbance, laying track, and other processes with a release height of 0.5 meter (1.6 feet) to reflect surface or near-surface releases from equipment activity. This represented the initial portion of rail line construction. For the second modeling phase, DOE modeled the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. This modeling used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). For both modeling studies, DOE assumed rail line construction would occur at a rate of 260 hours per month. The highest-year results from the two modeling runs were combined for the annual average to estimate the peak annual average concentration. For the shorter-term averages, the higher concentration was reported from each of these phases because the track construction and the subsequent ballast deliveries would not occur simultaneously.

E.3.1.5.2.2 Quarry Activity. DOE also performed air quality modeling to estimate air pollutant concentrations resulting from activity at the potential Malpais Mesa quarry site near Goldfield (DIRS 180881-Shannon & Wilson 2007, pp. 14-21). All model runs were made using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE used the same set of meteorological data as used for Silver Peak. DOE calculated emissions for each of the assumed 3 years of quarry operations, including emissions associated with construction of the quarry facilities during the first year of the construction phase. Emissions included those from the quarry, plant, railroad siding, and access roads. All sources were taken as surface-based releases. Annual emissions were distributed evenly over a 250-day-per-year work schedule, operating between 6:00 a.m. and 6:00 p.m. Receptor locations were set at the fence line surrounding the potential quarry and at a standard breathing height of 1.8 meters (5.9 feet).

Next DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations of each air pollutant at all receptors over all 3 years of meteorological data. Therefore, the analysis approach represents a conservative estimate of air pollutant concentrations.

E.3.1.6 Nye County Detail

E.3.1.6.1 Emissions Inventory

DOE based the total emissions expected to occur within Nye County from construction of the proposed railroad along the Mina rail alignment on the proposed rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from 126 kilometers (78 miles) to 148 kilometers (92 miles). Nye County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction material storage piles. Emissions from construction activities that would occur only in Nye County (for example, the Rail Equipment Maintenance Yard and facility access roads) were allocated solely to Nye County. DOE estimated exhaust and fugitive dust emissions that would be attributable to rail line construction and associated facility construction activity in Nye County for each of the assumed 4 years of construction. The highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase were used in subsequent analysis.

E.3.1.6.2 Air Quality Modeling

Because no quarries are proposed for the southern portion of Nye County in the vicinity of the Mina alignment and the rail line would not pass near any communities, DOE did not conduct any site-specific air quality modeling.

E.3.2 RAILROAD OPERATIONS IMPACT ASSESSMENT – MINA RAIL ALIGNMENT

E.3.2.1 Overview

The operations impact assessment included estimating emissions and potential impacts to air quality associated with proposed railroad operations.

E.3.2.1.1 Emissions from Railroad Operations

Spent nuclear fuel and high-level radioactive waste would be transported along the proposed rail line sealed in rail casks. Each DOE cask car would have a gross weight as high as 240 metric tons (264 tons); naval cask cars would weigh as much as 355 metric tons (390 tons). The railroad would operate for up to 50 years. DOE would use two to three 4,000-horsepower, diesel/electric locomotives with a maximum weight of approximately 180 metric tons (198 tons) when fully fueled and ready for use to transport the spent nuclear fuel and high-level radioactive waste.

Emissions associated with railroad operations would be related to the weight of the trains and their frequency. To conservatively estimate emissions, each train trip was assumed to operate with the nominal number of three cask cars per trip, but with the maximum number of locomotives and peak activity along the rail line. This estimate results in a total of six train cars (one escort car, three cask cars, and two buffer cars) plus the maximum number of three locomotive engines per trip, with an equal number returning unloaded each week.

DOE expects that train shipments to the repository would peak around 2013 to 2036 (DIRS 176173-Nevada Rail Partners 2006, Table 1, p. 4-2). At that time, there would be eight one-way cask train trips per week, in addition to the other trains anticipated to operate on the rail line. Other trains would include those needed for fuel oil, repository construction, and maintenance-of-way trains. DOE expects the total rail traffic on the rail line during the peak year would average 17 one-way trips per week (DIRS 175036-BSC 2005, Table 4.2). DOE made the most conservative estimate of activity along the rail line by assuming this activity level throughout the life of the project. DOE then estimated emissions from railroad operations by combining this activity level with estimates of the weight and fuel consumption of the train and appropriate emission factors (DIRS174085-Sierra Research 2004, pp. 6 and 18), and then dividing the emissions among the counties in which the railroad would operate. Although the level of activity would remain constant, because emissions factors generally decrease throughout the life of the project due to improvement in locomotive control technologies, total emissions could decrease over the life of the project.

To assess the potential impacts to air quality from railroad operations emissions near Schurz, the Staging Yard, Hawthorne, and Mina (all in Mineral County) and Silver Peak (in Esmeralda County), DOE modeled air quality using the EPA AERMOD Version 07026 model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all). In this assessment, a portion of the alternative segments that would pass near the two communities were modeled as a series of volume sources using local historical meteorological data. To assess the significance of potential impacts to air quality, comparisons were made with the applicable National Ambient Air Quality Standards.

E.3.2.1.2 Emissions from Facility Operations

The operations impact assessment also included emissions and potential impacts to air quality associated with operation of the Hawthorne Staging Yard in Mineral County. Other facilities (such as the Maintenance-of-Way Facility) would have similar or smaller operations or would be too distant from public access; therefore, their potential to impact air quality would be low.

DOE treated operations at the Staging Yard at Hawthorne as continuous throughout the life of the proposed railroad. Details on the activity and emissions at these facilities were taken from the Mina Rail Corridor, Task 13: EIS Interface Support (DIRS 180874-Nevada Rail Partners 2007, Appendix C) and Facilities–Design Analysis Report Mina Rail Corridor, Task 10: Facilities (DIRS 180873-Nevada Rail Partners 2007, pp. 3-1 and 3-2).

E.3.2.2 Churchill County Detail

E.3.2.2.1 Emissions Inventory

DOE estimated total emissions that would be associated with operation of the railroad through Churchill County from railroad operations on the possible rail alignments through the county (common segments and alternative segments), which range from 17 kilometers (11 miles) to 31 kilometers (20 miles), or between 67 and 69 percent of the total Mina rail alignment. Based on this percentage, Churchill County was allocated a corresponding fraction of total emissions arising from railroad operations. Exhaust emissions attributable to operation of the railroad (none in Churchill County) were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Churchill County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.2.3 Lyon County Detail

E.3.2.3.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Lyon County from railroad operations on the possible rail alignments through the county (common segments and alternative segments), which range from approximately 81 kilometers (51 miles) to approximately 61 kilometers (38 miles) depending on the route chosen. Lyon County was allocated the fraction of total emissions arising from railroad operations. Exhaust emissions attributable to operation of the railroad were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Lyon County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.2.4 Mineral County Detail

E.3.2.4.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Mineral County from railroad operations on the possible rail alignments (common segments and alternative segments) through the county, which range from approximately 153 kilometers (95 miles) to 171 kilometers (106 miles) depending on route chosen. Mineral County was allocated the fraction of total emissions that would result from railroad operations. Exhaust emissions attributable to railroad operations, including facilities (Staging Yard at Hawthorne) were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Mineral County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.2.4.2 Air Quality Modeling

DOE performed air quality modeling of the air pollutants that would be released from railroad operations near the communities of Schurz, Hawthorne, and Mina, as well as in the vicinity of the Staging Yard using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE modeled Schurz using the meteorological data collected by the Walker River Paiute Tribe in Schurz as reported through the Tribal Environmental Exchange Network. For missing hours in this record, DOE substituted data from the Fallon, Nevada, and Reno, Nevada sites (obtained from the Desert Research Institute) but also used cloud-cover data from Fallon as Schurz does not record cloud-cover information. This surface meteorological data represents the best available information for Schurz. Upper-air data for this location were taken from Reno, Nevada (National Weather Service station 72489). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Reno is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record of hourly data for 2004, 2005, and 2006. These data were preprocessed by AERMET for input into AERMOD.

DOE modeled Hawthorne, the Staging Yard, and Mina using the meteorological data collected by National Renewable Energy Laboratory at Luning 7W as reported through the Western Region Climate Center. For missing hours in this record, DOE substituted data from the Fallon, Nevada, site (obtained from the Desert Research Institute) and also used cloud-cover data from Fallon as Luning does not record cloud-cover information. This surface meteorological data represents the best hourly meteorological information available for Hawthorne. Upper-air data for this location were taken from Reno, Nevada, (National Weather Service station 72489). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Reno is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record of hourly data for 2004, 2005, and 2006 and these data were preprocessed by AERMET for input into AERMOD.

DOE selected Schurz alternative segment 1 as the most conservative segment in relation to proximity to Schurz, Hawthorne, and Mina using the common segments. All modeling was made using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all). These model runs used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). The peak results from the modeling runs were taken to determine all averaging periods.

DOE also modeled emissions from operation of the proposed 0.2-square-kilometer (50-acre) Staging Yard at Hawthorne. DOE set receptor locations surrounding the proposed Staging Yard along the public roads that would parallel the Yard. Receptors were set at a standard breathing height of 1.8 meters (5.9 feet) and a release height of 0.5 meter (1.6 feet) was employed to reflect near- surface releases from equipment and dust. Operations activities would include light running repairs, switching between Union Pacific Railroad and DOE locomotives, sorting of trains for delivery, and car inspection, refueling, and sanding. In all cases, emission rates were expressed in units of grams per second or grams per second per square meter for the appropriate activity and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year.

E.3.2.5 Esmeralda County Detail

E.3.2.5.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Esmeralda County from railroad operations on the possible rail alignments (common segments and alternative segments) through the county, which range from approximately 134 kilometers (83 miles) to 175 kilometers (109 miles) depending on route chosen. Esmeralda County was allocated the fraction of total emissions that would result from railroad operations. Exhaust emissions attributable to railroad, including support facilities (Maintenance-of-Way Facility in Esmeralda County), were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Esmeralda County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.2.5.2 Air Quality Modeling

DOE modeled Silver Peak and Goldfield using the Tonopah Airport meteorological data collected by the National Weather Service. For missing hours in this record, DOE substituted data from the Desert Rock, Nevada, site (obtained from the Desert Research Institute). This surface meteorological data represents the best available hourly weather information for Silver Peak. Upper-air data for this location were taken from Desert Rock, Nevada. Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Desert Rock is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record of hourly meteorological data for 2004, 2005, and 2006 for Silver Peak and a 4-year meteorological record for 1989, 1990, 1991, and 1992 for Goldfield. The older meteorological data was readily available for use in the Goldfield modeling. These data were preprocessed by AERMET for input into AERMOD.

DOE modeled air quality in Silver Peak to determine the impact of emissions from operation of the rail alignment near Silver Peak. DOE modeled the alternative segment (Montezuma 1) as the most conservative alignment in relation to proximity to Silver Peak and the exposure to emissions from railroad operations. DOE also modeled air quality to determine the impact of emissions from the operation of a segment of the rail alignment (Goldfield alternative segment 4) passing near Goldfield extending for 4.7 kilometers (2.9 miles) near the town. DOE selected Goldfield alternative segment 4 as the most conservative alignment in relation to proximity to population and the exposure to emissions from operation of the railroad. In addition to the receptors placed alongside the construction and permanent operation rights-of-way, DOE also placed five receptors at key locations in Goldfield. These include the tanks west of Goldfield alternative segment 4, the School Bus Maintenance Facility east of the alignment, and three houses east of the alignment at the periphery of the town nearest the alignment. DOE determined pollutant concentrations at each of these locations in addition to those at the rights-of-way to indicate potential project impact at key locations in addition to the overall maximum impact at any location along the modeling domain. All model runs were made using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

The highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at any receptor were determined for each model year.

E.3.2.6 Nye County Detail

E.3.2.6.1 Emissions Inventory

DOE estimated total emissions that would be associated with operation of the railroad through Nye County using the same procedure as previously described for Esmeralda County. The anticipated routes through Nye County range from 126 kilometers (78 miles) to 148 kilometers (92 miles).

The analysis compares operations-related emissions with 2002 Nye County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.3 SHARED-USE OPTION – MINA RAIL ALIGNMENT

Although the Shared-Use Option would require the construction of some additional sidings along the alignment, the additional sidings would be placed parallel to existing track and would not require additional roadbed foundation, only laying of track. Given that these activities would result in minimal additional construction-related emissions over those produced under the Proposed Action without shared use, it was not necessary to calculate an annual emissions inventory, or conduct additional air quality model runs to assess construction-related impacts for the Shared-Use Option beyond those already conducted for evaluation of the Proposed Action without shared use.

DOE calculated emissions for 18 additional one-way trips per week north of Schurz and ten additional one-way trips south of Schurz of commercial train activity consisting of 60 cars and three locomotives. The emissions for each county were determined by scaling the total emissions along the Mina rail alignment by the anticipated range of distances associated with the various possible rail alignment options through each county.

The analysis compares operations-related emissions associated with the Shared-Use Option with each county's 2002 data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

Emissions would increase marginally beyond those associated with railroad operations without shared use. In sum, the maximum air pollutant concentrations would increase marginally. Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for railroad operations along the Mina rail alignment under the Shared-Use Option.

E.4 Glossary

AERMAP (AERMOD Maps terrain Preprocessor)	The terrain preprocessor that uses data from the Digital Elevation Model Database and creates a file suitable for use within AERMOD. This file contains elevation and hill-height scaling factors for each receptor for use by AERMOD.
AERMET (AERMOD Meteorological Preprocessor)	The meteorological preprocessor component of AERMOD. Surface meteorological observations, hourly cloud-cover observations, and twice-a-day upper air sounds are "preprocessed" by AERMET into data used by AERMOD.
AERMOD (AMS/EPA Regulatory Model)	A short-range steady-state air quality dispersion model. The model incorporates air dispersion concepts based on the state-of-the-science understanding of planetary boundary layer turbulence structure and scaling concepts. AERMOD became the U.S. Environmental Protection Agency preferred air dispersion model in place of ISC3 on December 9, 2005.
ambient air	The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It is not the air in the immediate proximity to emission sources.
carbon monoxide	A colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion; one of the six pollutants for which there is a national ***ambient air quality standard***.
criteria air pollutants	Six common pollutants (***ozone***, ***carbon monoxide***, ***particulate matters***, ***sulfur dioxide***, lead, and ***nitrogen dioxide***) known to be hazardous to human health and the environment, and for which the U.S. Environmental Protection Agency sets National ***Ambient Air Quality Standards*** under the Clean Air Act. See ***toxic air pollutants***.
fugitive dust	***Particulate matter*** composed of soil; can include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is removed or redistributed.
hazardous chemical	As defined under the Occupational Safety and Health Act (Public Law 91-956) and the Emergency Planning and Community Right-to-Know Act (42 U.S.C. 116), a chemical that is a physical or health hazard.

hazardous pollutant	A ***hazardous chemical*** that can cause serious health and environmental hazards; listed on the federal list of hazardous air pollutants (Clean Air Act; 42 U.S.C. 7412). See ***toxic air pollutants***.
National Ambient Air Quality Standards	Standards established on a federal or state level that define the limits for airborne concentrations of designated ***criteria pollutants*** [***nitrogen dioxide***, ***sulfur dioxide***, ***carbon monoxide***, ***particulate matter*** with aerodynamic diameters less than 10 micrometers (PM_{10}), particulate matter with aerodynamic diameters less than 2.5 micrometers ($PM_{2.5}$), ***ozone***, and lead] to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).
nitrogen dioxide	See ***nitrogen oxides***.
nitrogen oxides (oxides of nitrogen)	Gases formed in great part from atmospheric nitrogen and oxygen when combustion occurs under conditions of high temperature and high pressure; a major air pollutant. Two primary nitrogen oxides, nitric oxide (NO) and ***nitrogen dioxide*** (NO_2), are noteworthy airborne ***contaminants***. Nitric oxide combines with atmospheric oxygen to produce nitrogen dioxide. Both nitric oxide and ***nitrogen dioxide*** can, in high concentrations, cause lung ***cancer***. ***Nitrogen dioxide*** is a ***criteria air pollutant***.
particulate matter	Any finely divided solid or liquid material other than pure water (such as dust, smoke, mist, fumes, or smog) found in air or emissions.
sulfur dioxide	A pungent, colorless gas produced during the burning of sulfur-containing fossil fuels. It is the main pollutant involved in the formation of acid rain. Coal- and oil-burning electric utilities are the major source of sulfur dioxide in the United States. Inhaled sulfur dioxide can damage the human respiratory tract and can severely damage vegetation. See ***criteria air pollutants***, ***National Ambient Air Quality Standards***.
toxic air pollutants	***Hazardous pollutants*** not listed as either ***criteria air pollutants*** or hazardous pollutants.

E.5 References

175036	BSC 2005	BSC (Bechtel SAIC Company) 2005. Nevada Transportation Requirements Document. TER-NVT-RQ-000001 REV 00. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20050621.0004.
173568	California Environmental Protection Agency 2004	California Environmental Protection Agency 2004. Public Hearing to Consider Proposed Regulatory Amendments Extending the California Standards for Motor Vehicle Diesel Fuel to Diesel Fuel Used in Harborcraft and Intrastate Locomotives. Sacramento, California: State of California, California Environmental Protection Agency. TIC: 257531.
174081	Countess Environmental 2004	Countess Environmental 2004. WRAP Fugitive Dust Handbook. Westlake Village, California: Countess Environmental. TIC: 257525.
103679	EPA 1991	EPA (U.S. Environmental Protection Agency) 1991. Mobile Sources. Volume II of Supplement A to Compilation of Air Pollutant Emission Factors. AP-42. [Washington, D.C.]: U.S. Environmental Protection Agency. ACC: MOL.20010724.0298.

174202	EPA 2002	EPA (U.S. Environmental Protection Agency) 2002. Revised Draft, User's Guide for the AMS/EPA Regulatory Model - Aermod. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency. ACC: MOL.20050714.0435.
174201	EPA 2003	EPA (U.S. Environmental Protection Agency) 2003. User's Guide to Mobile6.1 and Mobile6.2, Mobile Source Emission Factor Model. EPA420-R-03-010. Ann Arbor, Michigan: U.S. Environmental Protection Agency, National Vehicle and Fuel Emissions Laboratory. ACC: MOL.20050714.0436.
174089	EPA 2004	EPA (U.S. Environmental Protection Agency) 2004. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling--Compression-Ignition. EPA420-P-04-009. [Washington, D.C.]: U.S. Environmental Protection Agency. ACC: MOL.20050615.0515.
181091	EPA 2004	EPA (U.S. Environmental Protection Agency) 2004. “User's Guide for the AMS/EPA Regulatory Model - AERMOD.” Technology Transfer Network Support Center for Regulatory Atmospheric Modeling, AERMOD Modeling. EPA-454/B-03-001. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Accessed May 24, 2007. ACC: MOL.20070529.0122. URL: http://www.epa.gov/scram001/dispersion_prefrec.htm
181955	EPA 2004	EPA (U.S. Environmental Protection Agency) 2004. “Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation.” Modeling and Inventories, MOBILE6 Vehicle Emission Modeling Software. EPA420-R-04-013. [Washington, D.C.]: U.S. Environmental Protection Agency, Office of Transportation and Air Quality. Accessed July 16, 2007. ACC: MOL.20070731.0065. URL: http://www.epa.gove/otaq/m6.htm
181090	EPA 2007	EPA (Environmental Protection Agency) 2007. “AERMOD (dated 07026).” Model Change Bulletin MCB #2. [Washington, D.C.]: Environmental Protection Agency. Accessed May 29, 2007. ACC: MOL.20070622.0002. URL: http://www.epa.gov/scram001/7thconf/aermod/aermod_mcb2.txt
174215	Maricopa County 2004	Maricopa County 2004. Emissions Inventory Help Sheet for Vehicle Travel on Unpaved Roads. [Phoenix, Arizona: Maricopa County, Department of Air Quality Control]. TIC: 257528.
177709	MO0607NEI2002D.000	MO0607NEI2002D.000. National Emissions Inventory 2002 All-Sector Summary Data for Criteria Air Pollutants. Submittal date: 07/18/2006.
175945	Nevada Rail Partners 2005	Nevada Rail Partners 2005. Ballast Requirements and Quarries Technical Memorandum Caliente Rail Corridor, Task 14: Construction Planning Support. Document No. NRP-R-SYSW-CP-0003-01A. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060109.0032.
176168	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, REV. 01. Document No. NRP-R-SYSW-FA-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0019.

176172	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Construction Plan Caliente Rail Corridor, Task 14: Construction Planning Support, REV. 01. Document No. NRP-R-SYSW-CP-0008-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0021.
176173	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Operations and Maintenance Report Caliente Rail Corridor, Task 15: Operations and Maintenance Planning Support REV. 01. Document No. NRP-R-SYSW-OM-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060424.0016.
180873	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Facilities-Design Analysis Report, Mina Rail Corridor, Task 10: Facilities, REV. 00. Document No. NRP-R-SYSW-FA-0002-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0004.
180874	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Air Quality Emission Factors and Socioeconomic Input, Mina Rail Corridor, Task 13: EIS Interface Support, Rev. 00. Document No. NRP-R-SYSW-EI-0003-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0013.
180875	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Construction Plan, Mina Rail Corridor, Task 14: Construction Planning Support, Rev. 00. Document No. NRP-R-SYSW-CP-0010-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0002.
180921	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Air Quality Emissions Factors and Socioeconomic Input Caliente Rail Corridor, Task 13: EIS Interface Support, Rev. 02. Document No. NRP-R-SYSW-EI-0002-02. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070402.0013.
174084	Piechota et al. 2002	Piechota, T.; van Ee, J.; Batista, J.; Stave, K.; and James, D. 2002. Potential Environmental Impacts of Dust Suppressants: “Avoiding Another Times Beach.”. EPA/600/R-04/031. [Washington, D.C.]: U.S. Environmental Protection Agency. ACC: MOL.20050615.0511.
176182	Shannon & Wilson 2006	Shannon & Wilson 2006. Ballast Quarry Report, Task 4.8: Ballast Quarry Report, (Submittal No. 8.6), Rev. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20060414.0011.
180881	Shannon & Wilson 2007	Shannon & Wilson 2007. Ballast Quarry Report, Mina Rail Corridor, Task 2.5a: Quarry Site Description Report (Submittal No. 7.32), REV. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20070418.0014.
181954	USEPA, Office of Transportation and Air Quality 2007	EPA (U.S. Environmental Protection Agency) 2007. “MOBILE6 Vehicle Emission Modeling Software, MOBILE6 Model.” Modeling and Inventories. [Washington, D.C]: U.S. Environmental Protection Agency, Office of Transportation and Air Quality. Accessed July 16, 2007. ACC: MOL.20070731.0066. URL: http://www.epa.gov/otaq/m6.htm

APPENDIX F

FLOODPLAINS AND WETLANDS ASSESSMENT

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ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
CFR	Code of Federal Regulations
DIRS	Document Input Reference System
DOE	U.S. Department of Energy
EIS	environmental impact statement
FEIS	final environmental impact statement
FEMA	Federal Emergency Management Agency
NEPA	National Environmental Policy Act

APPENDIX F

FLOODPLAIN AND WETLANDS ASSESSMENT

F.1 Introduction

Pursuant to Executive Order 11988, *Floodplain Management*, each federal agency is required, when conducting activities in a floodplain, to take actions to reduce the risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. Pursuant to Executive Order 11990, *Protection of Wetlands*, each Federal agency is to avoid, to the extent practicable, the destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands if a practicable alternative exists. The U.S. Department of Energy (DOE or the Department) issued regulations that implement these Executive Orders (10 Code of Federal Regulations [CFR] 1022, *Compliance with Floodplain/Wetlands Environmental Review Requirements*). In accordance with the terms of this regulation, specifically 10 CFR 1022.11(d), DOE must prepare a floodplain assessment for proposed actions that would take place in floodplains and a wetlands assessment for any proposed actions that would occur in wetlands. The purpose of this appendix is to meet both of these requirements.

In February 2002, DOE published *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (hereinafter referred to as the Yucca Mountain FEIS) (DIRS 155970-DOE 2002, all). As part of that environmental impact statement (EIS) process, DOE prepared a floodplain/wetlands assessment in accordance with 10 CFR Part 1022, and published the assessment as Appendix L of the Yucca Mountain FEIS. The assessment examined the effects of repository construction and operation and potential construction of a rail line on (1) floodplains near the Yucca Mountain site and (2) floodplains and areas that may have wetlands along potential rail alignments.

Because DOE chose rail as the preferred mode of transporting spent nuclear fuel, high-level radioactive waste, and other materials to the repository site, the Rail Alignment EIS evaluates the potential effects of the construction and operation of the rail line (its common segments, alternative segments, and associated facilities) on floodplains and wetlands along the proposed rail alignment. The EIS also evaluates potential impacts to floodplains and wetlands from the implementation of the Shared-Use Option.

In accordance with 10 CFR 1022.13, this Floodplain and Wetlands Assessment includes a Project Description (see Section F.2), an analysis of floodplain and wetland impacts (see Section F.3), and a discussion of alternatives (see Section F.4).

F.2 Project Description

Chapter 2 of the Rail Alignment EIS contains a detailed description for the Proposed Action and two implementing alternatives (the Caliente Implementing Alternative and the Mina Implementing Alternative, each with a Shared-Use Option). Sections 3.2.5 and 3.3.5 of the Rail Alignment EIS describe the existing environment for surface-water resources along the Caliente and Mina rail alignments; this appendix does not repeat that information. This section of the Floodplain and Wetlands Assessment provides additional information on floodplains and wetlands associated with the Caliente and Mina rail alignments. Section F.3 provides additional data regarding potential impacts to floodplains and wetlands to support the floodplain and wetlands assessment.

F.2.1 FLOODPLAIN DATA REVIEW

Title 10 CFR Part 1022.11 lists four sources of information that must be reviewed to determine whether a proposed action would be located within a floodplain. These sources include the following:

- Flood Insurance Rate Maps or Flood Hazard Boundary Maps prepared by the Federal Emergency Management Agency (FEMA)
- Information from a land-administering agency or from other government agencies with floodplain determination expertise
- Information in safety basis documents as defined in 10 CFR Part 830 (*Nuclear Safety Management*)
- DOE environmental documents

DOE collected and analyzed floodplain data, which are provided in Section F.2.1.1 for the Caliente rail alignment and in Section F.2.1.2 for the Mina rail alignment.

For actions that would be located in a floodplain, DOE is required to describe the nature and extent of the flood hazard. DOE must determine if an action would be located within either a base-action floodplain or a critical-action floodplain, using the most authoritative information available about site conditions. The base floodplain is, at a minimum, the area inundated by a flood having a 1-percent chance of occurring in any given year (referred to as the 100-year floodplain). The critical-action floodplain is the area inundated by a flood having an 0.2-percent chance of occurring in any given year (referred to as the 500-year floodplain).

Critical action is defined as any activity for which even a slight chance of flooding would be too great. Such actions could include the storage of highly volatile, toxic, or water-reactive materials. DOE considered the critical action floodplain (500-year floodplain) in this assessment because petroleum, oil, lubricants, and other hazardous materials could be used during the construction and operation of the proposed railroad and because spent nuclear fuel and high-level radioactive waste would be transported on the rail line.

The spent nuclear fuel and high-level radioactive waste that DOE would transport to a repository at Yucca Mountain would be considered highly toxic, but when in transit or temporarily positioned at an associated facility, this material would be managed in shipping casks that meet U.S. Nuclear Regulatory Commission regulations. Commission regulations (10 CFR Part 71) are intended to ensure that the public will be protected both during normal transportation activities and in the event a shipment is involved in a transportation accident. These regulations state that each shipping cask must meet certain containment, radiation control, and criticality control requirements when it is subjected to specified normal transportation conditions and hypothetical accident conditions. The test conditions include a 9-meter (30-foot) free drop; a puncture test allowing the container to free fall 1 meter (3.3 feet) onto a steel rod 15 centimeters (6 inches) in diameter; a 30-minute, all-engulfing fire at 800°C (1,500°F); and an 8-hour immersion under 0.9 meter (3 feet) of water. Further, an undamaged package must be subjected to 1-hour immersion under 200 meters (655 feet) of water. These regulations define radiological criteria (that is, radioactivity release and radiation levels external to the cask) that must be achieved. These criteria require the cask structural integrity to be effectively unimpaired.

Shipping casks would never be opened during the transportation process and the potential for a release during any accident or flooding scenario would be extremely remote (DIRS 104774-Fischer et al 1987, pp. 9-1 to 9-15). Hazardous materials that would be most susceptible to accidental spills and releases would be the fuels and other petroleum products required to support power and equipment needs during the railroad construction and operations phases. Storage of these materials would be according to normal environmental regulatory requirements (within secondary containment) and, as practicable, would be stored outside of floodplains.

F.2.1.1 Caliente Rail Alignment

DOE analyzed floodplain data in accordance with 10 CFR Part 1022 for the Caliente rail alignment; the analysis is here and documented in the *Hydrologic and Drainage Evaluation Report for the Caliente Rail Corridor* (DIRS 182755-PBS&J 2007, pp. 8 to 12).

FEMA has mapped floodplains on Flood Insurance Rate Maps for areas of Lincoln, Nye, and Clark Counties. In Lincoln County, applicable flood-map coverage was only available for the City of Caliente. FEMA provides these maps for use in community planning and development to adequately prepare for potential flood events. FEMA has mapped 500-year floodplains only within the city limits of Caliente. The FEMA flood map coverage is shown on Figure F-1 and described in detail in Sections F.3.2.1 through F.3.2.12.

Overlaying the Caliente rail alignment on the FEMA maps allows for estimates of crossing distances (that is, the length of the rail alignment within the various floodplains). Table F-1 lists the floodplains identified along the Caliente rail alignment by alternative segments and common segments. Sections F.3.2.1 through F.3.2.12 describe the floodplains, where information is available, that would be encountered by each of the rail line segments.

In addition to the FEMA flood maps, DOE used two studies completed in support of the Rail Alignment EIS to provide additional information related to discharge rates and flood hazards. The *Hydrologic and Drainage Evaluation Report for the Caliente Rail Corridor* (DIRS 182755-PBS&J 2007, all) included field reconnaissance of every drainage feature along the entire Caliente rail alignment and a review of all available streamflow and precipitation data sources. Also, an earlier study completed by Kennedy, Jenks, and Chilton in 1990 (DIRS 176903-De Leuw, Cather and Company 1992, Appendix H) provides approximate design discharge flow rates for portions of the alignment with drainage areas greater than 2.6 square kilometers (1 square mile) in size. The study also identifies locations along the Caliente rail alignment with significant and unusual flooding hazards, including sections of the alignment affected by alluvial fans, closed-basin lakes, extremely high peak discharges, and wide shallow flow. Sections F.3.2.1 through F.3.2.12 summarize these studies.

DOE also contacted Bureau of Land Management (BLM) field offices having jurisdiction over the federally owned lands along the Caliente rail alignment to determine if they were aware of any floodplain data beyond that available from FEMA. None of the offices DOE contacted provided any floodplain data (DIRS 176303-Ong 2005, all; DIRS 176304-Ong 2005, all).

F.2.1.2 Mina Rail Alignment

DOE analyzed floodplain data in accordance with 10 CFR Part 1022 for the Mina rail alignment. The analysis is summarized here and documented in the *Phase I Hydrologic and Drainage Evaluation Report for the Mina Rail Corridor* (DIRS 180885-Parsons Brinckerhoff 2007, pp. 8 to 11).

FEMA has mapped floodplains on Flood Insurance Rate Maps for areas of Lyon, Mineral, and Nye Counties. In Lyon County, applicable flood-map coverage is available for most of the county, which includes areas north and west of the Mason Valley Wildlife Management Area, and approximately 20 percent of Nye County. FEMA has mapped floodplains only in the southernmost section of Walker Lake.

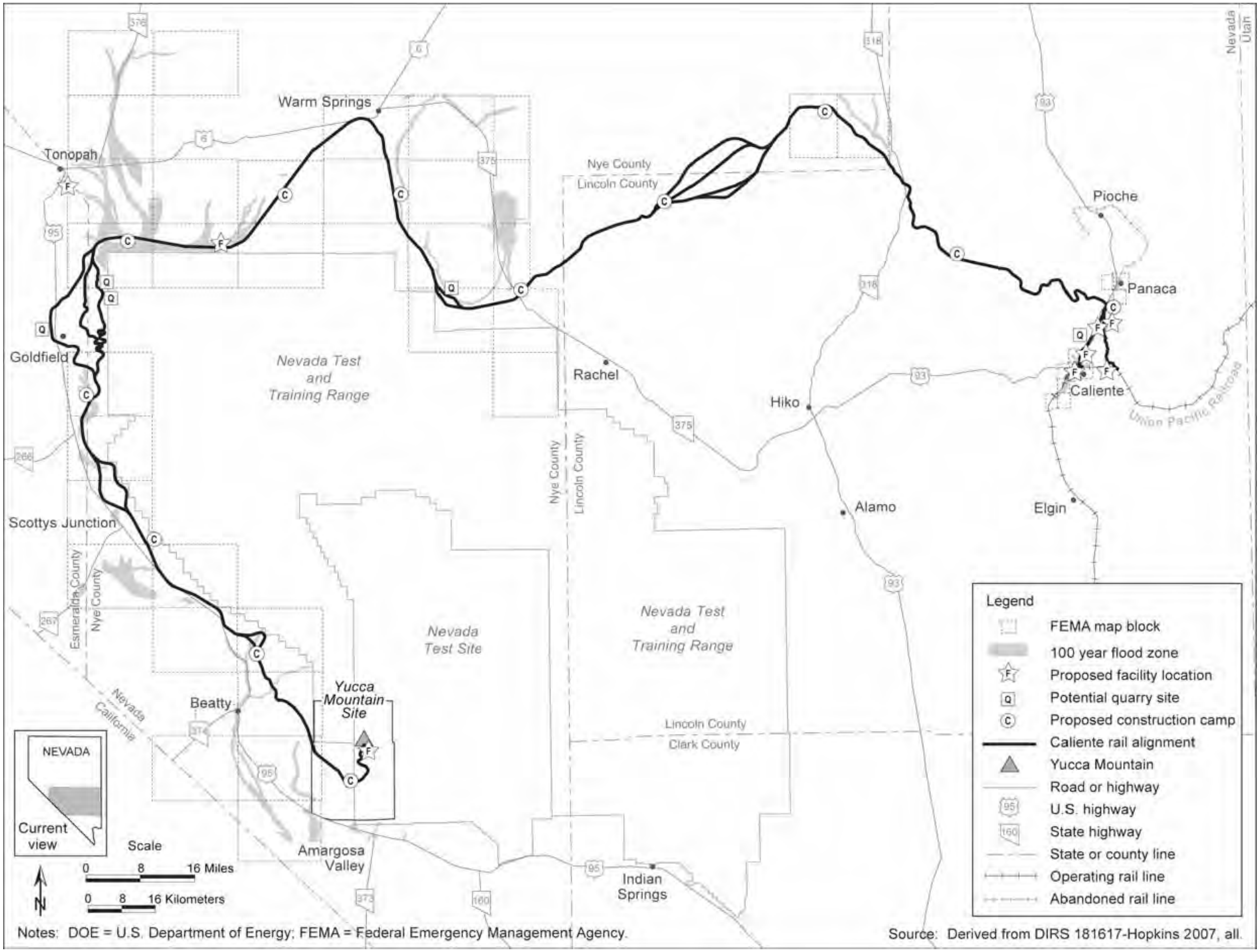


Figure F-1. FEMA floodplain map coverage for the Caliente rail alignment.

Table F-1. Floodplains the Caliente rail alignment would cross (page 1 of 2).

Rail line segment	Portion covered by FEMA[a] maps (percent)	Floodplain crossing distance (kilometers)[b]		Description of feature that would be crossed
		Mapped	Additional estimated	
Caliente alternative segment	28	2.6	2.5	Starting from the southern end of the alignment with the Clover Creek Floodplain to its junction with the Meadow Valley Wash Floodplain and up the alignment approximately 4 kilometers (2.5 miles). No FEMA map available above Caliente city limit. Additional floodplain estimated by using shaded relief map and extending flood plain. Crossing distance for Meadow Valley Wash is based on the width of the flood zones farther south where there is flood map coverage.
Eccles alternative segment	0	0	1.0	FEMA map coverage is not available for the Eccles alternative segment. Crossing distance is estimated from the width of the 100-year flood zone along Clover Creek near its confluence with Meadow Valley Wash where there is flood zone map coverage.
Common segment 1	14	0	2	No floodplains identified.
Garden Valley alternative segment 1	0	0	3.9	No FEMA map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 2	0	0	9.5	No FEMA map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 3	0	0	3.9	No FEMA map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 8	0	0	9.5	No FEMA map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Common segment 2	26	0	0	No floodplains identified.
South Reveille alternative segment 2	100	23.1	0	Reveille Valley braided wash floodplain extending from Railroad Valley around southern tip of Reveille Range.
South Reveille alternative segment 3	100	0	0	No floodplains identified.
Goldfield alternative segment 1	58	1	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up Mud Lake Playa minor tributaries and Jackson Wash and China Wash, respectively.

Table F-1. Floodplains the Caliente rail alignment would cross (page 2 of 2).

Rail line segment	Portion covered by FEMA[a] maps (percent)	Floodplain crossing distance (kilometers)[b]		Description of feature that would be crossed
		Mapped	Additional estimated	
Goldfield alternative segment 3 (continued)	55	1	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up Mud Lake Playa minor tributaries and Jackson Wash and China Wash, respectively.
Goldfield alternative segment 4	43	1.5	0	Floodplains from Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat extending up Mud Lake Playa minor tributaries, Big Wash tributaries, and Jackson Wash and China Wash tributaries, respectively. Alkali Lake Playa floodplain not mapped by FEMA.
Common segment 4	100	1.3	0	Floodplain extends downgradient of Stonewall Flat Playa to the Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.9	0	Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.3	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	1.1	0	Floodplain of the Amargosa River within Thirsty Canyon.
Oasis Valley alternative segment 3	100	0.4	0	Floodplain of the Amargosa River within Thirsty Canyon.
Common segment 6	55	0.1	0	Beatty Wash Floodplain extending from Amargosa River Floodplain.
		0.23[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (wash and tributaries crossed).

a. FEMA = Federal Emergency Management Agency.
b. To convert kilometers to miles, multiply by 0.62137.
c. There are no FEMA maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of flood zone crossings in this area are from DOE 2002 flood mapping efforts (DIRS 155970-DOE 2002, Figure 3-12).

There are no FEMA flood maps for any part of Esmeralda County. The FEMA flood map coverage is shown on Figure F-2 and described in detail in Sections F.3.3.1 through F.3.3.12.

In the areas FEMA has mapped, flood insurance studies have been completed that include a hydraulic analysis and a computation of the floodway and/or flood zones. FEMA defines the floodway as “the

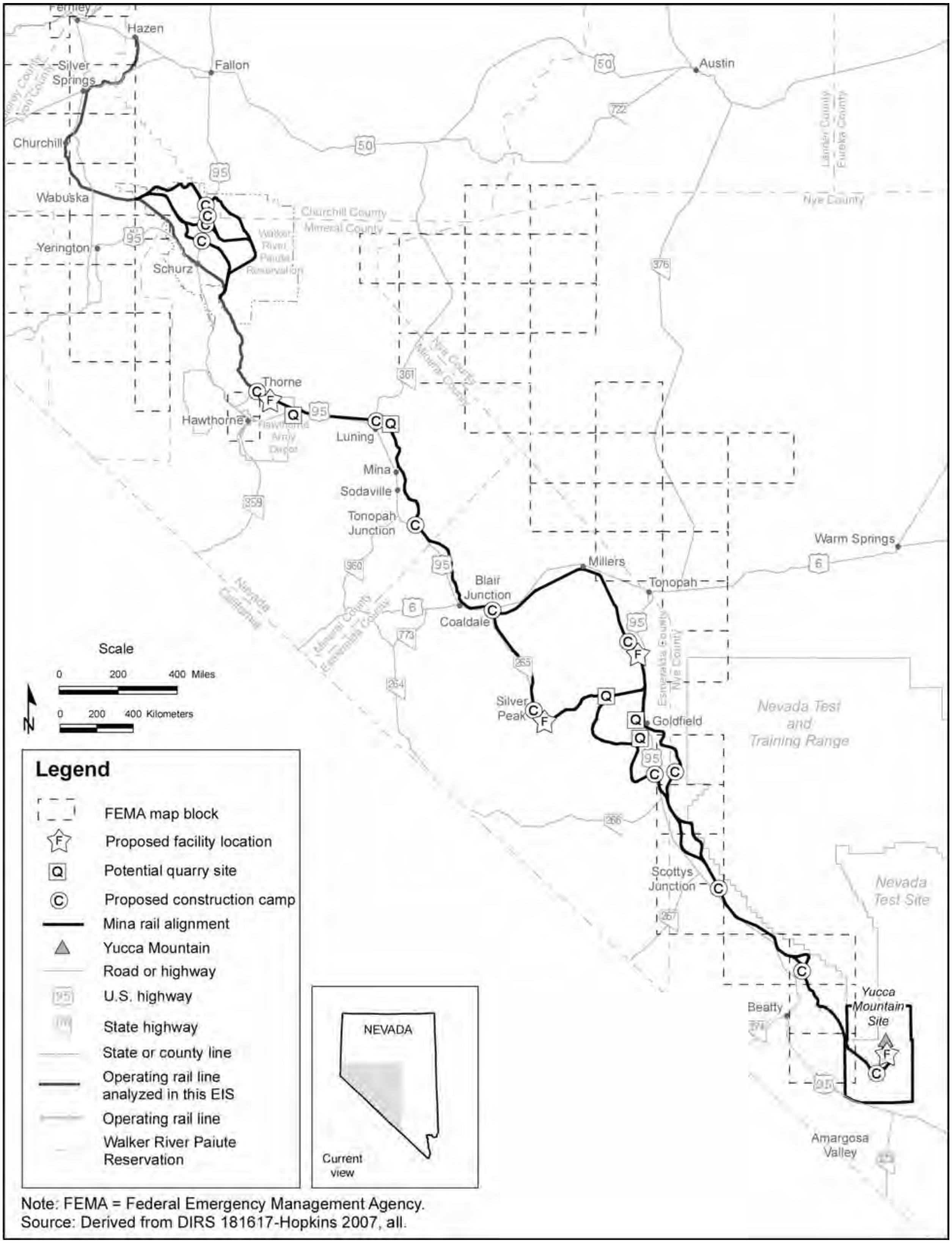


Figure F-2. FEMA floodplain map coverage for the Mina rail alignment.

channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights." Minimum federal standards limit such increases to 0.3 meter (1 foot). The area of the floodplain between the floodway and the outer limit of the 100-year flood limit is defined as the floodway fringe. The floodway is identified to assist the community in management of the floodplains detailed in the flood insurance study.

In addition to the FEMA flood maps, DOE used three studies completed in support of the Rail Alignment EIS to provide additional information related to discharge rates and flood hazards. The *Phase I Hydrologic and Drainage Evaluation Report for the Mina Corridor* (DIRS 180885-Parsons Brinckerhoff 2007, all) and the *Hydrologic and Drainage Evaluation Report for the Caliente Corridor* (DIRS 182755-PBS&J 2007, all) included field reconnaissance of every drainage feature along the entire Mina rail alignment and a review of all available streamflow and precipitation data sources. Also, an earlier study completed by Kennedy, Jenks, and Chilton in 1990 (DIRS 176903-De Leuw, Cather and Company 1992, Appendix H) provides approximate design discharge flow rates for portions of the alignment. The study also identifies locations along the Mina rail alignment with significant and unusual flooding hazards, including sections of the alignment affected by alluvial fans, closed-basin lakes, extremely high peak discharges, and wide shallow flow. Sections F.3.3.1 through F.3.3.12 summarize these studies.

Overlaying the Mina rail alignment on the FEMA maps allows for estimates of crossing distances (that is, the length of the rail alignment within the various floodplains). Table F-2 lists the floodplains identified along the Mina rail alignment by alternative segments and common segments. Sections F.3.3.1 through F.3.3.12 discuss the floodplains, where information is available, that would be encountered by each of the rail line segments.

DOE also contacted BLM field offices with jurisdiction over the federally owned lands along the Mina rail alignment to determine if they were aware of any floodplain data beyond that available from FEMA. None of the offices DOE contacted provided any floodplain data (DIRS 176303-Ong 2005, all; DIRS 176304-Ong 2005, all).

Table F-2. Floodplains the Mina rail alignment would cross (page 1 of 2).

Rail line segment	Portion covered by FEMA[a] maps (percent)	Floodplain crossing distance (kilometers)[b]		Description of feature that would be crossed
		Mapped	Additional estimated	
Union Pacific Hazen Branchline	-	-	-	-
Department of Defense Branchline North	-	-	-	-
Schurz alternative segment 1	0	0	-	No floodplains mapped.
Schurz alternative segment 4	0	0	-	No floodplains mapped.
Schurz alternative segment 5	0	0	-	No floodplains mapped.
Schurz alternative segment 6	0	0	-	No floodplains mapped.
Department of Defense Branchline South	-	-	-	-

Table F-2. Floodplains the Mina rail alignment would cross (page 2 of 2).

Rail line segment	Portion covered by FEMA[a] maps (percent)	Floodplain crossing distance (kilometers)[b] Mapped	Floodplain crossing distance (kilometers)[b] Additional estimated	Description of feature that would be crossed
Common segment 1	0	0	0	No floodplains identified.
Montezuma alternative segment 1	0.10	0.0 10	0	Floodplain from Jackson Wash and Jackson Wash tributaries, respectively. Alkali Lake Playa floodplain not mapped by FEMA.
Montezuma alternative segment 2	10	2.0	0	The floodplain is located between Stonewall Mountains and Cuprite Hills and is associated with Stonewall Flat.
Montezuma alternative segment 3	0.10	0.0 10	0	The very southern end of Montezuma 3 would cross a very small section of FEMA floodplains just before it joins with common segment 2.
Common segment 2	100	1.3	0	Floodplain extends downgradient of Stonewall Flat Playa to the Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.9	0	Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.3	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	1.1	0	Floodplain of the Amargosa River within Thirsty Canyon.
Oasis Valley alternative segment 3	100	0.4	0	Floodplain of the Amargosa River within Thirsty Canyon.
Common segment 6	55	0.1	0	Beatty Wash Floodplain extending from Amargosa River Floodplain.
		0.23[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (wash and tributaries crossed).

a. FEMA = Federal Emergency Management Agency.
b. To convert kilometers to miles, multiply by 0.62137.
c. There are no FEMA maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of flood zone crossings in this area are from DOE flood mapping efforts (DIRS 155970-DOE 2002, Figure 3-12).

F.2.2 WETLAND DATA REVIEW

Title 10 CFR 1022.11 requires DOE to examine the following information to determine whether a proposed action would be located in a wetland, consistent with the most authoritative information available about site conditions:

- U.S. Army Corps of Engineers, *Wetlands Delineation Manual*
- U.S. Fish and Wildlife Service National Wetlands Inventory
- U.S. Department of Agriculture, Natural Resources Conservation Service local identification maps
- U.S. Geological Survey topographic maps
- DOE environmental documents

DOE used these data sources to support the delineation of wetlands along the Caliente and Mina rail alignments. The Department identified and delineated all wetlands within 0.40 kilometer (0.25 mile) of the Caliente and Mina rail alignments, except for the southern portion of the Caliente alternative segment. The evaluation corridor was restricted to a 61-meter (200-foot) width in this area due to the presence of private property and the fact that DOE would construct the alignment within an area narrower than the 61-meter delineation corridor. Wetlands typically must exhibit three general characteristics, including wetland hydrology, hydrophytic vegetation, and hydric soils, and there generally must be a positive indicator of each of these characteristics for a site to be classified as a wetland (DIRS 180914-PBS&J 2006, all; DIRS 180889-PBS&J 2007, all).

Sections F.3.2.1 through F.3.2.12 describe the wetland delineation for the Caliente rail alignment. Sections F.3.3.1 through F.3.3.12 describe the wetland delineation for the Mina rail alignment.

F.3 Floodplain and Wetland Impacts

In accordance with 10 CFR 1022.12(a)(2), a floodplain assessment must discuss the positive and negative, direct and indirect, and long- and short-term effects of a proposed action on floodplains and wetlands. In addition, the effects on lives and property, and on natural and beneficial values of floodplains, must be evaluated. For actions taken in wetlands, the assessment should evaluate the effects of the proposed action on the survival, quality, and natural and beneficial values of the wetlands. If DOE could find no practicable alternative to locating railroad construction and operations activities in floodplains or wetlands, the Department would design or modify its actions to minimize potential harm to or in the floodplains and wetlands.

For the purpose of assessing direct impacts to floodplains and wetlands, the region of influence for these resources is limited in most cases to the area of disturbance. DOE has defined the area of construction as the area within 150 meters (500 feet) on either side of the centerlines of the rail alignments (called the nominal width of the rail line construction right-of-way; see Section 2.2 of the Rail Alignment EIS). The goal of conceptual design and engineering is to limit impacts to this area to the maximum extent practicable. The area of disturbance would be limited to a smaller area along sections of the alignment where there are wetlands or private property; in areas requiring deep cuts or high fills, the area of disturbance could extend beyond the nominal width of the construction right-of-way.

The region of influence for surface-water resources would be limited in most cases to the nominal width of the rail line construction right-of-way. In places where surface-water flow patterns (including floodwaters) could be modified or surface-water drainage could carry eroded soil, sediment, or spills downstream, the region of influence extends beyond the construction right-of-way. Within the region of influence, there could be impacts to floodwaters such that they would back up on the upstream side of the rail line, while there could be impacts to water quality if pollutants traveled downstream during a storm event without precipitating out (soils from erosion) or becoming too dilute (petroleum-based lubricants or fuels) to detect.

DOE evaluated potential impacts to floodplains and wetlands based on a series of criteria, as listed in Table F-3. There would be an impact if railroad construction and operations would cause any of the conditions listed in Table F-3. To avoid or limit adverse impacts to floodplains and wetlands, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Most importantly, careful pre-planning of construction and operations activities will allow the Department to assess and minimize potential impacts before they occur (see Section 2.1 in the Rail Alignment EIS).

Table F-3. Impact assessment standards.

Resource criteria	Basis for assessing adverse impact
Wetlands	• Cause filling of wetlands or otherwise alter drainage patterns such that wetlands or waters are adversely affected.
Floodplains	• Alter floodway or floodplain or otherwise impede or redirect flows such that human health, the environment, or personal property is adversely impacted. • Conflict with applicable flood management plans or ordinances.

The areas where surface-water impacts would be greatest and where DOE would implement direct controls (such as erosion and sedimentation controls) would be within the construction right-of-way. DOE would reduce impacts to floodplains and wetlands by avoiding these resources where practicable and reducing the footprint of impact where the alignment would cross floodplains or wetlands. The Department would minimize the filling of wetlands and in some cases would reduce the width of the construction footprint in areas where the rail line would intersect or abut wetlands to reduce adverse impacts to wetlands in these areas. Impacts are addressed in this section in relation to the impact assessment standards listed in Table F-3, including construction in floodplains, alterations to floodwater discharge, construction in wetlands, and water-quality degradation.

The presence of floodplains or wetlands in the areas of the Caliente and Mina rail alignments depends in large part on the meteorology and hydrology of the area. Central and southern Nevada is characterized by low precipitation and high annual evaporation rates typical of desert climates, as described in Sections 3.2.5 and 3.3.5 of the Rail Alignment EIS. Because of the climate and topography (which is mostly north-south trending, parallel mountain ranges with broad, intervening valleys) in this area, internal drainage is the predominant hydrologic feature. Important characteristics of this hydrologic system include ephemeral streams and playas. Ephemeral streams might be dry over multiple seasons or years during periods of drought, but could have multiple periods of flow or standing water during wet periods, as happened during the winter of 2004-2005.

Runoff in the area is the result of snowmelt and seasonal precipitation that occurs most commonly in winter and occasionally in fall and spring. Localized thunderstorms also occur in this area, primarily in the summer. Thunderstorms can be intense, creating runoff in one wash while an adjacent wash receives little or no rain. In rare cases, however, storm and runoff conditions can be extensive enough to result in flow being present throughout the drainage systems. Although flow in most washes is rare, the area is subject to flash flooding from intense summer thunderstorms or sustained winter precipitation. When it occurs, intense flooding can include mud and debris flows in addition to runoff. Much of the runoff quickly infiltrates into rock fractures or into the dry soils, some is carried down alluvial fans in arroyos, and some drains onto dry lakebeds where it might stand for weeks as a lake (DIRS 180885-Parsons Brinckerhoff 2007, p. 17).

Washes in the areas of the Caliente and Mina rail alignments typically terminate in playas and flats within enclosed basins, typical of the Great Basin hydrologic regime (DIRS 174207-NDWR [n.d.], Part 1, p. 4-1). The exception is Meadow Valley Wash at the eastern end of the Caliente rail alignment, which is part of the Colorado River drainage system. The Amargosa River drainage system terminates within an enclosed basin, but in this case, outside of the Nevada state boundary into the Death Valley area of California. Sections 3.2.5 and 3.3.5 of the Rail Alignment EIS includes a detailed discussion of all of the mapped surface-water features along the Caliente and Mina rail alignments, respectively.

The proposed rail alignments pass through numerous valleys and over or around numerous ranges, as described in Sections 3.2.5 and 3.3.5 of this EIS. Physical limitations on the design of a rail line (for example, the need for relatively gentle gradients and wide turns) require that the alignments follow valley floors to go around ranges or parallel the mountain ranges in transition zones to gradually change elevation to reach, or descend from, passes. In the valley floors, the alignments parallel predominant drainage channels and cross through or near flats and playas. Closer to ranges, the alignments are laid out at a right angle to the predominant drainage (from topographic highs to inland basins). As a result, the proposed rail alignments would encounter a wide variety of surface drainage features.

50-year flood is a flood that has a 2-percent chance of being equaled or exceeded in any given year.

100-year flood is a flood that has a 1-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.

500-year flood is a flood that has a 0.2-percent chance of being equaled or exceeded in any given year.

F.3.1 COMMON IMPACTS

F.3.1.1 Construction in Floodplains

Many of the floodplains that would be encountered by the proposed rail line are associated with internally draining basins with few, if any, inhabitants or facilities, and where the floodwaters end up in playa areas. The floodplains assessed herein are primarily those areas of normally dry washes that are temporarily and infrequently inundated from runoff during 100-year or 500-year floods. The proposed rail alignments are in a region where flash flooding events are the primary concern. Although such flooding can be violent and hazardous, it is generally focused in its extent and duration, limiting the potential for extensive impacts associated with the proposed rail line; that is, any damage would be expected to be confined to a small portion of the rail line.

Construction of a rail line along the Caliente rail alignment or the Mina rail alignment would affect floodplains, either through direct alteration of the stream channel cross section that would affect the flow pattern of the stream, or through indirect changes in the amount of impervious surfaces and additional water volume added to the floodplain. In most of the areas along the proposed rail alignment, construction in a floodplain would not increase the risk of future flood damage or increase the impact of floods on human health and safety because there are very few human activities or facilities in the areas adjacent to the proposed alignments, with a few exceptions, such as the City of Caliente along the Caliente rail alignment and town of Mina along the Mina rail alignment. DOE expects that adverse impacts along the proposed rail alignments would be minimized because construction activities would adhere to design standards that limit the degree to which floodwaters would be allowed to rise. DOE would incorporate hydraulic modeling into the engineering design process to ensure that all crossings are designed in a manner that limits adverse impacts to nearby populations and resources; therefore, DOE expects that impacts associated with construction in floodplains would be small.

Subgrade elevation of the rail line is the elevation of the top of the ***subballast***.

Subballast is a layer of crushed gravel that is used to separate the ***ballast*** and roadbed for the purpose of load distribution and drainage.

Ballast is crushed stone used to support the railroad ties and provide drainage.

Except in areas where drainage structures cross a Federal Emergency Management Agency-designated 100-year floodplain, hydraulic design would be based upon typical Class 1 freight railroad standard design criteria. Class 1 freight railroad standard criteria require that the ***50-year flood*** should not come into contact with the top (crown) of the culvert or the lowest point of the bridge, whichever is applicable. For the ***100-year flood***, these criteria require that the floodwaters should not rise above the ***subgrade elevation*** at the structure. To conform to these standards, DOE would use circular culverts where flow rates would be small (less than 4 cubic meters per second [140 cubic feet per second]). For larger flows (up to 28 cubic meters per second

[1,000 cubic feet per second]), DOE would use box culverts. The Department would construct bridges where flows were larger and where the rail surface would not be tall enough to accommodate a sufficiently sized culvert, and would install the culverts with ***riprap*** around the exposed ends to protect the fill material from erosion (DIRS 176166-Nevada Rail Partners 2006, p ii). Bridge abutments and piers would be similarly protected. In some places, training dikes or ***berms*** would be required to redirect flow and ensure that the flow would be conveyed through the structure. In places, channel improvements might be necessary for a short distance upstream and downstream of the rail line to intercept and effectively redirect flows through drainage structures.

DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible. Where there would be very wide and shallow depths of flow during a 100-year flood, or the flow would be divided into multiple natural channels that would cross the rail line, the Department would use a series of multiple culverts, potentially in concert with small bridges to span the main flow channel. In locations where there were very high fill conditions, it would be more economical to use multiple culverts than to construct a bridge (DIRS 176166-Nevada Rail Partners 2006, p ii). Because DOE would design stormwater conveyance systems to safely convey design floods (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts associated with construction of the rail line on stormwater conveyance would be small.

Although DOE would generally design rail line features to accommodate 100-year floods, based on typical Class 1 freight railroad standard design criteria as described above, the final design process could also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2c). In areas where drainage structures cross a Federal Emergency Management Agency-designated 100-year floodplain, the bridge would be designed to comply with Agency standards and appropriate county regulations. Federal Emergency Management Agency standards require that floodway surcharge (the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. These standards are designed to limit the impacts of floodwater impacts to structures built in or adjacent to floodplains (DIRS 176166-Nevada Rail Partners 2006, p. ii). By adhering to these standards, the Department would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

The placement of a bridge typically involves encroachment into the floodplain by the bridge abutments. This encroachment can have some impact on the height of floodwaters upstream of the bridge. Excessive encroachment can also result in increased scour potential at the abutments, piers, and the stream bottom, and through the bridge opening, due to increases in flow velocities. Based on the conceptual design for the proposed alternative segments, encroachments up to 30 percent of the floodplain width would be possible, which could result in an increase of 0.3 meter (1 foot) in the height of floodwaters at the upstream side of the proposed bridge where the floodplain is wide and shallow (DIRS 180918-Nevada Rail Partners 2007, p. ii).

DOE would reduce impacts to floodplains and the resources close to the floodplains by adhering to the design standards that limit the degree to which floodwaters would be allowed to rise. DOE would incorporate hydraulic modeling into the engineering design process to ensure that all crossings were designed to limit impacts to nearby populations and resources.

In general, construction-related impacts associated with the floodplains would be similar to those that could occur in any other identified drainage areas (in other words, the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas may reduce the area through which floodwaters naturally flow, which could cause water levels to rise at the upstream side of crossings. Sedimentation would be likely to occur on the upstream side of crossings in these areas where the flow of water is restricted to the point where ponding occurs. DOE would manage sedimentation of this type under a regular maintenance program (DIRS 155970-DOE 2002, pp. 6 to 79). Impacts to floodplains resulting from restrictions in flow and resulting sedimentation are expected to be small due to the regular maintenance DOE would perform.

F.3.1.2 Alterations to Floodwater Discharge

Alterations to natural drainage, sedimentation, and erosion would be unlikely to increase future flood damage, increase the effect of floods on human health and safety, or cause significant harm to the natural and beneficial values of the floodplains. This is because of the relatively limited size of the disturbance that would be necessary to construct a rail line and because the rail line design would include appropriate water-conveyance structures or devices to accommodate flood flows.

Alterations to floodplains (such as cuts and fills) due to rail line construction could cause the alteration of natural drainage patterns and runoff rates that could affect downgradient resources. Construction activities that could alter surface drainage temporarily include moving large amounts of soil and rock to develop the track platform (or subgrade) and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and to allow movement of equipment to the construction initiation points. Permanent alterations to drainage would be limited to engineered drainage structures and grading and excavation activities. DOE would not expect alterations to floodplain drainage to adversely impact people and property downstream because DOE would use best management practices and standard engineering design and construction practices to minimize adverse impacts.

Depending on site-specific conditions, construction grading may be used to channel a number of minor drainage channels into a single culvert or under a single bridge, which would result in water flowing from a single location on the downstream side rather than across a broader area. As a result, some localized changes in drainage patterns would occur. However, these changes would be limited to areas where natural drainage channels were small; therefore, DOE would expect adverse impacts associated with altered drainage patterns to be small. The Department does not expect that any increase in the velocity of floodwaters caused from rechanneling or regrading would result in adverse impacts to downgradient resources because alterations to drainage would be limited to the area of construction and the associated facility locations.

F.3.1.3 Construction in Wetlands

Direct impacts to wetlands associated with the rail alignment would result from temporary or permanent filling or draining of these resources. Indirect impacts would include potential water-quality degradation resulting from actions in and around these resources. Wetland areas would be filled or disturbed as a result of construction of the proposed rail line.

Wetlands improve water quality by acting as filters and slowing seasonal floodwater as it moves around wetland vegetation. It acts similar to a sponge by storing water and then slowly releasing water downslope (DIRS 178594-EPA 2006, all). Wetlands also filter water-borne sediments out of the water column when seasonal floodwaters come in contact with vegetation and other debris such as rocks and logs. Plant roots and microorganisms on plant stems and roots function in transforming pollutants into a less mobile form and play an important role in the atmospheric nitrogen cycle.

DOE would minimize filling of wetlands by incorporating avoidance into engineering and design of the rail line to the maximum extent practicable. DOE would use a minimum-width footprint when possible.

This would be accomplished by increasing the slope of the roadbed or bridging across wetlands and not constructing access roads in wetlands.

F.3.1.4 Water-Quality Degradation

Construction and operation activities associated with the Proposed Action would have the potential to degrade water quality and cause negative impacts to floodplains and wetlands due to the potential release and spread of contaminants (that is, materials potentially harmful to human health or the environment), which could be released through an accidental spill or discharge. These types of releases could be localized (in the event of a small spill) or widespread (in the case where precipitation or intermittent runoff carried contaminants away from the site of the spill). Sections 4.2.12 and 4.3.12 of the Rail Alignment EIS discuss hazardous materials in more detail, including petroleum products (such as fuels and lubricants) and coolants (such as antifreeze) for equipment operation. Other contaminants could include solvents used in cleaning or degreasing actions. The construction camps and some of the railroad operations support facilities would include some bulk storage of hazardous materials, and supply trucks would routinely bring new materials and remove used materials and wastes (such as lubricants and coolants) from the construction sites (see Section 4.2.12 of the Rail Alignment EIS). These activities would present some potential for accidental spills and releases, the significance of which would greatly depend on the nature and volume of the material spilled and its location. A release or spill of contaminants to a stream or wash, or carrying of contaminants to such receptors by stormwater runoff, would have the greatest potential for adverse environmental impact.

The potential for such impacts would be reduced because of the arid environment and lack of flowing water along either rail alignment. Also, construction contractors would be required to comply with regulatory requirements on spill prevention measures, reporting and remediating spills, and properly disposing or recycling used materials. Employees responsible for railroad operations would also be required to comply with any regulatory requirements and best management practices applicable to the proper storage and use of hazardous materials. Common stormwater pollution control practices mandate that hazardous materials be stored inside facilities, or have secondary containment or other protective devices, and that spill control and containment equipment be stationed close to hazardous material (such as fuel) storage areas. Thus, the potential for an accidental release that would not be localized or contained would be very small. During construction activities, water sprayed to control dust and achieve soil compaction criteria would not be used in quantities large enough to support surface-water flow and possible contaminant transport for any distance.

During operation of the rail line, it would be extremely unlikely that a railcar carrying spent nuclear fuel or high-level radioactive waste would derail in a floodplain or wetland, or in one of the washes crossed by the proposed rail alignment that drains to a floodplain or wetland. If a railcar transporting a shipping cask containing radioactive waste were to derail, the chances of a radiation release would be remote. As described in Section F.2.1, the shipping casks are designed to withstand accident conditions and are subject to very stringent design and testing standards to ensure their structural integrity. Impacts to wetlands and floodplains resulting from a release of hazardous materials of any type would be expected to be very small because of the precautions that would be taken to avoid and respond to spills. Further, shipping casks would never be opened during the transportation process and the potential for a release to occur during any accident or flooding scenario is extremely remote (DIRS 104774-Fischer et al. 1987, pp. 9-1 to 9-15).

Increased sediment loading as a result of soil disturbance actions during construction would be the most likely adverse impact associated with the Proposed Action. DOE would be required to identify the appropriate and applicable steps that would be taken during construction to minimize sediment loading. These steps most likely would be actions to reduce potential for increased erosion and subsequent sedimentation and to ensure that any downstream water did not experience increases in sediment loading or turbidity that would threaten the beneficial use of that water. DOE would not expect adverse impacts to surface waters along the proposed rail alignment that would interfere with any beneficial use of the water, which is a primary criterion applied by the State of Nevada environmental standards (Nevada Administrative Code 445A.121).

F.3.2 SEGMENT-SPECIFIC IMPACTS FOR THE CALIENTE RAIL ALIGNMENT

F.3.2.1 Interface with the Union Pacific Railroad Mainline – Caliente and Eccles Alternative Segments

Two alternative segments (Caliente and Eccles alternative segments) are under consideration for connecting to the existing Union Pacific Railroad Mainline. Facilities at the Interface with the Union Pacific Railroad Mainline include the Interchange Yard, the Staging Yard, a Satellite Maintenance-of-Way Facility, train crew facilities, and possibly the Nevada Railroad Control Center and National Transportation Operations Center.

F.3.2.1.1 Caliente Alternative Segment

FEMA has mapped flood zones only for the very southern portion of the Caliente alternative segment, as shown in Figures F-3 and F-4. From its starting point on the southern bank of Clover Creek, the alignment would cross 100-year and 500-year flood zones associated with both Clover Creek and Meadow Valley Wash. The Interchange Yard would be within 100-year and 500-year flood zones associated with Clover Creek. The alignment would remain in the 100-year floodplain associated with Meadow Valley Wash as it traveled north and left the area mapped by FEMA. Based on an analysis of the FEMA flood mapping and topographic contour data for the alignment, it appears that the Caliente alternative segment would be in a floodplain associated with Meadow Valley Wash from the time it left Caliente until it turned west just before joining Caliente common segment 1.

As listed in Table F-1, the alignment would cross a total of 2.6 kilometers (1.6 miles) of FEMA-mapped floodplains and approximately 2.6 kilometers of additional floodplains that FEMA has not mapped. It should be noted that the Caliente rail alignment would follow an existing abandoned Union Pacific rail bed from where it originates in Caliente for most of its length before joining common segment 1. Therefore, most rail line construction activities (except for operations support facilities) would be confined to the existing railbed.

The Interchange Yard on the Caliente alternative segment would be in the City of Caliente, directly across from the former Union Pacific Railroad Caliente Station within the area of the former Union Pacific Railroad yards. FEMA floodplain maps for this area show that a 240-meter (790-foot) section of the Interchange Yard would be in a 100-year floodplain and the remainder would be in a 500-year floodplain. Floodwaters from Meadow Valley Wash flow through the center of Caliente to the south where they merge with the runoff from three dry washes that flow to the southwest. In the area where the Interchange Yard would intersect the 100-year floodplain, the floodwater depth was calculated to be 0.90 meter (3 feet) during the 100-year storm event (DIRS 176806-FEMA 1985, all). Because the interchange tracks would be in an area already occupied by an existing Union Pacific siding, the Interchange Yard would not be likely to obstruct the flow of floodwaters to the point that floodwater depths would increase.

Two of the three alternative locations being considered for the Staging Yard are along the Caliente alternative segment (Indian Cove and Upland). The southern portion of the Indian Cove Staging Yard would be constructed in the 100-year floodplain mapped by FEMA along Meadow Valley Wash. Based on the elevation of the meadow in which the Staging Yard would be constructed, it appears that the

Figure F-3. FEMA floodplain map for map area 1 of the Caliente rail alignment.

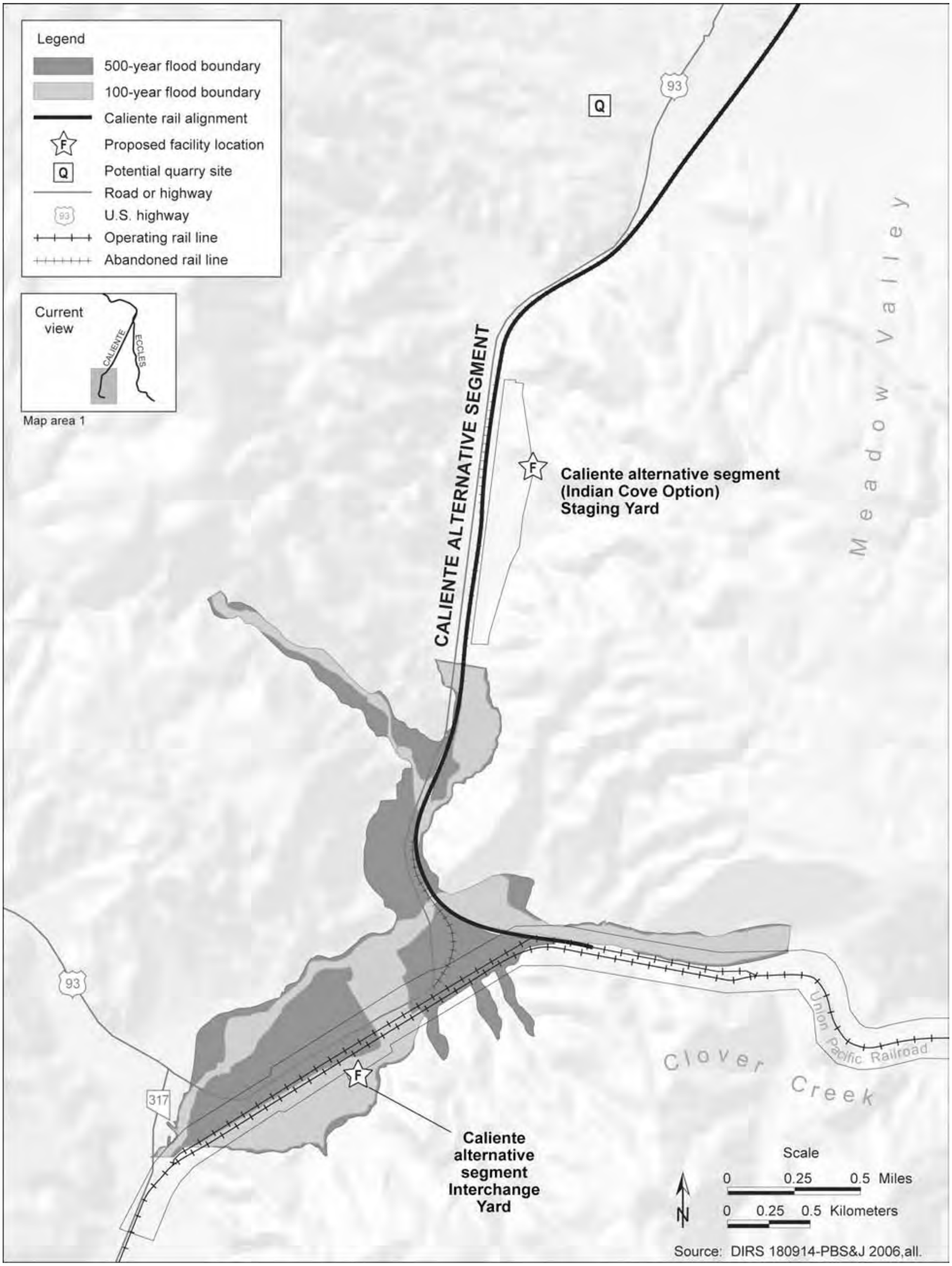


Figure F-4. FEMA floodplain map for the Caliente alternative segment.

entire meadow could be considered floodplain. The Caliente-Upland optional location for the Staging Yard is also susceptible to flooding from Meadow Valley Wash; however, FEMA has not mapped floodplains in this area. One of the construction camps would be about 2.5 kilometers (1.6 miles) south of the Caliente alternative segment junction with Caliente common segment 1. This construction camp would not intersect floodplains or wetlands. Section F.3.1 addresses the common impacts to floodplains the Caliente alternative segment and its associated facilities would cross.

DOE delineated wetlands within 30 meters (100 feet) of the Caliente alternative segment (see Figures F-5 and F-6) in a field survey completed in support of the Rail Alignment EIS (DIRS 180914-PBS&J 2006, Figures 4A to 4RT). Some larger wetland areas extend beyond the area delineated. Field investigations for wetlands along the Caliente alternative segment determined wetlands are primarily vegetated by herbaceous plants, but contain scattered clusters of scrub/shrub plant communities, pools of open water, and drainages (DIRS 180914-PBS&J 2006, Table 6). Most wetlands along the Caliente alternative segment contain dense communities of persistent herbaceous wetland plants that cause water-borne sediments to precipitate out of the seasonal sheet flow and slow the velocity of surface water flowing over the landscape. The root structure of herbaceous plants also functions in binding and retaining soil sediments. Persistent herbaceous vegetation along the rail alignment can provide a high magnitude of water-quality functions. Persistent vegetation is characterized as plants that retain their above-ground biomass during the nongrowing season (DIRS 178728-Bartoldus, Garbisch, and Kraus 1994, pp. 6 to 14) and contribute to sediment stabilization and flood flow attenuation functions. Nonpersistent vegetation decomposes during the nongrowing season, and therefore provides a lower magnitude of sediment retention functions.

Some wetlands along the Caliente alternative segment have a moderately complex wildlife habitat structure, as evidenced by the presence of trees and shrubs, and pools of open water or streams with flowing water. These wetlands function as important breeding sites, provide habitat for larval development, and serve as a primary food source for adults. Insects, spiders, snails, worms, and small fish living in wetlands are prey for certain amphibians. Wetlands also function as reproductive and nursery habitat for a variety of reptiles (DIRS 178594-EPA 2006, p. 3). Left undisturbed, these wetlands would continue to provide a variety of commonly recognized ecological functions such as wildlife habitat, sediment stabilization, nitrogen and nutrient cycling, flood attenuation, and water-quality benefits. These wetlands could play a more significant role in maintaining water quality and wildlife habitat during rail line construction. For example, undisturbed wetlands would intercept and cause the precipitation of sediments carried by ephemeral water. In addition, wetland vegetation could transform, relocate, and volatize small amounts of pollutants accidentally released into the environment.

The magnitude and quality of functions provided by undisturbed wetlands depends on the size of wetlands. Generally, large contiguous wetlands provide a suite of functions and higher ecological functional capacity. For example, a moderate- to large-sized wetland could provide the food, shelter, and reproductive requirements for wildlife, provide flood reduction capabilities, and filter sediments. Smaller wetlands might only provide limited habitat for transient wildlife, have little or no flood storage capacities, or depending on its position within the landscape, could easily be overwhelmed by a sudden influx of sediments and lose its capacity to effectively filter sediments.

Construction along the Caliente alternative segment would result in the permanent loss of some wetland habitat. Removal of the persistent wetland vegetation would result in short-term exposure to erosion by wind or water and desiccation by the warm climate. Undisturbed wetlands would continue to perform water-quality functions by filtering potential unconsolidated sediments; however, the flood flow attenuation capacity would be slightly reduced, and could result in some minor localized flooding and erosion during seasonal precipitation events. Wetlands could also be affected by increased sedimentation

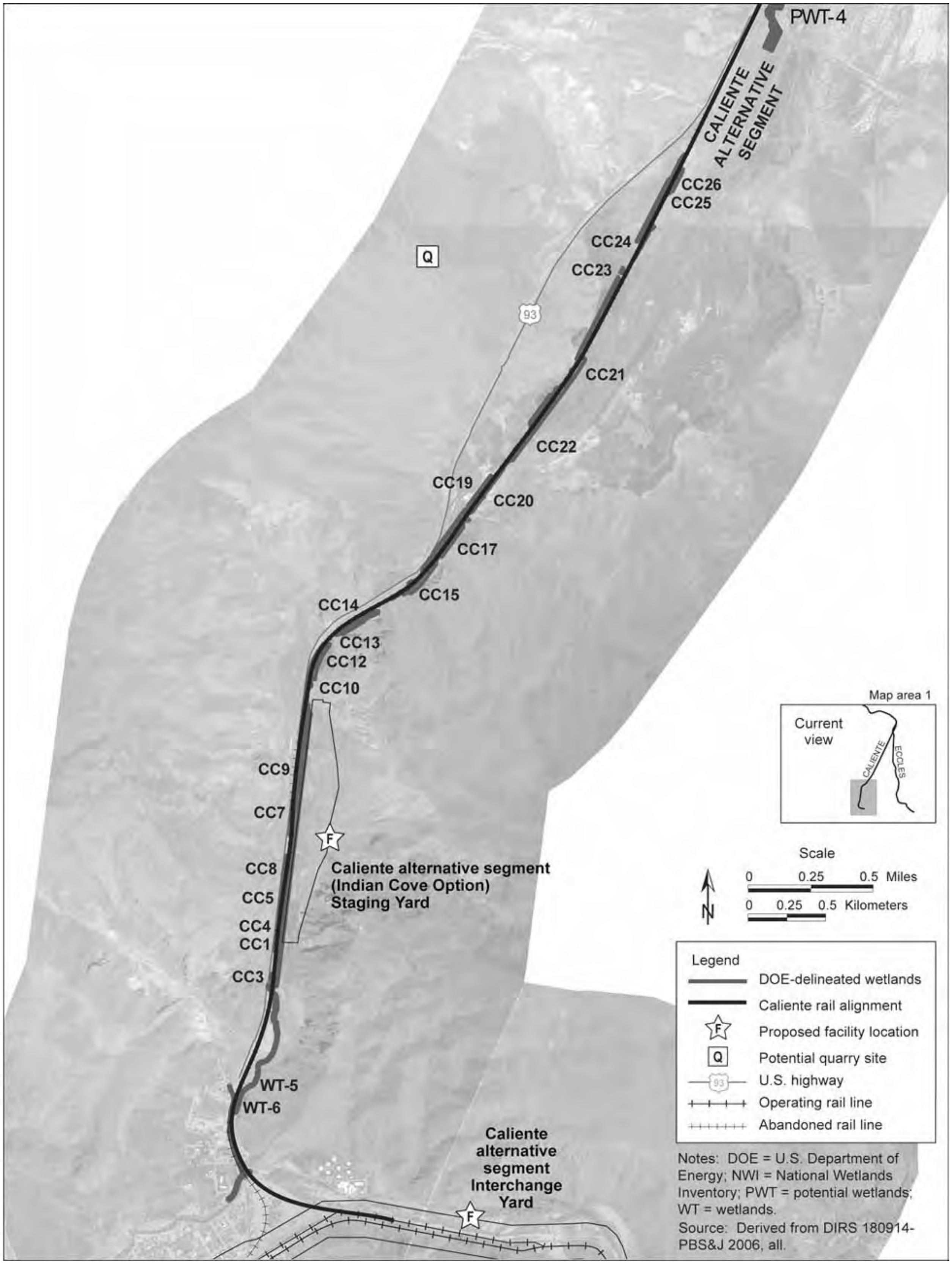


Figure F-5. Wetlands along southern portion of the Caliente alternative segment.

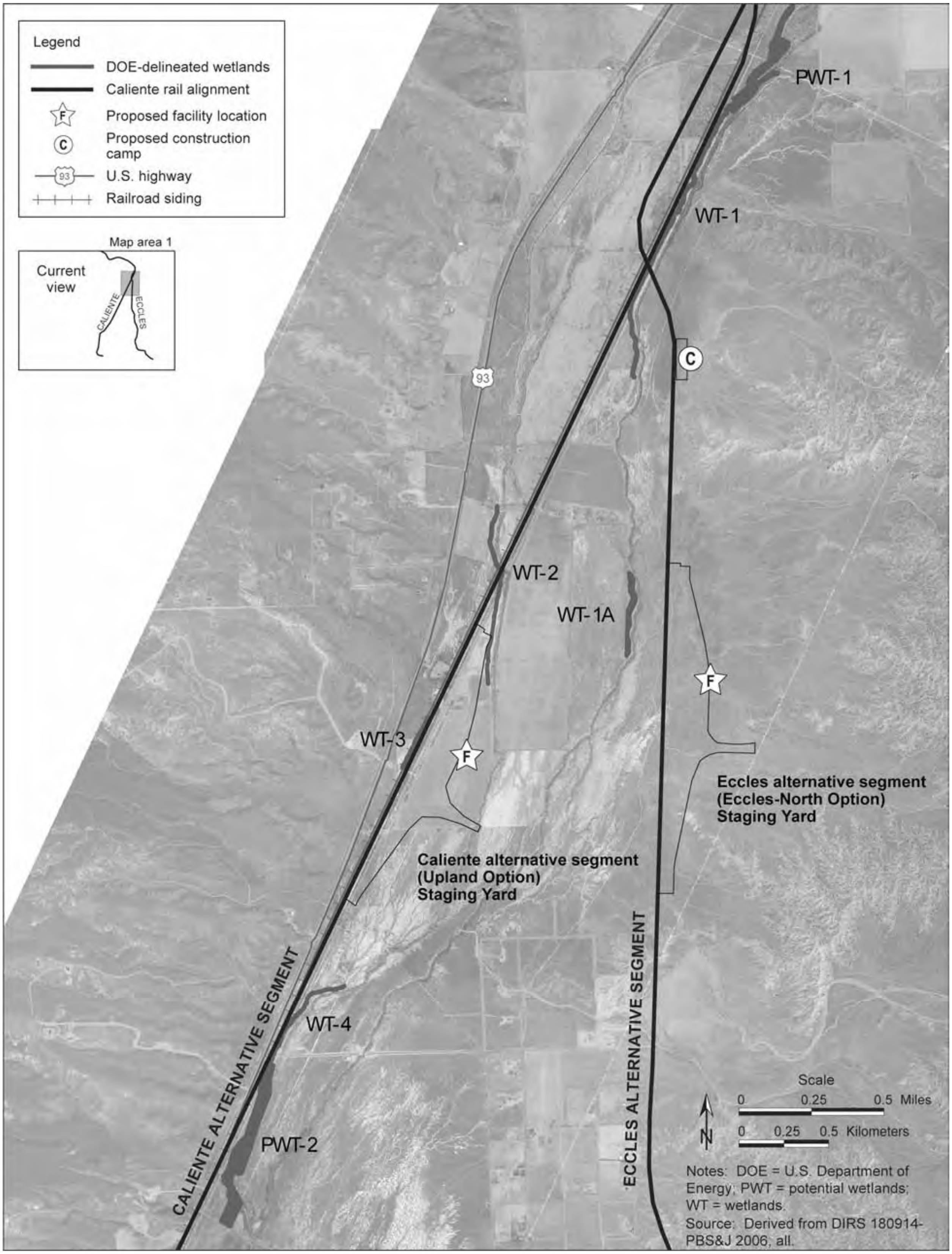


Figure F-6. Wetlands along northern portion of the Caliente alternative segment.

resulting from construction-related activities. Implementing best management practices such as constructing sediment ponds and installing hay bales or silt fences would minimize potential impacts. Wildlife utilizing wetlands in the proposed disturbance areas would be temporarily displaced, but would probably use nearby wetlands. DOE would minimize impacts to wetlands, which in turn, would minimize adverse impacts to herpetofauna (amphibians and reptiles) using these water resources. Where feasible, affected areas would be restored to the maximum extent practicable.

Removal of vegetation along the Caliente rail alignment would reduce the flood alteration capacity, and result in the loss of wildlife and increased sedimentation, particularly during rain events. In some areas, an influx of sediments related to disturbances could produce an accreting environment on the streambed and result in decreased flood storage capacities. Wildlife affected by the Caliente alternative segment would be temporarily displaced and would utilize nearby habitats. Over time, some wildlife species would return to affected areas, especially if lost habitat was reestablished.

The total area of wetlands delineated within 30 meters (100 feet) of the Caliente alternative segment is 0.28 square kilometer (68 acres). DOE would minimize impacts to wetlands in this area by reducing the width of the construction footprint to approximately 21 meters (70 feet), which would reduce the area of wetlands to be filled to 0.05 square kilometer (12 acres). Although DOE evaluated the use of vertical retaining walls and other methods to further reduce the construction footprint and the amount of wetlands that would be filled, the Department found that those methods would be impracticable due to cost (DIRS 180916-Nevada Rail Partners 2007, Appendix F-1). DOE could modify the final design of the alignment to avoid additional wetlands, such as those adjacent to the old rail roadbed along Meadow Valley Wash, by using a slightly narrower construction footprint; however, this would only slightly reduce the area of wetlands that would be filled.

DOE is considering two optional locations for the Staging Yard along the Caliente alternative segment (Indian Cove and Upland), as shown on Figures F-5 and F-6. The Indian Cove Staging Yard would be constructed in a wetland. Construction of the Staging Yard in Indian Cove would require the wetland meadow area to be drained and built up above the level of the floodplain. It might also require an active drainage system and a channel around the site to keep the area dry and in a stable condition. Meadow Valley Wash drainage through the site is from north to south toward the City of Caliente. Drainage of the site would be accomplished by constructing a channel along the eastern edge of the facility. The channel around the site would be approximately 1,680 meters (5,500 feet) long. The Department would determine final channel dimensions during final design of the Staging Yard. It is very likely that a system of drains would have to be constructed under the Staging Yard tracks. Fill could be needed to elevate portions of the site out of the floodplain. These actions would require permits from the U.S. Army Corps of Engineers, as well as compliance with Section 404 of the Clean Water Act for stormwater runoff control measures. Assuming that the entire meadow is wetlands, the Staging Yard at Indian Cove would require up to 0.19 square kilometer (47 acres) of wetlands to be filled.

One of the proposed quarry locations (and its associated siding) is also along the Caliente alternative segment. The railroad siding for this quarry would be constructed on the west side of the alignment in the vicinity of the quarry. Since the wetland delineation did not extend into this area, the amount of wetlands that would be filled must be estimated based on the wetlands that were delineated along the alignment. The total area of the siding is 0.18 square kilometer (44 acres) and a conservative assumption that half of this area is wetlands that would be filled would mean that 0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.

The construction of the Caliente alternative segment would require the filling of wetlands associated with Meadow Valley Wash. In addition, if the Caliente quarry and/or the Indian Cove Staging Yard are selected, a significant portion of additional wetlands would be filled. In order to mitigate the loss of wetlands that must be filled, DOE would enhance adjacent wetlands. By minimizing the footprint of the rail roadbed within wetlands and mitigating the loss of wetlands that are filled, DOE would minimize adverse impacts to these wetlands (and the functions served by wetlands); therefore, direct impacts to wetlands left intact are expected to be localized and small. Indirect impacts, such as disruption of water flow, will be avoided by constructing the rail line on an existing berm and constructing bridges and culverts in areas where water crosses the rail line; therefore, indirect impacts from the construction of the rail line would be small. The filling of up to 0.19 square kilometer (47 acres) of wetlands in Indian Cove for the Staging Yard would greatly impact the wetland functions served by the wet meadow, such as its ability to support wildlife, retain flood flows, and filter water; therefore, this is considered a large impact.

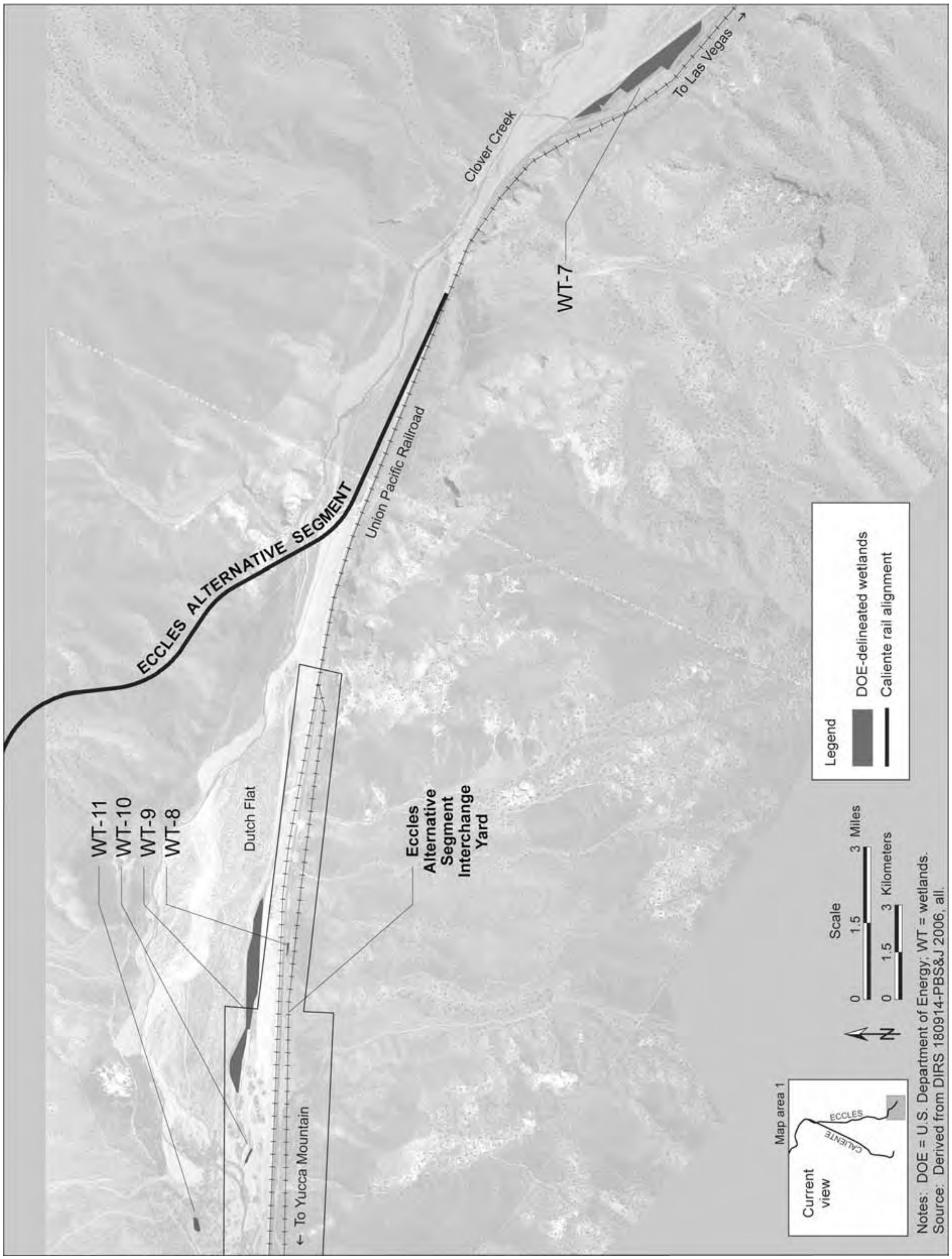
F.3.2.1.2 Eccles Alternative Segment

There are no FEMA flood maps for the area of the Eccles alternative segment; however, it is reasonable to assume that the floodplain mapped for Clover Creek in the area of Caliente extends to the east, upstream to the starting point of this alternative segment (see Figure F-3). Clover Creek is a tributary of Meadow Valley Wash. The place where the Eccles alternative segment would cross Meadow Valley Wash is also a likely floodplain. Section F.3.1 addresses the common impacts to floodplains that would be crossed by and adjacent to the Eccles alternative segment.

DOE delineated one wetland area in an incised channel along Meadow Valley Wash that would be crossed by the Eccles alternative segment approximately 1.5 kilometers (0.93 mile) south of the junction with common segment 1. A bridge would be used to cross Meadow Valley Wash and its associated wetlands in this area. The wetlands in this area are about 7.6 meters (25 feet) wide. Since a bridge will be used to cross this area, the fill estimate is based on the assumption that one pier would be constructed in the wetlands encompassing an area of 1.9 square meters (20 square feet).

Five other areas with wetlands (see Figure F-7) were identified near the proposed location of the Eccles Interchange Yard in Clover Creek (DIRS 180914-PBS&J 2006, Figure 4B). Three of those wetlands (WT-9, WT-10, and WT-11) are in Clover Creek about 30 to 180 meters (100 to 600 feet) north of the proposed Interchange Yard and would not be disturbed during construction. These three wetlands could be indirectly impacted by the construction of the Staging Yard. The existing railroad embankment would be expanded by filling and grading to match the mainline elevation, which would require fill along and within the confines of Clover Creek. The fill would extend approximately 15 meters (50 feet) into the creek for approximately 1,400 meters (4,600 feet) along the creek. For construction of the interchange siding, the fill would extend approximately 7.5 meters (25 feet) into the creek for approximately 900 meters (3,000 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks. Based on these assumptions, the total amount of fill required for the Interchange Yard would be approximately 0.033 square kilometer (8.2 acres). Appropriate protection measures (for example, lining the fill with riprap and gabions) would be used along the entire length of the Interchange Yard to stabilize and protect the structure from the floodwaters.

Filling a long section of a stream bank has the potential to create greater adverse impacts than simply crossing a stream, because the structure of the stream itself would be modified to a much greater extent as opposed to a bridge crossing or culvert that would have less of a presence within the stream. It is likely that fill required to construct the Interchange Yard could result in the permanent alteration of the localized hydraulic conditions. Such alterations to the hydraulic conditions of the stream would have the potential to increase flow velocity and result in a higher potential for erosion during high flow (flood) events. Indirect impacts to the wetlands within Clover Creek could result from the increased flow rates during flood events. Clover Creek and its associated floodplain, which encompasses Dutch Flat, ranges in width from 130 to 400 meters (430 to 1,300 feet). Since the Staging Yard would only extend about 15 meters (50 feet) into Clover Creek and its associated floodplain, impacts to the wetlands within Clover Creek



Notes: DOE = U.S. Department of Energy; WT = wetlands.
Source: Derived from DIRS 180914-PBS&J 2006, all.

Figure F-7. Wetlands in vicinity of Eccles Interchange Yard.

from increased flow rates are expected to be small. DOE would minimize these impacts through the use of erosion control practices and hydraulic design. The other two areas with wetlands (WT-7 and WT-8) are on the opposite side of the existing Union Pacific tracks from the proposed Interchange Yard and would not be filled for construction of that yard. DOE would maintain all surface-water connections from those two wetlands to Clover Creek by constructing bridges or culverts at connecting drainage features. DOE would flag or fence all wetlands within the area of construction to protect them during construction activities; therefore, no direct impacts are expected to these wetlands during construction.

F.3.2.2 Caliente Common Segment 1

FEMA has published only one flood map that covers a small section of the area crossed by Caliente common segment 1. This flood map covers a portion of land in White River Valley and the adjacent north end of the Seaman Range, as shown in Figure F-8. Common segment 1 would not cross any FEMA floodplains shown in the area on this single map. Common segment 1 would run 1.4 kilometers (0.87 mile) north of an unnamed playa that is 47 square kilometers (18 square miles) in size when crossing Dry Lake Valley. During periods of heavy rainfall, runoff from the Highland, Chief, North Pahroc, and Seaman Ranges can produce ephemeral lakes in these playas. One construction camp would be located along the common segment, but it would not intersect floodplains or wetlands. Common impacts to nearby playas and their associated floodplains are addressed in Section F.3.1.

In the North Pahroc Range pass (between White River Valley to the west and Dry Lake Valley to the east), Caliente common segment 1 would pass within 600 meters (2,000 feet) of a small group of three isolated wetlands (see Figure F-9). These isolated, nonjurisdictional (not regulated under Section 404 of the Clean Water Act) wetlands were delineated during the field survey conducted in support of the Rail Alignment EIS (DIRS 180914-PBS&J 2006, Figure 4S). These wetlands are labeled WT-12, WT-13, and WT-14 and are associated with an unnamed spring. A lack of wildlife habitat was observed in this area. The shoreline of the ponds lacks the vegetation that would provide food, shelter, or reproductive habitat for a variety of species (DIRS 180914-PBS&J 2006, Photos 50 and 51, pp. B-25 and B-26). Using the Cowardin (DIRS 178724-Cowardin et al. 1979, all) classification scheme, the stock watering pond (WT-12) is classified as a palustrine emergent/rock bottom/unconsolidated bottom wetland and the other areas (WT-13 and WT-14) as emergent wetlands (DIRS 180914-PBS&J 2006, p. 19).

The unnamed spring appears to have been created by excavating (or blasting) a hole into the soil and excavating a channel to convey water into a basin used as a stock watering pond. The spring head and excavated channel (WT-13) and the stock pond (WT-12) occupy less than 0.0081 square kilometer (2 acres). The channel was flowing from the spring head through the channel to the stock pond at the time of the field survey (DIRS 180914-PBS&J 2006, p. 13). No direct impacts are anticipated to these wetlands since they are uphill of and outside the rail line construction right-of-way; therefore, there would be no direct or indirect impacts to these wetlands as a result of the construction or operation of the proposed rail line.

F.3.2.3 Garden Valley Alternative Segments

FEMA flood maps do not cover any of the Garden Valley alternative segments. However, it is likely that some areas in the valley experience periodic flooding. Garden Valley alternative segment 2 would cross three of the same intermittent creeks and washes and the drainage feature designated as Water Gap, which is characterized as a topographically constricted area through which several small drainage channels run. Although the area is normally dry, Water Gap must be considered a suspect area for flooding issues. Garden Valley alternative segment 2 would also skirt (within 1 kilometer [0.6 mile]) the Coal Valley

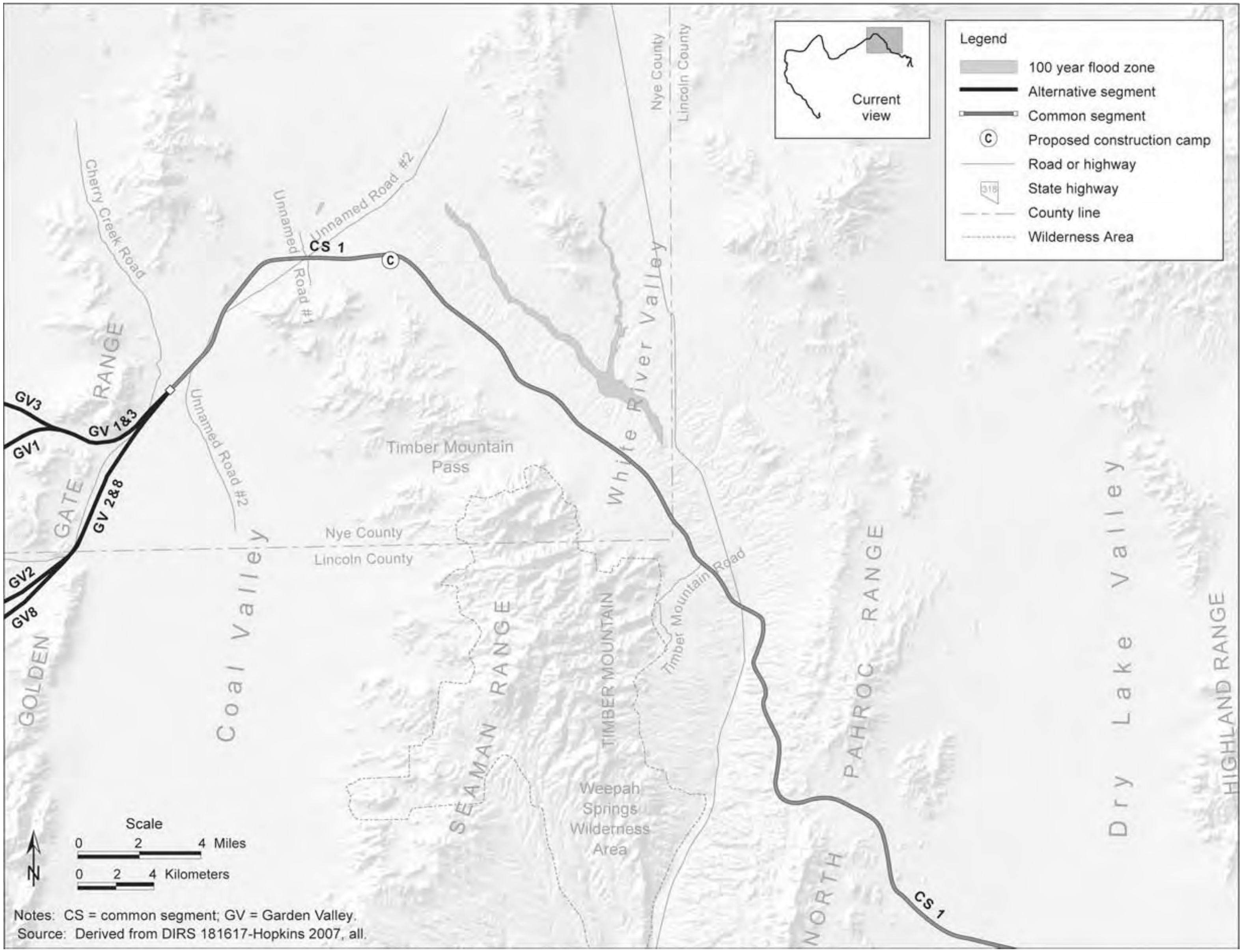


Figure F-8. FEMA floodplain map for map area 2 of the Caliente rail alignment.

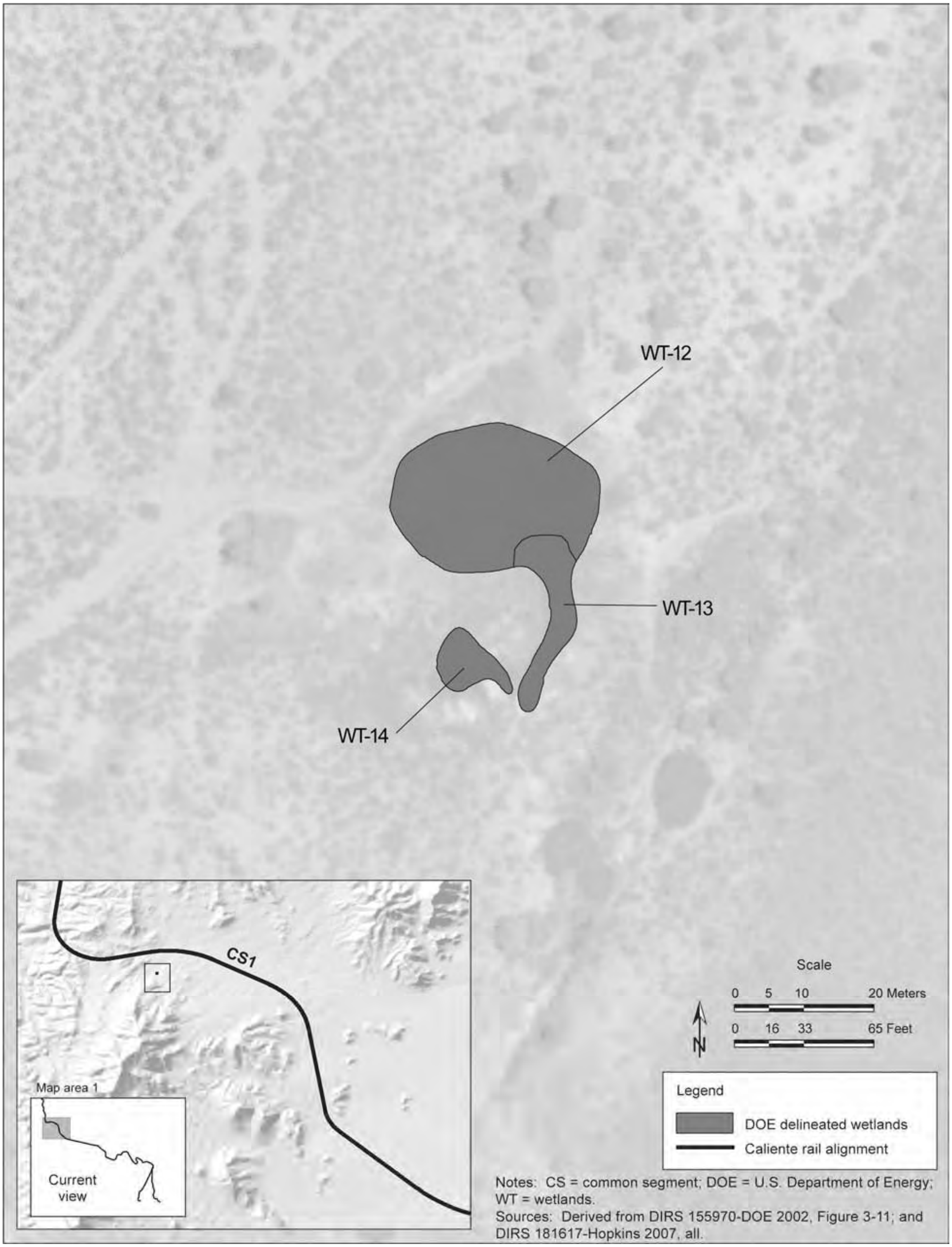


Figure F-9. Isolated wetlands south of Caliente common segment 1.

playa, another area expected to be susceptible to flooding and standing water. Each alternative segment would have a construction camp located about 6 kilometers (3.7 miles) east of the junction with Caliente common segment 2. None of these three locations intersect floodplains. Common impacts to nearby floodplains are addressed in Section F.3.1.

Although the National Wetlands Inventory dataset identifies the Coal Valley playa as a lacustrine littoral unconsolidated shore wetland, DOE field studies in support of the Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-PHE 2007, p. 3). No wetlands were identified along any of the Garden Valley alternative segments.

F.3.2.4 Caliente Common Segment 2

The only portion of Caliente common segment 2 covered by FEMA flood maps is the west end in Railroad and Reveille Valleys, but common segment 2 would not cross any floodplains in this limited area, as shown in Figure F-10. Two washes in this area have associated floodplains. One of these washes originates in Reveille Valley and runs adjacent to the proposed rail alignment and the other originates in the hills to the south and would be crossed by the rail alignment. Both of these washes terminate in the Railroad Valley playa north of the rail alignment. The floodplain for the adjacent wash does not extend laterally as far as the proposed rail alignment and the floodplain associated with the wash that would be crossed does not extend as far south as the proposed rail alignment. In the eastern portion of common segment 2, where there is no flood map coverage, the proposed rail alignment would cross drainage features, including Davis Creek and Quinn Canyon Wash, both of which have the potential to be associated with floodplains that have not been mapped. Two construction camps would be located along common segment 2; however, neither intersects floodplains. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Caliente common segment 2.

There are no wetlands identified along Caliente common segment 2 or its associated facilities.

F.3.2.5 South Reveille Alternative Segments

FEMA flood maps encompassing the area of these two short alternative segments are shown in Figure F-10. South Reveille alternative segment 2 would cross a 3.1-kilometer (1.9-mile) stretch of the 100-year floodplain associated with five tributaries draining to the well-defined, unnamed braided wash. Two potential quarry sites are located near the origination of the alternative segments. The proposed sites for the quarry plants that would support quarry NN-9A are located within the same floodplain that South Reveille alternative segment 2 would cross. South Reveille alternative segment 3 lies farther away from the wash and would not cross any 100-year floodplains. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the South Reveille alternative segments.

There are no wetlands identified along the South Reveille alternative segments or their associated facilities.

F.3.2.6 Caliente Common Segment 3

Most of Caliente common segment 3 would cross land that has FEMA flood map coverage. According to the FEMA maps, the common segment would not cross 100-year floodplains until it nears the vicinity of Mud Lake Playa and its tributaries where the flood boundaries are fairly extensive, as shown in Figures F-10 and F-11. From the east, the rail alignment would first encounter floodplains associated with Stone Cabin Creek and Saulsbury Wash as they converge on Mud Lake Playa. The proposed rail alignment would then cross the floodplain of a wash draining the central Ralston Valley before it would

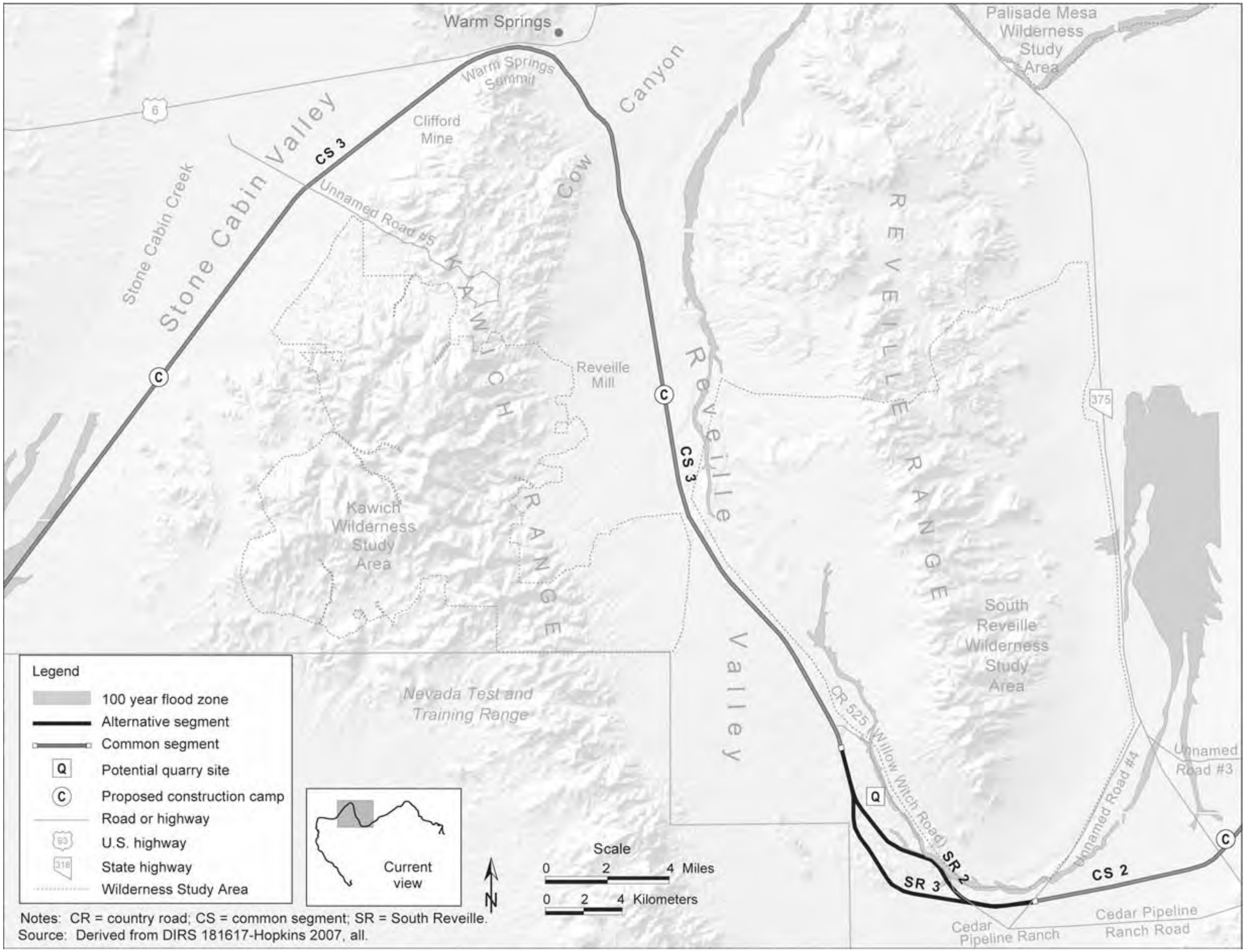


Figure F-10. FEMA floodplain map for map area 4 of the Caliente rail alignment.

cross through two legs of a drainage system draining the western Ralston Valley. The Mud Lake Playa area has by far the most extensive area of 100-year floodplains. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Caliente common segment 3.

Three construction camps would be located along Caliente common segment 3 (see Figures F-10 and F-11), one of which would be constructed within a floodplain associated with Mud Lake Playa. DOE would construct the Maintenance-of-Way Trackside Facility (see Section 2.2.4.1.2.1) in the southwestern portion of Stone Cabin Valley (see Figure F-11) in floodplains associated with Stone Cabin Creek. Common impacts to floodplains in which these facilities would be constructed are addressed in Section F.3.1.

There are no wetlands identified along Caliente common segment 3 or its associated facilities.

F.3.2.7 Goldfield Alternative Segments

FEMA flood maps cover the northern and southern portions of the Goldfield alternative segments, but not the central area that includes Goldfield, as shown on Figure F-11. According to FEMA flood maps, the alternative segments would cross a small portion of the floodplain associated with Mud Lake Playa, and each segment would cross a small portion of the floodplain associated with the drainage channel leading to Stonewall Flat Playa. There are three proposed quarry sites along the Goldfield alternative segments, two along Goldfield alternative segment 3, and one that would be accessible from Goldfield alternative segment 4; however, none of them intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by or adjacent to the Goldfield alternative segments..

There are no wetlands identified along the Goldfield alternative segments.

F.3.2.8 Caliente Common Segment 4

The FEMA flood maps provide coverage for almost all of Caliente common segment 4. The proposed rail alignment segment would skirt within 0.5 kilometer (0.31 mile) of Stonewall Flat Playa to the east and Alkali Flat Playa to the southwest and cross over the drainage path that connects the two areas. As shown in Figure F-11, the rail alignment would cross a 1.3-kilometer (0.81-mile) portion of the 100-year floodplain associated with the drainage between Stonewall Flat Playa and Alkali Flat Playa in Lida Valley. One construction camp would be located along common segment 4; however, it would not intersect any floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Caliente common segment 4.

Although the segment would not cross any mapped wetlands, Stonewall Flat Playa is classified by the National Wetlands Inventory dataset as a lacustrine littoral unconsolidated shore (L2US) wetland system. DOE field studies in support of the Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-PHE 2007, p. 6).

There are no wetlands within the region of influence for Caliente common segment 4.

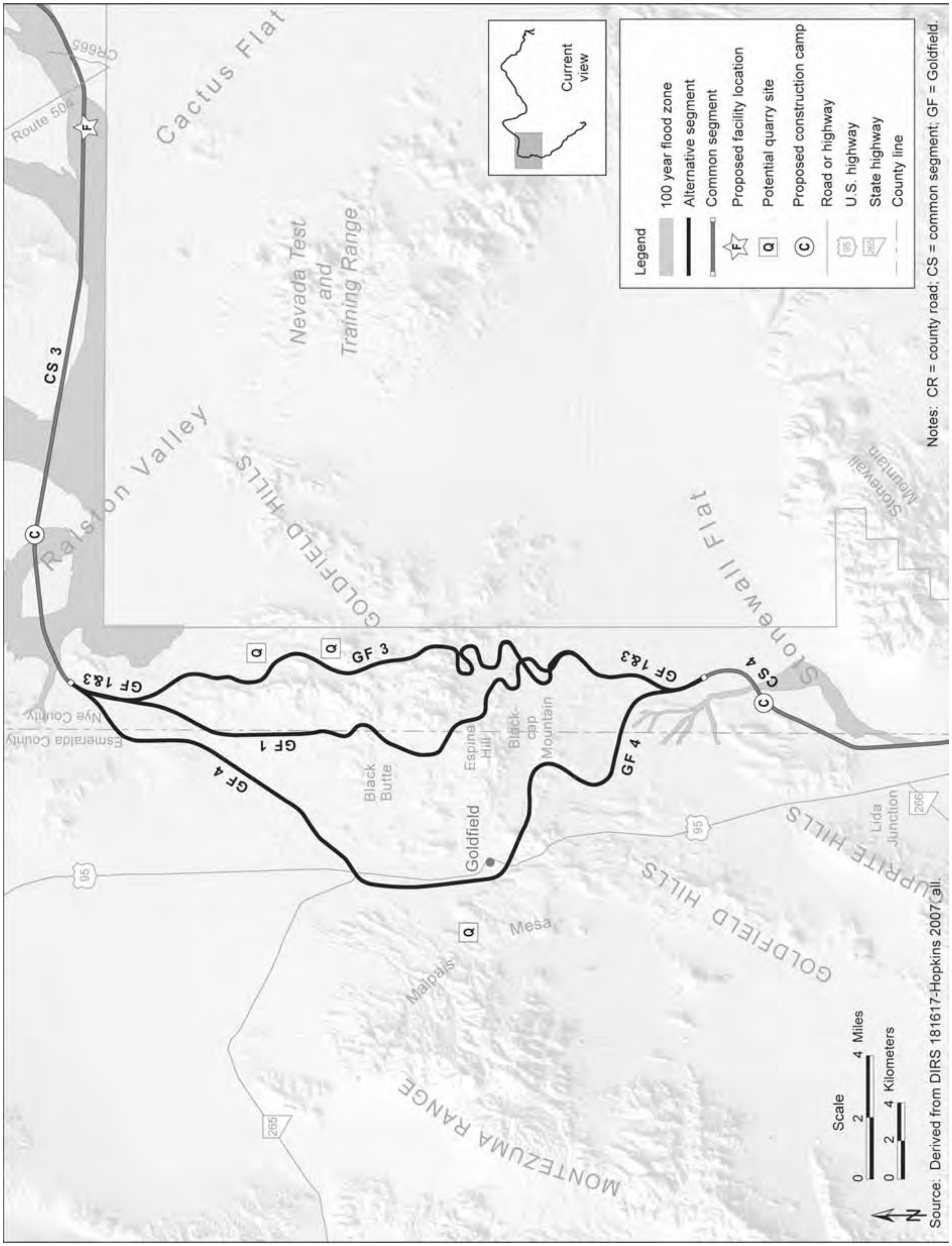


Figure F-11. FEMA floodplain map for map area 5 of the Caliente rail alignment.

F.3.2.9 Bonnie Claire Alternative Segments

FEMA flood maps cover most of the Bonnie Claire alternative segments, but do not include land east of the segments, which are shown on maps as an old boundary of the Nevada Test and Training Range. Consequently, there is no floodplain mapping east of this boundary. Bonnie Claire alternative segment 3, the western alternative segment, has more extensive flood map coverage than Bonnie Claire alternative segment 2. As shown in Figure F-12, the northwest end of Bonnie Claire alternative segment 3 would cross a 100-year floodplain associated with the Alkali Flat playa. The flood maps also show a floodplain for an unnamed drainage channel from Pahute Mesa. This floodplain ends just south of Bonnie Claire alternative segment 3 at one of the old Test and Training Range boundaries.

The floodplain is sufficiently close to Bonnie Claire alternative segment 3 to assume it could have a similar width if floodplain mapping were extended upslope to where it would be crossed by Bonnie Claire alternative segment 3. It is possible this floodplain would extend far enough northeast to be encountered by Bonnie Claire alternative segment 2; however, the distance is too far to support such an assumption. In addition, Bonnie Claire alternative segment 2 would occur at higher elevations in the foothills where the wash would encounter fewer tributaries. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the Bonnie Claire alternative segments.

There are no wetlands identified along the Bonnie Claire alternative segments.

F.3.2.10 Common Segment 5

FEMA flood maps provide coverage for almost all of common segment 5 (see Figures F-12 and F-13) and indicate the proposed rail alignment would cross a 100-year floodplain associated with Tolicha Wash as it drains toward Sarcobatus Flat. FEMA has also identified a 100-year floodplain approximately 2 kilometers (1.2 miles) southwest of the alignment. This small floodplain is associated with two minor playas in Sarcobatus Flat. One construction camp would be located along common segment 5; however, it would not intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to common segment 5.

There are no wetlands identified along common segment 5.

F.3.2.11 Oasis Valley Alternative Segments

FEMA flood maps provide complete coverage for the Oasis Valley alternative segments, as shown in Figure F-13. The maps show both alternative segments would cross the Amargosa River 100-year floodplain. The linear distance required to cross the Amargosa River in Oasis Valley would be less for Oasis Valley alternative segment 3 because there are fewer braided channels upstream than there are downstream. One construction camp would be located along the alternative segments; however, it would not intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the Oasis Valley alternative segments.

DOE field surveys identified a small isolated wetland, WT-15, (74 square meters [0.018 acre]) just outside the construction right-of-way, approximately 160 meters (530 feet) north of Oasis Valley alternative segment 1 (see Figure F-14). This wetland does not have a connection to interstate commerce, and would be regarded as isolated, and thus considered nonjurisdictional. The wetland occurs within a slight topographic depression (DIRS 180914-PBS&J 2006, Table 6 and Figure 4T). This wetland can be characterized as a shrub-shrub/emergent wetland complex with a moderately complex wildlife habitat structure (DIRS 180914-PBS&J 2006, Photos 52 and 53). There would be no direct impacts to this wetland during rail line construction because it is outside the construction right-of-way and it would be

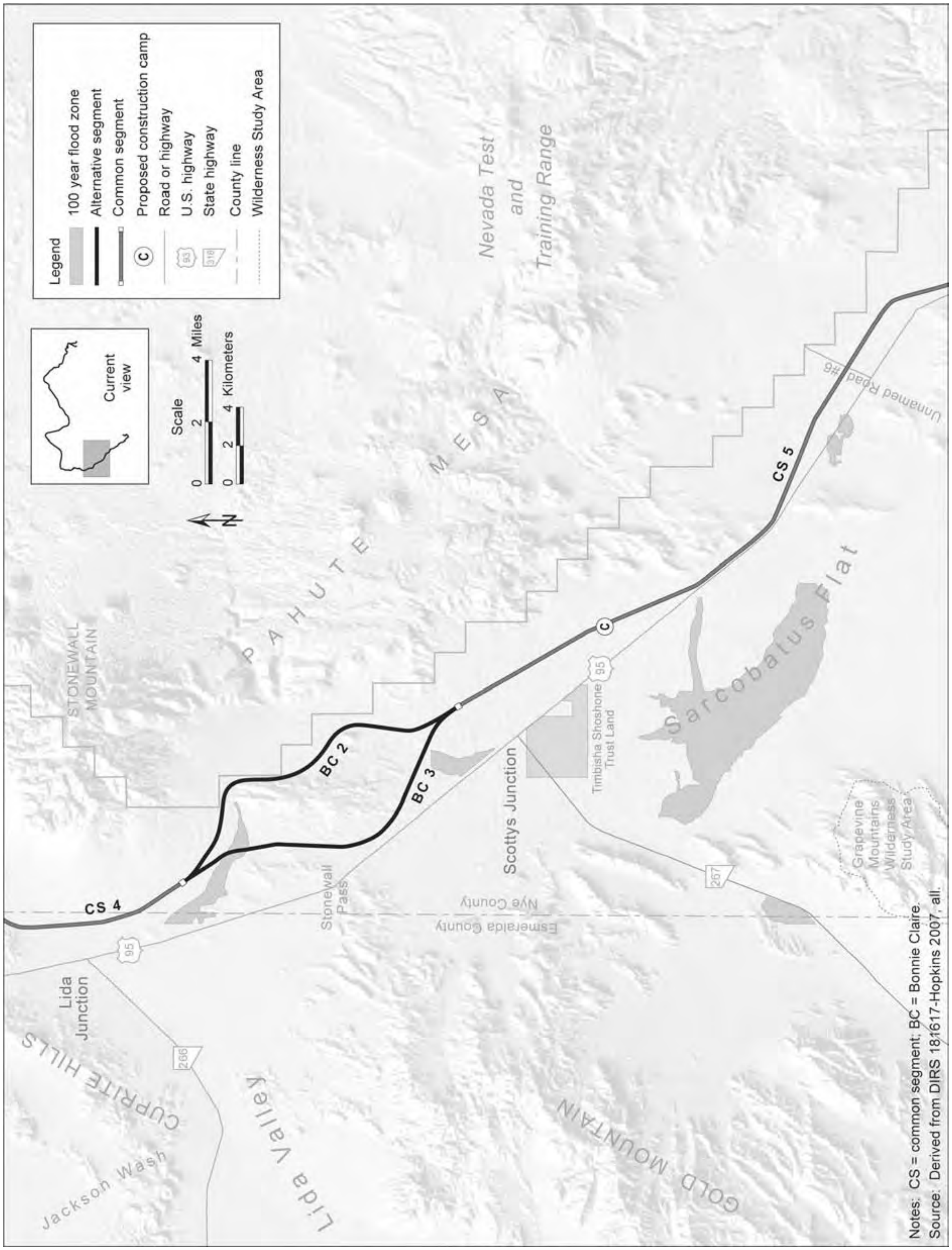


Figure F-12. FEMA floodplain map for map area 6 of the Caliente rail alignment.

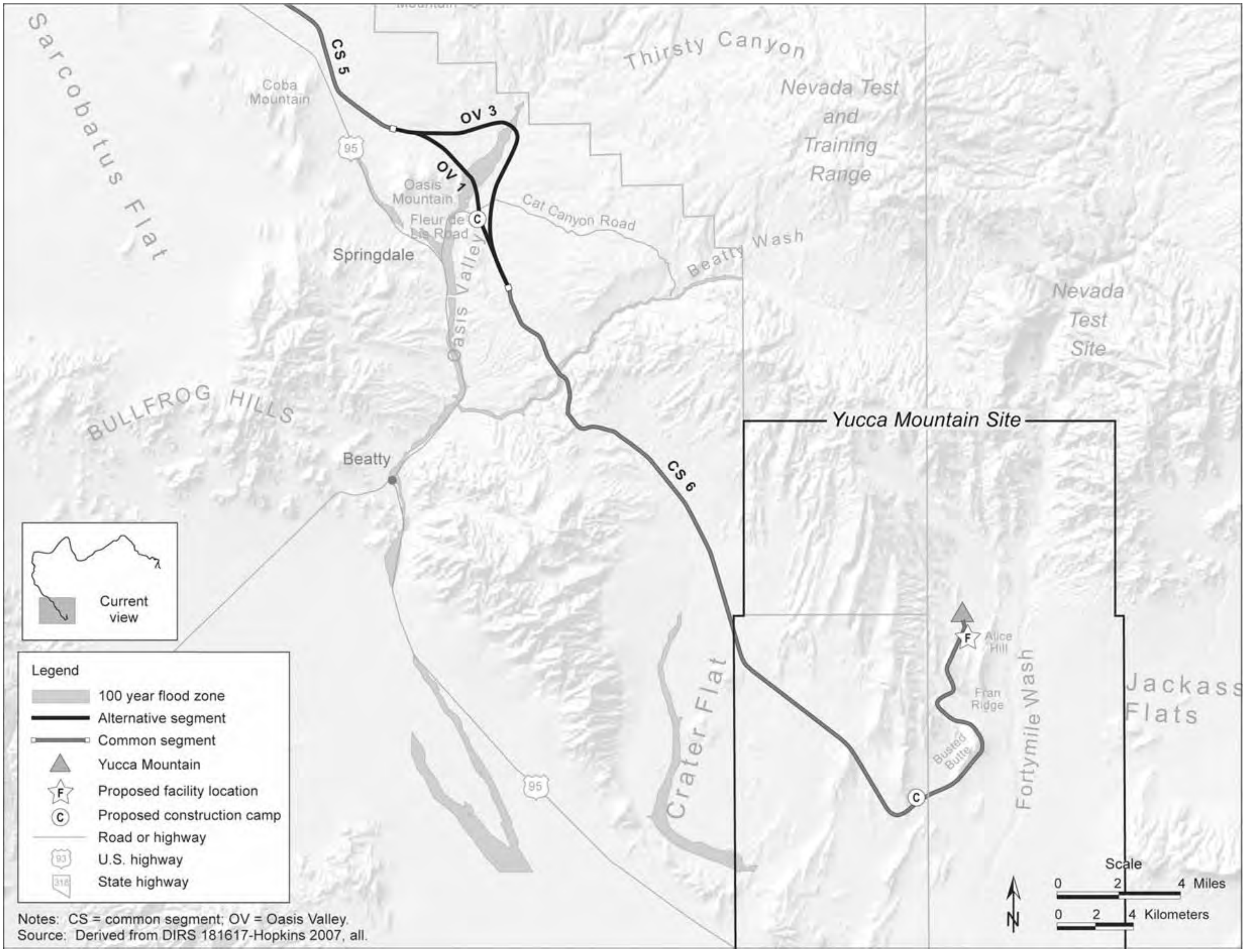


Figure F-13. FEMA floodplain map for map area 7 of the Caliente rail alignment.

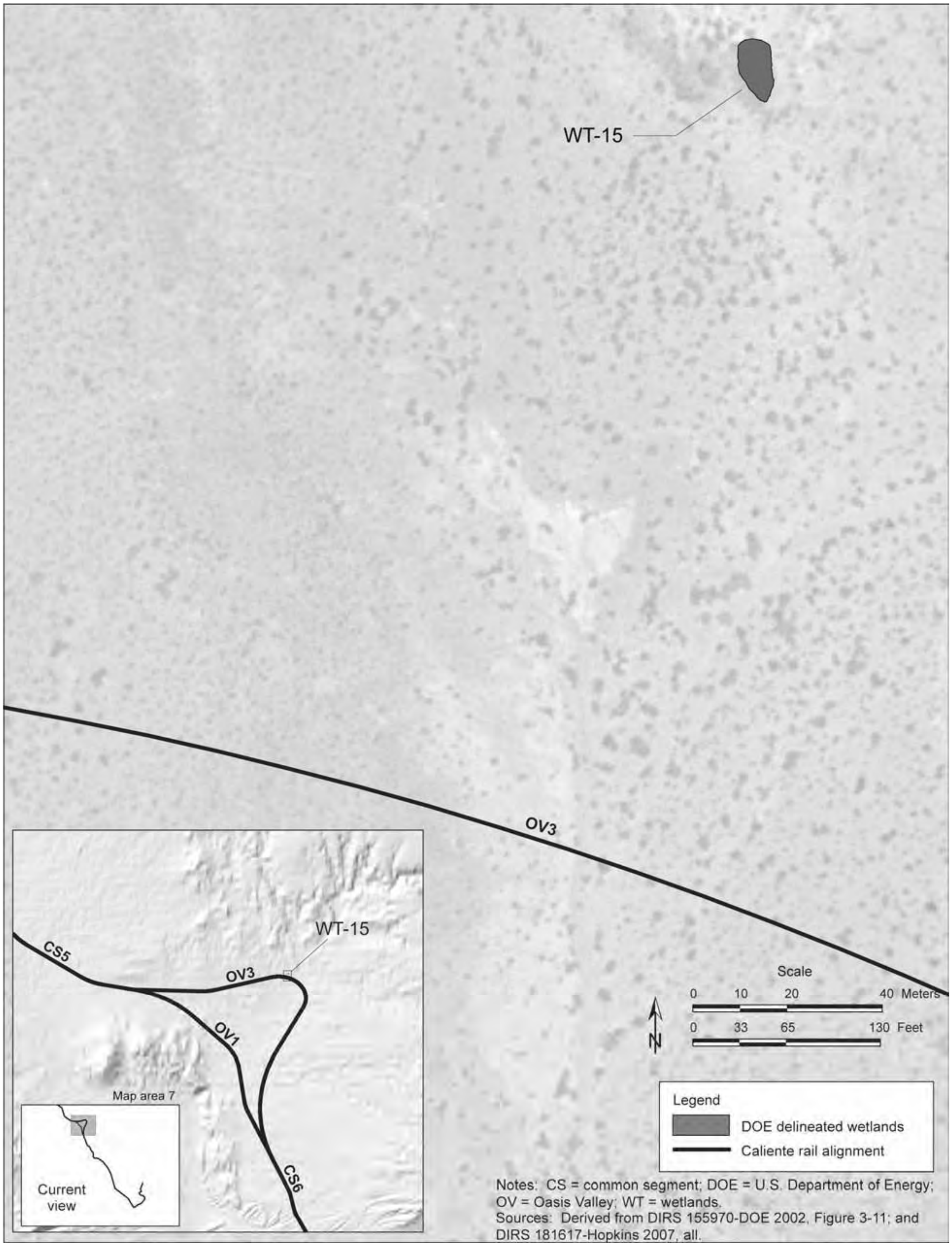


Figure F-14. Isolated wetland near Oasis Valley alternative segment 3.

fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible and are addressed in Section F.3.1.

F.3.2.12 Common Segment 6

Slightly more than half of common segment 6 has coverage on FEMA flood maps. The coverage terminates at about the point where the proposed rail alignment reaches the repository land withdrawal area (see Figure F-13). Although the flood maps do not provide coverage for the area of the repository on the eastern side of Yucca Mountain, DOE has performed flood studies on several washes in that area, as addressed in the Yucca Mountain FEIS. An overlay of the proposed rail alignment with the Yucca Mountain FEIS (see Figure-15) indicates that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash (also known as Dune Wash) and Drill Hole Wash (DIRS 155970-DOE 2002, pp. 3-38 and 3-39, and Figure 3-11). As shown in Table F-1, common segment 6 would cross a 0.10-kilometer (0.062-mile) section of the Beatty Wash floodplain. The FEMA flood maps also show a floodplain associated with an unnamed wash in Crater Flat; however, the floodplain does not extend upstream to the point where it would be crossed by the proposed rail alignment.

Table F-4 lists peak discharges for estimated floods along the main washes at Yucca Mountain, including a value for the estimated regional maximum flood. In addition to the flood estimates listed in the table, DOE used another estimating method, the probable maximum flood methodology (based on American National Standards Institute and American Nuclear Society Standards for Nuclear Facilities) to generate another maximum flood value for washes adjacent to the existing facilities and operations at the repository north and south portals. The flood value this method generates, which includes a bulking factor to account for mud and debris (including boulder-size materials), is the most severe reasonably possible for the location under evaluation and is larger than the regional maximum flood. DOE used the probable maximum flood values to predict the areal extent of flooding in the area of the repository and to determine if facilities and operations at the repository could be at risk for flood damage.

Table F-4. Estimated peak discharge along washes at the Yucca Mountain Repository.[a]

Name	Drainage area, square kilometers (square miles)	Peak discharge 100-yr flood, cubic meters per second (cubic feet per second)	Peak discharge 500-yr flood, cubic meters per second (cubic feet per second)	Regional maximum flood, cubic meters per second (cubic feet per second)
Fortymile Wash	810 (310)	340 (12,000)	1,600 (56,800)	15,000 (530,000)
Busted Butte Wash	17 (6.6)	40 (1,400)	180 (6,400)	1,200 (42,000)
Drill Hole Wash	40 (15)	65 (2300)	280 (9,900)	2,400 (85,000)
Yucca Wash	43 (17)	68 (2,400)	310 (11,000)	2,600 (92,000)

a. Source: DIRS 155970-DOE 2002, Table 3-9.

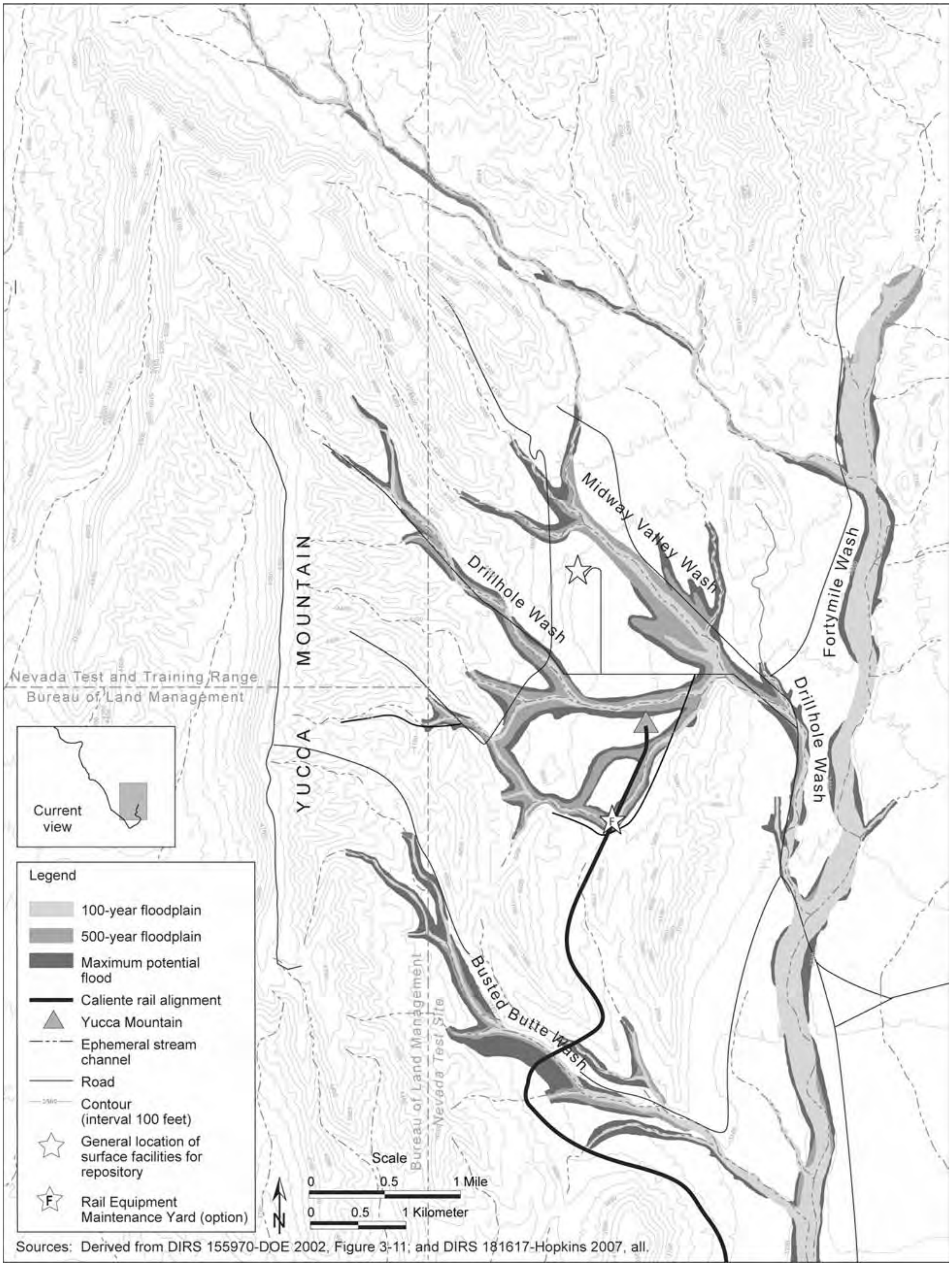


Figure F-15. DOE floodplain map for repository area.

During March 1995 and February 1998, Fortymile Wash and the Amargosa River flowed simultaneously through their primary channels to Death Valley. The 1995 event represented the first documented case of this flow condition. During the 1995 event, the peak flow near the location where the existing Yucca Mountain access road crosses Fortymile Wash was reported as approximately 85 cubic meters per second (3,000 cubic feet per second) (DIRS 182755-Parsons Brinckerhoff 2007, p. 13). The 1995 event was brought about by relatively short-term precipitation events at higher altitudes near Yucca Mountain; the 1998 flood was characterized by sustained regional precipitation over several days (DIRS 159895-Tanko and Glancy 2001, p. 3). One construction camp would be located along common segment 6; however, it would not intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to common segment 6.

No wetlands were identified along common segment 6.

F.3.3 SEGMENT-SPECIFIC IMPACTS FOR THE MINA RAIL ALIGNMENT

F.3.3.1 Interface with the Union Pacific Railroad Hazen Branchline (Hazen to Wabuska)

DOE would not perform any construction activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to floodplains or wetlands along the existing Union Pacific Railroad Hazen Branchline.

F.3.3.2 Department of Defense Branchline North (Wabuska to the boundary of the Walker River Paiute Reservation)

DOE would not perform any construction activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to floodplains or wetlands along the existing Department of Defense Branchline North (see Figure F-16).

F.3.3.3 Department of Defense Branchline through Schurz

DOE would not perform any new construction activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to floodplains or wetlands along the existing Department of Defense Branchline through Schurz (see Figure F-16).

F.3.3.4 Schurz Alternative Segments

As shown in Figure F-2, FEMA flood maps do not cover any of the Schurz alternative segments. However, it is reasonable to assume that the floodplain mapped for the very southern portion of Walker Lake extends upstream to where the Schurz alternative segments would cross over the Walker River. Because the alternative segments would follow valley floors, utilize mountain gaps, and cross unnamed ephemeral playas, it is feasible that floodplains could exist in low-lying areas along the alternative segments. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the Schurz alternative segments.

A survey for wetlands along the Mina rail alignment conducted by DOE in support of the Rail Alignment EIS identified emergent wetlands (WRN-1, WRN-2, WRN-3, and WRN-4) that would be crossed by the Schurz alternative segments (see Figure F-17). The total surface area for these wetlands is 0.065 square kilometer (16 acres). Emergent and scrub-shrub wetlands continue north and south beyond the region of influence.

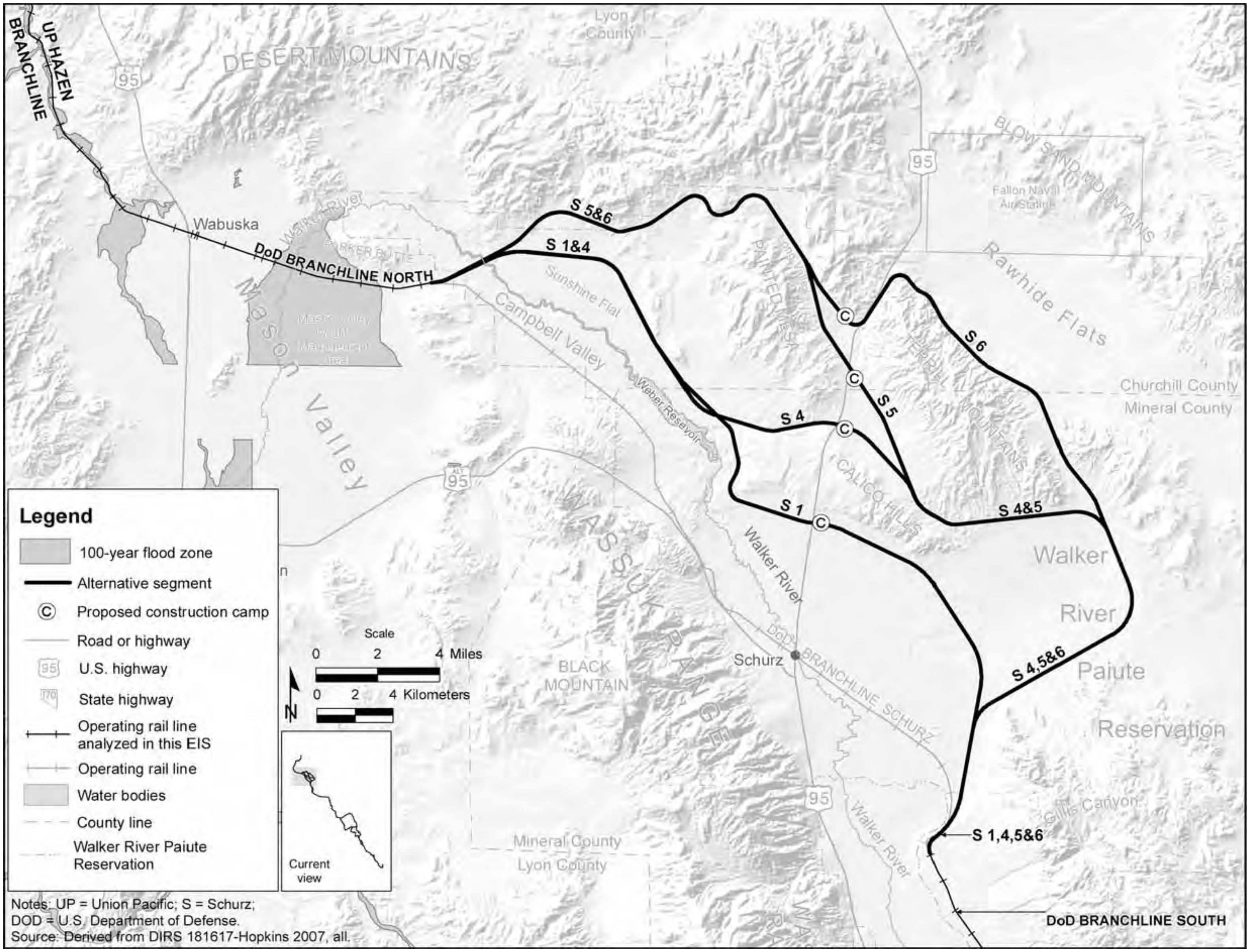


Figure F-16. FEMA floodplain map for map area 1 of the Mina rail alignment.

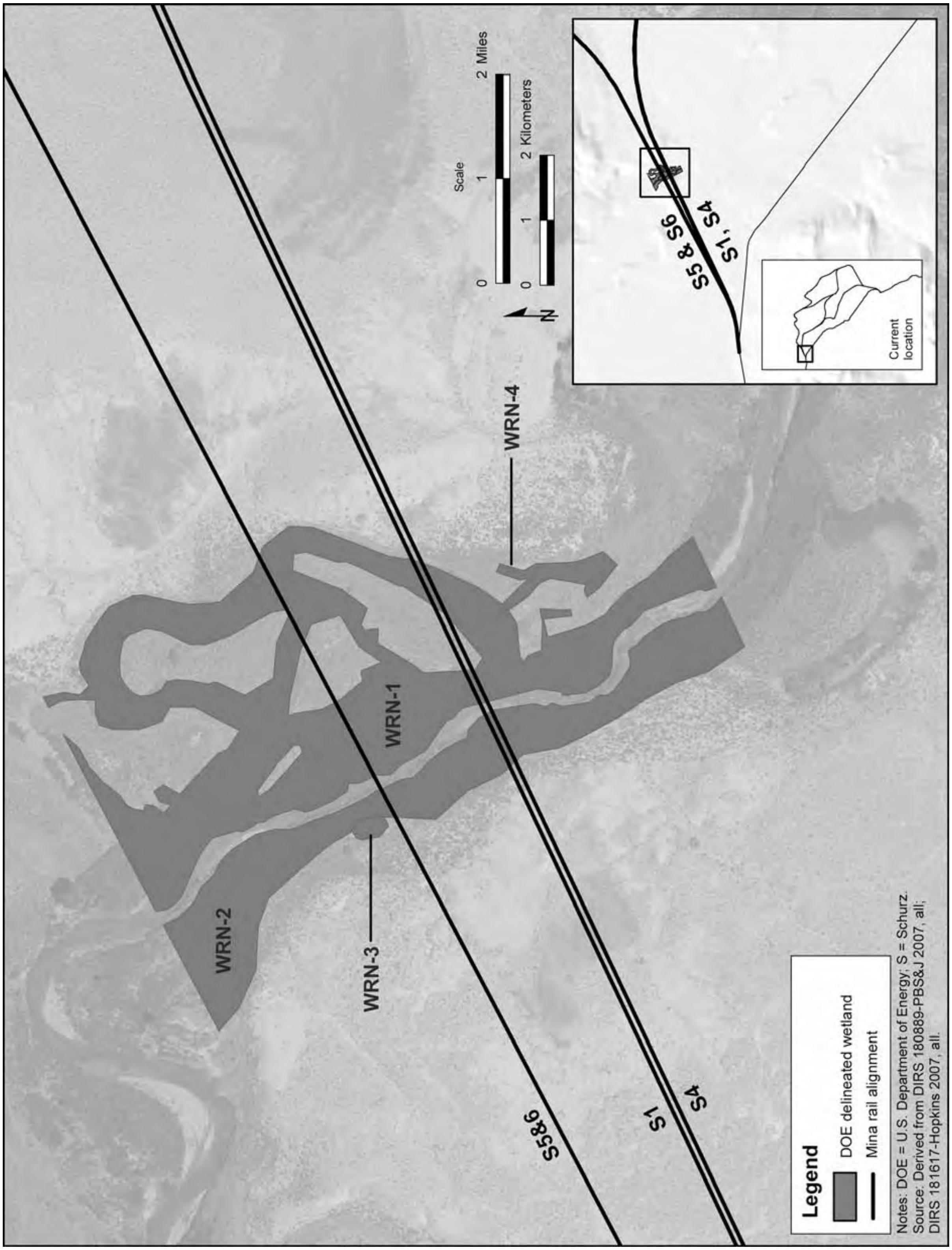


Figure F-17. Wetlands along Walker River (shows WRN-1 through WRN-4).

Placement of piers and construction of the bridge in the active stream would occur during low flow (generally September through April). To provide access for cranes and other heavy equipment to the stream channel, which is about 12 meters (40 feet) wide in this area, heavy mats made of wood or other solid material would be sunk into the stream. There would be sufficient gaps between the mats to allow flow of water. No sand, gravel, or other loose fill will be placed in the stream channel. The mats would be removed from the channel after the bridge pilings are driven into ground and the concrete bridge sections are erected over the channel.

The double-cell bridge would be about 300 meters (1,000 feet) long with 12-meter (40-foot) pier spacing. The only permanent fill will be the concrete pilings required to support the bridge piers. Using these methods, the only permanent fill or loss of wetlands would be a total of about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6.

Construction of the Schurz alternative segments would result in the permanent loss of wetland habitat. Wildlife migration corridors would be fragmented, and result in a localized loss of shelter and concealment for some wildlife species. Shading provided by the riparian vegetation would be lost in the areas of disturbance, which would result in localized increased surface-water temperatures. The removal of vegetation could also result in the permanent loss of fisheries habitat, sediment stabilization and retention, and flood flow attenuation functions.

Removal of the persistent wetland vegetation in temporarily impacted areas would result in short-term exposure to wind erosion and enhanced desiccation by the summer sun heat, loss of shade to the Walker River shoreline, and loss of fish and wildlife habitat. Freshly disturbed areas would provide an opportunity for non-native invasive species, such as salt cedar, to colonize new areas and further decrease the quality of the wetland habitat.

Undisturbed wetlands would continue to perform water-quality functions by filtering potential unconsolidated sediments. The flood flow attenuation capacity would be slightly reduced, and could result in some minor localized flooding and erosion during seasonal precipitation events. The remaining undisturbed wetlands would continue to provide commonly recognized functions. For example, Baltic rush and salt grass would filter water-borne sediments from draining into Walker River from the surrounding terrestrial environment and would provide nesting habitat for water-dependant wildlife species. The remaining woody vegetation would continue to provide flood flow attenuation functions and provide wildlife habitat.

DOE would minimize impacts by constructing a bridge over the Walker River and its associated wetlands. Of the 0.065 square kilometer (16 acres) crossed in this area, only 28 square meters (300 square feet) would be permanently filled to facilitate the construction of the bridge. By maximizing avoidance in this way, DOE would minimize permanent impacts to the maximum extent practicable. DOE would also implement best management practices such as constructing sediment ponds and installing hay bales or silt fences, which would minimize potential impacts during construction. Wildlife utilizing wetlands in the proposed disturbance areas would be temporarily displaced, but would continue to use the undisturbed adjacent areas; therefore, impacts to the wetlands in this area from the construction of the rail alignment are expected to be small.

F.3.3.5 Department of Defense Branchline South (Hawthorne to Mina Common Segment 1)

Although Department of Defense Branchline South represents an existing railway, DOE would develop construction camp 17 on the southern portion of this rail alignment. The construction camp would not overlie any floodplains or wetlands. Aside from construction of this camp, DOE does not anticipate any other surface disturbances along this portion of the Mina rail alignment (see Figure F-18).

F.3.3.6 Mina Common Segment 1 (Gillis Canyon to Blair Junction)

FEMA flood maps do not cover any part of Mina common segment 1. Because the proposed segment would follow valley floors, cross unnamed ephemeral washes and playas, or utilize mountain gaps, it is feasible that a floodplain could exist in low-lying areas along the common segment, especially in low-lying areas receiving seasonal water from ephemeral washes. The Staging Yard at Hawthorne, four construction camps, and two potential quarry sites would be located along common segment 1; however, none of these facilities intersect with floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Mina common segment 1.

Although the National Wetlands Inventory dataset indicates Mina common segment 1 would cross through wetlands within Soda Springs Valley, field investigations conducted by DOE in support of this EIS determined that surface water shown by the NWI dataset are absent from the region of influence (DIRS 180889-PBS&J 2007, Figures 5A and 5B, Photos 16 to 22). These areas are mostly unvegetated, barren landscapes that are more representative of ephemeral playas. A review of existing data indicates that areas shown as NWI wetlands actually correspond to unnamed ephemeral playas as identified by the National Hydrologic Dataset. No wetlands were identified along Mina common segment 1.

F.3.3.7 Montezuma Alternative Segments

FEMA flood maps only cover a small portion of the Montezuma alternative segments, near their southern termination. Because the proposed alternative segments would follow valley floors, cross unnamed ephemeral washes and playas, or utilize mountain gaps, it is feasible that a floodplain could exist in low-lying areas along the alternative segments, especially in low-lying areas receiving seasonal water from ephemeral washes. As shown in Figure F-19, Montezuma alternative segment 2 would cross approximately 2 kilometers (1.2 miles) of floodplains associated with a drainage in Lida Valley and the Stonewall Flat playa. Two alternative locations for the Maintenance-of-Way Facility (Klondike option and Silver Peak option) would also be located along the alternative segments, as well as four proposed construction camp sites and three quarry sites. None of these facilities would intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the Montezuma alternative segments.

For Montezuma alternative segment 1, the National Wetland Inventory dataset identifies an unnamed pond in the private area near the Town of Silver Peak as wetlands; however, DOE field studies in support of the Rail Alignment EIS determined there are no wetlands in this area. For Montezuma alternative segments 2 and 3, the National Wetland Inventory dataset classifies the large playas in Big Smoky Valley and Stonewall Flat as wetlands; however, DOE field studies in support of this EIS confirmed no wetlands exist within the region of influence (DIRS 180889-PBS&J 2007, Figure 5C, Photos 23 and 24). No wetlands were identified along the Montezuma alternative segments.

F.3.3.8 Mina Common Segment 2

As shown in Figure F-19, FEMA flood maps provide coverage for the entire length of Mina common segment 2; however, no floodplains are crossed by the segment. Because the proposed segment would follow valley floors, cross unnamed ephemeral washes and playas, or utilize mountain gaps, it is feasible that a floodplain could exist in low-lying areas along common segment 2, especially in low-lying areas receiving seasonal water from ephemeral washes. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Mina common segment 2.

No wetlands were identified along Mina common segment 2.

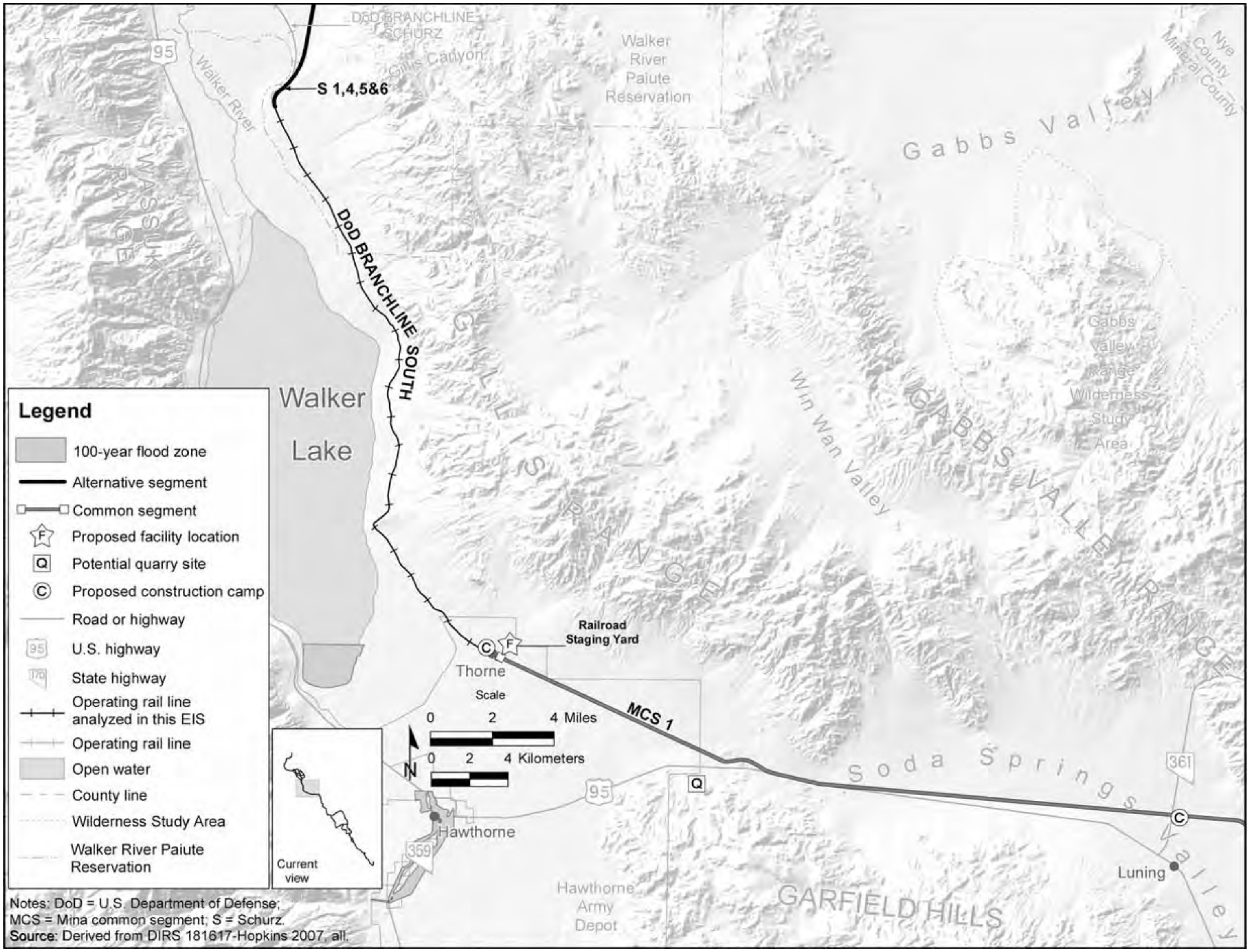


Figure F-18. FEMA floodplain map for map area 2 of the Mina rail alignment.

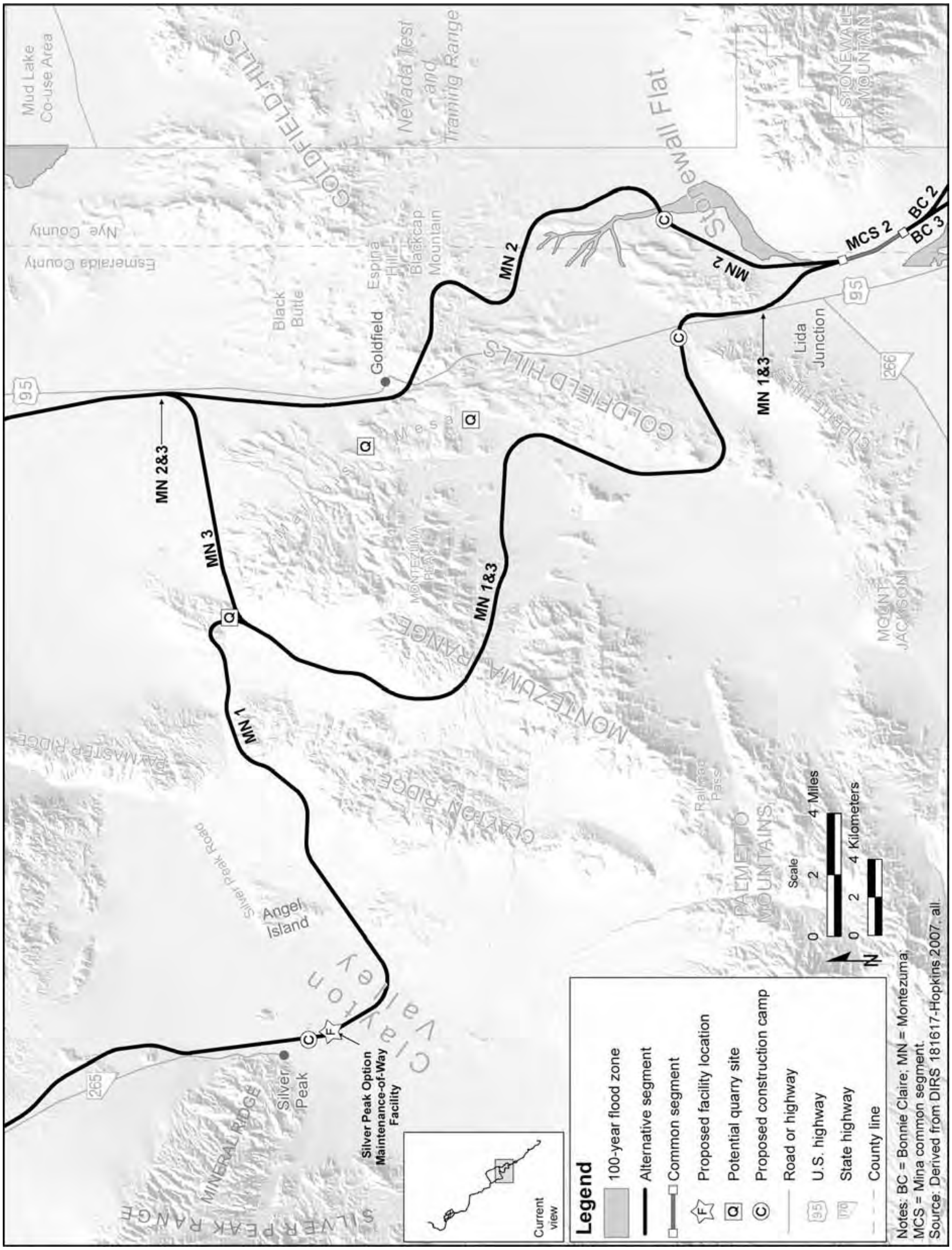


Figure F-19. FEMA floodplain map for map area 5 of the Mina rail alignment.

F.3.3.9 Bonnie Claire Alternative Segments

Refer to Section F.3.2.9.

F.3.3.10 Common Segment 5 (Sarcobatus Flat Area)

Refer to Section F.3.2.10.

F.3.3.11 Oasis Valley Alternative Segments

Refer to Section F.3.2.11.

F.3.3.12 Common Segment 6 (Yucca Mountain Approach)

Refer to Section F.3.2.12.

F.4 Alternatives

In accordance with 10 CFR 1022.13(a)(3), DOE must consider alternatives to the Proposed Action that would avoid adverse impacts and incompatible development in the floodplain or wetland, including alternative sites, alternative actions, and no action. Further, DOE must evaluate measures that mitigate the adverse impacts of actions in a floodplain or wetland including, but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically sensitive areas.

As shown in Figure F-20, the Proposed Action includes two implementing alternatives, each with a ***Shared-Use Option***.

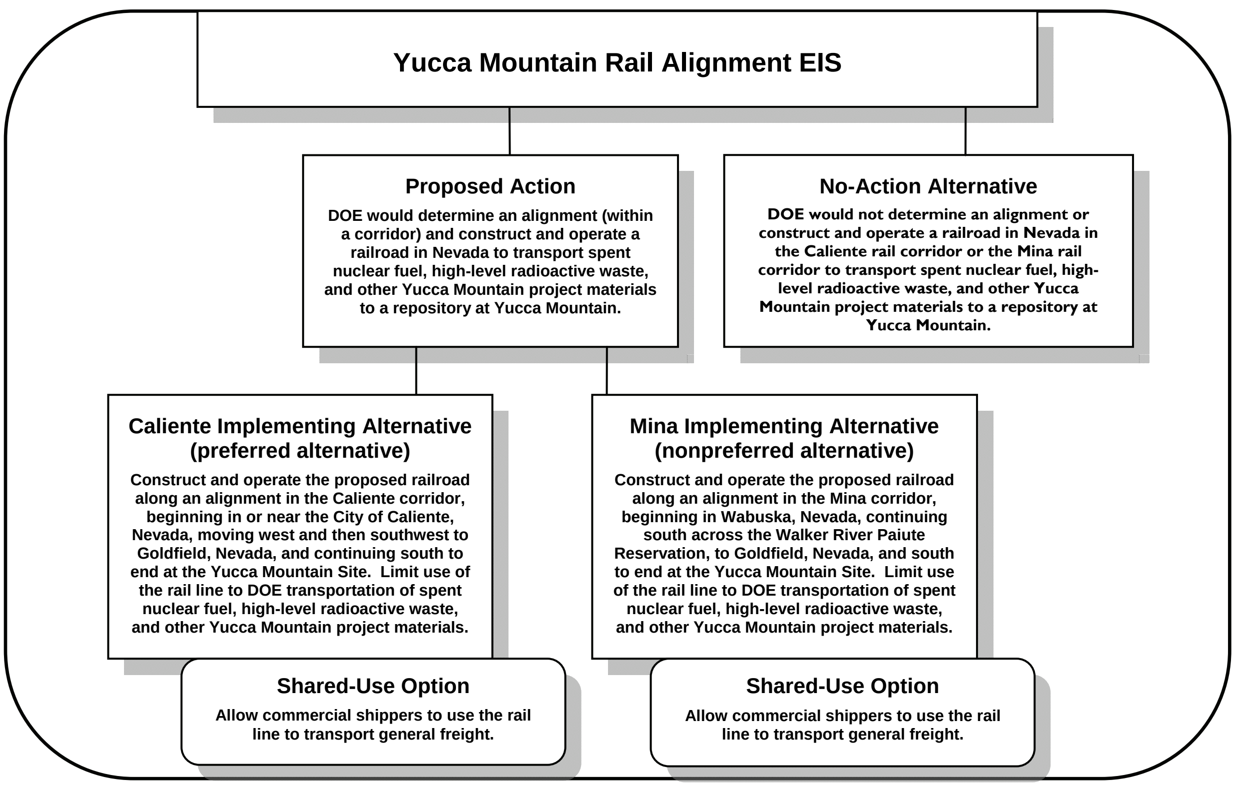


Figure F-20. Alternatives analyzed in the Rail Alignment EIS.

Under the Proposed Action Caliente Implementing Alternative, DOE would determine a rail alignment within the Caliente rail corridor and would construct and operate a railroad for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials within Nevada. The proposed railroad would run from a site in or near the City of Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada. The Caliente Implementing Alternative is the DOE preferred alternative.

Under the Proposed Action Mina Implementing Alternative, DOE would determine a rail alignment within the Mina rail corridor and would construct and operate a railroad for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials within Nevada. The proposed railroad would run from Wabuska, Lyon County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada. The Mina Implementing Alternative is the DOE nonpreferred alternative.

Along each of the rail alignments, DOE considered a range of alternative segments and a series of common segments, and eliminated some of the alternative segments from detailed analysis. Appendix C, Evolution of Common Segments and Alternative Segments, describes the elimination process.

Under either Proposed Action implementing alternative, the Shared-Use Option would allow commercial shippers to use the rail line. Under the Shared-Use Option, other organizations could construct commercial sidings and additional facilities that would allow commercial commodities (such as nonmetallic minerals or stone) to be transported on the rail line.

Under the ***No-Action Alternative***, DOE would not determine a rail alignment or construct and operate the proposed railroad within the Caliente rail corridor or the Mina rail corridor. As such, the No-Action Alternative provides a basis for comparison with the Proposed Action.

Section F.4.1 summarizes the process DOE used to define and select the two implementing alternatives. It also addresses the more recent selection of the preferred alignment.

F.4.1 PROPOSED ACTION

F.4.1.1 Alternative Evaluations under the Proposed Action

Appendix C describes the process DOE used to evaluate and determine the range of alternative segments for the Caliente and Mina rail alignments considered in the Rail Alignment EIS, and the results of that process.

F.4.1.2 Preferred Alignment

The Council on Environmental Quality NEPA implementing regulations require an agency to identify its preferred alternative, if one or more exists, in the Draft EIS (40 CFR 1502.14[e]). For the Rail Alignment EIS, the DOE preferred alternative is to construct and operate a railroad along the Caliente rail alignment and to implement the Shared-Use Option. DOE identified preferred alternative segments (Figure F-21) within the Caliente rail alignment based on analysis of environmental impacts, engineering and cost factors, and regulatory compliance issues, including permit requirements and challenges, stakeholder preference, land-use conflicts, and uncertainties (see Table 2-30 of the Rail Alignment EIS).

Appendix C provides a more detailed description of the evaluation process DOE used to screen the various alternative segments and select the proposed rail alignments (still with some alternative segments).

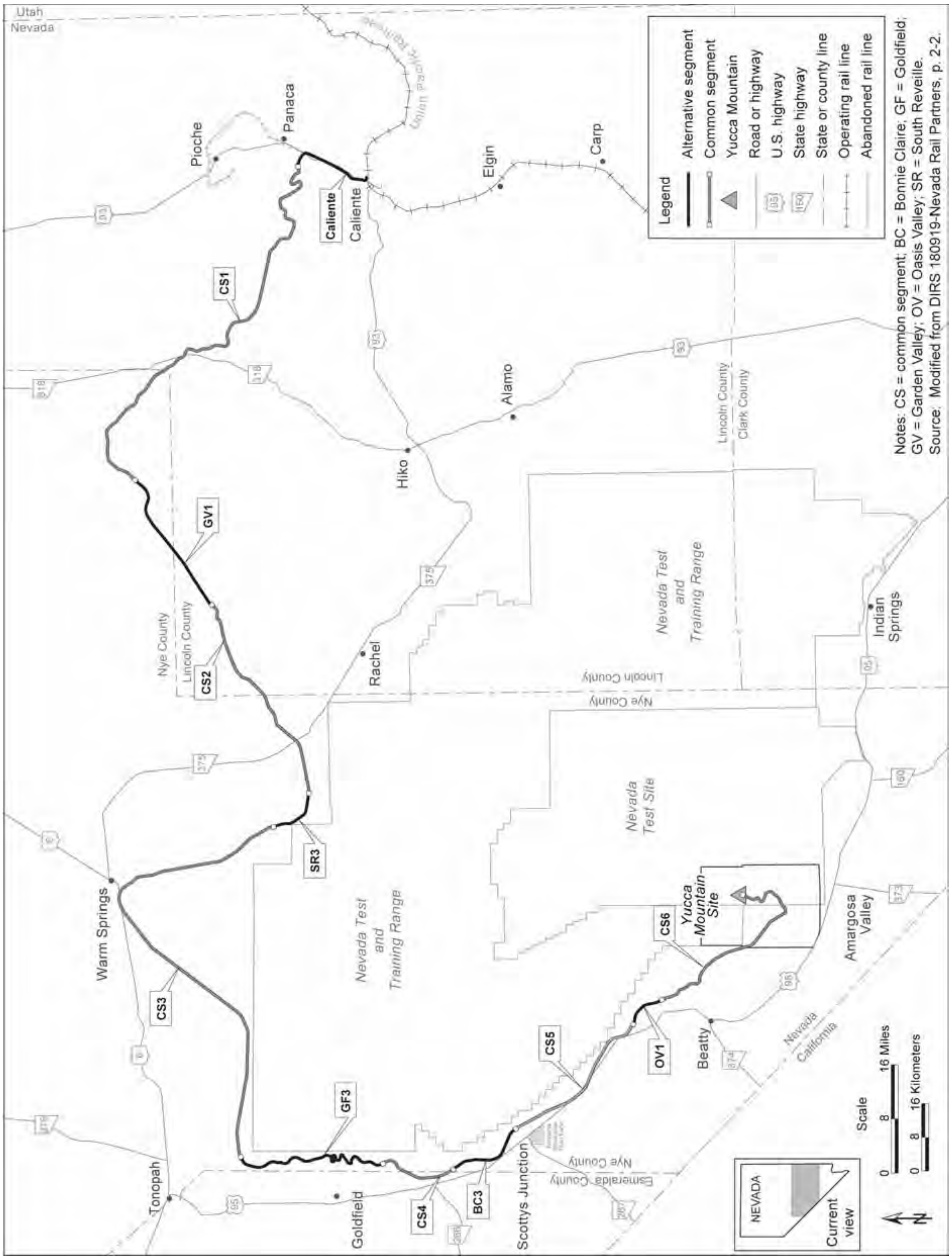


Figure F-21. Preferred Caliente rail alignment, combination of common segments and alternative segments.

F.4.2 SHARED-USE OPTION

The Shared-Use Option would involve the use of the DOE rail line for general freight such as mineral resources or oil that could be shipped by private companies. Construction-related impacts to floodplains and wetlands would be similar to those identified for the Proposed Action without shared use.

F.4.3 NO-ACTION ALTERNATIVE

Council on Environmental Quality regulations (40 CFR 1502.14) require that the alternatives analysis in an EIS include the alternative of no action. Under the No-Action Alternative in the Rail Alignment EIS, DOE would not select a rail alignment within the Caliente or Mina rail corridors for the construction and operation of a railroad. As such, the No-Action Alternative provides a basis for comparison with the Proposed Action.

In the event that DOE were not to select a rail alignment in the Caliente or Mina rail corridors, the future course that it would pursue to meet its obligations under the NWPA is uncertain. DOE recognizes that other possibilities could be pursued, including identifying and evaluating alignments in other corridors considered in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 6).

DOE would relinquish the public lands withdrawn from surface and mineral entry for purposes of evaluating the lands for the potential construction, operation, and maintenance of a railroad (70 *FR* 76854, December 28, 2005). These lands would then become available for other uses as determined by the BLM once it amended or revoked the withdrawal.

F.4.4 MITIGATION MEASURES

In accordance with 10 CFR 1022.12(a)(3), DOE must address measures to mitigate the adverse impacts of actions in a floodplain or wetlands, including but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically sensitive areas. Whenever possible, DOE would avoid disturbing floodplains and wetlands and would minimize impacts to the extent practicable, if avoidance was not possible. This section discusses the floodplain and wetland mitigation measures that would be considered in the vicinity of the proposed rail alignment and, where necessary and feasible, implemented during railroad construction, operations, and maintenance. In general, DOE would minimize impacts to floodplains and wetlands through the implementation of engineering design standards and best management practices.

DOE has identified several measures to help avoid, minimize, or mitigate potential adverse impacts to floodplains and wetlands under the Proposed Action and Shared-Use Option. DOE has designed the rail alignment segments to avoid direct and indirect impacts to water resources wherever practicable. Due to the nature of rail line design and the construction activities that would be required to implement the design, the rail line cannot avoid crossing floodplains and wetlands. The engineering design process would ensure that the engineered structures used to pass water runoff from one side of the rail line to the other would do so in a way that would minimize impacts to floodplains and wetlands. Such impacts would be limited mostly to the construction phase and would be subject to Clean Water Act regulations and permitting. In most cases DOE would minimize adverse impacts through the implementation of best management practices in concert with the permits and plans regulatory agencies would require.

F.4.4.1 Engineering Design Standards

Before any construction could begin, DOE would require pre-construction surveys to ensure that the work would minimize impacts to floodplains and wetlands. In addition, the site's reclamation potential would be determined during these surveys. If the surveys indicate that construction would threaten these resources, and modification or relocation of the proposed rail line and associated roads would not be reasonable, DOE would develop mitigation measures. DOE would incorporate mitigation measures developed during the pre-construction surveys into the final design of the proposed rail line and associated facilities.

DOE would minimize the disturbance of surface areas and vegetation and would maintain natural contours to the maximum extent feasible. DOE would expect to establish reclamation guidelines for site clearance, topsoil salvage, erosion and runoff control, recontouring, revegetation, siting of roads, and construction practices similar to that established for the repository (DIRS 102188-YMP 1995, pp. 2-1 to 2-14). DOE would stabilize slopes to minimize erosion and would avoid unnecessary off-road vehicle travel.

Although DOE would generally design rail line features to accommodate 100-year flows, the final design process may also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2.c). DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible (DIRS 180918-Nevada Rail Partners 2007, p. ii). In areas where drainage structures would cross a FEMA Flood Zone A (such as a 100-year flood zone), DOE would design the bridge to comply with FEMA standards and appropriate county regulations. The FEMA standards require that floodway surcharge (the difference between the 100-year-flood elevation and the actual flood surface elevation) would not cause more than a 0.3-meter (1-foot) rise at any location. The FEMA standards have been designed to limit floodwater impacts to structures built in or adjacent to the floodplain (DIRS 180918-Nevada Rail Partners 2007, p. ii). By adhering to these standards, DOE would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

Where very wide and shallow depths of flow occur during the 100-year event, or the flow is divided into multiple natural channels that would cross the alignment, DOE would use a series of multiple culverts, potentially in concert with small bridges, to span the main flow channel where practicable. In locations where there are very high fill conditions, multiple culverts would be more practical and economical than constructing a bridge (DIRS 180918-Nevada Rail Partners 2007, p. ii). DOE would install culverts with riprap around the exposed ends and use other measures, as necessary, to protect the fill material from erosion. DOE would take similar actions as needed for bridges to protect the structures and to ensure disturbed areas are not subject to increased erosion.

F.4.4.2 Best Management Practices

A National Pollutant Discharge Elimination System General Construction Permit would be required for construction activities. In accordance with this permit, construction contractors would be required to prepare and submit a Stormwater Pollution Prevention Plan. The Stormwater Pollution Prevention Plan would be prepared consistent with State of Nevada and federal standards for construction activities and would detail the best management practices DOE would employ to minimize soil loss and degradation to nearby water resources. DOE would base the design of the best management practices program on practices listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all) and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all). Table F-5 lists many of the categories of best management practices that would be considered for the construction and operation of the proposed rail line.

Table F-5. Best management practices (page 1 of 2).

Practice	Description
Road and construction site practices	
Development site plan	A site plan identifies the physical features of the site, the location of proposed development, and the location of temporary and/or permanent best management practices. By utilizing a development site plan, the proposed development can be situated to minimize impact to natural resources and the land, and to enable water-quality protection measures and runoff conveyance measures to be properly located.
Grading seasons and practices	The grading season is determined by the local climate conditions. All grading, clearing, and excavation work should be conducted during this period to avoid climatic conditions that could increase the chances for erosion. Grading and construction activities should be coordinated such that bare and disturbed soil exposure is minimized during the winter snow and rainy seasons.
Erosion and sediment controls	
Erosion and sediment control structures	Properly designed, installed, and maintained, erosion and sediment control structures will effectively reduce the transport of sediments, minimize erosion and the degradation of water resources, and reduce negative impacts to natural resources (vegetation and wildlife).
Runoff interceptor trench or swale	Properly designed, installed, and maintained, a runoff interceptor trench or swale will effectively convey surface runoff, minimize soil erosion resulting from surface runoff, and reduce the degradation of receiving water resources.
Siltation or filter berms	Siltation or filter berms capture and retain runoff from construction sites and allow sediments to settle out, and direct runoff water through filter berms at outlets to stabilized drainage ways.
Filter or silt fence	Filter or silt fences are constructed to intercept and capture sediment by decreasing the velocity of surface runoff.
Sediment basins	Sediment basins are effective in reducing water pollution by trapping sediment originating from construction sites and by providing basins for deposition and storage of silt, sand, gravel, stone, and other debris.
Soil stabilization practices	
Rock and gravel mulches	The application of gravel or crushed rock as a mulch is used to stabilize soils during construction activities for erosion control on a variety of surface disturbance areas.
Wood chip, straw, and black mulches	Wood chips, straw, and bark mulches are used as mulch to protect the soil surface from raindrop and irrigation impacts, and decrease runoff.
Jute and synthetic netting	The primary purpose of nettings is to anchor mulch in place on varying topography or in wind-prone areas. Netting provides stability to surface disturbances and reduces the soil erosion potential.
Slope stabilization practices	
Slope shaping	Slope shaping is comprised of designing and modifying cut or fill slopes to reduce the soil erosion and runoff potential. Activities include predisturbance planning and design, terraces, benches, serrations, and steps.

Table F-5. Best management practices (page 2 of 2).

Practice	Description
Slope stabilization practices (continued)	
Retaining structures	Retaining structures are walls comprised of wood, rock, concrete, or other material, constructed at the toe of a slope in order to protect the slope face or toe from scour and erosion from storm runoff.
Rock riprap	Rock riprap is a layer of loose rock placed over an erodible soil or surface disturbance in order to protect the soil surface, to provide for slope stabilization on steep slopes, and to reduce soil erosion within a project area.
Infiltration systems	
Infiltration trench or basin	A shallow rock- or gravel-filled trench located at the drip line of roofs or adjacent to other impervious surfaces such as paved driveways and parking areas can percolate runoff from impervious surfaces and prevent erosion.
Watershed management	
Stream protection and stabilization	Stabilization of stream channels and stream banks is an effective treatment to reduce sediment loading and control erosion and land damage.
Floodwater retarding structure	Floodwater retarding structures are installed to reduce flood damage downstream by controlling the release rate from flood flows of predetermined frequencies.
Floodwater diversion	Floodwater diversions will protect the land, surface improvements, and the watershed by reducing erosion and sediment delivery to receiving waters.
Mining (quarries)	
Excavation stabilization	Excavation stabilization of mined surfaces may prevent erosion, sedimentation, and the degradation of surface and ground water quality through the discharge of sediments or other pollutants into stream channels, drainage ways, or waters of the state.
Surface runoff management	Stormwater runoff management practices when designed, installed, and maintained properly, are effective methods to treat nonpoint source pollution and minimize impacts to surface and ground water quality.
Urban resource management	
Street runoff collection	Street runoff collection prevents erosion of roadside shoulders and adjacent roadway slopes from surface runoff.
Storm drainage structures	Storm drainage structures include pipes, channels, drop inlets, slotted drains, grease and oil traps, or other facilities used to collect and/or convey surface runoff. Their effectiveness depends on keeping them free from debris or filled with sediment.
Landscaping	Proper landscaping can stabilize disturbed sites in a manner that controls surface drainage and soil erosion.

Best management practices are structural and nonstructural controls that are used to control ***nonpoint source pollution*** such as sedimentation and stormwater runoff. Structural controls are best management practices that need to be constructed (such as detention or retention basins). Nonstructural controls refer to best management practices that typically do not require construction, such as planning, education, revegetation, or other similar measures. Sedimentation and stormwater runoff are typically addressed through the use of temporary and permanent best management practices. These include techniques such as grading that would induce positive drainage, installation of silt fences, and revegetation to minimize or prevent soil exposed during construction from becoming sediment to be carried offsite. DOE would implement, inspect, and maintain best management practices to minimize the potential for adversely affecting downstream water quality. Therefore, DOE expects impacts from erosion and sediment runoff associated with construction efforts to be small.

During large flood events, when water is held on the upstream side of the structure, it is possible that sediment could accumulate on the upstream side of the crossings. DOE would remove this material periodically so that future floods would have sufficient space to accumulate, rather than overflow the structures during successively smaller floods. Sediment removed from these areas would be removed by truck and disposed of appropriately or, depending on the location of the drainage channel, simply moved out of the drainage channel and left at the site. Under natural conditions this sediment would have continued downstream and been deposited as the floodwaters dispersed. Compared to the total amount of sediment that is moved by floodwater along the entire length of a wash, the amount deposited behind a crossing would be minor.

Storage of hazardous materials during the construction and operations periods would be in accordance with normal environmental regulatory requirements (for example, within secondary containment) and best management practices. As practicable, DOE would store hazardous materials outside of floodplains. Hazardous materials that would be most susceptible to accidental spills and releases would be the fuels and other petroleum products that would be required to support power and equipment needs for the construction and operation of the proposed rail line.

F.4.4.3 Regulatory Mitigation

If it is determined that the potential wetland areas along Meadow Valley Wash do qualify as jurisdictional wetlands, mitigation for their loss would be determined with the appropriate state and federal agencies. This might involve the enhancement of remaining wetlands or the development of replacement wetlands in other areas along Meadow Valley Wash or elsewhere in Nevada.

For surface-water resources, there are several actions DOE would take in accordance with regulatory requirements that would define mitigation measures during implementation of either the Proposed Action or the Shared-Use Option. These actions would include preparing plans and acquiring permits, as identified as follows in Sections F.4.4.3.1 through F.4.4.3.4.

F.4.4.3.1 Stormwater Discharge

Sediment is the primary pollutant generated at construction sites. Runoff from construction and industrial activities has the potential to generate large quantities of sediment and other contaminants if not properly addressed. In response to this common cause of water-quality impairment, the Environmental Protection Agency promulgated regulations requiring the permitting of stormwater-generated pollution under the National Pollutant Discharge Elimination System (Section 402 of the Clean Water Act). The Nevada Division of Environmental Protection has been delegated the authority to administer these federal regulations and has adopted state regulations to administer a National Pollutant Discharge Elimination System Stormwater program. A National Pollutant Discharge Elimination System General Construction

Permit would be required for construction activities associated with the Proposed Action or Shared-Use Option. In accordance with the National Pollutant Discharge Elimination System, DOE must do the following:

- Prepare a Stormwater Pollution Prevention Plan or plans to address construction of the proposed rail line, including (but not limited to) quarry sites, borrow pits, associated facilities, and labor camps.
- Obtain stormwater National Pollutant Discharge Elimination System permit(s) from the Nevada Bureau of Water Pollution Control, which may involve general and individual permits.
- As part of the National Pollutant Discharge Elimination System permit application, identify proposed measures, including best management practices, to control pollutants in stormwater discharges during and after construction, such as diversion, detention, erosion control, sediment traps, gravel construction entrances, covered storage, spill response, and good housekeeping.

F.4.4.3.2 Discharge of Dredged or Fill Materials

Jurisdictional waters of the United States, subject to regulation under Section 404 of the Clean Water Act, include interstate waters, intrastate waters with a nexus to interstate commerce, tributaries to such waters, and wetlands that are adjacent to waters of the United States. For purposes of this floodplain and wetlands assessment, DOE treated all wetlands equally whether or not they were jurisdictional or nonjurisdictional wetlands. Direct impacts to wetlands associated with the proposed rail alignment would result from temporary or permanent filling or draining of these resources. Indirect impacts would include potential degradation of water quality resulting from actions in and around these resources. Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into jurisdictional waters, including wetlands. Construction activities, such as those proposed for the development of the rail alignment, that impact jurisdictional wetlands are regulated under this program.

DOE is considering complying with Section 404(r) of the Clean Water Act, which states that the discharge of dredged or fill material as part of the construction of a federal project specifically authorized by Congress is not prohibited or subject to regulation under Section 404 of the Clean Water Act so long as certain conditions are met. One of those conditions is to publish EIS information on the effects of such discharge, including an analysis of alternatives as required by Section 404(b)(1) of the Clean Water Act. The analysis in Sections 4.2.5 and 4.3.5 of the Rail Alignment EIS describes the effects of discharges to wetlands and other waters of the United States. If DOE determines that it will comply with Section 404(r), an alternatives analysis that meets the requirements of Sections 404(b)(1) and 404(r) will be published in the final Rail Alignment EIS. Otherwise, DOE would apply to the Army Corps of Engineers for a permit to fill jurisdictional waters.

DOE would minimize filling of wetlands by incorporating avoidance into engineering and design of the rail line to the maximum extent practicable. DOE would use a minimum-width footprint when practicable, which DOE would accomplish by increasing the slope of the roadbed or bridging across wetlands and not constructing access roads in wetlands. In the areas where wetlands could not be avoided altogether (such as the areas along the Caliente alternative segment), DOE would reduce the width of the construction right-of-way from 300 meters (1,000 feet) to 21 meters (70 feet) at a minimum. By incorporating avoidance of these resources into the engineering and design of the rail line, DOE would minimize adverse impacts to wetlands (and the functions served by wetlands).

F.4.4.3.3 Working in Waterways

According to Nevada Revised Statutes 445A.465, which discusses the prohibition on discharging pollutants into waters of the state without a permit, DOE would have to obtain a permit from the Nevada Division of Environmental Protection, Bureau of Water Pollution Control, to work in waterways. The application for this permit would have to include a description of best management practices DOE would propose to use in and along waterways to protect water quality; control erosion and sedimentation; protect and restore riparian areas; stabilize, protect, and rehabilitate stream banks; and control water pollution. In addition, DOE would have to perform construction activities when streambeds were at low flows or preferably dry, and preserve and restore existing drainage patterns to the extent practicable.

F.4.4.3.4 Flood Hazard Control

In areas where drainage structures would cross a FEMA Flood Zone A (that is, a 100-year flood zone), DOE would design the bridge to comply with FEMA standards and appropriate county regulations. The FEMA standards require that floodway surcharge (that is, the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. The FEMA standards have been designed to limit floodwater impacts to structures built in or adjacent to the floodplain (DIRS 180918-Nevada Rail Partners 2007, p. ii). By adhering to these standards, DOE would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains. Other practices DOE would use to minimize impacts to floodplains include:

- Construct the proposed rail line in such a way as to maintain current drainage patterns to the extent practicable and not result in new drainage of wetland areas.
- Inspect all drainages, bridges, and culverts semi-annually, or more frequently, as seasonal flows dictate, for debris accumulation.
- Remove debris from drainage structures and properly dispose of debris in an upland area.
- Coordinate with the local floodplain administrators to ensure that new project-related stream and floodplain crossings were appropriately designed to minimize impacts.

F.5 Glossary

100-year flood	A flood event of such magnitude that it occurs, on average, every 100 years; this equates to a 1-percent chance of its occurring in a given year. A base flood may also be referred to as a 100-year storm. The area inundated during the base flood is sometimes called the 100-year floodplain.
50-year flood	A flood event of such magnitude that it occurs, on average, every 50 years; this equates to a 2-percent chance of its occurring in a given year.
accessible environment	For this ***environmental impact statement*** (EIS), all points on Earth outside the surface and subsurface area controlled over the long term for the ***repository***, including the atmosphere above the controlled area.
accident	An unplanned sequence of events that results in undesirable consequences. Examples in this Rail Alignment EIS include an inadvertent release of radiation from the casks or hazardous materials from their containers; train derailments; vehicular accidents; and construction-related accidents that could affect workers.
air quality	A measure of the concentrations of pollutants, measured individually, in the air.
alpha particle	A positively charged particle ejected spontaneously from the nuclei of some ***radioactive*** elements. It is identical to a helium nucleus and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See ***ionizing radiation.***
alternative	One of two or more actions, processes, or propositions, from which a decisionmaker will determine the course to be followed. The National Environmental Policy Act, as amended, states that in preparing an EIS, an agency "shall … (s)tudy, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" [42 U.S.C. 4321, Title I, Section 102(E)]. The regulations of the Council on Environmental Quality that implement the National Environmental Policy Act indicate that the alternatives section is "the heart of the environmental impact statement (40 CFR 1502.14), and include rules for presentation of the alternatives, including no action, and their estimated impacts. The Nevada Rail Corridor SEIS analyzes one alternative to the ***Proposed Action***, the ***No-Action Alternative***. Under the Nevada Rail Corridor SEIS No-Action Alternative, the U.S. Department of Energy (DOE or the Department) would not select a rail alignment within the Mina rail corridor for the construction and operation of a railroad. As such, the No-Action Alternative provides a basis for comparison to the Proposed Action. The Rail Alignment EIS analyzes one alternative to the Proposed Action – the No-Action Alternative – and two implementing alternatives under the Proposed Action – the Caliente Implementing Alternative and the Mina Implementing Alternative – for constructing, operating, and possibly abandoning a ***railroad*** for the shipment of ***spent nuclear fuel*** and ***high-level radioactive waste*** for long-term ***disposal*** in a ***geologic repository*** at Yucca Mountain. Under the No-Action Alternative, DOE would not construct the proposed railroad along the Caliente ***rail alignment*** or the Mina rail alignment.

alternative segments	Geographic region of the ***rail alignment*** for which multiple routes for the ***rail line*** have been identified. In this Rail Alignment EIS, there are different alignments identified within the Caliente ***rail corridor*** and the Mina rail corridor that could minimize or avoid environmental ***impacts*** and reduce construction complexities.
atomic mass	The mass of a neutral atom, based on a relative scale, usually expressed in atomic mass units. See ***atomic weight.***
atomic nucleus	See ***nucleus***.
atomic number	The number of ***protons*** in an atom's ***nucleus***.
atomic weight	The relative mass of an atom based on a scale in which a specific carbon atom (carbon-12) is assigned a mass value of 12. Also known as relative ***atomic mass***.
ballast	The coarse rock that is placed under the ***railroad*** tracks to support the railroad ties and improve drainage along the ***rail line***.
barrier	Any material, structure, or condition (as a thermal barrier) that prevents or substantially delays the movement of water or ***radionuclides***.
berm	A mound or wall of earth.
beta particle	A negatively charged ***electron*** or positively charged positron emitted from a ***nucleus*** during ***decay***. Beta decay usually refers to a radioactive transformation of a ***nuclide*** by electron emission, in which the ***atomic number*** increases by 1 and the mass number remains unchanged. In positron emission, the atomic number decreases by 1 and the mass number remains unchanged. See ***ionizing radiation.***
boiling-water reactor (BWR)	A ***nuclear reactor*** that uses boiling water to produce steam to drive a turbine.
canister	An unshielded metal container used as: (1) a pour mold in which molten vitrified ***high-level radioactive waste*** can solidify and cool; (2) the container in which DOE and electric utilities place intact ***spent nuclear fuel***, loose rods, or nonfuel components for shipping or ***storage***; or (3) in general, a container used to provide ***radionuclide confinement***. Canisters are used in combination with specialized overpacks that provide structural support, ***shielding*** or confinement for storage, transportation, and ***emplacement***. Overpacks used for transportation are usually referred to as transportation ***casks***; those used for emplacement in a ***repository*** are referred to as ***waste packages***.
cask	A heavily shielded container that meets applicable regulatory requirements used to ship ***spent nuclear fuel*** or ***high-level radioactive waste***.
common segment	Geographic region of the ***rail alignments*** for which a single route for the ***rail line*** has been identified.
confinement	As it pertains to ***radioactivity***, the retention of ***radioactive*** material within some specified bounds. Confinement differs from containment in that there is no absolute physical ***barrier*** in the former.
decay (radioactive)	The process in which one ***radionuclide*** spontaneously transforms into one or more different radionuclides called decay products.
disposal (of spent nuclear fuel and high-level radioactive waste)	The ***emplacement*** in a ***repository*** of ***spent nuclear fuel***, ***high-level radioactive waste***, or other highly ***radioactive*** material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste, and the ***isolation*** of such waste from the ***accessible environment***.

dose (radioactive)	The amount of ***radioactive*** energy taken into (absorbed by) living tissues. See ***effective dose equivalent***.
effective dose equivalent	Often referred to simply as ***dose***, it is an expression of the ***radiation*** dose received by an individual from external radiation and from ***radionuclides*** internally deposited in the body.
electron	A stable elementary particle that is the negatively charged constituent of ordinary matter.
environment	(1) Includes water, air, and land and all plants and humans and other animals living therein, and the interrelationship existing among these. (2) The sum of all external conditions affecting the life, development, and survival of an organism.
emplacement	The placement and positioning of ***waste packages*** in the ***repository***.
environmental impact statement (EIS)	A detailed written statement that describes: "...the environmental impact of the ***proposed action***; any adverse environmental effects which cannot be avoided should the proposal be implemented; ***alternatives*** to the proposed action; the relationship between local short-term uses of man's ***environment*** and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Preparation of an EIS requires a public process that includes public meetings, reviews, and comments, as well as agency responses to the public comments.
exposure (to radiation)	The condition of being subject to the effects of or potentially acquiring a ***dose*** of ***radiation***. The incidence of radiation on living or inanimate material by ***accident*** or intent. Background exposure is the exposure to natural ionizing radiation. Occupational exposure is the exposure to ionizing radiation that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.
fission	The splitting of a ***nucleus*** into at least two other nuclei, resulting in the release of two or three ***neutrons*** and a relatively large amount of energy.
fission products	***Radioactive*** or nonradioactive atoms produced by the ***fission*** of heavy atoms, such as uranium.
fuel assembly	A number of fuel elements held together by structural materials, used in a ***nuclear reactor***; sometimes called a fuel bundle.
gamma ray	The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. See ***ionizing radiation.***
geologic repository	A system for the ***disposal*** of ***radioactive*** waste in excavated geologic media, including surface and subsurface areas of operation, and the adjacent part of the geologic setting that provides ***isolation*** of the radioactive waste in a controlled area.
high-level radioactive waste	(1) The highly ***radioactive*** material that resulted from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains ***fission products*** in sufficient concentrations.
impact	For an EIS, the positive or negative effect of an action (past, present, or future) on the natural ***environment*** (land use, ***air quality***, water resources, geological resources, ecological resources, aesthetic and scenic resources) and the human environment (***infrastructure***, economics, social, and cultural).

infrastructure	Basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communication systems.
ionizing radiation	(1) ***Alpha particles***, ***beta particles***, ***gamma rays***, ***X-rays***, ***neutrons***, high-speed ***electrons***, high-speed ***protons***, and other particles capable of producing ions. (2) Any ***radiation*** capable of displacing electrons from an atom or molecule, thereby producing ions.
irradiation	***Exposure*** to ***radiation***.
isolation	Inhibiting the transport of ***radioactive*** material so that the amounts and concentrations of this material entering the ***accessible environment*** stay within prescribed limits.
neutron	An atomic particle with no charge and an ***atomic mass*** of 1; a component of all atoms except hydrogen; frequently released as ***radiation***.
No-Action Alternative	Under the No-Action Alternative in the Nevada Rail Corridor SEIS, DOE would not construct and operate a railroad within the Mina rail corridor from Wabuska to Yucca Mountain. Under the No-Action Alternative the Rail Alignment ***EIS***, DOE would not implement the ***Proposed Action*** in the Caliente rail corridor or the Mina rail corridor.
nonpoint source pollution	Pollution does not come from a single source but from many unidentifiable sources. An example of nonpoint source pollution would be urban runoff of items like oil, fertilizers, and lawn chemicals. As rainfall or snowmelt moves over and through the ground, it picks up and carries away natural and human-made pollutants. These pollutants are eventually deposited into natural bodies of water, such as lakes, rivers, wetlands, coastal waters, and underground sources of drinking water.
nuclear reactor	A device in which a nuclear fission chain reaction can be initiated, sustained, and controlled to generate heat or to produce useful ***radiation***.
nucleus	The central, positively charged, dense portion of an atom. Also known as ***atomic nucleus***.
nuclide	An atomic ***nucleus*** specified by its ***atomic weight***, ***atomic number***, and energy state; a ***radionuclide*** is a ***radioactive*** nuclide.
pressurized-water reactor (PWR)	A nuclear power ***reactor*** that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.
Proposed Action	The activity proposed to accomplish a federal agency's purpose and need. An EIS analyzes the environmental ***impacts*** of a proposed action, which includes the project and its related support activities. The Proposed Action in the Nevada Rail Corridor SEIS, is to construct and operate a railroad to connect the Yucca Mountain repository to an existing rail line near Wabuska, Nevada (the Mina rail corridor). The Proposed Action in the Rail Alignment EIS, is to determine an alignment (within a corridor) and construct and operate a railroad in Nevada to transport spent nuclear fuel, high-level radioactive waste, and other Yucca Mountain project materials to a repository at Yucca Mountain.
proton	An elementary particle that is the positively charged component of ordinary matter and, together with the ***neutron***, is a building block of all atomic nuclei.

radiation	Energy traveling through space. Radiation can be non-ionizing, like radio waves, ultraviolet radiation, or visible light, or ionizing, depending on its effect on atomic matter. As used in this Rail Alignment EIS “radiation” refers to ***ionizing radiation***. Ionizing radiation has enough energy to ionize atoms or molecules while non-ionizing radiation does not. Radioactive material is a physical material that emits ionizing radiation.
radioactive	Emitting ***radioactivity***.
radioactivity	(1) The spontaneous transformation of unstable atomic nuclei, usually accompanied by the emission of ionizing ***radiation*** (e.g., such as ***alpha***, ***beta***, or ***gamma rays***). (2) The property of unstable nuclei in certain atoms (of elements such as uranium) to spontaneously emit ionizing radiation during nuclear transformations.
radionuclide	See ***nuclide***.
rail alignment	An engineered refinement of a ***rail corridor*** in which DOE would identify the location of a rail line. A rail alignment is comprised of ***common segments*** and ***alternative segments***.
rail corridor	As used in this Rail Alignment EIS, a strip of land, 400 meters (0.25 mile) wide through which DOE would identify an alignment (***rail alignment***) for the construction of a ***rail line*** in Nevada to a ***geologic repository*** at Yucca Mountain.
rail line	An engineered feature incorporating the track, ties, ***ballast***, and ***subballast*** at a specific location.
railroad	A transportation system incorporating the rail line, operations support facilities, railcars, locomotives, and other related property and infrastructure.
reactor	See ***nuclear reactor***.
repository	See ***geologic repository***.
riprap	Broken rocks or chunks of concrete used as foundation material or to protect embankments and gullies to control water flow or prevent erosion.
roadbed	The earthwork foundation upon which the track, ties, ***ballast***, and ***subballast*** of a ***rail line*** are lain.
Shared-Use Option	An option under the ***Proposed Action***. DOE would allow commercial and other shippers to use the ***rail line*** for general freight shipments. General freight would include stone and other nonmetallic minerals, petrochemicals, waste materials (nonradioactive), or other commodities that private companies would ship or receive.
shielding	Any material that provides ***radiation*** protection.
spent nuclear fuel	Fuel that has been withdrawn from a ***nuclear reactor*** following ***irradiation***, the component elements of which have not been separated by reprocessing. For this project, this refers to (1) intact, nondefective ***fuel assemblies***, (2) failed fuel assemblies in ***canisters***, (3) fuel assemblies in canisters, (4) consolidated fuel rods in canisters, (5) nonfuel assembly hardware inserted in ***pressurized-water reactor*** fuel assemblies, (6) fuel channels attached to ***boiling-water reactor*** fuel assemblies, and (7) nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in canisters.
storage	The collection and containment of waste or ***spent nuclear fuel*** in a way that does not constitute ***disposal*** of the waste or spent nuclear fuel for the purposes of awaiting treatment or disposal capacity.

subballast	A layer of crushed gravel that is used to separate the ***ballast*** and ***roadbed*** for the purpose of load distribution and drainage.
subgrade elevation	The elevation of the top of the ***subballast*** in the ***rail line***.
waste packages	Two thick metal cylinders, one nested within the other. The inner cylinder would be made of stainless steel to provide structural strength. The outer cylinder would be made of a nickel alloy that is highly resistant to corrosion.
X-rays	Penetrating electromagnetic ***radiation*** having a wavelength much shorter than that of visible light. X-rays are identical to ***gamma rays*** but originate outside the ***nucleus***, either when the inner orbital ***electrons*** of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.

F.6 References

106860	AREA 1997	AREA (American Railway Engineering Association) 1997. Track. Volume 1 of Manual for Railway Engineering. Washington, D.C.: American Railway Engineering Association. TIC: 233847.
178728	Bartoldus, Garbisch, and Kraus 1994	Bartoldus, C.C.; Garbisch, E.W.; and Kraus, M.L. 1994. Evaluation for Planned Wetlands (EPW). St. Michaels, Maryland: Environmental Concern. TIC: 259078.
178724	Cowardin et al. 1979	Cowardin, L.M.; Carter, V.; Golet, F.C.; and LaRoe, E.T. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. Washington, D.C.: U.S. Government Printing Office. ACC: MOL.20070201.0265.
176903	De Leuw, Cather & Company 1992	De Leuw, Cather & Company 1992. Final, Yucca Mountain Rail Access Study Caliente Route, Conceptual Design Report. San Francisco, California: De Leuw, Cather & Company. ACC: MOL.20010612.0435.
155970	DOE 2002	DOE (U.S. Department of Energy) 2002. Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. DOE/EIS-0250. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314; MOL.20020524.0315; MOL.20020524.0316; MOL.20020524.0317; MOL.20020524.0318; MOL.20020524.0319; MOL.20020524.0320.
178594	EPA 2006	EPA (U.S. Environmental Protection Agency) 2006. Economic Benefits of Wetlands. EPA843-F-06-004. [Washington, D.C.]: U.S. Environmental Protection Agency, Office of Water. ACC: MOL.20070119.0082.
176806	FEMA 1985	FEMA (Federal Emergency Management Agency) 1985. Flood Insurance Study, City of Caliente, Nevada, Lincoln County. Community Number - 320015. San Francisco, California: Federal Emergency Management Agency. ACC: MOL.20060419.0203.

104774	Fischer et al. 1987	Fischer, L.E.; Chou, C.K.; Gerhard, M.A.; Kimura, C.Y.; Martin, R.W.; Mensing, R.W.; Mount, M.E.; and Witte, M.C. 1987. Shipping Container Response to Severe Highway and Railway Accident Conditions. NUREG/CR-4829. Volume 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: NNA.19900827.0230.
176309	NDEP 1994	NDEP (Nevada Division of Environmental Protection) 1994. Best Management Practices Handbook. Carson City, Nevada: State of Nevada, Nevada Division of Environmental Protection. ACC: MOL.20060206.0352.
176307	NDOT 2004	NDOT (Nevada Department of Transportation) 2004. Storm Water Quality Handbooks, Construction Site, Best Management Practices (BMPs) Manual. [Carson City], Nevada: Nevada Department of Transportation. ACC: MOL.20060313.0203.
174207	NDWR [n.d.]	NDWR (Nevada Division of Water Resources) [n.d.]. Nevada State Water Plan. Carson City, Nevada: Nevada Division of Water Planning, Department of Conservation and Natural Resources. ACC: MOL.20050714.0439.
176166	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Route Sections and Structures – Typical Concepts of Structural Features Caliente Rail Corridor, Task 7: Route Sections and Structures, REV. 01. Document No. NRP-R-SYSW-TY-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0016.
180916	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Alignment Development Report Caliente Rail Corridor, Task 6: Route Alignment Definition, REV. 03. Document No. NRP-R-SYSW-DA-0001-03. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070620.0014.
180918	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Route Sections and Structures - Typical Concepts of Structural Features Caliente Rail Corridor, Task 7: Route Sections and Structures, Rev. 02. Document No. NRP-R-SYSW-TY-0001-02. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070423.0016.
176303	Ong 2005	Ong, C. 2005. "Inquiry to Available Flood Data at NV Division of Water Resources." Memorandum for the Record from C. Ong (PHE) to K. Groenewold (NFIP), December 15, 2005. ACC: MOL.20060206.0365.
176304	Ong 2005	Ong, C. 2005. "Inquiry to Available Flood Data at BLM." Memorandum for the Record from C. Ong (PHE) to BLM, December 9 - 15, 2005. ACC: MOL.20060206.0366.
182755	Parsons Brinckerhoff 2005	Parsons Brinckerhoff 2005. Hydrologic and Drainage Evaluation Report, Task 2.6, Rev. 0. Subcontract No. NN-HC4-00207. [Las Vegas, Nevada]: Parsons Brinckerhoff. ACC: ENG.20070614.0003.
180885	Parsons Brinckerhoff 2007	Parsons Brinckerhoff 2007. Phase 1 Hydrologic and Drainage Evaluation Report, Mina Rail Corridor, Task 2.3: Preliminary Investigations for Hydrologic and Drainage Evaluations for Conceptual Design, Rev. 00. 07-00022. [Las Vegas, Nevada]: Parsons Brinckerhoff. ACC: ENG.20070523.0007.

180914	PBS&J 2006	PBS&J (Post, Buckley, Schuh & Jernigan) 2006. Waters of the U.S. Jurisdictional Determination Report for Yucca Mountain Project - Caliente Rail Corridor, Task 1.1 Information on Wetlands and Floodplains, REV. 03. 06-00104. Henderson, Nevada: Post, Buckley, Schuh & Jernigan. ACC: ENG.20070102.0010.
180889	PBS&J 2007	PBS&J (Post, Buckley, Schuh & Jernigan) 2007. Waters of the U.S. Jurisdictional Determination Report for Yucca Mountain Project, Mina Rail Corridor, Task 1.1a Information on Wetlands and Floodplains, Revision 0. 07-00021. Henderson, Nevada: Post, Buckley, Schuh & Jernigan. ACC: ENG.20070426.0022.
180696	Potomac-Hudson Engineering 2007	Potomac-Hudson Engineering 2007. RA EIS Caliente Rail Alignment Wetland Reconnaissance Technical Memo, February 6, 2007. Bethesda, Maryland: Potomac-Hudson Engineering. ACC: MOL.20070511.0008.
159895	Tanko and Glancy 2001	Tanko, D.J. and Glancy, P.A. 2001. Flooding in the Amargosa River Drainage Basin, February 23-24, 1998, Southern Nevada and Eastern California, Including the Nevada Test Site. Fact Sheet 036-01. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20010924.0092.
102188	YMP 1995	YMP (Yucca Mountain Site Characterization Project) 1995. Reclamation Implementation Plan. YMP/91-14, Rev. 1. Las Vegas, Nevada: Yucca Mountain Site Characterization Office. ACC: MOL.19970109.0256.

APPENDIX G

METHODOLOGY FOR ASSESSING IMPACTS TO GROUNDWATER

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ACRONYMS AND ABBREVIATIONS

DIRS	Document Input Reference System
DTN	Data Tracking Number
DOE	U.S. Department of Energy
DEIS	Draft Environmental Impact Statement
GIS	Geographic Information System
GNIS	Geographic Names Information System
NDWR	Nevada Division of Water Resources
NWIS	National Water Information System
USGS	U.S. Geological Survey

APPENDIX G

METHODOLOGY FOR ASSESSING IMPACTS TO GROUNDWATER

This appendix provides detailed information on the methods DOE used to assess potential impacts to groundwater provided in Sections 4.2.6 and 4.3.6 of the Rail Alignment EIS (DOE/EIS-0369).

Section G.3 defines terms shown in ***bold italics***.

This appendix describes:

- The general approach and assumptions the U.S. Department of Energy (DOE or the Department) used to identify existing groundwater resources and to assess potential impacts to those groundwater resources from the proposed groundwater withdrawal for construction and operation of the proposed rail line
- The methodology for determining the impact to the aquifer (at an existing groundwater resource feature) due to pumping at a specific well location or the location of a group of wells
- The aquifer types considered and the corresponding calculations employed for the proposed well locations where an assessment was performed

Section G.1 describes the methods DOE used to assess impacts to groundwater from railroad construction along either the Caliente rail alignment or the Mina rail alignment; Section G.1.3 describes the methods for determining potential impacts from railroad operations along either alignment. DOE used the same methods to assess potential impacts to groundwater resources under the Shared-Use Option for each alignment as described in Section G.2.

DOE performed calculations to quantitatively evaluate potential impacts to existing water wells and springs from withdrawing groundwater from proposed new wells that would support construction and operation of the proposed rail line. DOE has proposed many locations along the Caliente and Mina rail alignments for water wells. Each set of calculations evaluates impacts on the host aquifer from pumping of these wells. DOE has categorized wells into construction wells (Section G.1.2), which would be temporary, and operations wells (Section G.1.3), which would be permanent. DOE further categorized construction wells into: (1) construction water wells which would provide water during construction of the rail roadbed and to support water needs at construction camps (Section G.1.2.2), and to support water needs associated with construction of rail facilities (Section G.1.2.3); and (2) quarry wells (Section G.1.2.5), which would provide water to specific quarry sites. The evaluation of construction impacts includes a sensitivity analysis for locations along the Caliente rail alignment (Section G.1.2.4), which DOE conducted to identify favorable locations where increased productivity rates would not impact existing groundwater uses.

G.1 Construction Impacts Assessment

G.1.1 OVERVIEW OF GROUNDWATER ASSESSMENT METHODOLOGY AND ASSUMPTIONS

For assessing potential impacts to groundwater resources, DOE assumed the total duration of the construction phase would be 4 years, the shortest construction period being considered. Actual construction would occur during about the first 3 years, with the final year allocated to installation and testing of signal and communications equipment, and putting the rail line into service. DOE assumed this 4-year construction duration because it would require higher or the same groundwater withdrawal rates from the new proposed water wells than if a longer duration were assumed. This analysis approach is conservative and any impacts identified would include impacts under a longer (up to 10 years) construction duration.

DOE assumed that all of the water required for the Proposed Action would be obtained from the proposed new water wells. DOE also assumed that all of the groundwater required for rail roadbed construction activities within each hydrographic area that the Caliente rail alignment or Mina rail alignment would cross would be acquired within a 9-month period (DIRS 176189-Converse Consultants 2006, Section 2.1; DIRS 180888-Converse Consultants 2007, Section 2.1).

The construction impacts assessment involved calculating the approximate ***radius of influence*** of the ***cone of depression*** surrounding each proposed new water-supply well located in an area with existing wells or any known springs that could potentially be impacted. Section G.1.2.1 provides details regarding the approach that was used for identifying existing wells and known springs that could be located within the radius of influence of the cone of depression surrounding each proposed new water-supply well. The cone of depression generated by pumping groundwater from a well increases (approximately radially) in relation to its areal extent, and the magnitude of the drawdowns contained within it increase during the initial, transient period of operation. As the system approaches steady state, both the size of the cone of depression and the magnitude of drawdowns would be expected to expand to reach maximum (equilibrium) values within the specified pumping time frame (in this case, 9 months), unless there were barriers to flow that could affect the generally radial flow behavior surrounding a pumping well and these barriers were located within the radius of influence of that pumping well. The maximum impact of a well on the aquifer is achieved once steady-state conditions have developed. Therefore, DOE performed the impact evaluations using steady-state well formulae so that the likely maximum impacts could be assessed.

Vertical flow can also occur between aquifers. If a well is ***screened*** in a ***leaky aquifer***, part of the flow is derived from the horizontal flow in that aquifer, and part from the vertical flow from underlying or overlying aquifers, located below or above the aquifer in question. DOE neglected this phenomenon in the impact analyses because additional flow originating from other aquifers would decrease the calculated drawdown in the aquifer of interest. Therefore, DOE has conservatively estimated the impact of the well on the water-bearing zone.

DOE determined and evaluated a range of potential aquifer conditions. At several locations, DOE completed more than one calculation of the radius of influence to reflect different potential aquifer conditions (confined aquifer versus unconfined aquifer; alluvial aquifer versus fractured volcanic rock aquifer, etc.; see Section G.1.2.2) that might occur at the pumping location.

If a calculated radius of influence equaled or exceeded the distance separating the proposed well location and an existing well or spring, then DOE assumed there would be a hydrogeologic impact on that existing well or spring. The *Hydrogeologic DEIS Analysis Report, REV. 0, April 10, 2006* (DIRS 176189-

Converse Consultants 2006, all) describes the locations and characteristics of wells proposed for supplying water needed for rail roadbed earthwork compaction along the Caliente rail alignment. The *Hydrogeologic DEIS Analysis Report, REV. 0, April 27, 2007* (DIRS 180888-Converse Consultants 2007, all) describes the locations and characteristics of wells proposed for supplying water needed for rail roadbed earthwork compaction along the Mina rail alignment.

G.1.2 CONSTRUCTION WATER-SUPPLY WELLS

DOE performed calculations to evaluate the potential impacts of groundwater withdrawals from individual wells or groups of wells on nearby existing wells and springs. DOE varied the analytical methods used for the impacts analyses at the various locations to reflect the different aquifer conditions inferred to be present at each pumping site. The impacts analyses consisted of:

- Identifying the average and peak withdrawal rates of each proposed well or group of wells
- Identifying potential hydrogeologic conditions that could be present at each location and evaluating an appropriate calculation methodology for each potential condition
- Calculating the extent and magnitude of drawdowns that would be generated by the proposed well or an equivalent single well for a well cluster pumping at the specified average withdrawal rate (under the range of potential hydrogeologic conditions postulated)
- Identifying the location and characteristics of existing water wells and springs that might be impacted by the drawdown generated by the proposed groundwater withdrawals
- Estimating the potential reduction in well capacity or spring discharge, if any, that could occur as a result of the proposed groundwater withdrawals

G.1.2.1 Hydrogeologic Impacts Analysis Approach

DOE used the following approach to evaluate potential impacts on existing wells and springs from the proposed groundwater withdrawals from new water wells:

- Review the specified data regarding the proposed well locations, well construction details, estimated groundwater depths, and proposed groundwater withdrawal rates and timeframes. The references containing these data for the Caliente rail alignment include DIRS 176189-Converse Consultants 2006, all; DIRS 176168-Nevada Rail Partners 2006, Section 3.1.5; DIRS 180922-Nevada Rail Partners 2007, Section 3.1.5; DIRS 176172-Nevada Rail Partners 2006, Section 4.4; DIRS 180875-Nevada Rail Partners 2007, Section 4.4; and DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5. The references containing these data for the Mina rail alignment include DIRS 180888-Converse Consultants 2007, all; DIRS 180873-Nevada Rail Partners 2007, Section 2.1.5; and DIRS 180875-Nevada Rail Partners 2007, Section 4.4.
- Identify all the existing wells and springs in proximity to the proposed pumping well locations and their characteristics, use category, and permit status using report information (such as DIRS 176600-Converse Consultants 2005, all; DIRS 180887-Converse Consultants 2007, all) and information from on-line sources, including the Nevada Division of Water Resources (NDWR) water-rights and well-log databases, the U.S. Department of the Interior, U.S. Geological Survey (USGS), and National Water Information System (NWIS) (DIRS 176325-USGS 2006, all). DOE used the following Geographic Information System (GIS) datasets in the analyses:
    - GNIS-Nevada Springs. Data Tracking Number (DTN) MO0605GOISGNISN.000 (DIRS 176979)
    - USGS Existing Wells Location Information for the State of Nevada. DTN MO0607USGSWNVD.000 (DIRS 177294)

   - Nevada Division of Water Resources Well Data. DTN MO0607NDWRWELD.000 (DIRS 177292)
   - Two New Existing Wells within Dry Lake Valley. DTN MO0607PWMAR06D.000 (DIRS 177293)
   - National Hydrological Dataset Point Information for the State of Nevada 2006. DTN MO0607NHDPOINT.000 (DIRS 177712)
   - National Hydrological Dataset Waterbody Information for the State of Nevada 2006. DTN MO0607NHDWBDYD.000 (DIRS 177710)
   - Converse Consultants 2007 (DIRS 182759)
   - NDWR (DIRS 182898)
   - NDWR (DIRS 182899)

  The (location) coordinates assumed for most of these existing wells are based on the center of the 40-acre Quarter Quarter Section description provided on well logs that were submitted to the NDWR. Therefore, these wells could actually be anywhere within each described 40-acre Quarter Quarter Section of land.

- For initial screening purposes, if DOE identified an existing well or a spring within a 1.6-kilometer (1-mile) radius (buffer distance) of a proposed new water well, DOE selected that proposed well location as a candidate for conducting a groundwater hydrogeologic impacts evaluation. If DOE found no spring or existing well within this initial search radius, it extended the search distance outward from the proposed well location to identify the nearest spring or existing well and determined its hydrogeologic and construction characteristics (for the existing wells). If the nearest existing well or spring was farther away than the initial search distance of 1.6 kilometers, an impacts analysis was still performed if one was deemed appropriate for that location, provided the nearest existing well was found to be within a distance of 2.4 kilometers (1.5 miles) of the proposed pumping well location. The analysis was done taking into account the withdrawal rate at the proposed new well location and the annual duty for the nearest existing well if it had a formal appropriated water right. DOE searched the NDWR water-rights database and well-log databases to confirm the identity, use, water-rights status, if any, and appropriated annual duty and diversion rate, if applicable, associated with each existing well (or spring) within the final searched buffer distance.
- Existing wells and known springs were deemed significant, even if there was not an active water right associated with the well (provided that the well has a use that is listed as being other than the uses listed immediately below) or the spring. In addition to possibly being a source of water for human use, springs provide a water source for wildlife and form unique habitats within the desert ecosystem.
- DOE did not analyze impacts on existing wells that were found to have no productive use based on use category or status (that is, were confirmed to be groundwater exploration or test wells, thermal gradient test wells, or were dry). For example, DOE excluded from the list of wells of potential concern several existing wells cataloged in the USGS NWIS database that were confirmed to be either monitoring wells, thermal gradient or oil and gas testing wells, or hydrogeologic investigation wells and that have no associated productive (beneficial) use other than their potential future use as monitoring wells.
- DOE included wells with a designation of Domestic. The State of Nevada does not require a water-rights application or permit (formal appropriation) to drill a well for domestic purposes. However, DOE considered domestic wells in the impacts analyses.
- DOE reviewed available geologic and hydrogeologic information for known and potential aquifers in areas where existing wells or springs near proposed new pumping wells indicated that a quantitative analysis of hydrogeologic impacts was warranted. Information and data reviewed included well-log data (total well depth, lithologic units, depth to groundwater, pumping-test data, appropriated duty

balance, and diversion rate data, if applicable) for existing wells near proposed new well locations, published geologic and hydrogeologic reports, and groundwater resource appraisal reports. DOE used this information to identify appropriate analytical methods for quantitatively evaluating the drawdown effects from the proposed groundwater withdrawals on the aquifer in which the wells would be installed. The following references containing available geologic and hydrogeologic information for the study area were reviewed:

Caliente Rail Alignment

- DIRS 177524-Anning and Konieczki 2005
- DIRS 173179-Belcher 2004
- DIRS 176851-Brothers, Bugo, and Tracy 1993
- DIRS 176883-Brothers, Katzer, and Johnson 1996
- DIRS 176852-Drici, Garey, and Bugo 1993
- DIRS 116801-Driscoll 1986
- DIRS 176818-Eakin 1962
- DIRS 181909-Fridrich et al. 2007, all
- DIRS 129721-Geldon et al. 1998
- DIRS 106094-Harrill, Gates, and Thomas 1988
- DIRS 180775-Lopes et al. 2006
- DIRS 106695-Malmberg and Eakin 1962
- DIRS 103136-Prudic, Harrill, and Burbey 1993
- DIRS 169384-Reiner et al. 2002
- DIRS 176519-Rowley and Shroba 1991
- DIRS 176947-Rowley et al. 1994
- DIRS 176502-Rush 1964
- DIRS 176849-Rush 1968
- DIRS 176950-Rush and Everett 1966
- DIRS 174643-Seaber, Kapinos, and Knapp 1994
- DIRS 173842-Shannon & Wilson 2005
- DIRS 175986-Shannon & Wilson 2005
- DIRS 150228-Slate et al. 2000
- DIRS 176488-State of Nevada 2006
- DIRS 147766-Thiel Engineering Consultants 1999
- DIRS 172905-USGS 1995
- DIRS 176325-USGS 2006
- DIRS 176848-Van Denburgh and Rush 1974

Mina Rail Alignment

- DIRS 180760-Albers and Stewart 1981
- DIRS 177524-Anning and Konieczki 2005
- DIRS 173179-Belcher 2004

- DIRS 181394-Everett and Rush 1967
- DIRS 181909-Fridrich et al. 2007, all
- DIRS 129721-Geldon et al. 1998
- DIRS 106094-Harrill, Gates and Thomas 1988
- DIRS 180697-Huxel and Harris 1969
- DIRS 180775-Lopes et al. 2006
- DIRS 106695-Malmberg and Eakin 1962
- DIRS 180777-Mauer et al. 2004
- DIRS 103136-Prudic, Harrill, and Burbey 1993
- DIRS 169384-Reiner et al. 2002
- DIRS 176849-Rush 1968
- DIRS 180754-Rush et al. 1971
- DIRS 174643-Seaber, Kapinos, and Knapp 1994
- DIRS 173842-Shannon & Wilson 2005
- DIRS 175986-Shannon & Wilson 2005
- DIRS 180881-Shannon & Wilson 2007
- DIRS 150228-Slate et al. 2000
- DIRS 176488-State of Nevada 2006
- DIRS 180975-Stewart, Carlson, and Johannessen 1982
- DIRS 181896-Stoller-Navarro 2005
- DIRS 147766-Thiel Engineering Consultants 1999
- DIRS 172905-USGS 1995
- DIRS 176325-USGS 2006
- DIRS 180759-Van Denburgh and Glancy 1970

- DOE completed quantitative analyses to calculate the estimated lateral extent of the drawdown cone of depression that would be induced in the aquifer surrounding each proposed new water-well location (or well cluster) during pumping at the water-well location(s) at the prescribed withdrawal rate. DOE performed quantitative analyses using one or more sets of analytical equations to correspond to one or more sets of assumptions. The analyses were designed to cover the range of possible aquifer conditions that might be encountered at the proposed well locations. For those proposed new well locations that were evaluated due to the presence of a nearby existing well with a water right, results of these analyses were combined with an analysis undertaken to quantitatively evaluate the radius of influence that might be induced by pumping at that existing well. DOE compared the results of the radius-of-influence calculations for both the proposed new location and the existing well to determine whether the drawdown cones of depression from the two well locations could contact each other. Analytical results demonstrated that such conditions (that is, that the radii of influence would intersect each other, based on the assumptions made for analysis) would occur only in a few cases. These cases of likely impact to existing groundwater were a result of high average groundwater withdrawal rates prescribed at a proposed new well location (see the sensitivity analysis cases described in Section G.1.2.4), unfavorable hydrogeologic conditions in the area, the proximity of the nearest existing well to the proposed well location, or a very large appropriated annual duty for the existing well. Sections G.1.2.2 and G.1.2.4 provide details regarding the calculation methods and assumptions.

Tables G-1 and G-2 list proposed new well locations for the Caliente and Mina rail alignments for which DOE performed hydrogeologic impacts analyses.

Table G-1. Proposed new well locations pumped at specified average (base-case) groundwater withdrawal rates for which DOE performed groundwater impacts analyses – Caliente rail alignment (page 1 of 2).

Proposed new well	Hydrographic area number	Hydrographic area name	Alternative segment/common segment
ClV1	204	Clover Valley	Eccles/common segment 1
ClV2	204	Clover Valley	Eccles/common segment 1
PanV1	203	Panaca Valley	Eccles/common segment 1
PanV4	203	Panaca Valley	Eccles/common segment 1
PanV23	203	Panaca Valley	Eccles/common segment 1
PanV2/PanV24	203	Panaca Valley	Eccles/common segment 1
PanV6/PanV3	203	Panaca Valley	Eccles/common segment 1
PanV25/PanV26	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV7/PanV8	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV9/PanV10/PanV11/PanV12	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV13/PanV15	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
DLV3	181	Dry Lake Valley	Common segment 1
DLV4	181	Dry Lake Valley	Common segment 1
PahV1/PahV2/PahV3	208	Pahroc Valley	Common segment 1
PahV7/PahV8/PahV9	208	Pahroc Valley	Common segment 1
GV2	172	Garden Valley	Garden Valley 2
GV10	172	Garden Valley	Garden Valley 1
RrV5	173A	Railroad Valley South	Comment segment 2/South Reveille 3/common segment 3
RrV6/RrV11	173A	Railroad Valley South	Common segment 2/South Reveille 2/common segment 3 Common segment 2/South Reveille 3/common segment 3
RrV8	173A	Railroad Valley South	Common segment 2/South Reveille 3/common segment 3
HC4	156	Hot Creek Valley	Common segment 3
HC5/HC7	156	Hot Creek Valley	Common segment 3
SCV3	149	Stone Cabin Valley	Common segment 3
ASV6	142	Alkali Spring Valley	Goldfield 4
SaF1/SaF2	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5
SaF4	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5

Table G-1. Proposed new well locations pumped at specified average (base-case) groundwater withdrawal rates for which DOE performed groundwater impacts analyses – Caliente rail alignment (page 2 of 2).

Proposed new well	Hydrographic area number	Hydrographic area name	Alternative segment/common segment
SaF5/SaF9	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5 Bonnie Claire 2/common segment 5
SaF7/SaF11	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5 Bonnie Claire 2/common segment 5
OV9	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV24/OV25/OV26	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV12/OV18/OV19/OV20/OV21	228	Oasis Valley	Common segment 5/Oasis Valley 3/common segment 6
OV3/OV4/OV5/OV13	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6 Common segment 5/Oasis Valley 3/common segment 6
OV14/OV16/OV6/OV8	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6

Table G-2. Proposed new well locations pumped at the maximum groundwater withdrawal rates for which DOE performed groundwater impacts analyses – Mina rail alignment (page 1 of 2).

Proposed new well	Hydrographic area number	Hydrographic area name	Alternative segment/common segment
WLA-3a	110A	Walker Lake Valley	Department of Defense Branchline North/Schurz alternative segment 1/Department of Defense Branchline South
WLc-2a	110C	Walker Lake Valley	Department of Defense Branchline South/Mina common segment 1
CSM-2a	118	Columbus Salt Marsh	Mina common segment 1
CSM-3a	118	Columbus Salt Marsh	Mina common segment 1
SSa-2	121A	Soda Springs Valley East	Mina common segment 1
SSa-3	121A	Soda Springs Valley East	Mina common segment 1
SSa-4	121A	Soda Springs Valley East	Mina common segment 1
SSb-2	121B	Soda Springs Valley West	Mina common segment 1
BSa-1a	137A	Big Smoky Valley – Tonopah Flat	Mina common segment 1/Montezuma alternative segment 1; Mina common segment 1/Montezuma alternative segment 2
BSa-2a	137A	Big Smoky Valley – Tonopah Flat	Mina common segment 1/Montezuma alternative segment 2
BSa-3a	137A	Big Smoky Valley – Tonopah Flat	Mina common segment 1/Montezuma alternative segment 2
AS-1b	142	Alkali Spring Valley	Montezuma alternative segment 2

Table G-2. Proposed new well locations pumped at the maximum groundwater withdrawal rates for which DOE performed groundwater impacts analyses – Mina rail alignment (page 2 of 2).

Proposed new well	Hydrographic area number	Hydrographic area name	Alternative segment/common segment
AS-2b	142	Alkali Spring Valley	Montezuma alternative segment 2
ASV6	142	Alkali Spring Valley	Montezuma alternative segment 2
Cl-1a	143	Clayton Valley	Montezuma alternative segment 1
Cl-8a	143	Clayton Valley	Montezuma alternative segment 1
Cl-9a	143	Clayton Valley	Montezuma alternative segment 1
Li-3a	144	Lida Valley	Montezuma alternative segment 1
SaF4	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5
SaF5/SaF9	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5, Bonnie Claire 2/common segment 5
SaF7/SaF11	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5, Bonnie Claire 2/common segment 5
OV24/OV25/OV26	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV12/OV18/OV19/OV 20/OV21	228	Oasis Valley	Common segment 5/Oasis Valley 3/common segment 6
OV3/OV4/OV5/OV13	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6, common segment 5/Oasis Valley 3, common segment 6
OV9	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV14/OV16/OV6/OV8	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6

G.1.2.2 Hydrogeologic Impacts Calculation Methods

DOE performed calculations using one or more sets of analytical equations reflecting one or more sets of assumptions made regarding the hydrogeologic conditions present at the analysis location. These calculations were designed to cover the range of possible aquifer conditions that might be encountered at the proposed new well locations. Applicable aquifer conditions varied according to well location, proposed well depth, and the available geologic and hydrogeologic information for each area. Types of aquifers considered for the various proposed locations included alluvial valley-fill aquifers, alluvial valley-fill aquifers with transecting faults, and faulted and/or fractured consolidated rock aquifers. Types of aquifer conditions assumed to exist at the various well locations for either the Caliente or the Mina rail alignment included:

- Infinite-extent unconfined aquifer
- Infinite-extent confined aquifer
- Semi-infinite-extent unconfined aquifer
- Semi-infinite-extent confined aquifer
- Carbonate and volcanic rock aquifers
- Limited-extent unconfined aquifer

A particular pumping well location could have calculations for more than one type of aquifer condition depending on the assumptions made due to varying geologic information from different reports. For these locations with more than one potential type of aquifer condition, the results from the calculations for the different types of aquifer conditions served to identify the range and extent of possible impacts to the aquifer as a result of pumping groundwater. Sections G.1.2.2.1 through G.1.2.2.6 describe the analytical methods DOE utilized.

Hydrogeologic impacts analysis calculations were generally performed for those proposed construction wells that are intended to supply water for rail roadbed construction; development and operation of construction camps; and development and operation of potential quarries. Water consumption rates during the period of use of construction camps during the peak output year have been estimated at approximately 76 liters (20 gallons) per minute, which is equivalent to approximately 110,000 liters (28,800 gallons) per day (DIRS 180888-Converse Consultants 2007, Table 2-4*)*. Methodologies and approaches used for evaluating impacts from wells intended to support the first two of these activities are provided in Sections G.1.2.2.1 through G.1.2.2.6 and Section G.1.2.4. Section G.1.2.3 provides a discussion of the approach used for evaluating potential impacts from groundwater withdrawals for wells used to support construction of rail facilities. Section G.1.2.5 provides a discussion of the approach used for evaluating potential impacts from groundwater withdrawals for wells used to support development and operation of proposed quarries.

G.1.2.2.1 Infinite-Extent Unconfined Aquifer

For the case of an unconfined aquifer, the governing equation describing the relationship between the withdrawal rate of a well and the hydraulic head in the aquifer is (DIRS 105038-Bear 1979, eq. 8-24):

$$H_0^{\,2} - h^2 = \frac{Q_w}{\pi K} \ln\left(\frac{R}{r}\right)$$

The terms are:

H_0 undisturbed saturated thickness, [Distance or Length (L)],

h saturated thickness at distance “r” from the well, [L],

K hydraulic conductivity, [Length/Time (L/T)], where T is time

Q_w withdrawal rate, [Volume (L^3)/T],

R radius of influence of the well, [L], and

r radial distance from the well, [L].

The saturated thickness (h) at distance “r” from the well, or h(r), is calculated as follows (DIRS 105038-Bear 1979, eq. 8-4 and Figure 8-4):

$$h(r) = \sqrt{H_0^{\,2} - \frac{Q_w}{\pi K} \ln\left(\frac{R}{r}\right)}$$

The drawdown “s” at distance “r” from the well (DIRS 105038-Bear 1979, Figure 8-4), or s(r), is calculated using the expression for h(r),

$$s(r) = H_0 - h(r) = H_0 - \sqrt{H_0^{\,2} - \frac{Q_w}{\pi K} \ln\left(\frac{R}{r}\right)}$$

When the hydraulic head at the face of the well is set to a given value ($h(r=r_w) = h_w$), the well capacity is obtained from the following relationship (DIRS 105038-Bear 1979, eq. 8-23):

$$H_0^2 - h_w^2 = \frac{Q_w}{\pi K} \ln\left(\frac{R}{r_w}\right) \qquad \text{or} \qquad Q_w = \frac{\pi K (H_0^2 - h_w^2)}{\ln\left(\frac{R}{r_w}\right)}$$

The drawdown "s_w" at the face of a well is a factor in both the capacity of the well and the extent of the well's radius of influence. This drawdown is generally not equal to the drawdown observed within the casing of the pumping well because of various head losses that take place near the well and within the well screened interval (perforated interval in well casing) and the sand pack (interval in the well bore annular space backfilled with sand). The magnitude of these losses depends mostly on the quality of well construction and characteristics of the water in the aquifer, and is difficult to estimate beforehand. Examples discussed in the literature (such as DIRS 116801-Driscoll, 1986, pp. 554 to 569) discuss aggregate well and head losses for typical wells resulting in effective well efficiencies from on the order of 50 to 85 percent. DOE assumed (conservatively) for these calculations that the useful drawdown, that is, the drawdown at the face of the well, would be equal to 85 percent of the maximum drawdown that could occur within the well casing. This assumption is based on engineering judgment. For an unconfined aquifer, the theoretical maximum drawdown within a well is equal to the undisturbed saturated thickness minus the length of the well screen ($s_{max} = H_0 – L$), assuming that the bottom of the screen is located at the bottom of the aquifer and that the screen is not exposed during well operation (these are typical practices when a well is screened in an unconfined aquifer). It is also assumed that the screen is long enough to accommodate the pump. The maximum useful drawdown (at the well face) is then:

$$s_w = 0.85\ (H_0 – L)$$

The radius of influence is defined as the distance from the well where the drawdown becomes insignificant and can be neglected. For wells deriving most of their groundwater flow from water from recharge in the area immediately surrounding the well, this radius of influence can be estimated based on mass balance considerations. However, this scenario is likely not applicable in much of the study area, where ***evapotranspiration*** rates generally exceed precipitation rates and/or recharge rates to aquifers are very low (in lower-elevation valley bottom areas) (DIRS 176502-Rush 1964, Table 10; DIRS 103136-Prudic, Harrill, and Burbey 1993, p. 2; DIRS 180759-Van Denburgh and Glancy 1970, p. 17 and Table 6; DIRS 169384-Reiner et al. 2002, Table 5). For wells assumed to derive most of their flow from the horizontal movement of water within the aquifer, as is typically the case in this analysis, empirical formulae were developed to estimate the radius of influence. Two such formulae are presented (DIRS 105038-Bear 1979, eqns. 8-11 and 8-12); note that units are meters and seconds and that s_w is the drawdown at the face of withdrawal well ($s_w = H_0 - h_w$):

$$R = 3{,}000\ s_w\ K^{1/2} \qquad \text{and} \qquad R = 575\ s_w\ (H_0\ K)^{1/2}$$

DOE used the second of these two formulae in this analysis, because it is expressed in terms of aquifer transmissivity "H_0 K" and can be directly applied to cases involving both confined and unconfined aquifers. The first formula uses the hydraulic conductivity, which in the case of a confined aquifer, would have to be calculated by assuming a given thickness of the permeable zone, which may be unknown.

An example of a proposed water-supply area where DOE assumed an infinite-extent, unconfined alluvial aquifer case is well location SCV3 in the Stone Cabin Valley hydrographic area along proposed Caliente common segment 3. The SCV3 location lies in an area underlain by alluvial valley fill. The nearest mapped rock units are at least several miles from the proposed well site; therefore, an infinite-extent, alluvial aquifer is assumed.

Another example of a proposed water-supply well location where DOE assumed an infinite-extent unconfined aquifer is the proposed well location Cl-1A southwest of the community of Silver Peak in hydrographic area 143 (Clayton Valley) along the Mina rail alignment. This well location would be southwest of an existing well field that services Silver Peak. This well location and the corresponding analysis is a special case in that the proposed withdrawal rate at the Cl-1A well location is approximately 1,300 liters (350 gallons) per minute (gpm) or less. This withdrawal rate is higher than the anticipated withdrawal rate for other proposed new water-supply wells along the Mina rail alignment because groundwater underlying much of Clayton Valley is extremely brackish (DIRS 180760-Albers and Stewart 1972, p. 2) as a result of an existing mineral processing operation in the valley. Therefore, locations that could serve as sources of better-quality groundwater for use in rail roadbed construction and for supplying water for a proposed construction camp in this vicinity are very limited in this area.

G.1.2.2.2 Infinite-Extent Confined Aquifer

If the producing zone in the host aquifer occurs below a relatively thick, impermeable layer, such as a layer of clay, then the system could behave as a confined aquifer. For a confined aquifer, the relationship between the withdrawal rate of a well and the hydraulic head in the aquifer can be written as follows (DIRS 105038-Bear 1979, eq. 8-6):

$$s = \frac{Q_w}{2\pi T} \ln\left(\frac{R}{r}\right)$$

where the terms are:

T transmissivity T = H_0 K (undisturbed saturated thickness times the hydraulic conductivity) [L^2/T; where T is time].

s drawdown, [L],

Q_w withdrawal rate, [L^3/T],

R radius of influence of the well, [L], and

r radial distance from the well, [L].

For drawdown at the well face, the expression for well capacity becomes (DIRS 105038-Bear 1979, eq. 8-4):

$$Q_w = \frac{s_w 2\pi T}{\ln\left(\frac{R}{r_w}\right)}$$, where T is transmissivity

The formula for the radius of influence used in these calculations for a confined aquifer is the same as that used for the unconfined case. As for the case of an unconfined aquifer, DOE assumed for these calculations that the useful drawdown (that is, the drawdown at the face of the well) would be equal to 85 percent of the maximum drawdown that could occur within the well casing. In the confined case, the theoretical maximum drawdown within the well is the distance between the static hydraulic head to the top of the permeable zone ($s_{max} = \varphi_0 - EL_{top}$). The maximum useful drawdown is then:

$$s_w = 0.85\ (\varphi_0 - EL_{top})$$

An example of a proposed water supply area where DOE assumed an infinite-extent confined alluvial aquifer case consists of the proposed set of new well locations HC5 and HC7 in the Hot Creek Valley hydrographic area along the Caliente rail alignment. The proposed well locations are considered infinite-extent confined because location HC5/HC7 is described as being mapped on alluvial valley-fill materials, the estimated total depth of the wells is 150 meters (500 feet), and it was considered possible that a relatively impermeable geologic layer, such as a clay unit, might be present above the targeted aquifer, which could lead to confined conditions.

G.1.2.2.3 Semi-Infinite-Extent Unconfined Aquifer

DOE assumed a semi-infinite-extent confined alluvial aquifer case for some proposed well locations where a single (linear) geologic boundary exists adjacent to the proposed well location(s) and assumed that this boundary might act as a no-groundwater-flow feature (flow barrier) that could affect groundwater flow characteristics in the aquifer surrounding the pumping well location(s). Geologic boundaries considered as representing potential no-flow boundaries include faults offsetting a geologic unit of likely low permeability (low hydraulic conductivity) from a geologic unit of likely higher permeability (higher hydraulic conductivity) or an unfaulted geologic contact between two such different geologic units. For these cases, the relationship between the withdrawal rate of a well and the hydraulic head in the aquifer can be calculated using the same formulae as for the infinite-extent unconfined aquifer described in Section G.1.2.2.1. However, in these cases, to account for this assumed adjacent no-flow boundary, the system is modeled by increasing the withdrawal rate in the pumping well by a factor of two to simulate the adjacent boundary. The “method of images” is used in this case to account for the possible no-flow boundary adjacent to the proposed well (DIRS 105038-Bear 1979, p. 356).

To simulate a no-flow boundary, an image pumping well is placed opposite the real pumping well on the other side of the boundary. The system simulating the pumping well and the boundary therefore consists of the real well and an image well, both equal in strength. Strictly speaking, a semi-infinite aquifer has two boundaries, and the far boundary should be treated in the same way. However, in most cases, this far boundary would be a great enough distance from the proposed well (in other words, the far boundary would lie beyond the radius of influence for the proposed pumping well) that the effects of this far boundary on the proposed pumping well would be negligible and can be ignored. Because the proposed well location is adjacent to one boundary and far enough away from the other boundary, a semi-infinite aquifer is considered. One can assume that in relation to the adjacent boundary, the proposed well is close enough to this no-flow boundary that the distance between it and its reflection (image well) across that boundary is negligible. Recall that the image well is equal in strength to the real well. Therefore, the system can be approximated by keeping only the real pumping well and increasing its extraction rate by a factor of two, which is the same as placing the image well right at the same location of the real well.

To solve for the radius of influence, the infinite-extent aquifer formula, unconfined in this case, can be used, but the pumping rate substituted in the equation must equal the actual pumping rate multiplied by two. Note that assuming an impervious boundary is conservative. In reality, geological boundaries would not be completely impervious and would provide some flow. This is especially true for cases where a fault occurs in alluvial valley-fill deposits. In such cases, the faulted zone/fault boundaries would not likely be completely impermeable to flow. This flow across the boundary would lessen the impact of the proposed well on the aquifer. Therefore, the assumption that such faults would act as completely impermeable barriers to flow is conservative; that is, this assumption would result in the determination of a greater amount of impact than might actually occur.

An example of a new well location where DOE assumed a semi-infinite-extent unconfined alluvial aquifer case is proposed new well location RrV8 (a quarry well) in the Railroad Valley South hydrographic area along the Caliente rail alignment. The proposed well location is situated in a valley-fill alluvial aquifer adjacent to mapped volcanic rock units. Section G.1.2.5 describes the methodology and approach used in the hydrogeologic impacts calculation performed for this location.

G.1.2.2.4 Semi-Infinite-Extent Confined Aquifer

DOE assumed a semi-infinite-extent confined alluvial aquifer case for some proposed new well locations where the same conditions occur that are described in Section G.1.2.2.3 except that the host aquifer is assumed to be confined rather than unconfined in nature. For the case of a semi-infinite-extent confined aquifer, the relationship between the withdrawal rate of a well and the hydraulic head in the aquifer can be calculated using the same formulae as for the infinite-extent confined aquifer described in Section G.1.2.2.2. However, as in the semi-infinite-extent unconfined aquifer case, DOE assumed that a (linear) no-flow boundary exists and that this no-groundwater flow feature lies adjacent to the proposed withdrawal well. To simulate the no-flow boundary, the “method of images” is used (DIRS 105038-Bear 1979, p. 356). Section G.1.2.2.3 provides a more detailed explanation concerning the use of “method of images” for a semi-infinite aquifer case. Because the no-flow boundary is adjacent to the pumping well location, the system is approximated by a real well and an image well, both at the same location and extracting groundwater at the same rate. Therefore, the formula for an infinite-extent confined aquifer is applicable, provided the pumping rate used in the formula is double the actual pumping rate (to account for the image well).

An example of a new well location where DOE assumed a semi-infinite-extent confined alluvial aquifer case is proposed new location PanV6/PanV3 in the Panaca Valley hydrographic area. The proposed well location is mapped in alluvial valley fill, and is adjacent to rock units variously characterized as “tuffaceous sedimentary rocks” or lakebed deposits (Panaca Formation). The lithologic makeup of these rock materials and available published information suggest that these rock materials might be either relatively permeable or relatively impermeable, depending on location. Based on this condition and the existing available hydrogeologic information for the area surrounding the proposed PanV6/PanV3 location, DOE assumed the host aquifer for well location PanV3/PanV6 to be a horizontal alluvial aquifer, semi-infinite in extent, and confined.

G.1.2.2.5 Carbonate and Volcanic Rock Aquifers

The hydrogeologic characteristics of carbonate rock aquifers and volcanic rock aquifers vary depending on their location within the areas that either the Caliente rail alignment or the Mina rail alignment would cross. Depending on factors such as the degree of fracturing or faulting, and degree of welding, volcanic rocks along the proposed rail alignments might be either relatively permeable to relatively impermeable, or even moderately permeable (transmissive) with respect to groundwater flow. Carbonate rock aquifers present within some areas of the proposed rail alignments are generally assumed to be relatively permeable due to fracturing and openings caused by dissolution (see DIRS 103136-Prudic, Harrill, and Burbey 1993, p. 13). In the hydrogeologic impact calculations, for those cases where the aquifer was assumed to be comprised of carbonate rock or permeable volcanic rock, DOE treated the aquifer as an equivalent porous media and used the same formulae as for the infinite-extent unconfined or confined aquifer cases (Sections G.1.2.2.1 and G.1.2.2.2 above).

DOE assumed a volcanic rock aquifer case at proposed new well location ASV6 in the Alkali Spring Valley hydrographic area. This proposed well location is in an area of mapped volcanic rock units and alluvial fan deposits with the target aquifer being a fractured volcanic rock unit, assumed to be overlain by a layer of alluvial fan materials (DIRS 176189-Converse Consultants 2006, Appendix B). An example of a new well location where DOE assumed a carbonate rock aquifer is proposed new location DLV4 for the Caliente rail alignment in the Dry Lake Valley hydrographic area. The proposed well location is in an area underlain by alluvial valley fill; however, a carbonate rock aquifer underlying the alluvial materials is assumed to be host aquifer for the well based on the characteristics of other wells installed in this area (DIRS 176189-Converse Consultants 2006, Appendix B).

G.1.2.2.6 Limited-Extent Unconfined Aquifer

DOE assumed a limited-extent unconfined aquifer case for some locations where multiple potential no-flow boundaries are located adjacent to the proposed new well location(s). A limited-extent aquifer case was assumed for proposed new well locations OV3, 4, 5, and 13 in the Oasis Valley hydrographic area (area 228). The Oasis Valley hydrographic area calculations assumed a wedge-shaped alluvial aquifer of limited extent because of the presence of different rock units along the sides of the wedge-shaped alluvium. In this case, it was assumed that the two lateral boundaries of the alluvial aquifer could represent geologic contacts with relatively impermeable volcanic rocks. At Oasis Valley, the source of water to Upper Oasis Valley Ranch Springs downgradient of the proposed well locations was assumed to be groundwater underflow derived from upgradient areas, possibly with some vertical inflow component.

DOE intended the approach taken in the limited-extent unconfined aquifer calculations to be very conservative, because the lateral boundaries likely are not true no-flow boundaries. Available information suggests that at both locations there is likely to be some hydraulic connection between the alluvium and adjacent rock units, which would support an assumption that at least some groundwater underflow from adjacent rock units to the alluvial aquifer would occur (see DIRS 169384-Reiner et al. 2002, pp. 8 to 10 for the case of the Oasis Valley calculations).

At Oasis Valley, DOE assumed an upper-bound limiting pumping rate at the proposed wells that would not affect discharge rates at existing springs downgradient of the proposed new well locations. To evaluate the potential impact of such pumping on existing spring discharges, two criteria must be considered: the radius of influence and the relative percentage of the withdrawal rate to total aquifer discharge. In this evaluation, DOE assumed the total discharge from springs to be similar to the aquifer discharge, which is a conservative assumption because the total spring discharge would represent the lowest possible aquifer discharge (given that evapotranspiration is a significant component of aquifer discharge). Because DOE assumed a limited-extent aquifer, it was necessary to establish an upper bound for the pumping rate to ensure that the proposed groundwater withdrawal would not impact aquifer conditions enough to alter water levels throughout the aquifer. In this calculation, DOE estimated that the maximum pumping rate at the proposed groundwater pumping wells should be at least an order of magnitude (a factor of 10) lower than the total discharge from the limited-extent aquifer (assumed to be the total discharge rate from the springs in the alluvium). With this constraint, DOE then calculated a radius of influence for each proposed new well location and compared these calculated radii of influence to the distances separating each proposed new well location and the nearest existing spring to show that these calculated radii of influence would be valid and representative indicators of the extent of impact at each proposed pumping location, and demonstrate that existing springs should not be affected by the proposed groundwater withdrawals.

G.1.2.2.7 Treatment of Faults and Major Fracture Systems

For a selected set of new groundwater withdrawal well locations, the proposed new well was determined to be located in the vicinity of one or more faults or extensive fracture systems or was found to be specifically targeted for installation directly within a major fault zone or an extensive fracture zone (DIRS 176189-Converse Consultants 2006, Appendix B). For such cases, additional evaluations of hydrogeologic data and/or additional analyses were performed.

In cases where a proposed well was determined to be oriented lateral to a mapped fault trace or fracture zone trace, the fault or fracture zone was treated as a potential no-flow barrier if it was located sufficiently close to the proposed new well to be within the region of influence from pumping at that well location. In such cases, the calculations included a specific method (method of images as described in Section G.1.2.2.3) to simulate the potential effects of the fault or fracture zone on groundwater flow behavior.

Hydraulic tests performed in faulted and fractured consolidated rock aquifers at a few wells in the region of the Nevada Test Site and Yucca Mountain indicate that high-permeability zones associated with faults are capable of acting as conduits for transmitting hydraulic responses from pumping wells over larger-scale (on the order of kilometers) distances if the pumping well draws its water from the fault zone. These effects have been observed for both faulted and fractured volcanic rock and faulted and fractured carbonate rock aquifers (DIRS 181896-Stoller-Navarro 2005, Section 2.0; DIRS 129721-Geldon et al. 1998, pp. 23 to 24 and p. 31). Results from pump tests conducted at these wells often indicate that very complex hydrogeologic conditions, including heterogeneous hydraulic rock properties, the presence of complex structural systems controlling flow, and other non-isotropic conditions, exist at these test sites. For these reasons, where a proposed new well was initially identified as targeting a specific fault or fracture system that might be capable of acting as a high-permeability conduit, DOE identified the locations of existing wells and springs up to 10 kilometers (6.2 miles) away from each such proposed well. In these cases, DOE reviewed available data on existing wells and springs and locations of known (mapped) fault and fracture zone traces within the 10-kilometer radius surrounding each new well location and compared these with the locations of the proposed well to estimate the likelihood of a hydraulic connection occurring between the proposed well and existing wells and springs beyond a distance of 2.4 kilometers (1.5 miles) but within the approximately 10-kilometer distance. If sufficient evidence was found that a proposed new well would likely intercept a fault/fault zone, and that an existing well or spring within the 10-kilometer search distance could likely be hydraulically connected to the proposed withdrawal well withdrawal zone, potential impacts to the nearest such well or spring caused as a result of the proposed withdrawal were assessed. Tables G-3 and G-4 summarize those proposed new well locations for the Caliente and Mina rail alignments, respectively, where a fault or fault zone was initially targeted as a potential water-bearing zone for a new well.

G.1.2.3 Groundwater Withdrawals for Construction of Rail Facilities and Sidings

Water needs and required groundwater well withdrawal rates associated with construction of rail facilities and sidings are small compared to the amount of water required to support construction of the rail line. Construction of the Cask Maintenance Facility would require approximately 4,400 cubic meters (approximately 3.6 acre-feet, or 1.176 million gallons) of water, with construction estimated to occur over approximately 2 years (DIRS 104508-CRWMS M&O 1999, Table III-2). The amount of water needed to construct the other facilities (Staging Yard, Maintenance-of-Way Facilities, and the Rail Equipment

Table G-3. Proposed new well locations where a fault or fault zone was initially identified as a targeted water-bearing zone – Caliente rail alignment.

Well location identification	Rail line segment
PanV14/PanV16	Common segment 1
DLV2, DLV3, DLV4, and DLV6	Common segment 1
PahV1 and PahV2	Common segment 1
PahV5 and PahV8	Common segment 1
StF10	Goldfield alternative segments
LV5/LV13	Goldfield alternative segments
LV8/LV19	Goldfield alternative segments
OV7/OV15	Common segment 6
OV22/OV23	Common segment 6

Table G-4. Proposed new well locations where a fault or fault zone was initially identified as a targeted water-bearing zone – Mina rail alignment.

Well location identification	Rail line segment
BSa-3a	Mina common segment 1/Montezuma alternative segments 2 and 3
WLa-1c	Department of Defense Branchline North/Schurz alternative segment 4/Department of Defense Branchline South
CSM-2a	Mina common segment 1
As-2a and AS-3a	Montezuma alternative segment 1
OV7/OV15	Common segment 6
OV22/OV23	Common segment 6

Maintenance Yard) would range from approximately 14,000 to 200,000 cubic meters, which is equivalent to 11.5 to 161.1 acre-feet, or 3.75 to 52.5 million gallons (DIRS 180873-Nevada Rail Partners 2007,Table 2-2; DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). When compared to the total amount of water needed for railroad construction, and compared to existing groundwater resources in the respective hydrographic areas where the facilities would be constructed, the direct short-term impacts to groundwater resources in the respective hydrographic areas due to water withdrawals associated with construction of facilities and sidings would be small and long term. Direct and indirect impacts on groundwater resources also would be small. For this reason, DOE did not perform quantitative impact analyses for water wells that would be used (for example, at proposed base-case withdrawal rate) solely to support construction of these facilities and sidings (DIRS 176189-Converse Consultants 2006, Appendixes A and B; DIRS 180888-Converse Consultants 2007, Appendixes A through X).

G.1.2.4 Sensitivity Analysis

G.1.2.4.1 Caliente Rail Alignment

The productivity of the proposed wells would vary depending on a number of variables, including aquifer depth, aquifer lithology, permeability, well efficiency, degree of cementing or fracturing present in the host aquifer, the presence or absence of nearby faults or flow boundaries, or other factors. Therefore, it might be necessary to use one or more highly productive wells rather than all proposed wells within each hydrographic area. Higher withdrawal rates at one or more highly productive wells could help fulfill more of the required water demand within a hydrographic area if other wells had lower-than-expected productivities. It should be noted that the temporary nature of the construction water wells would require that short-term higher withdrawal rates be only temporarily imposed. This factor would help reduce potential long-term impacts of increased withdrawal at the applicable higher-productivity locations.

To allow for possible uncertainties in future well productivities and withdrawal rates, DOE considered the possibility of using more highly productive wells and performed sensitivity analyses to evaluate the degree of increased impacts expected to result from the imposition of higher (in other words, higher short-term or peak) withdrawal rates at such more productive water-well locations. For planning purposes, DOE assumed that a maximum withdrawal rate of 0.014 cubic meter (0.5 cubic foot) per second (approximately 852 liters [225 gallons] per minute) might, at least in theory, be imposed at any of the proposed new well locations (with the exception of proposed quarry wells, as described in Section G.1.2.5). Table G-5 lists the proposed new well locations where DOE performed sensitivity analysis calculations. The methodologies and analytical equations used for completing these sensitivity analyses are the same as described in Section G.1.2.2.

Table G-5. Proposed new well locations pumped at higher groundwater withdrawal rates (sensitivity analysis) for which DOE performed groundwater impacts analyses – Caliente rail alignment.

Name of proposed well	Hydrographic area number	Hydrographic area name	Alternative segment/ common segment
ClV2	204	Clover Valley	Eccles/common segment 1
PanV1	203	Panaca Valley	Eccles/common segment 1
PanV4	203	Panaca Valley	Caliente/common segment 1
PanV5	203	Panaca Valley	Caliente/common segment 1
PanV2/PanV24	203	Panaca Valley	Eccles/common segment 1
PanV6/PanV3	203	Panaca Valley	Eccles/common segment 1
PanV25/PanV26	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV7/PanV8	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV9/PanV10/PanV11/PanV12	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV13/PanV15	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
DLV3	181	Dry Lake Valley	Common segment 1
DLV4	181	Dry Lake Valley	Common segment 1
PahV1/PahV2/PahV3	208	Pahroc Valley	Common segment 1
PahV7/PahV8/PahV9	208	Pahroc Valley	Common segment 1
GV2	172	Garden Valley	Garden Valley 2
GV10	172	Garden Valley	Garden Valley 1
RrV5	173A	Railroad Valley South	Common segment 2/South Reveille 3/common segment 3
RrV6/RrV11	173A	Railroad Valley South	Common segment 2/South Reveille 2/South Reveille 3/common segment 3
HC4	156	Hot Creek Valley	Common segment 3
HC5/HC7	156	Hot Creek Valley	Common segment 3
SCV3	149	Stone Cabin Valley	Common segment 3
SaF1/SaF2	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5
SaF4	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5
SaF5/SaF9	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5, Bonnie Claire 2/common segment 5
SaF7/SaF11	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5, Bonnie Claire 2/common segment 5
OV9	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV24/OV25/OV26	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV12/OV18/OV19/OV20/OV21	228	Oasis Valley	Common segment 5/Oasis Valley 3/common segment 6
OV14/OV16/OV6/OV8	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6

DOE evaluated potential impacts on existing wells and existing springs caused by these higher-withdrawal-rate wells by evaluating the size of the radius of influence induced by pumping at the hypothetical higher withdrawal rate. DOE applied the same types of equations to the nearest existing well with a water right located nearest to each higher-withdrawal-rate well to calculate the estimated radius of influence induced by pumping at the existing well. The geology and hydrogeology associated with existing and proposed wells were evaluated to identify the appropriate flow equations in the same manner as described in Sections G.1.2.2.1 and G.1.2.2.2. In these sensitivity analysis calculations, pumping-rate assumptions used for existing wells were derived from annual duty (appropriated annual duty) and diversion rate data contained in the NDWR Water Rights Database.

G.1.2.4.2 Mina Rail Alignment

Sensitivity analyses were not required for well locations proposed for the Mina rail alignment. Calculations performed for evaluating groundwater impacts for the proposed Mina well locations initially assumed a maximum pumping rate expected to be applied at each location, approximately 852 liters (225 gallons) per minute, which is identical (with the exception of proposed new well location Cl-1a, where a withdrawal rate of approximately 1,300 liters [350 gallons] per minute or less was assumed) to the potentially higher withdrawal rate value used in each sensitivity analysis calculation completed for the Caliente alignment well locations.

G.1.2.5 Quarry Water Wells

G.1.2.5.1 Caliente Rail Alignment

The construction impacts assessments also included the evaluation of the potential impacts from pumping at new water wells proposed to support quarry operations along the Caliente rail alignment. DOE considered the potential for impacts to occur resulting from proposed groundwater withdrawals from the proposed quarry water well locations for both the Caliente and Mina rail alignments. Based on the review of the available information, DOE completed impacts analysis calculations for the following proposed quarry well locations:

- One water well (PanV23) associated with a potential quarry northwest of the community of Caliente in hydrographic area 203 in Lincoln County
- Up to two water wells (RrV8 and RrV10) associated with a potential quarry northeast of the South Reveille alternative segments 2 and 3 in hydrographic area 173A in Nye County
- Up to two water wells (AsV6 and AsV7) associated with a potential quarry in hydrographic area 142 in Nye County

Each quarry would operate for approximately 2 years following an initial startup period. Water consumption rates during the period of use of quarries have been estimated at approximately 90.8 liters (24 gallons) per minute, which is equivalent to approximately 131,000 liters (34,560 gallons) per day (DIRS 180888-Converse Consultants 2007, Table 2-4). The *Hydrogeologic DEIS Analysis Report, REV. 0, April 10, 2006* (DIRS 176189-Converse Consultants 2006, all) provides details pertaining to the characteristics and use of the water wells that would be associated with these potential quarry sites. DOE performed impacts analysis calculations for potential quarry wells PanV23, RrV8, and AsV6. An example of the methodology used for a quarry well impact calculation (for proposed well RrV8) is summarized below.

For proposed well site RrV8, DOE proposes a 90- to 120-meter (300- to 400-foot)-deep quarry well and anticipates that this well would be used to supply water at a withdrawal rate of 91 liters (24 gallons) per minute over approximately a 2-year period following an initial startup period (DIRS 176189-Converse

Consultants 2006, Appendix A). Based on geologic information for this area, the well would likely be screened in an alluvial aquifer adjacent to volcanic rock units. Available published information suggests that the volcanic rock materials might be either relatively permeable or relatively impermeable, depending on location. DOE assumed a semi-infinite-extent unconfined alluvial aquifer wherein the adjacent volcanic unit (lava-flow unit) was assumed to be an essentially impermeable rock unit. Based on hydrogeologic information for the area surrounding the proposed RrV8 well location, the host aquifer for the well location RrV8 was assumed to be a horizontal alluvial aquifer and unconfined. The semi-infinite aquifer case is considered to be conservative because the adjacent volcanic rock unit is not likely to be completely impermeable.

Because the potential quarry sites are typically located in bedrock-dominated terrain, wells installed near the quarry sites would be expected to be lower-productivity wells and, therefore, groundwater withdrawal rates at quarry water wells would not be expected to vary significantly from the specified average withdrawal rate of 91 liters (24 gallons) per minute. Therefore, DOE did not perform additional sensitivity analyses for the quarry water wells to assess any increased impacts that might result from imposing higher withdrawal rates at these well sites.

G.1.2.5.2 Mina Rail Alignment

The construction impacts assessments also included the evaluation of the potential impacts from pumping at new water wells proposed to support quarry operations along the Mina rail alignment. DOE evaluated impacts from one proposed quarry water well, WLc-2a, associated with a potential quarry in Garfield Hills in hydrographic area 110C in Mineral County. Each quarry used to support construction of the Mina alignment would operate for approximately 2 years following an initial startup period. The *Hydrogeologic DEIS Analysis Report, REV. 0, April 27, 2007* (DIRS 176189-Converse Consultants 2007, all) provides details pertaining to the characteristics and use of the water wells that would be associated with these potential quarry sites. Section G.1.2.5.1 provides an example of the methodology used for a quarry well impact calculation (for a proposed quarry well at location RrV8 along the Caliente rail alignment).

G.1.3 OPERATIONS IMPACTS ASSESSMENT

G.1.3.1 Caliente Rail Alignment

G.1.3.1.1 Overview

The operations impacts assessment included estimating groundwater-supply impacts associated with operation of the rail line and railroad construction and operations support facilities.

G.1.3.1.2 Facility Operations

Permanent facilities considered include the Staging Yard, the Maintenance-of-Way Facility, the Maintenance-of-Way Headquarters Facility, the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, Facilities at the Interface with the Union Pacific Railroad Mainline, and rail sidings. These would be permanent facilities corresponding to an assumed railroad operations phase of up to 50 years.

G.1.3.1.3 Evaluation of Potential Hydrogeologic Impacts

Details on the water requirements activity and groundwater impacts at the rail operations facilities are provided in the *Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 03* (DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). These facilities would require only limited amounts of water, with water required for operations estimated to range from approximately 9,500 to

23,000 liters (2,500 to 6,000 gallons) per day at the facilities, which is equivalent to approximately 6 to 16 liters (1.7 to 4.2 gallons) per minute. Operations water requirements were derived from estimated staffing and shift projections, a 190-liter per day (50-gallon per day) per capita use ratio, estimated shop process needs, and a multiplier of 1.5 to account for miscellaneous water needs (DIRS 180873-Nevada Rail Partners 2007, Section 3.1.5; DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). Water needed for meeting emergency water storage capacity requirements (for fire safety) are estimated to range from approximately 379,000 to 833,000 liters (100,000 to 220,000 gallons). Water needs for meeting water storage requirements at each facility could be readily met using a new low-productivity well. Because the well withdrawal rates (approximately 16 liters [4.2 gallons] per minute or less) required to support operation of these railroad operations support facilities are relatively low (DIRS 180919-Nevada Rail Partners 2007, Table 3-B), the magnitude of impacts on the host aquifers for the individual facility water-supply wells would be expected to be small. For this reason, DOE did not perform quantitative impacts analyses for water wells that would be used (for example, at proposed base-case withdrawal rate) solely to support operation of these facilities.

G.1.3.2 Mina Rail Alignment

G.1.3.2.1 Overview

The operations impacts assessment included estimating groundwater-supply impacts associated with operation of the rail line and railroad construction and operations support facilities.

G.1.3.2.2 Facility Operations

Permanent facilities considered include the Staging Yard at Hawthorne in hydrographic area 110C, the Maintenance-of-Way Facility at either Silver Peak in hydrographic area 143 or Klondike in hydrographic area 142, the Rail Equipment Maintenance Yard in hydrographic area 227A, and proposed sidings in several hydrographic areas. These would be permanent facilities corresponding to an assumed railroad operations period of up to 50 years.

G.1.3.2.3 Evaluation of Potential Hydrogeologic Impacts

Similar to the case for the Caliente rail alignment, DOE did not perform quantitative impact analyses for water wells that would support facilities operations or sidings. The reason for not performing quantitative analyses is the same as for the Caliente alignment – because required well withdrawal rates for wells supporting operations of facilities and sidings are very small, the magnitude of short-term or long-term impacts on the host aquifer for the individual facility water wells would be small.

G.2 Shared-Use Option

G.2.1 CONSTRUCTION IMPACTS ASSESSMENT – CALIENTE RAIL ALIGNMENT

Under the Shared-Use Option, additional commercial access sidings would be constructed as a third track alongside passing sidings. However, the total length of the additional sidings would be relatively short in comparison to the total length of the rail line. The water requirement for construction of the rail line under the Shared-Use Option would only increase by approximately 150,000 cubic meters (122 acre-feet), or approximately 2 percent, compared to the total estimated likely water demand of 7.52 million cubic meters (6,100 acre-feet) for construction of the rail line without shared use.

For purposes of this analysis, DOE assumed that the commercial access sidings would be in the same hydrographic areas the Caliente rail alignment would cross. Therefore, additional impacts to groundwater features in these areas would likely be small, given that the additional water requirement under the Shared-Use Option represents only a small portion of the total water demand for construction of the rail line without shared use. The overall impacts to groundwater resources in these areas would be similar to the impacts described in Section G.1.2.3.

Commercial-use facilities under the Shared-Use Option would likely be constructed close to the DOE-owned and -operated rail facilities and so would likely overlie the same hydrographic areas as the DOE facilities. Therefore, additional impacts to groundwater features in these areas as a result of construction of facilities under the Shared-Use Option would also be small. The overall impacts would be similar to the impacts described in Section G.1.2.3.

G.2.2 OPERATIONS IMPACTS ASSESSMENT – CALIENTE RAIL ALIGNMENT

Groundwater impacts for railroad operations along the Caliente rail alignment under the Shared-Use Option would be similar to those identified in Sections G.1.3.1 and G.1.3.2. Impacts to groundwater from operation of additional sidings would be small. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

Commercial-only facilities would require water for daily operations. Water demand to operate these facilities has not yet been identified, but DOE assumes it would be small. Therefore, additional impacts to groundwater features would likely be small, and the overall impacts would be similar to those described in Section G.1.3.

G.2.3 CONSTRUCTION IMPACTS ASSESSMENT – MINA RAIL ALIGNMENT

Under the Shared-Use Option, additional commercial access sidings would be constructed as a third track alongside passing sidings. However, the total length of the additional sidings would be relatively short in comparison to the total length of the rail line. The water requirement for the construction of the rail line under the Shared-Use Option would only increase by approximately 147,000 cubic meters (119 acre-feet), or approximately 2 percent, compared to the total estimated likely water demand of 7.34 million cubic meters (5,950 acre-feet) for construction of the rail line without shared use.

For purposes of this analysis, DOE assumed that the commercial access sidings would be in the same hydrographic areas the Mina rail alignment would cross. Therefore, additional impacts to groundwater features in these areas would likely be low, given that the additional water requirement under the Shared-Use Option represents only a small portion of the total water demand for construction of the rail line without shared use. The overall impacts to groundwater resources in these areas would be similar to the impacts described in Section G.1.2.3.

Commercial-use facilities under the Shared-Use Option would likely be constructed close to the DOE-owned and -operated rail facilities and would likely overlie the same hydrographic areas as the DOE facilities. Therefore, additional impacts to groundwater features in these areas would also be small. The overall impacts would be similar to the impacts described in Section G.1.2.3.

G.2.4 OPERATIONS IMPACTS ASSESSMENT – MINA RAIL ALIGNMENT

Groundwater impacts for railroad operations along the Mina rail alignment under the Shared-Use Option would be similar to those identified in Sections G.1.3.1 and G.1.3.2. Impacts to groundwater from operation of additional sidings would be small. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

Commercial-only facilities would require water for daily operations. Water demand to operate these facilities has not yet been identified, but DOE assumes it would be small. Therefore, additional impacts to groundwater features would likely be small, and the overall impacts would be similar to those described in Section G.1.3.

G.3 Glossary

aquitard	A confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores groundwater.
cone of depression	The lowering of the water table in a cone-shaped depression around a pumped well.
evapotranspiration	The combined process of evaporation and transpiration. Evaporation is water loss to the atmosphere from sources such as soil, canopy interception, and water bodies; transpiration refers to the movement of water vapor from a plant to the air through the plant’s stomata or leaves.
leaky aquifer	An aquifer that has an ***aquitard*** either above or below that allows water to leak into or out of the aquifer depending on the direction of the hydraulic gradient.
radius of influence	The distance from the well where the drawdown becomes insignificant and can be neglected.
screened	The portion of a well that is screened is the interval in the well where the casing contains slots to let in the water from the primary (most productive) water-bearing zone or zones.

G.4 References

180760	Albers and Steward 1981	Albers, J.P. and Stewart, J.H. 1981. Geology and Mineral Deposits of Esmeralda County, Nevada. 1st Edition, 2nd Printing. Bulletin 78. Reno, Nevada: Nevada Bureau of Mines and Geology, University of Nevada, Reno. ACC: HQS.19880517.1904; JQS.19880517.1904.
177524	Anning and Konieczki 2005	Anning, D.W. and Konieczki, A.D. 2005. Classification of Hydrogeologic Areas and Hydrogeologic Flow Systems in the Basin and Range Physiographic Province, Southwestern United States. Professional Paper 1702. Reston, Virginia: U. S. Geological Survey. ACC: MOL.20060925.0025.
105038	Bear 1979	Bear, J. 1979. Hydraulics of Groundwater. New York, New York: McGraw-Hill. TIC: 217574.

173179	Belcher 2004	Belcher, W.R. 2004. Death Valley Regional Ground-Water Flow System, Nevada and California - Hydrogeologic Framework and Transient Ground-Water Flow Model. Scientific Investigations Report 2004-5205. Reston, Virginia: U.S. Geological Survey. ACC: MOL.20050323.0070.
181896	Bhark, Ruskauff, and Kelley 2005	Bhark, E.; Ruskauff, G.; and Kelley, V. 2005. Analysis of Hydraulic Responses from the ER-6-1 Multiple-Well Aquifer Test, Yucca Flat FY 2004 Testing Program, Nevada Test Site, Nye County, Nevada. S-N/99205--051, Rev. 0. Las Vegas, Nevada: Stoller-Navarro Joint Venture. ACC: MOL.20070721.0099.
176851	Brothers, Bugo, and Tracy 1993	Brothers, K.; Buqo, T.S.; and Tracy, J.V. 1993. Hydrology and Steady State Ground-Water Model of Coal and Garden Valleys, Lincoln and Nye Counties, Nevada. Water for Nevada's Future Report No. 8. Hydrographic Basins 171 & 172. Las Vegas, Nevada: Las Vegas Valley Water District, Cooperative Water Project. TIC: 255003.
176883	Brothers, Katzer, and Johnson 1996	Brothers, K.; Katzer, T.; and Johnson, M. 1996. Hydrology and Steady State Ground-Water Model of Dry Lake and Delamar Valleys, Lincoln County, Nevada. Water for Nevada's Future Report No. 16. Hydrographic Basins 181 & 182. [Las Vegas, Nevada]: Las Vegas Valley Water District, Cooperative Water Project. TIC: 255049.
176600	Converse Consultants 2005	Converse Consultants 2005. Water Resources Assessment Report, Caliente Rail Corridor, Yucca Mountain Project, Nevada, Task 3.4, Rev. 0. Converse Consultants Project No. 04-33110-01. Las Vegas, Nevada: Converse Consultants. ACC: ENG.20060315.0001.
176189	Converse Consultants 2006	Converse Consultants 2006. Hydrogeologic DEIS Analysis Report, REV. 0, April 10, 2006. Converse Project No. 04-33110-03. Las Vegas, Nevada: Converse Consultants. ACC: ENG.20060426.0001.
180887	Converse Consultants 2007	Converse Consultants 2007. Water Resources Assessment, Mina Rail Corridor, Task 3.5a: Phase 1 Water Resources Assessment, REV. 0. 04-33110-04. [Las Vegas, Nevada]: Converse Consultants. ACC: ENG.20070507.0003.
180888	Converse Consultants 2007	Converse Consultants 2007. Hydrogeologic DEIS Analysis Report Mina Rail Corridor, Task 3.6a: Identification of Water Resources, Rev. 0. Converse Consultants Project No. 04-33110-04. [Las Vegas, Nevada]: Converse Consultants. ACC: ENG.20070516.0009.
182759	Converse Consultants 2007	Converse Consultants 2007. NDWR Data Update - Technical Memorandum, Mina Rail Corridor. Las Vegas, Nevada: Parsons Brinckerhoff Quade & Douglas, Inc.. ACC: x.
104508	CRWMS M&O 1999	CRWMS M&O 1999. Repository Surface Design Engineering Files Report. BCB000000-01717-5705-00009 REV 03. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990615.0238.
176852	Drici, Garey, and Buqo 1993	Drici, O.; Garey, C.; and Buqo, T.S. 1993. Hydrology and Steady State Ground-Water Model of Pahroc Valley, Lincoln and Nye Counties, Nevada. Water for Nevada's Future Report No. 10. Hydrographic Basin 208. Las Vegas, Nevada: Las Vegas Valley Water District, Cooperative Water Project. TIC: 255004.
116801	Driscoll 1986	Driscoll, F.G. 1986. Groundwater and Wells. 2nd Edition. St. Paul, Minnesota: Johnson Filtration Systems. TIC: 217555.

176818	Eakin 1962	Eakin, T.E. 1962. Ground-Water Appraisal of Ralston and Stonecabin Valleys, Nye County, Nevada. Ground-Water Resources - Reconnaissance Series Report 12. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. ACC: MOL.20060417.0024.
181394	Everett and Rush 1967	Everett, D.E. and Rush, F.E. 1967. A Brief Appraisal of the Water Resources of the Walker Lake Area, Mineral, Lyon, and Churchill Counties, Nevada. Water Resources-Reconnaissance Series Report 40. [Carson City, Nevada: Nevada Department of Conservation and Natural Resources]. ACC: HQS.19880517.2129.
181909	Fridrich et al. 2007	Fridrich, C.J.; Minor, S.A.; Slate, J.L.; and Ryder, P.L. 2007. "Geologic Map of Oasis Valley Spring-Discharge Area and Vicinity, Nye County, Nevada." USGS Scientific Investigations Map 2957. Scientific Investigations Map 2957. [Denver, Colorado]: U.S. Geological Survey. Accessed July 13, 2007. ACC: MOL.20070719.0384; MOL.20070719.0385. URL: http://pubs.usgs.gov/sim/2007/2957
129721	Geldon et al. 1998	Geldon, A.L.; Umari, A.M.A.; Earle, J.D.; Fahy, M.F.; Gemmell, J.M.; and Darnell, J. 1998. Analysis of a Multiple-Well Interference Test in Miocene Tuffaceous Rocks at the C-Hole Complex, May-June 1995, Yucca Mountain, Nye County, Nevada. Water-Resources Investigations Report 97-4166. Denver, Colorado: U.S. Geological Survey. TIC: 236724.
106094	Harrill, Gates, and Thomas 1988	Harrill, J.R.; Gates, J.S.; and Thomas, J.M. 1988. Major Ground-Water Flow Systems in the Great Basin Region of Nevada, Utah, and Adjacent States. ATLAS HA-694-C. Denver, Colorado: U.S. Geological Survey. ACC: NNA.19940412.0059.
180697	Huxel and Harris 1969	Huxel, C.J. and Harris, E.E. 1969. Water Resources and Development in Mason Valley, Lyon and Mineral Counties, Nevada, 1948-65. Water Resources Bulletin No. 38. [Carson City], Nevada: State of Nevada, Department of Conservation and Natural Resources. ACC: MOL.20070626.0098.
180775	Lopes et al. 2006	Lopes, T.J.; Buto, S.G.; Smith, J.L.; and Welborn, T.L. 2006. Map Showing Water-Table Contours in Nevada, 1947-2004. Plate 1 of Water Table Levels and Gradients, Nevada 1947-2004. Scientific Investigations Report 2006-5100. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20070517.0181.
106695	Malmberg and Eakin 1962	Malmberg, G.T. and Eakin, T.E. 1962. Ground-Water Appraisal of Sarcobatus Flat and Oasis Valley, Nye and Esmeralda Counties, Nevada. Ground-Water Resources – Reconnaissance Series Report 10. [Carson City, Nevada]: State of Nevada, Department of Conservation and Natural Resources. TIC: 208666.
180777	Mauer et al. 2004	Mauer, D.K.; Lopes, T.J.; Medina, R.L.; and Smith, J.L. 2004. Hydrogeology and Hydrologic Landscape Regions of Nevada. Scientific Investigations Report 2004-5131. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20070517.0182.
176979	MO0605GISGNISN.000	MO0605GISGNISN.000. GNIS - Nevada Springs. Submittal date: 05/03/2006.

177292	MO0607NDWR WELD.000	MO0607NDWRWELD.000. Nevada Division of Water Resources Well Data. Submittal date: 07/18/2006.
177712	MO0607NHDPO INT.000	MO0607NHDPOINT.000. National Hydrological Dataset Point Information for the State of Nevada. Submittal date: 07/18/2006.
177710	MO0607NHDW BDYD.000	MO0607NHDWBDYD.000. National Hydrological Dataset Waterbody Information for the State of Nevada. Submittal date: 07/18/2006.
177293	MO0607PWMA R06D.000	MO0607PWMAR06D.000. Two New Existing Wells Within Dry Lake Valley. Submittal date: 07/18/2006.
177294	MO0607USGSW NVD.000	MO0607USGSWNVD.000. USGS Existing Wells Location Information for the State of Nevada. Submittal date: 07/18/2006.
182898	NDWR 2007	NDWR 2007. "Water Rights Database Special Hydrographic Abstract (Caliente Wells)." x, x: NDWR. Accessed 3/15-5/01/2007. ACC: X. URL: http://water.nv.gov/water%20Rights/permitdb/hyd_abs1.cfm?CFID=30072&CFTOKEN=30077354
182899	NDWR 2007	NDWR 2007. "Water Rights Database Special Hydrographic Abstract (Mina Wells)." x, x: NDWR. Accessed 6/13/07. ACC: X. URL: http://water.nv.gov/water%20Rights/permitdb/hyd_abs1.cfm?CFID=30072&CFTOKEN=30077354
176168	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, REV. 01. Document No. NRP-R-SYSW-FA-0001-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0019.
176172	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Construction Plan Caliente Rail Corridor, Task 14: Construction Planning Support, REV. 01. Document No. NRP-R-SYSW-CP-0008-01. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060426.0021.
180873	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Facilities-Design Analysis Report, Mina Rail Corridor, Task 10: Facilities, REV. 00. Document No. NRP-R-SYSW-FA-0002-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0004.
180875	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Construction Plan, Mina Rail Corridor, Task 14: Construction Planning Support, Rev. 00. Document No. NRP-R-SYSW-CP-0010-00. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070516.0002.
180919	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Facilities Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 03. Document No. NRP-R-SYSW-FA-0001-03. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070606.0020.
180922	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Construction Plan Caliente Rail Corridor, Task 14: Construction Planning Support, Rev. 03. Document No. NRP-R-SYSW-CP-0008-03. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070606.0023.

103136	Prudic, Harrill, and Burbey 1993	Prudic, D.E.; Harrill, J.R.; and Burbey, T.J. 1993. Conceptual Evaluation of Regional Ground-Water Flow in the Carbonate-Rock Province of the Great Basin, Nevada, Utah, and Adjacent States. Open-File Report 93-170. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.19950105.0016.
169384	Reiner et al. 2002	Reiner, S.R.; Laczniak, R.J.; DeMeo, G.A.; Smith, J.L.; Elliott, P.E.; Nylund, W.E.; and Fridrich, C.J. 2002. Ground-Water Discharge Determined from Measurements of Evapotranspiration, Other Available Hydrologic Components, and Shallow Water-Level Changes, Oasis Valley, Nye County, Nevada. Water-Resources Investigations Report 01-4239. Carson City, Nevada: U.S. Geological Survey. ACC: MOL.20040517.0541; MOL.20040517.0542; MOL.20040517.0543.
176519	Rowley and Shroba 1991	Rowley, P.D. and Shroba, R.R. 1991. Geologic Map of the Indian Cove Quadrangle, Lincoln County, Nevada. GQ-1701. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20010919.0344.
176947	Rowley et al. 1994	Rowley, P.D.; Shroba, R.R.; Simonds, F.W.; Burke, K.J.; Axen, G.J.; and Olmore, S.D. 1994. Geologic Map of the Chief Mountain Quadrangle, Lincoln County, Nevada. Geologic Quadrangle Map GQ-1731. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20060515.0162.
176502	Rush 1964	Rush, F.E. 1964. Ground-Water Appraisal of the Meadow Valley Area, Lincoln and Clark Counties, Nevada. Ground-Water Resources-Reconnaissance Series Report 27. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. TIC: 218944.
176849	Rush 1968	Rush, F.E. 1968. Water–Resources Appraisal of Clayton Valley–Stonewall Flat Area, Nevada and California. Water Resources – Reconnaissance Series Report 45. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. TIC: 217156.
176950	Rush and Everett 1966	Rush, F.E. and Everett, D.E. 1966. Water-Resources Appraisal of Little Fish Lake, Hot Creek, and Little Smoky Valleys, Nevada. Water Resources -- Reconnaissance Series Report 38. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. ACC: MOL.20060524.0139.
180754	Rush et al. 1971	Rush, F.E.; Scott, B.R.; Van Denburgh, A.S.; and Vasey, B.J. 1971. Water Resources and Inter-Basin Flows. [Carson City], Nevada: State of Nevada, Division of Water Resources. TIC: 217394.
174643	Seaber, Kapinos, and Knapp 1994	Seaber, P.R.; Kapinos, F.P.; and Knapp, G.L. 1994. Hydrologic Unit Maps. Water-Supply Paper 2294. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20050810.0042.
173842	Shannon & Wilson 2005	Shannon & Wilson 2005. Preliminary Geotechnical Report, DRAFT 2, Phase 1, Caliente Rail Corridor Yucca Mountain Project, Nevada. Job No. 21-1-20102-015. Two volumes. Seattle, Washington: Shannon & Wilson. ACC: ENG.20050815.0012; ENG.20050815.0013.

175986	Shannon & Wilson 2005	Shannon & Wilson 2005. Geotechnical Report Supplement 1, Task 1.5: Phase 1 Preliminary Geotechnical Analysis Report (Submittal No. SCN-5), Rev. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20060320.0004.
180881	Shannon & Wilson 2007	Shannon & Wilson 2007. Ballast Quarry Report, Mina Rail Corridor, Task 2.5a: Quarry Site Description Report (Submittal No. 7.32), REV. 0. Subcontract No. NN-HC4-00197. Seattle, Washington: Shannon & Wilson. ACC: ENG.20070418.0014.
150228	Slate et al. 2000	Slate, J.L.; Berry, M.E.; Rowley, P.D.; Fridrich, C.J.; Morgan, K.S.; Workman, J.B.; Young, O.D.; Dixon, G.L.; Williams, V.S.; McKee, E.H.; Ponce, D.A.; Hildenbrand, T.G.; Swadley, W C; Lundstrom, S.C.; Ekren, E.B.; Warren, R.G.; Cole, J.C.; Fleck, R.J.; Lanphere, M.A.; Sawyer, D.A.; Minor, S.A.; Grunwald, D.J.; Laczniak, R.J.; Menges, C.M.; Yount, J.C.; Jayko, A.S.; Mankinen, E.A.; Davidson, J.G.; Morin, R.L.; and Blakely, R.J. 2000. Digital Geologic Map of the Nevada Test Site and Vicinity, Nye, Lincoln and Clark Counties, Nevada, and Inyo County, California, Revision 4; Digital Aeromagnetic Map of the Nevada Test Site and Vicinity, Nye, Lincoln, and Clark Counties, Nevada, and Inyo County, California; and Digital Isostatic Gravity Map of the Nevada Test Site and Vicinity, Nye, Lincoln, and Clark Counties, Nevada, and Inyo County, California. Open-File Report 99-554—A, —B, and —C. Denver, Colorado: U.S. Geological Survey. TIC: 248049; 251985; 251981.
176488	State of Nevada 2006	State of Nevada 2006. “Nevada's Hydrographic Regions (Basins), Areas and Sub-Areas Nevada Division of Water Resources.” [Carson City], Nevada: State of Nevada, Department of Conservation & Natural Resources, Division of Water Resources. Accessed February 20, 2006. ACC: MOL.20060320.0120. URL: http://water.nv.gov/water%20planning/basins/hydro_nv.htm
180975	Stewart, Carlson, and Johannessen 1982	Stewart, J.H.; Carlson, J.E.; and Johannessen, D.C. 1982. Geologic Map of the Walker Lake 1° by 2° Quadrangle, California and Nevada. Miscellaneous Field Studies Map MF-1382-A. Denver, Colorado: U.S. Geological Survey. ACC: MOL.20070524.0071.
147766	Thiel 1999	Thiel Engineering Consultants 1999. Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin. Reno, Nevada: Thiel Engineering Consultants. ACC: MOL.19990218.0214.
172905	USGS 1995	USGS (U.S. Geological Survey) 1995. “California, Nevada.” Ground Water Atlas of the United States. HA 730-B. [Denver, Colorado]: U.S. Geological Survey. Accessed March 1, 2005. ACC: MOL.20050404.0254. URL: http://capp.water.usgs.gov/gwa/gwa.html
176325	USGS 2006	USGS (U.S. Geological Survey) 2006. “Water Resources of the United States.” National Water Information System Web Site. Reston, Virginia: U.S. Geological Survey. Accessed February 1, 2006. ACC: MOL.20060301.0385. URL: http://www.usgs.gov/

180759	Van Denburgh and Glancy 1970	Van Denburgh, A.S. and Glancy, P.A 1970. Water-Resources Appraisal of the Columbus Salt Marsh - Soda Spring Valley Area, Mineral and Esmeralda Counties, Nevada. Water Resources - Reconnaissance Series Report 52. [Carson City, Nevada: Nevada Department of Conservation and Natural Resources]. TIC: 217168.
176848	Van Denburgh and Rush 1974	Van Denburgh, A.S. and Rush, F.E. 1974. Water–Resources Appraisal of Railroad and Penoyer Valleys, East–Central Nevada. Water Resources – Reconnaissance Series Report 60. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. TIC: 217169.

APPENDIX H

BIOLOGICAL RESOURCES

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ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
DOE	U.S. Department of Energy
FWS	U.S. Fish and Wildlife Service
GPS	Global Positioning System
NDOW	Nevada Department of Wildlife
NNHP	Nevada Natural Heritage Program
HMA	herd management area

APPENDIX H

BIOLOGICAL RESOURCES

This appendix supports the descriptions of the affected environment for biological resources in Chapter 3 and the impacts analyses in Chapter 4 of the Rail Alignment EIS (DOE/EIS-0369). It describes the field survey methods and other technical data that support the biological resource analysis described in those chapters.

H.1 Introduction

Sections H.2 through H.5 of this appendix summarize the research and field methods the U.S. Department of Energy (DOE) used to compile information necessary to assess potential impacts on biological resources from implementation of the Proposed Action along either the Caliente rail alignment or the Mina rail alignment, and presents the information resulting from those varied efforts. Generally, this information is organized by biological resource.

This appendix summarizes information from previous studies and documents such as the *Environmental Baseline File for Biological Resources* (DIRS 104593-CRWMS M&O 1999, all), applicable BLM resource management plans, conservation plans for various species or communities, and other similar documents. Additionally, the appendix summarizes information obtained from BLM institutional knowledge (such as noxious and invasive weed locations and wild horse and burro herd management areas), Nevada Department of Wildlife institutional knowledge (including big game species distributions and habitat requirements), Nevada Natural Heritage Program occurrence database (DIRS 182061-NNHP 2005, all) of protected and sensitive species, the Southwest Regional Gap Analysis Project (SWReGAP) data of land cover (DIRS 174324-NatureServe 2004, all), and other similar data. The appendix also includes descriptions of the methods DOE used during field observations for vegetation, special status species, game species, and wild horses and burros. Figure H-1 shows survey locations along the Caliente rail alignment; Figure H-2 shows field observation points along the Mina rail alignment.

H.2 Vegetation

H.2.1 METHODS

H.2.1.1 Research

Prior to field surveys, DOE identified existing information regarding the occurrence and distribution of plant communities within the Caliente rail alignment and Mina rail alignment study areas (8 kilometers [5 miles] on either side of the centerline of the proposed rail alignment; a total width of 16 kilometers [10 miles]). This effort included literature searches and consultations with federal and state agencies including the U.S. Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (FWS), the Nevada Natural Heritage Program (NNHP), the Nevada Department of Wildlife (NDOW), and the Nevada Division of Forestry.

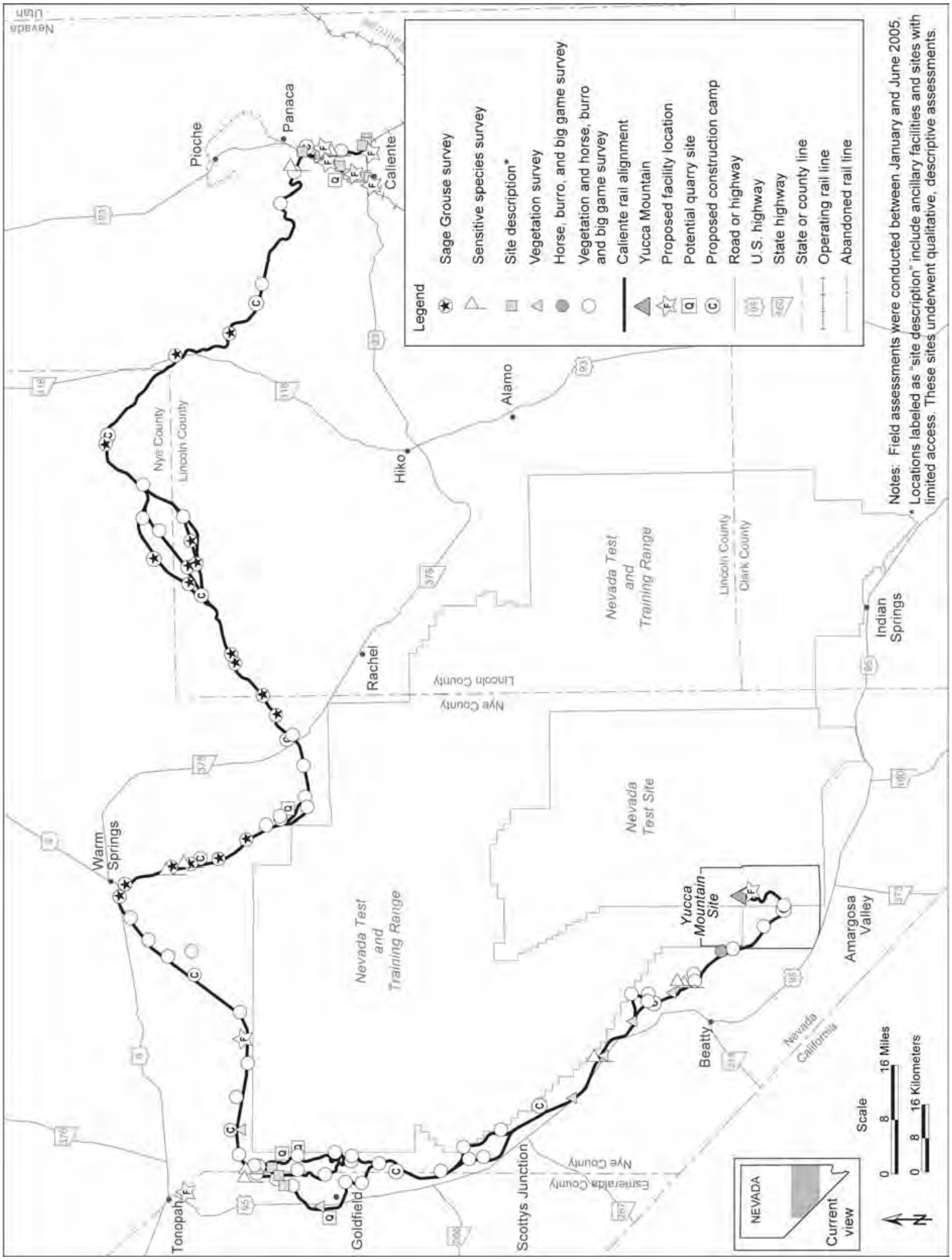

Figure H-1. Survey locations for biological resources along the Caliente rail alignment.

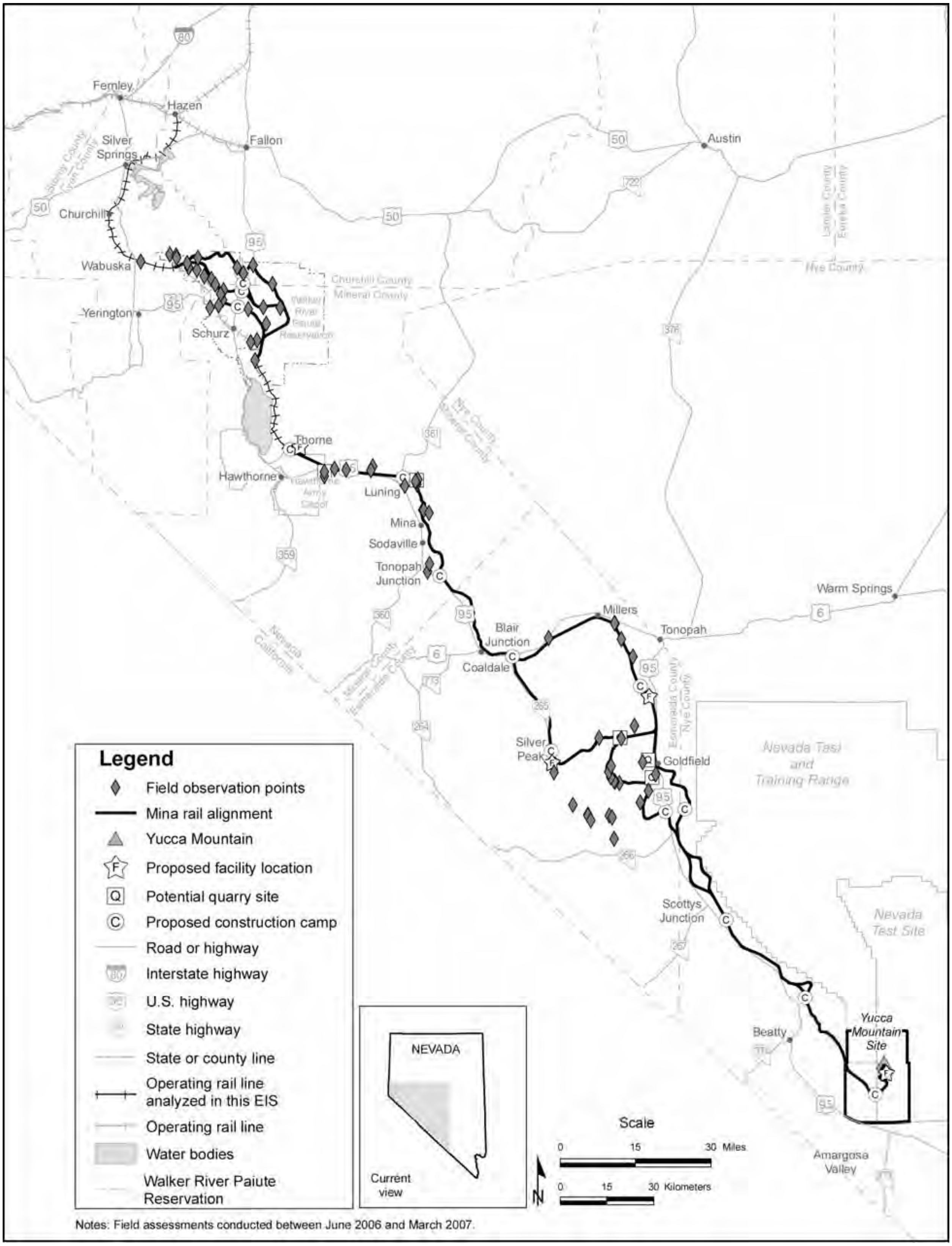

Figure H-2. Field observation points for biological resources along the Mina rail alignment.

DOE also obtained spatial data, in digital and print form, from the BLM, the Nevada Department of Wildlife, the Nevada Natural Heritage Program, the University of Nevada, Reno, and other sources, for computer-based and paper-based evaluation of biological resources within the study area. DOE assessed plant communities within the study area of the rail alignments and rail line construction and operations support facilities using the 2004 SWReGAP (DIRS 174324-NatureServe 2004). The SWReGap is a multi-institutional cooperative mapping and assessment of biodiversity within Arizona, Utah, Nevada, New Mexico, and Colorado and provides digital land-cover maps that contain plant community distribution data. This dataset also provides information about the existing natural vegetation to the level of dominant or codominant plant species, public and private land ownership, and management and conservation land status. DOE overlaid this information, in conjunction with digital, orthographically corrected, aerial photos (DIRS 174497-Keck Library 2004, all), onto maps of the two rail alignments and associated facilities and used to it identify unique vegetation communities within the study area (such as sagebrush and riparian), and identified areas where there could be sensitive species.

DOE then conducted field surveys in the study area along the proposed Caliente and Mina rail alignments to characterize the existing SWReGAP (DIRS 174324-NatureServe 2004) land-cover analyses in locations that closely represent the land-cover types. DOE also surveyed areas that are considered unique relative to the region, such as riparian habitat, playas, and sand dunes. Locations were also chosen to provide a relatively consistent survey among alternative segments, in order to adequately compare the alternative segments for the impact analysis.

H.2.1.2 Field Surveys

Caliente Rail Alignment

Field surveys for the proposed Caliente alignment included 72, 200-meter (660-foot)-long vegetation transects in which plant species were formally identified and the composition of plant communities was quantitatively assessed. The vegetation transects were located at various intervals along the entire proposed Caliente rail alignment, including all common segments and all alternative segments.

In addition to quantitative assessments, qualitative field observations were made at many of the sites where formal transect-based surveys were conducted and at other locations where no transects were established, including areas where limitations such as private property prevented access. These qualitative site descriptions typically consisted of a visual assessment of vegetation, landform, land use and level of disturbance, physical relationship to the proposed rail alignment, and the presence of water or evidence of the influence of water on the habitat.

DOE performed vegetation surveys along the proposed Caliente rail alignment from February 4 through March 11, 2005, from May 5 through May 7, 2005, on June 7 and 8, 2005, and from January 23 through January 27, 2006. Before conducting the 2005 vegetation surveys, and periodically throughout the course of the 2005 field surveys, Dr. Kent Ostler, an expert in regional plant ecology, provided survey personnel with guidance in the field regarding regional plant ecology and identification (DIRS 174634-Thebeau and Huenefeld 2005, p. 2). Surveys conducted in 2006 were performed by a qualified biologist following the same research methods and field survey protocols as outlined in this appendix.

DOE conducted vegetation sampling along a transect or straight line of 200 meters (660 feet) parallel to the proposed location of the rail alignment. The bearing or direction of each transect was determined using a geographic positioning system receiver or a compass. After establishing the starting point and the bearing of a transect, a 1-square-meter (11-square-foot) plot was sampled every 20 meters (66 feet), resulting in 10 sample plots or quadrats. In most cases, a wooden stake was driven into the ground to semi-permanently mark the location of the start and end of a transect. Photos and geographic positioning system location surveys were taken at the beginning and end of each transect.

Field personnel recorded vegetation survey data on the two-page data sheet used for vegetation assessments shown in Figure H-3. Trees, shrubs, cacti, invasive and noxious plants, and most grasses were identified by genus or species, whereas non-weed forb species were recorded as forbs, and lumped together. For each species identified within the quadrat, field personnel estimated the percent of the quadrat covered by that species and recorded that information on data sheets. Field personnel also recorded the percent cover for dead plant material, mosses, rock, and cryptobiotic soil crust (a crust formed by cyanobacteria, lichens, and mosses over the surface of the soils). The total percent cover in a quadrat could add to more than 100 due to overlap. Field personnel collected samples and took photographs of unrecognized plant species for subsequent identification. General descriptions of the landform, the slope, aspect, land use of the site (grazing, mining, wilderness), and the type of plant community present on the site were also recorded. The general description was used to identify the presence of indicator or key species present but occurring scattered and outside of transects. Such species included Joshua tree (*Yucca brevifolia*), Utah juniper (*Juniperus osteosperma*), and singleleaf pinyon (*Pinus monophylla*).

Mina Rail Alignment

DOE performed field surveys along the proposed Mina rail alignment and associated facility and quarry locations during three separate field visits: June 12 through 15, 2006; December 11 through 13, 2006; and March 26-29, 2007. Surveys consisted of a visual assessment of vegetation, land use, disturbance, water resources, and potential habitat for wildlife and special status species within the study area.

General field observation points were taken at locations along the alignment where there was an obvious change in the landscape and/or land-cover type, and at "micro-site" locations. Micro-sites are small vegetative or physically dissimilar areas that occur within a larger continuous community type (such as rock outcrops, playas, vegetated sand dunes [Figure H-2]).

A list of special status species was provided by the Nevada Natural Heritage Program Database (DIRS 182061-NNHP 2005, all). These historical occurrences were overlaid on topographic maps of the project area and assessed in the field for the potential occurrence of special status species. Habitat assessment points were documented using Global Positioning System (GPS), photography, and data forms.

The assessment included identifying all plant species present and determining community type based on primary and secondary composition of plant species. In addition, the assessment used general observations of the landscape, including slope, aspect, elevation, land use, and any wildlife observations.

Special status species and any areas determined to be micro-sites were used to establish the specific survey locations along the proposed rail alignment and quarry sites.

H.2.1.3 Impact Analysis

DOE assessed potential adverse impacts on vegetation communities as a result of the Proposed Action described in Chapter 2 of the Rail Alignment EIS, which were based on the review of SWReGAP data and field observations. Direct long-term impacts include the loss of vegetation and fragmentation of vegetation communities and were assessed using Geographic Information System vegetation and construction datasets, and a Geographic Information System process called Intersect was used to quantify the amount of specific land-cover types that would be removed in relation to rail line, facility, and quarry footprints. Indirect short-term impacts were assessed using the same methods, however calculations for

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:	OBSERVERS:	LOCATION:	TRANSECT BEARING:

	GPS FILENAME - START:					
Coordinates	WAYPOINT	UTM N	UTM E	PDOP	WAAS USED?	ELEVATION
START TRANSECT					yes / no	
END TRANSECT					yes / no	
	GPS FILENAME - END (if different):					

TRANSECT START PHOTO:	TRANSECT END PHOTO:

SLOPE:	ASPECT:	LANDFORM (elaborate in Notes section): Valley Flat Toe Slope/Alluvuial Fan Slope Cliff/Scarp Other	LAND USE: Wilderness Mining Recreation Grazing Transportation Plowed Fields Urban/Developed Other

SW REGAP CLASS:

ESTIMATED DOMINANT SPECIES:

	NAME/CODE	EXTENT*	WAYPOINT	UTM N	UTM E	PDOP	WAAS	ELEVATION
Sensitive Species 1							yes / no	
Sensitive Species 2							yes / no	
Sensitive Species 3							yes / no	
* Categories for sens spp and inv/nox spp extent: Solitary, Few Clumped, Few Scattered, Many Clumped, Many Scattered, Dense, Other								
Invasive/Nox Species 1							yes / no	
Invasive/Nox Species 2							yes / no	
Invasive/Nox Species 3							yes / no	

NOTES:

Figure H-3. Vegetation data sheet (page 1 of 2).

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:							LOCATION:			TRANSECT BEARING:
QUADRAT NUMBER		1	2	3	4	5	6	7	8	9	10	NOTES/PHOTOS
SPECIES												
Forbs												
Litter												
Crypto												
Bare												
NOTES:												

Figure H-3. Vegetation data sheet (page 2 of 2).

short-term impacts included the area from the toe of slope to the edge of the construction right-of-way and is outside of the rail line, facility, and quarry footprints. They are considered short-term impacts because DOE would minimize disturbance within the construction right-of-way and would mitigate or restore disturbed areas not used during the operations phase.

The magnitude of impact was determined based on the SWReGAP dataset. A small impact to vegetation would neither destabilize nor noticeably alter a specified land-cover type and would not affect the overall function or viability of the plant community. A moderate impact would noticeably alter a specific land-cover type, but not destabilize or affect important attributes of that land-cover type. An indication of a moderate impact pertains to a land-cover type that is uncommon within the Mojave and Great Basin Deserts, such as riparian vegetation. A large impact would significantly alter or destabilize the land-cover type. However, no large impacts were found to occur in the analysis.

H.2.2 VEGETATION COMMUNITIES

The vegetation communities present along the Caliente and Mina rail alignments are indicative of the Great Basin and the Mojave Deserts. Table H-1 lists the land-cover types and vegetation communities identified as potentially occurring within the Caliente rail alignment and Mina rail alignment regions of influence as described in the Southwest Regional Gap Analysis Project databases and confirmed by field surveys.

Table H-1. Southwest Regional Gap Analysis Project land-cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 1 of 5).

Land-cover type	Characteristic plant species and distribution
Agriculture	This land-cover type includes row crops, irrigated pasture and hay fields, dry farm crops.
Barren	This land-cover type includes barren soil or rock with less than 5 percent vegetative cover.
Developed, Medium - High Intensity	Developed, Medium Intensity: Includes areas with a mixture of constructed materials and vegetation. Impervious surface accounts for 50 to 79 percent of the total cover. These areas most commonly include single-family housing units. Developed, High Intensity: Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.
Developed, Open Space - Low Intensity	Open Space: Includes areas with a mixture of some construction materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes. Developed, Low Intensity: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of total cover. These areas most commonly include single-family housing units.
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	This land-cover type occurs in mountain ranges from about 1,220 to more than 2,135 meters (4,000 to more than 7,000 feet). This type often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. The variety of plant associations connected to this type reflects elevation, stream gradient, floodplain width, and flooding events. Dominant trees may include white fir, thinleaf alder, water birch, narrowleaf cottonwood, balsam poplar, Fremont cottonwood, red willow, Gooding's willow, and Douglas fir. Dominant shrubs include silver sagebrush, Redosier dogwood, narrowleaf willow, arroyo willow, Lemmon's willow, or yellow willow.

Table H-1. Southwest Regional Gap Analysis Project land-cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 2 of 5).

Land-cover type	Characteristic plant species and distribution
Great Basin Pinyon-Juniper Woodland	This land-cover type occurs on dry mountain ranges and is typically found at lower elevations ranging from 1,600 to 2,600 meters (5,200 to 8,500 feet). These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Woodlands dominated by a mix of singleleaf pinyon and Utah juniper, and woodlands dominated solely by either species comprise this land-cover type. Associated species include shrubs such as desert mahogany, green manzanita, low sagebrush, black sagebrush, Great Basin sagebrush, mountain mahogany, littleleaf mountain mahogany, blackbrush, Gambel oak, scrub oak, bunch grasses needle-and-thread, Idaho fescue, bluebunch wheatgrass, Great Basin wild rye, and mutton grass.
Great Basin Xeric Mixed Sagebrush Shrubland	This land-cover type occurs in the Great Basin on dry flats and plains, alluvial fans, rolling hills, rocky hill slopes, saddles, and ridges at elevations between 1,000 to 2,600 meters (3,300 to 8,500 feet). Sites are dry, often exposed to desiccating winds, with typically shallow, rocky, non-saline soils. Shrublands are dominated by black sagebrush (mid and low elevations), low sagebrush (higher elevation), and may be codominated by Wyoming big sagebrush or yellow rabbitbrush.
Inter-Mountain Basins Big Sagebrush Shrubland	This widespread land-cover type occurs throughout much of the intermountain west and is found at slightly higher elevations farther south. Soils are typically deep with minimal salt, and often with a microphytic crust. This system is dominated by perennial grasses and forbs (greater than 25 percent cover) with big basin sagebrush, big sagebrush, Wyoming big sagebrush, threetip sagebrush, and/or antelope bitterbrush dominating or codominating the open to moderately dense (10 to 40 percent cover) shrub layer.
Inter-Mountain Basins Big Sagebrush Steppe	This land-cover type occurs throughout much of the Columbia Plateau and northern Great Basin and Wyoming, and is found at slightly higher elevations farther south. Soils are typically deep and non-saline, often with a microphytic crust. This shrub-steppe is dominated by perennial grasses and forbs with basin big sagebrush, big sagebrush, Wyoming big sagebrush, threetip sagebrush, and/or desert bitterbrush dominating or codominating the open to moderately dense shrub layer. Shadscale saltbush, yellow rabbitbrush, rubber rabbitbrush, horsebrush, or prairie sagewort may be common, especially in disturbed stands. Associated grasses include Indian ricegrass, plains reedgrass, thickspike wheatgrass, Idaho fescue, rough fescue, prairie junegrass, Sandberg bluegrass, and bluebunch wheatgrass. Common forbs are spiny phlox, sandworts, and milkvetches.
Inter-Mountain Basins Cliff and Canyon	This land-cover type is found from foothills to subalpine elevations and includes barren and sparsely vegetated landscapes of steep cliff faces, narrow canyons, and smaller rock outcrops of various bedrock types. Also included are unstable slopes with accumulations of broken rock (known as talus or scree) that typically occur below cliff faces. Widely scattered trees and shrubs may include white fir, twoneedle pinyon, limber pine, singleleaf pinyon, Juniper, big sagebrush, desert bitterbrush, curl-leaf mountain mahogany, Mormon tea, oceanspray, and other species often common in adjacent plant communities.
Inter-Mountain Basins Greasewood Flats	This land-cover type occurs throughout much of the western United States in intermountain basins. It typically occurs near drainages on stream terraces and flats or may form rings around playas. Sites typically have saline or salty soils, a shallow water table, and may flood intermittently, but remain dry for most growing seasons. This system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or codominated by greasewood. Fourwing saltbush, shadescale saltbush, or winterfat may be present to codominant.

Table H 1. Southwest Regional Gap Analysis Project land-cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 3 of 5).

Land-cover type	Characteristic plant species and distribution
Inter-Mountain Basins Mixed Salt Desert Scrub	Includes shrublands of typically saline basins, lower mountain slopes, and plains across the intermountain western United States. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more saltbush (*Atriplex*) species such as shadescale saltbush, fourwing saltbush, cattle saltbush, or spinescale saltbush.
Inter-Mountain Basins Playa	This ecological system is composed of barren and sparsely vegetated playas (generally less than 10 percent plant cover) found in the intermountain western United States. Salt crusts are common throughout, with small saltgrass beds in depressions and sparse shrubs around the margins. These systems are intermittently flooded. The water is prevented from filtering through the soil by an impermeable soil layer and is left to evaporate. Soil salinity varies greatly with soil moisture and greatly affects species composition. Characteristic species may include iodinebush, greasewood, spiny hopsage, Lemon's alkaligrass, basin wildrye, saltgrass, and saltbush.
Inter-Mountain Basins Semi-Desert Grassland	This widespread land-cover type occurs throughout the intermountain western United States on dry plains and mesas, at approximately 1,450 to 2,320 meters (4,800 to 7,600 feet) in elevation. These grasslands occur in a wide range of landscape locations and on varied soil types. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or codominated by Indian ricegrass, three-awns, blue grama, needle-and-thread grass, Torrey's muhly, or James's galleta, and may include scattered shrubs and dwarf-shrubs of species of sagebrush, saltbush, blackbrush, jointfir, snakeweed, or winterfat.
Inter-Mountain Basins Semi-Desert Shrub Steppe	This land-cover type occurs throughout the intermountain western United States, typically at lower elevations on alluvial fans and flats with moderate to deep soils. This semi-arid shrub-steppe is typically dominated by grasses (greater than 25 percent cover) with an open shrub layer, but includes sparse mixed shrublands without a strong grass layer. Characteristic grasses include Indian ricegrass, blue grama, inland saltgrass, needle-and-thread grass, James's galleta, Sandberg bluegrass, and alkali sacaton. The shrub layer is often a mixture of shrubs and dwarf-shrubs including fourwing saltbush, sand sagebrush, Greene's rabbitbrush, yellow rabbitbrush, jointfir, rabbitbrush, broom snakeweed, and winterfat.
Inter-Mountain Basins Wash	This barren and sparsely vegetated (generally less than 10 percent plant cover) land-cover type is restricted to intermittently flooded streambeds and banks that are often lined with *Sarcobatus vermiculatus*, rabbitbrush, Apache plume and/or silver sagebrush (in more northern and wetter stands). Spiny hopsage may also dominate in the Great Basin. Shrubs often form a continuous or intermittent linear canopy in and along drainages but do not extend out into flats.
Invasive Annual and Biennial Forbland	This land-cover type occurs in areas dominated by the invasive thistles (*Salsola* spp.), Mexican fireweed (*Kochia scoparia*), and halogeton (*Halogeton glomeratum*).
Invasive Annual Grassland	This land-cover type occurs in areas dominated by species of oats (*Avena* spp.), brome (*Bromus* spp.), and Mediterranean grasses (*Schismus* spp.).
Mojave Mid-Elevation Mixed Desert Scrub	This land-cover type represents the extensive desert scrub in the transition zone above creosote-burrobush desert scrub and below the lower montane woodlands (700 to 1,800 meters [2,300 to 5,900 feet] elevations) that occurs in the eastern and central Mojave Desert, around elevations of 700 to 1,800 meters. It is also common on lower slopes in the transition zone into the southern Great Basin. The vegetation in this land-cover type is quite variable. Codominant species include blackbrush, Eastern Mohave buckwheat, Nevada jointfir, spiny hopsage, spiny menodora, beargrass, buckhorn cholla, Mexican bladdersage, Parish's goldeneye, Joshua tree, or Mohave yucca.

Table H 1. Southwest Regional Gap Analysis Project land-cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 4 of 5).

Land-cover type	Characteristic plant species and distribution
North American Arid West Emergent Marsh	This land-cover type is found throughout much of the arid and semi-arid regions of western North America. Natural marshes may occur in depressions in the landscape (ponds), as fringes around lakes, and along slow-flowing streams and rivers (such riparian marshes are also referred to as sloughs). Marshes are frequently or continually inundated, with water depths up to two meters. Water levels may be stable, or may fluctuate one meter or more over the course of the growing season. Marshes have distinctive soils that are typically mineral, but can also accumulate organic material. Soils have characteristics that result from long periods of anaerobic conditions in the soils. The vegetation is characterized by herbaceous plants that are adapted to saturated soil conditions. Common emergent and floating vegetation includes species of bulrush, cattail, rush, pondweed, knotweed, pond-lily, and canarygrass. This system may also include areas of relatively deep water with floating-leaved plants and submergent and floating plants.
North American Warm Desert Bedrock Cliff and Outcrop	This ecological system is found from subalpine to foothill elevations and includes barren and sparsely vegetated landscapes (generally less than 10 percent plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. Species present are diverse and may include elephant tree, ocotillo, Bigelow's nolina, teddybear cholla, and other desert species, especially succulents. Lichens are predominant lifeforms in some areas. May include a variety of desert shrublands less than 0.02 square kilometer (5 acres) in size from adjacent areas.
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	This ecological system occurs in mountain canyons and valleys of southern Arizona, New Mexico, and adjacent Mexico and consists of mid- to low-elevation (1,100 to 1,800 meters [3,300 to 5,900 feet]) riparian corridors along perennial and seasonally intermittent streams. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include narrowleaf cottonwood, Rio Grande cottonwood, Fremont cottonwood, Arizona sycamore, Arizona walnut, velvet ash, and wingleaf soapberry. Shrub dominants include narrowleaf willow, plum, Arizona alder, and mule's fat. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and annual rise in the water table for growth and reproduction.
North American Warm Desert Playa	This land-cover type is composed of barren and sparsely vegetated dry lakes (generally less than 10 percent plant cover) found across the warm deserts of North America. Playas form with intermittent flooding, followed by evaporation, leaving behind a saline or salty residue. Salt crusts are common, with small saltgrass beds present in depressions and sparse salt-tolerant shrubs around the margins. Soils often include an impermeable layer of clay. Large desert playas tend to be defined by vegetation rings formed in response to salinity. Given their common location in wind-swept desert basins, dune fields often form downwind of large playas. Species may include iodinebrush, seepweed, inland saltgrass, common spikerush, ricegrass, dropseed, crinklemat, or saltbush.
Sonora-Mojave Creosotebush -White Bursage Desert Scrub	This land-cover type forms the vegetation matrix in broad valleys, lower bajadas (masses of gravel and sand deposited by streams as they emerge from narrow mountain valleys), plains, and low hills in the Mojave and lower Sonoran deserts. This desert scrub is characterized by a sparse to moderately dense layer (2 to 50 percent cover) of small-leaved, drought-tolerant, and broad-leaved shrubs. Creosote and burrobush are typically dominants, but many different shrubs, dwarf-shrubs, and cacti may be present or form typically sparse understories.

Table H-1. Southwest Regional Gap Analysis Project land cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 5 of 5).

Land-cover type	Characteristic plant species and distribution
Sonora-Mojave Mixed Salt Desert Scrub	This land-cover type includes extensive open-canopied shrublands of typically salty basins in the Mojave and Sonoran deserts. Stands often occur around playas. Substrates are generally fine-textured, saline soils. Vegetation is typically composed of one or more saltbush species such as fourwing saltbush or cattle saltbush along with other species of saltbush. Species of iodinebush, pickleweed, seepweed, or other salt-loving plants are often present to codominant. Grasses may include alkali sacaton or inland saltgrass at varying densities.

a. Species and distribution description are derived from DIRS 174324-NatureServe 2004, all, and field studies.
b. Sources: DIRS 174399-MO9901COV97208.000; DIRS 174324-NatureServe 2004, all; DIRS 174324-NatureServe 2004, all.
c. To convert meters to feet, multiply by 3.2808.

H.2.3 NOXIOUS WEEDS AND INVASIVE SPECIES

There are numerous species considered to be noxious weeds or invasive species present in the region. Table H-2 lists such species, including their scientific name and general habitat requirements. Several of these species have been designated by the State of Nevada as noxious. For these species, the table displays the Nevada Department of Agriculture noxious weed category, and discusses primary habitat characteristics associated with each species. These categories are defined as follows:

- Category A, weeds not found or that are limited throughout the state and are controlled wherever they are found
- Category B, weeds in scattered populations in some counties in Nevada and that are actively excluded where possible
- Category C, weeds that are widespread in many counties in Nevada

Table H-2. Noxious weeds and invasive species[a] (page 1 of 4).

Common name(s)	Scientific name	Noxious weed category[b]	Habitat[c]
African mustard	*Malcolmia africana*	--	Found in disturbed areas and desert shrubland at elevations between 1,250 and 2,000 meters (4,100 to 6,600 feet).
Asian mustard	*Brassica tournefortii*	--	Found along roadsides and washes and in open areas below 800 meters (2,600 feet) in elevation. It is likely that the species will be designated as noxious by the state of Nevada in the near future.
Common crupina	*Crupina vulgaris*	A	Prefers well-drained, sandy, or loamy soils, and southern slopes on steep canyon grasslands. Also, it commonly grows along field edges, and in improved pastures, hayfields, and grass seed fields. It frequently infests gravel pits, roadsides, railroad embankments, and other rights-of-way. No information has been found that indicates it is or is not in Nevada.
Dalmation toadflax	*Linaria dalmatica*	A	Commonly found in cultivated fields, roadsides, railways, waste areas, clearcuts, overgrazed pastures and rangeland, and in plant communities that are typically open or disturbed. Neither Dalmation nor yellow toadflax (*Linaria vulgaris*) occur as frequently in intact wild lands and natural areas.

Table H-2. Noxious weeds and invasive species[a] (page 2 of 4).

Common name(s)	Scientific name	Noxious weed category[b]	Habitat[c]
Downy brome/ cheatgrass	*Bromus tectorum*	--	Grows in many climatic conditions. It is found primarily in locations that receive 15 to 56 centimeters (6 to 22 inches) of precipitation. Cheatgrass will grow in almost any type of soil. Research shows that it is most often found on coarse-textured soils and does not grow well on heavy, dry, or saline soils. Cheatgrass has been found growing in eroded soil areas and areas low in nitrogen. It grows in a narrow range of soil temperatures. It has been found in Nye and Esmeralda Counties (DIRS 174674-Carpenter and Murray [n.d.], all).
Dyer's woad	*Isatis tinctoria*	A	Found on disturbed and undisturbed sites, roadsides, railroad rights-of-way, fields, pastures, grain and alfalfa fields, forests, and rangeland. The species can grow on dry, rocky, or sandy soils.
Hoary cress/ Whitetop	*Cardaria draba*	C	Grows well in many environments, but they commonly grow in disturbed, alkaline soils with moderate moisture or acidic soils with limited moisture. They grow well in sub-irrigated pastures, hay fields (especially alfalfa), rangeland meadows, along roadsides, ditch banks, and in many other unshaded disturbed areas. They are aggressive invaders in much of Nevada because their seeds germinate and plants grow in moderately salty soils.
Halogeton	*Halogeton glomeratus*	--	An annual that is often found along rail roadbeds, roads, trails, and other places where the soil has been disturbed, in areas that have been overgrazed or burned over, and on dry lake beds. It can tolerate very saline soils. It cannot effectively compete with healthy native vegetation, but can form dense stands where native vegetation is sparse (DIRS 174505-Torell, Young, and Kvasnicka 2005, p. 1-3).
Houndstongue	*Cynoglossum officinale*	A	Can survive hot, dry summers, as well as cold winters. It is found on a variety of soils from well-drained, relatively coarse, alkaline soils to clay subsoil. It is tolerant of shade and prospers in wetter grasslands. It is found on roadsides, meadows, and disturbed places. Houndstongue has been found in Elko County, Nevada and can quickly spread to other areas of the state.
Klamath weed/ common St. Johnswort/ goatweed	*Hypericum perforatum*	A	A large, bushy plant that prefers dry, sandy, or gravelly soils and open, sunlit areas. It can be found in pastures, pinyon-juniper woodlands, foothill forests, waste places, and along roadsides. It may dominate a site as a monoculture. Klamath weed spreads by seed and by creeping horizontal stems that root when they touch the ground (DIRS 174671-Graham & Johnson [n.d.], all).
London rocket/ Tumbling mustard	*Sisymbrium irio*	--	Is common in irrigated cropland and orchards, and disturbed areas such as roadsides, fence lines, and ditches below 800 meters (2,600 feet) elevation.

Table H-2. Noxious weeds and invasive species[a] (page 3 of 4).

Common name(s)	Scientific name	Noxious weed category[b]	Habitat[c]
Medusahead	*Taeniatherum caput-medusae*	B	Invades grasslands, oak savannah, oak woodland, and chaparral communities. It grows in a wide range of climatic conditions. Clay or clay-loam soils with at least 25.4 centimeters (10 inches) of rainfall annually are most susceptible to invasion. However, medusahead has been found on coarse-textured soils, as well.
Musk thistle	*Carduus nutans*	B	Musk thistle is found in saline soils in low valleys to acidic soils at 3,048 meters (1,000 feet). It prefers moisture and sunlight, and it often grows in pastures, construction sites, ditches, and rangeland (DIRS 174670-Kadrmas and Johnson [n.d.], all).
Perennial pepperweed/Tall whitetop	*Lepidium latifolium*	C	Infests wet sites along streams, rivers, and wetlands. It is found in riparian areas of the entire western United States. Tall whitetop is very tolerant of salty soils and adapts well to many sites under adverse conditions. It is found in native hay meadows, abandoned agricultural lands, pastures, hayfields, residential areas, and along roadsides.
Purple loosestrife	*Lythrum salicaria*	A	Moist soils, especially on the fringes of water bodies and is potentially found around Meadow Valley Wash and the Amargosa River areas.
Red brome	*Bromus rubens*	--	A cool-season annual bunchgrass that commonly grows in open, disturbed areas below 1,524 meters (5,000 feet) elevation. It is less frost-tolerant than the closely related cheatgrass, and is more common in the Mojave region that in the Great Basin. It can form extensive monocultures, which, as the fine textured plants dry in the summer, dramatically increases the frequency of wildfires (DIRS 174673-Newman 1992, all).
Russian knapweed	*Acroptilon repens*	B	Common along roadsides, riverbanks, irrigation ditches, pastures, waste places, clearcuts, and croplands. Russian knapweed does not establish readily in healthy, natural habitats. It typically invades disturbed areas, forming dense single-species stands. Once established, Russian knapweed inhibits the growth of nearby plants to spread outward into undisturbed areas. Specimens have been found in Nye, Clark, and Esmeralda Counties.
Russian olive	*Elaeagnus angustifolia*	--	Invasive in many states and typically inhabits disturbed areas. It fixes nitrogen and can therefore persist in poor soils. It is drought and salt tolerant. In the Great Basin it grows at elevations of 240 to 600 meters (790 to 2,000 feet). It has been found in Meadow Valley Wash.

Table H-2. Noxious weeds and invasive species[a] (page 4 of 4).

Common name(s)	Scientific name	Noxious weed category[b]	Habitat[c]
Russian thistle	*Salsola spp.*	--	An annual that grows along fence lines, crop margins, and roadsides, in areas that have been overgrazed, and other places where the native vegetation has been disrupted. Its seeds are spread when the plant dies in the autumn and breaks free from its roots, allowing it to tumble freely in the wind (hence, the common name, “tumble weed”). Like halogeton, it can not effectively compete with intact communities of native vegetation (DIRS 174498-Taylor 1992, p. 66).
Saltcedar	*Tamarix ramosissima*	C	Requires a large amount of groundwater, and is most common in riparian areas and areas with a seasonally-high water table. The amount of water used by the species can lower the water table that supplies springs and shallow wells. It is extremely salt tolerant and accumulate salts in its deciduous leaves, which, when dropped, create soil conditions beneath the plant that are too salty for most other species to grow.
Scotch thistle	*Onopordum acanthium*	B	An invasive weed that infests disturbed and neglected lands. It prefers sites near ditch banks and rivers but also infests pastureland, crops, rangeland, and roadsides. Although scotch thistle prefers disturbed areas with high soil moisture, drier areas do not limit its invasive nature. It commonly invades overgrazed lands, rangeland, pastures, roadsides, and construction sites.
Spotted knapweed	*Centaurea maculosa*	A	Found in rangelands that have disturbed soils and that receive less than 20 centimeters (7.9 inches) of precipitation annually. Spotted knapweed is believed to produce a substance that retards the growth of other nearby species (DIRS 174672-Graham & Johnson [n.d.], all).
Yellow starthistle	*Centaurea solstitalis*	A	Found in rangelands that receive less than 38 centimeters (15 inches) of annual precipitation, grows in disturbed areas such as roadside ditches and construction areas, and is also found on rangelands and hay pastures. It has been observed in Clark County (DIRS 174669-Johnson et al. [n.d.]).
Yellow toadflax/ Butter-n-eggs	*Linaria vulgaris*	A	Commonly found in cultivated fields, roadsides, railways, waste areas, clearcuts, overgrazed pastures and rangeland, and in plant communities that are typically open or disturbed. It is not found as frequently in intact wild lands and natural areas.

a. Source: DIRS 130301-Hickman 1993, all.

b. Nevada Department of Agriculture noxious weed category definitions: A = weeds not found or limited in distribution throughout the state, controlled wherever found; B = weeds established in scattered populations in some counties of the state, actively excluded where possible; C = weeds currently established and generally widespread in many counties of the state (DIRS 174543-NDOA 2005, all).

c. To convert meters to feet, multiply by 3.2808; to convert centimeters to inches, multiply by 0.3937.

H.3 Wildlife

H.3.1 METHODS

H.3.1.1 Research

DOE gathered information regarding wildlife potentially found within the study area of the Caliente rail alignment and Mina rail alignment from reviews of BLM resource management plans, field guides, NatureServe database, discussion with and acquisition of GIS data from federal and state agencies (BLM, NDOW), and field observations. Using the information gathered from these sources, DOE developed general descriptions and locations of the wildlife communities relative to the proposed alignments, including sage-grouse habitat and mule deer, elk, and antelope winter and summer range.

H.3.1.2 Field Surveys

DOE did not perform field surveys specifically to characterize the wildlife communities along the Caliente and Mina rail alignments. Wildlife observed during the surveys discussed in Section H.3.1.2 were documented and included in the field notes and data sheets. All surveys were conducted during daylight hours; therefore, field personnel would not have observed species that are exclusively nocturnal, but they recorded signs or other indicators of the presence of these species.

H.3.1.2.1 Sage-Grouse Habitat Quality Surveys

DOE performed field surveys in habitat for greater sage-grouse (*Cetrocercus urophasianus*) and other sage-dependent species. To assess the quality of sagebrush (*Artemisia* ssp.) habitat, the percentage of sagebrush cover and sagebrush height were measured along 18, 50-meter (160-feet) transects along the rail alignments within sage-grouse population management units. DOE performed assessments of sagebrush habitat for potential suitability as winter habitat for sage-grouse from February 27, 2005 through March 9, 2005, along the Caliente rail alignment.

At sites predetermined for sage-grouse habitat surveys, a sage-grouse habitat transect was set up as an extension of the previously completed vegetation survey, in the same direction and along the same bearing. A 50-meter (160-foot) tape measure was staked and stretched out along the alignment from the predetermined transect start point. A digital photo was taken, Universal Transverse Mercator coordinates collected and recorded, and a wooden stake driven into the ground at the beginning and end of transects. On data sheets, a sample of which is presented in Figure H-4, sagebrush canopy cover (by species of sagebrush, *Artemisia* spp.) was recorded using the line-intercept method that required measuring the amount of live sagebrush that occurs along the line created by the tape measure. Gaps in live canopy of less than 5 centimeters (2 inches) were ignored. Additionally, at each 5-meter (16-foot) increment along the tape, starting at the 5-meter (16-foot) point, the height and species of the nearest sagebrush plant were recorded.

Sage-grouse habitat quality surveys were not performed for the Mina alignment since there is no designated sage-grouse habitat within the study area.

H.3.1.2.2 Big Game Surveys

For big game surveys, the appropriate BLM or Nevada Department of Wildlife management unit was identified and overlain on the proposed rail alignment study area. DOE conducted big game surveys in areas where the proposed rail alignment and documented big game habitat would intersect. Field study included the survey of 66, 800-meter (2,600-foot) transects along the length of the proposed rail alignment to identify signs of habitat use by big game species. An 800-meter transect was chosen to take into consideration indirect impacts, which is 500 meters (1,640 feet) beyond the 300-meter (1,000-foot)-wide proposed construction right-of-way. Rather than attempt to describe population sizes or habitat quality, these field surveys were designed specifically to determine use of the areas near the proposed rail alignment by game species. DOE conducted field surveys, which included track and pellet counts, to verify use of the area and identify important migration corridors. Section H.5 provides additional information on the big game surveys (methods and equipment).

H.3.2 WILDLIFE COMMUNITIES

Sections 3.2.7 and 3.3.7 of the Rail Alignment EIS describe the wildlife species potentially occurring within the Caliente and Mina rail alignments regions of influence, respectively. However, in several cases, the list of species in several groups of wildlife were too numerous and the data too extensive to include in those sections. Therefore, the information is included in this appendix.

Table H-3 lists the game species identified in the Nevada Administrative Code Sections 503.020, 503.045, 503.060 and their occurrence in the biological resources study area for the Caliente and Mina rail alignments. Table H-4 lists bird species and their occurrence within the study area for the Caliente and Mina rail alignments. Table H-5 lists the protection status, a description of preferred habitat, and the probability of occurrence for 23 bat species potentially found along the Caliente and Mina rail alignments. Table H-6 lists amphibians and reptiles potentially found along the Caliente and Mina rail alignments, including their protection status and a description of preferred habitat.

H.3.3 IMPACT ANALYSIS

DOE assessed potential adverse impacts on wildlife as a result of the Proposed Action described in Chapter 2 of the Rail Alignment EIS, based on the review of Nevada Department of Wildlife datasets, review of BLM resource management plans, and field observations. Direct long-term impacts include the loss of and fragmentation of habitat and potential death of individuals. Indirect short-term impacts include avoidance, change in movement patterns, and potential contamination of water resources in the event of derailment. The potential for impacts on game species, including mule deer, elk, antelope, and sage-grouse, were determined based on the location of the rail line, facilities, and quarries in relation to their identified habitat range. In addition, DOE used the SWReGAP data and field observations to determine the likelihood of an occurrence of a particular species based on its known preferred habitat and the vegetation community present.

The magnitude of impact was determined based on the type of habitat (such as crucial winter range, yearlong, migratory corridor) through which the rail line would pass. A small impact to wildlife would neither destabilize nor noticeably alter the species' habitat or population. A moderate impact would noticeably alter a species' habitat or population, but would not destabilize it. A large impact would significantly alter or destabilize a species' habitat and population. However, no large impacts were found to occur in the analysis.

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:	OBSERVERS:		LOCATION:	TRANSECT BEARING:
	GPS FILENAME - START:					
Coordinates	WAYPOINT	UTM N	UTM E	PDOP	WAAS USED?	ELEVATION
START TRANSECT					yes / no	
END TRANSECT					yes / no	
	GPS FILENAME - END (if different):					
TRANSECT START PHOTO:			TRANSECT END PHOTO:			
SLOPE:	ASPECT:	LANDFORM (elaborate in Notes section): Valley Flat Toe Slope/Alluvuial Fan Slope Cliff/Scarp Other		LAND USE: Wilderness Mining Recreation Grazing Transportation Plowed Fields Urban/Developed Other		
SW REGAP CLASS:						
ESTIMATED DOMINANT SPECIES:						

Big sagebrush intercepts (include units)	Total	% Cover

Big Sagebrush Height at: (ARTRT)	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m

Other sagebrush spp. intercepts (include units)	Total	% Cover

Other Sagebrush Height at:	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m

Figure H-4. Data sheet for assessing sage-grouse habitat quality.

Table H-3. Nevada game species[a] and their occurrence in the biological resources study areas for the Caliente and Mina rail alignments (page 1 of 2).

Common name	Scientific name	Occurrence within the study area[b] Caliente rail alignment	Mina rail alignment
Game mammals			
Pronghorn antelope	*Antilocapra americana*	Present	Present
Black bear	*Ursus americanus*	Absent	Absent
Mule deer	*Odocoileus hemionus*	Present	Present
Mountain goat	*Oreamnos americanus*	Absent	Absent
Mountain lion	*Felis concolor*	Present	Present
Moose	*Alces alces*	Absent	Absent
Peccary	*Pecari angulatus*	Absent	Absent
Cottontail rabbit	*Sylvilagus* spp	Present	Present
Pygmy rabbit	*Sylvilagus idahoensis*	Present	Absent
Snowshoe rabbit	*Lepus americanus*	Absent	Absent
Black-tailed jackrabbit	*Lepus californicus*	Present	Present
Bighorn sheep	*Ovis canadensis*	Present	Present
Elk	*Cervus elaphus*	Present	Present
Upland and migratory game birds			
Blue grouse	*Dendragapus obscurus*	Absent	Absent
Ruffed grouse	*Bonasa umbellus*	Absent	Absent
Sage-grouse	*Centrocercus urophasianus*	Potentially present	Potentially present
Sharp-tailed grouse	*Tympanuchus phasianellus*	Absent	Absent
Chukar	*Alectoris chukar*	Present	Present
Gray (Hungarian) partridge	*Perdix perdix*	Absent	Absent
Snow partridge	*Tetrogallus himalayensis*	Absent	Absent
Ring-necked pheasant	*Phasianus colchicus*	Present	Present
White-wing pheasant	*Phasianus colchicus*	Absent	Absent
Northern bobwhite quail	*Colinus virginianus*	Absent	Absent
California quail	*Callipepla californicus*	Absent	Absent
Gambel's quail	*Callipepla gambelii*	Present	Present
Mountain quail	*Oreortyx pictus*	Absent	Absent
Scaled quail	*Callipepla squamata*	Absent	Absent
Wild turkey	*Meleagris gallopavo*	Present	Present
American crow	*Corvus brachyrhynchos*	Present	Present
Ducks, geese, and swans	Family *Anatidae*	Present only in wetland/marsh areas	Present only in wetland/marsh areas
Wild doves and pigeons	Family *Columbidae*	Present	Present
Cranes	Family *Gruidae*	Present only in wetland/marsh areas	Present only in wetland/marsh areas
Rails, coots, and gallinules	Family *Rallidae*	Present only in wetland/marsh areas	Present only in wetland/marsh areas

Table H-3. Nevada game species[a] and their occurrence in the biological resources study areas for the Caliente and Mina rail alignments (page 2 of 2).

Common name	Scientific name	Occurrence within the study area[b]	
		Caliente rail alignment	Mina rail alignment
Woodcocks and snipes	Family *Scolopacidae*	Present only in wetland/marsh areas	Present only in wetland/marsh areas
Game fish			
Bonneville cutthroat trout	*Oncorhynchus clarki utah*	Absent	Absent
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Absent	Present
Snake River cutthroat trout	*Oncorhynchus clarki bouvieri*	Absent	Absent
Salmon	*Oncorhynchus* ssp.	Absent	Absent
Atlantic salmon	*Salmo salar*	Absent	Absent
Brook trout	*Salvelinus fontinalis*	Absent	Absent
Brown trout	*Salmo trutta*	Absent	Present
Bull trout	*Salvelinus confluentis*	Absent	Absent
Lake trout	*Salvelinus namyaycush*	Absent	Absent
Rainbow trout	*Oncorhynchus mykiss*	Absent	Present
Redband trout	*Oncorhynchus mykiss gibbsi*	Absent	Absent
Mountain whitefish	*Prosopium williamsoni*	Absent	Present
Black bullhead	*Ameiurus melas*	Absent	Absent
Brown bullhead	*Ameiurus nebulosus*	Absent	Absent
Channel catfish	*Ictalurus punctatus*	Absent	Present
White catfish	*Ameiurus catus*	Absent	Present
Striped bass	*Morone saxatilis*	Absent	Absent
White bass	*Morone chrysops*	Absent	Present
Largemouth black bass	*Micropterus salmoides*	Absent	Present
Smallmouth black bass	*Micropterus dolomieu*	Absent	Absent
Spotted bass	*Micropterus punctulatus*	Absent	Present
Black crappie	*Pomoxis nigromaculatus*	Absent	Absent
White crappie	*Pomoxis annularis*	Absent	Present
Sacramento perch	*Archoplites interruptus*	Absent	Absent
Yellow perch	*Perca flavescens*	Absent	Present
Bluegill sunfish	*Lepomis macrochirus*	Absent	Present
Green sunfish	*Lepomis cyanellus*	Absent	Absent
Redear sunfish	*Lepomis microlophus*	Absent	Absent
Walleye	*Stizostedion vitreum*	Absent	Present

a. Source: Nevada Administrative Code Sections 503.020, 503.045, and 503.060.
b. Sources: DOE field surveys; DIRS 182061-NNHP 2005; BLM RMPs (DIRS 174518-BLM 2005; DIRS 103079-BLM 1998; DIRS 173224-BLM 1997; DIRS 179560-BLM 2001).

Table H-4. Non-game bird species and their potential occurrence in the biological resources study areas for the Caliente and Mina rail alignments [a] (page 1 of 3).

Common name	Scientific name	Description	Potential occurrence Caliente	Potential occurrence Mina
Northern goshawk	*Accipiter gentilis*	Feeds on small mammals, nests in large tree limbs or crotch of tree.	Low	Low
Tricolored blackbird	*Agelaius tricolor*	Found in riparian habitat and grasslands; nests in marsh thickets.	None	None
Sage sparrow	*Amphispiza belli*	Prefers sagebrush or shadscale scrub; nests in depression on ground or in shrub.	High	High
Golden eagle	*Aquila chrysaetos*	Found in high deserts shrub habitat and montane; feeds on small mammals, birds, fish, insects; nests usually in tall trees or cliffs.	Low	Low
Long-eared owl	*Asio otus*	Nests in woodlands and hunts in open grasslands.	Low	Low
Western burrowing owl	*Athene cunicularia hypugaea*	Found in grassy shrub-steppe and juniper-pinyon woodlands; feeds on small mammals, frogs, birds; nests in abandoned burrows on ground.	Moderate	Low
Juniper titmouse	*Baeolophus griseus*	Found in pinyon-juniper woodlands; nests in tree cavities.	None	Low
Ferruginous hawk	*Buteo regalis*	Prefers open grassland and shrub-steppe communities; nests in various sites including trees, cliffs, power poles, and hillsides.	Moderate	Moderate
Red-tailed hawk	*Buteo jamaicensis*	Found in open shrub-steppe and montane; feeds on small mammals, birds, reptiles, insects; nests in tree branches.	High	High
Swainson's hawk	*Buteo swainsoni*	Feeds on reptiles, rodents, birds, insects; nests in tree or bush, power pole or cliff.	High	High
Western snowy plover	*Charadrius alexandrinus nivosus*	Found in sandy areas, salt flats, and shorelines; eats insects and aquatic invertebrates.	Low	High
Mountain plover	*Charadrius montanus*	Prefers grasslands, plowed fields, and sandy deserts; nests on ground in short grass or bare ground.	Low	Low
Black tern	*Chlidonia niger*	Found in desert marshlands.	Low	Low
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Found in thick riparian habitats or forests; nests in cottonwood trees.	Low	Low
Yellow warbler	*Dendroica petechia*	Found in riparian communities; nests in tree or shrub branches.	Low	Low
Southwestern willow flycatcher	*Empidonax traillii extimus*	Found in thick riparian areas with mature willow.	Low	Low

Table H-4. Non-game bird species and their potential occurrence in the biological resources study areas for the Caliente and Mina rail alignments [a] (page 2 of 3).

Common name	Scientific name	Description	Potential occurrence Caliente	Potential occurrence Mina
Prairie falcon	*Falco mexicanus*	Found in grasslands, alkali meadows and lower elevation montane; feeds on mammals, birds, insects; nests in high ledges.	Moderate	Moderate
Peregrine falcon	*Falco peregrinus*	Nests in high cliffs near water; feeds on mostly fish and waterfowl.	None	Low
Common loon	*Gavia immer*	Lakes with deep and shallow areas.	None	None
Common yellowthroat	*Geothlypis trichas*	Found in marshes, riparian areas; nests in cattails, brush, or grasses near water.	None	Low
Greater sandhill crane	*Grus Canadensis tabida*	Marsh areas or agricultural fields.	None	None
Pinyon jay	*Gymnorhinus cyanocephalus*	Prefers pinyon-juniper woodlands; nests in colonies.	None	Low
Bald eagle	*Haliaeetus leucocephahis*	Feeds on fish, small mammals, birds; nests near rivers and lakes in tall trees.	None	Low
Harlequin duck	*Histriontcus histrionicus*	Lakes.	None	None
Yellow-breasted chat	*Icteria virens*	Found in woodlands, scrub, fence rows; nests in bushes or trees in dense vegetation.	None	Low
Loggerhead shrike	*Lanius ludovicianus*	Found in shrub-steppe and pinyon-juniper woodlands; nests in bush or tree.	High	High
Long-billed curlew	*Numenius americanus*	Found in grasslands and wet meadows; nests on ground in short grasslands.	Moderate	Low
Macgillivray's warbler	*Oporornis tolmiei*	Prefers shrubby riparian woodlands; nests on ground.	None	Low
Flammulated owl	*Otus flammeolus*	Found in pinyon-juniper woodlands; feeds on insects.	Low	Moderate
Osprey	*Pandion haliaetus*	Near lakes and rivers with fish; nests in tall trees, power poles, towers.	None	Low
American white pelican	*Pelicanus erythrorhynchos*	Rivers, lakes, reservoirs.	None	None
Vesper sparrow	*Pooecetes gramineus*	Found in prairies, dry shrublands, sagebrush communities; nests on ground.	Moderate	Moderate
White-faced ibis	*Plegadis chihi*	Marshes, ponds, rivers; nests in low trees, bulrushes, or on a floating mat.	None	Low
Phainopepla	*Phainopepla nitens*	Found in pinyon-juniper or shadscale scrub; feeds on insects or berries.	Low	Low
Yuma clapper rail	*Rallus longirostris yumaensis*	Freshwater habitats with bulrushes and cattails.	None	Low
Red-naped sapsucker	*Sphyarpicus nuchalis*	Found mostly in montane forests or riparian woodlands; nests in dead trees.	Low	Low

Table H-4. Non-game bird species and their potential occurrence in the biological resources study areas for the Caliente and Mina rail alignments [a] (page 3 of 3).

Common name	Scientific name	Description	Potential occurrence Caliente	Potential occurrence Mina
Sage thrasher	*Oreoscoptes montanus*	Found in sagebrush shrub communities; feeds on insects on the ground; nests in sagebrush or on ground in concealed nests.	High	High
Crissal thrasher	*Toxostoma crissale*	Found in desert scrub, tall riparian brush or chaparral; nests in low tree or shrub.	Low	Low
Orange-crowned warbler	*Vermivora celata*	Found in low elevation shrub communities; nests on ground.	Low	Low
Lucy's warbler	*Vermivora luciae*	Found in deserts or riparian woodlands; nests in tree cavity.	Low	Low
Gray vireo	*Vireo vivinior*	Found in shrub-steppe and pinyon-juniper woodlands.	Moderate	Moderate
Wilson's warbler	*Wilsonia pusilla*	Prefers open areas in moist woodlands or thickets; nests on ground at base of shrub.	Low	Low

a. Sources: DIRS 182061-Hopkins 2006, all; DIRS 181899-USAF 2007, p. 40; DIRS 174518-BLM 2005, p. 3.6-10; DIRS 103079-BLM 1998; DIRS 182067-List Serve 2007; DIRS 174412-Ryser 1985, all.

Table H-5. Bat species' protection status and occurrence along the Caliente and Mina rail alignments[a] (page 1 of 4).

Scientific name	Common name	Protection status	Description	Probability of occurrence along Caliente rail alignment	Probability of occurrence along Mina rail alignment
Antrouzous pallidus	Pallid bat	Nevada protected, BLM-sensitive	Statewide, year-round resident, records in vicinity of alignment, especially around the Yucca Mountain repository area.	High	High
Choeronycteris mexicana	Mexican long-tongued bat	Unprotected	Known only from one individual found in Las Vegas. Extreme northern edge of range. Prefers desert canyons with riparian vegetation.	Low	None
Corynorhinus townsendii	Townsend's big-eared bat	Nevada sensitive, BLM-sensitive	Statewide, year-round resident; highly dependent on caverns and mines, susceptible to disturbance.	High	High
Eptesicus fuscus	Big brown bat	BLM-sensitive	Statewide, year-round resident; tolerant of and uses human-built structures.	High	None

Table H-5. Bat species' protection status and occurrence along the Caliente and Mina rail alignments[a] (page 2 of 4).

Scientific name	Common name	Protection status	Description	Probability of occurrence along Caliente rail alignment	Probability of occurrence along Mina rail alignment
Euderma maculatum	Spotted bat	Nevada threatened, BLM-sensitive	Scattered across Nevada, typically at higher elevations; roosts in cliff faces. Only Nevada mammal classified as threatened.	Moderate	Moderate
Eumops perotis californicus	Greater western mastiff bat	Nevada sensitive, BLM-sensitive	Only one dead specimen found in Las Vegas; occurs in various habitats ranging from desert scrub to montane coniferous forests; typically roosts in cliff crevices and boulder cracks, does not appear to hibernate.	Low	None
Idionycteris phyllotis	Allen's lappet-browed bat	Nevada protected, BLM-sensitive	Recorded only in Clark County, but may occur as far north as southern Lincoln and Nye Counties. Probable resident that migrates from higher summer elevations to lower winter elevations; typically roosts in tree cavities, but has been observed in mines and caverns.	Low	Low
Lasionycteris noctivagans	Silver-haired bat	BLM-sensitive	A forest-associated species, more common in mature forests; found primarily at higher latitudes and altitudes in coniferous and mixed deciduous/coniferous forests of pinyon-juniper, subalpine fir, white fir, limber pine, aspen, cottonwood, and willow. Probably a transient spring and fall migrant.	Low	Low
Lasiurus blossevillii	Western red bat	Nevada sensitive, BLM-sensitive	Forest-dwelling, thought to be a transient, very rare in Nevada, only two records until 1999 and development of acoustic detecting equipment. Three acoustical records have occurred since.	Low	Low
Lasiurus cinereus	Hoary bat	BLM-sensitive	Rare in Nevada, thought to be primarily a summer migrant, tree roosting.	Low	Low
Lasiurus xanthinus	Western yellow bat	Unprotected	Closely associated with fan-palms, found in palm groves in upper Moapa Valley. May be expanding its range due to use of palms in urban landscaping.	Low	None
Macrotus californicus	California leaf-nosed bat	Nevada sensitive, BLM-sensitive	No observations have occurred north of Clark County.	Low	None

Table H-5. Bat species' protection status and occurrence along the Caliente and Mina rail alignments[a] (page 3 of 4).

Scientific name	Common name	Protection status	Description	Probability of occurrence along Caliente rail alignment	Probability of occurrence along Mina rail alignment
Myotis califorincus	California myotis	BLM-sensitive	Resident throughout Nevada, widespread and locally common; will roost anywhere from caves to buildings to exfoliating tree bark. Found in habitats from desert scrub to forests.	High	High
Myotis ciliolabrum	Small-footed myotis	BLM-sensitive	Statewide resident; tends to prefer mid to high elevations in southern Nevada. Roosts in trees, mines, and caves. Inhabits a variety of habitats including desert scrub, grasslands, sagebrush steppe, blackbrush, greasewood, pinyon-juniper woodlands, pine-fir forests, agriculture, and urban areas.	High	High
Myotis evotis	Long-eared myotis	BLM-sensitive	Year-round, high elevation forest-dwelling resident. In southern part of Nevada found only in ponderosa forests. Roosts in hollow trees, under exfoliating bark, crevices in small rock outcrops, and occasionally in mines, caves, buildings, and bridges.	Low	Low
Myotis lucifugus	Little brown myotis	BLM-sensitive	Probably a year-round resident, found in the northern part of Nevada in high elevation coniferous forests. Must be close to water; day roosts in hollow trees, rock outcrops, buildings, and occasionally mines and caves. One of the species most commonly found in human structures.	Low	Low
Myotis thysanodes	Fringed myotis	Nevada protected, BLM-sensitive	Year-round resident of southern and central Nevada. Widespread but rare. Roost and nursery areas are easily disturbed; roosts in mines, caves, trees, and buildings.	Moderate (historic occurrence in Beatty area)	Moderate (historic occurrence in Beatty area)
Myotis velifer	Cave myotis	BLM-sensitive	Only recorded in one location in extreme southern Nevada at the Lake Mead National Recreational Area. Typically roosts in caves and bridges, commonly observed using swallow nests.	Low	None

Table H-5. Bat species' protection status and occurrence along the Caliente and Mina rail alignments[a] (page 4 of 4).

Scientific name	Common name	Protection status	Description	Probability of occurrence along Caliente rail alignment	Probability of occurrence along Mina rail alignment
Myotis volans	Long-legged myotis	BLM-sensitive	Probable resident found throughout Nevada, but more commonly in the north and central portions. Appears to prefer pinyon-juniper, Joshua tree woodlands, and montane coniferous forest habitats. Not found in low desert. Roosts in hollow trees and hibernates in caves and mines, but also uses rock crevices, caves, mines, and buildings.	Moderate (historic occurrence in Beatty area)	Moderate (historic occurrence in Beatty area)
Myotis yumanensis	Yuma myotis	BLM-sensitive	Tends to occur in the western and southern portions of Nevada, but recent records from eastern Nevada indicate it might be more widespread. Inhabits various habitats including sagebrush, salt desert scrub, agriculture, playa, and riparian habitats. One of few bat species that thrive in urban environments.	Low	Low
Nyctinomops macrotis	Big free-tailed bat	BLM-sensitive	Observed only in Clark County. Appears to be a transient, but has been commonly seen in the fall along the Muddy River basin.	Low	Low
Pipestrellus hesperus	Western pipistrelle	BLM-sensitive	Resident found throughout Nevada but is more prevalent in the south and west areas of the state. Prefers desert habitats of blackbrush, creosote, salt desert shrub, and sagebrush. In the summer, roosts in crevices, snags, under rocks, or in buildings. Hibernates in caves and mines in the winter.	High	High
Tadarida braziliensis	Brazilian free-tailed bat	Nevada protected, BLM-sensitive	A summer resident scattered across Nevada but commonly found in the southern portion. A ubiquitous colonial rooster, will use cliff faces, mines, caves, buildings, bridges, and hollow trees. Some summer colonies have up to 100,000 bats.	High	High

a. Source: DIRS 181865-Bradley et al. 2006, all.

Table H-6. Reptile and amphibian species occurrence along the Caliente and Mina rail alignments.[a]

Scientific name	Common name	Protection status	Description
Amphibians			
Ambystoma tigrinum	Tiger salamander	None	Found in ponds, reservoirs, streams, and stock ponds in deserts, sagebrush areas, grasslands, and mountain meadows.
Bufo boreas nelsoni	Amargosa toad	BLM-sensitive	Found in or near springs and wet meadows. Takes shelter under shrubs, woody material, and rocks, and may be found in rodent burrows.
Bufo cognatus	Great Plains toad	None	Found in streams, marshes, irrigation ditches, flooded fields, and adjacent creosote bush desert or sagebrush areas.
Bufo microscaphus	Southwestern toad	BLM-sensitive	May be found in cottonwood-willow associations, creeks, pools, irrigation ditches, flooded fields, and reservoirs.
Bufo punctatus	Red-spotted toad	None	Found in rocky, desert streams and adjacent open grassland and scrubland.
Bufo woodhousei	Woodhouse's toad	None	Found in grasslands, floodplains, and sagebrush flats and sandy areas near streams, marshes, and irrigation ditches.
Rana catesbeiana	Bullfrog	None	Found in ponds or slow moving streams with thick aquatic vegetation.
Rana pipiens[b]	Northern leopard frog	Nevada protected	Found in banks and shallow portions of marshes, ponds, lakes, reservoirs, beaver ponds, streams, and other bodies of permanent water. Also found in irrigation ditches and wet meadows.
Hyla regilla	Pacific treefrog	None	Found in grasslands, woodlands, farmlands, and desert areas in ponded wetlands, reservoirs, roadside ditches, and slow streams.
Scaphiopus intermontanus	Great Basin spadefood	None	Found in wet areas within pinion-juniper woods and sagebrush flats.
Reptiles			
Gopherus agassizii	Desert tortoise	Threatened	Found in desert shrubland habitat in the Mojave Desert.
Sauromalus obesus[b]	Common chuckwalla	None[c]	Found in rocky areas (rocky outcrops, lava flows, and rocky hillsides) within the Great Basin, Mohave, and Sonoran Deserts.

a. Source: DIRS 174414-Stebbins 2003, pp. 152, 204, 209, 211, 212, 213, 214, 215, 223, and 241.
b. Recorded only along the Mina rail alignment.
c. Being considered for a status change to "species of concern" in Nevada.

H.4 Special Status Species

H.4.1 METHODS

H.4.1.1 Research

DOE obtained information on federally and state-protected species from the Nevada Natural Heritage Program (DIRS 182061-NNHP 2005, all), an element occurrence database that maintains an inventory on the locations, biology, and conservation status of all threatened, endangered, sensitive, and at-risk species and biological communities in the state. DOE obtained additional information through discussions with resource management agencies and reviewing BLM resource management plans and similar documents. DOE consultation with the FWS provided a list of species protected under the Endangered Species Act that could occur along the Caliente and Mina rail alignments. Using the information gathered from these sources, DOE mapped species locations within the study area, and used the information for on-site verification investigations in 2005 (Caliente rail alignment) and 2007 (Mina rail alignment) and for the assessment of potential impacts.

H.4.1.2 Field Surveys

DOE conducted field surveys for sensitive plant species, sage-grouse habitat quality, and big game habitat use along the Caliente rail alignment in 2005 and along the Mina rail alignment in 2007 to support the evaluations of potential impacts of the proposed project on these resources. Section H.4.1.2.1 describes the methods DOE used for these surveys.

H.4.1.2.1 Sensitive Plant Species Surveys

DOE performed surveys for sensitive plant species along the Caliente rail alignment from May 6 through May 16, 2005 and along the Mina rail alignment during the field surveys described in Section H 2.1.2. DOE used the same field equipment described for the previous vegetation surveys for the sensitive plant species surveys. Field personnel used a datasheet to record the data gathered during these surveys (see Figure H-5).

Transects were centered along the rail alignments at the point closest to the known sensitive species location, as documented by the Nevada Natural Heritage Program element occurrence database (DIRS 182061-NNHP 2005, all). Locations of the start and end of the transect were recorded using a geographic positioning system unit, and the transect was photographed and staked. Two teams of two biologists examined the area for presence of the species in question; the two teams went in opposite directions with each team member walking 30 meters (100 feet) from the rail alignment centerline for 1 kilometer (0.6 mile). They covered a total distance of 2 kilometers (1.2 miles) in search of the target species or indicative habitat or sign. After reaching the end point of the transect, the biologists spread out an additional 30 meters from their original line and walked the transect back to the starting point. This approach resulted in a 2-kilometer (1.2-mile)-long, 180-meter (590-foot)-wide transect being inspected. When target species were located, the habitat and associated plant community surrounding the target species were documented to evaluate for uniqueness. The locations of locally rare or sparsely distributed species were determined and recorded using a geographic positioning system receiver, and photographed. For species that were locally common, individual plants were counted and their distribution was assessed and recorded on the data sheets shown in Figure H-3.

H.4.1.3 Impact Analysis

Potential adverse impacts on special status species as a result of the proposed actions provided in Chapter 2 were assessed based on the review of the NNHP dataset, review of BLM resource management plans, and field observations. Direct long-term impacts include the loss of and fragmentation of special status species suitable habitat and potential death of individuals. Indirect impacts include potential avoidance and/or displacement of animal species during construction and disturbance from passing trains. The potential for impacts on special status species was determined based on the location of the documented occurrence within the study area and in relation to the rail line, facilities, and quarries. In addition, DOE used the SWReGAP data and field observations to determine the likelihood of an occurrence of a particular species based on its known preferred habitat and the vegetation community present.

The magnitude of impact was determined based on the type of habitat. A small impact to a special status species would neither destabilize nor noticeably alter the species' habitat or population. A moderate impact would noticeably alter a species' habitat or population, but would not destabilize it. A large impact would significantly alter or destabilize a species' habitat and population. However, no large impacts were found to occur in the analysis.

H.5 Wild Horses, Burros, and Big Game Species

H.5.1 METHODS

H.5.1.1 Research

Before beginning fieldwork, DOE identified any existing information regarding the occurrence and distribution of herd management areas and big game habitats within the region of influence of the proposed rail alignment. These efforts included literature searches and consultations with land management agencies and authorities, including the BLM and the Nevada Department of Wildlife.

H.5.1.2 Field Surveys

DOE performed surveys along the Caliente rail alignment from February 4 through March 11, 2005, from May 5 through May 10, 2005, and on June 7 and 8, 2005, to assess relative use of areas by horses, burros, and big game. DOE performed surveys along the Mina rail alignment during the field surveys described in Section H 2.1.2.

DOE performed observational sampling along linear transects. Transect dimensions were 800 meters (2,600 feet) long, unless blocked by terrain, by 120 meters (390 feet) wide. The sampling interval was continuous, with three observers spaced 30 meters (100 feet) apart. At the beginning of each transect, the type of BLM or Nevada Department of Wildlife management unit (for example, wild horse and burro herd management area, game habitat) potentially affected was determined, the locations of the start and end of the transect were recorded using a geographic positioning system receiver, and the transect was photographed and staked as described above. Field notes concerning the surrounding terrain and special habitat features, such as water sources or fences, were recorded on the data sheets for horse and burro and big game habitat use surveys shown in Figure H-6.

The bearing of the transect was determined as described for vegetation surveys in Section H.2.1.2. Transects were walked by teams of three biologists, one walking along the center line of the proposed rail alignment, with each of the others 30 meters (100 feet) to either side. When only two biologists were available for surveys, this fact was noted on the data sheet and resultant data were interpreted to adjust for the decrease in area covered. Observers documented the presence of any visible large ungulates, wild horses, or burros, and their estimated distance from the transect. Notes were also recorded regarding the presence of small or nongame wildlife species, including birds, rabbits, foxes, coyotes, badgers, reptiles, and amphibians, or evidence of habitat use by these species, such as scat, owl pellets, or burrows.

Track counts were conducted in which discrete sets of mule deer, pronghorn antelope, bighorn sheep, wild horse, or burro tracks were identified and counted. Sets of animal tracks that crossed the path of more than one observer were counted only once. Areas of high track density were noted and roughly delineated using waypoints identified by a geographic positioning system to assist in determining migration routes and forage areas.

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:	OBSERVERS:		LOCATION:	TRANSECT BEARING:
	GPS FILENAME - START:					
Coordinates	WAYPOINT	UTM N	UTM E	PDOP	WAAS USED?	ELEVATION
START TRANSECT					yes / no	
END TRANSECT					yes / no	
	GPS FILENAME - END (if different):					
TRANSECT START PHOTO:			TRANSECT END PHOTO:			
SLOPE:	ASPECT:	LANDFORM (elaborate in Notes section): Valley Flat Toe Slope/Alluvuial Fan Slope Cliff/Scarp Other		LAND USE: Wilderness Mining Recreation Grazing Transportation Plowed Fields Urban/Developed Other		
SW REGAP CLASS:						
ESTIMATED DOMINANT SPECIES:						

	NAME/CODE	EXTENT*	WAYPOINT	UTM N	UTM E	PDOP	WAAS	ELEVATION
Sensitive Species 1							yes / no	
Sensitive Species 2							yes / no	
Sensitive Species 3							yes / no	
Sensitive Species 4							yes / no	
Sensitive Species 5							yes / no	
Sensitive Species 6							yes / no	
Sensitive Species 7							yes / no	
Sensitive Species 8							yes / no	
	* Categories for sens spp and inv/nox spp extent: Solitary, Few Clumped, Few Scattered, Many Clumped, Many Scattered, Dense, Other							
Invasive/Nox Species 1							yes / no	
Invasive/Nox Species 2							yes / no	
Invasive/Nox Species 3							yes / no	

NOTES:

Figure H-5. Data sheet for sensitive plant species survey.

Pellet counts were conducted in which individual piles of large ungulate, wild horse, or burro scat that appeared to be less than 3 months old (based on degree of weathering), were identified and counted. Bighorn sheep, pronghorn antelope, and mule deer scat were sometimes difficult to differentiate by appearance alone. In these cases, the species was determined by examining other evidence (habitat, terrain, tracks, known distribution information). In the case of wild horses, stallion piles, which consist of two or more depositions of scat, were counted separately from single depositions resulting from mares and subordinate stallions. In some cases, burro scat was difficult to differentiate from foal and yearling horses and a determination of species was based on other evidence, such as the presence of other horse scat or tracks. Evidence of commercial sheep grazing activities was noted where present, because these operations can hinder the assessment of deer and antelope tracks and pellets.

H.5.2 HERD MANAGEMENT AREAS (HMAs)

The Caliente rail alignment and the Mina rail alignment each would cross a number of herd management areas. Section H.5.2.1 describes herd management areas the Caliente rail alignment would cross; Section H.5.2.2 describes herd management areas the Mina rail alignment would cross. The primary sources for information about each area listed are the BLM Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, all) and additional information DOE gathered from herd management plans and evaluations, as indicated in the descriptions.

H.5.2.1 Caliente Rail Alignment

H.5.2.1.1 Miller Flat and Little Mountain Herd Management Areas

The Miller Flat HMA and Little Mountain HMA are in Lincoln County, Nevada, approximately 3.2 kilometers (2 miles) northeast of the City of Caliente and, combined, are approximately 580 square kilometers (140,000 acres) in size. Both the Caliente and the Eccles alternative segments would cross the Little Mountain HMA. Each herd management area has an appropriate management level of nine to 15 horses. A 2004 census (DIRS 174047-Bennet 2005, p. 2) indicates that there are 40 horses in the Little Mountain HMA and 35 horses in the Miller Flat HMA. The herds move from Miller Flat to Little Mountain in the winter and move back to Miller Flat during the summer. The 2005 Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.8-6) indicates that forage, water, space, and habitat in these herd management areas are inadequate and recommends removing the horses and eliminating the HMA status. Permanent water sources consist of nine small springs on both private and public lands primarily in the Miller Flat HMA, Clover Creek, and water troughs installed for livestock. Only two small springs are available to horses and burros within the Little Mountain HMA, so the resident horses and burros are forced to travel to the Miller Flat HMA for water (DIRS 173057-BLM [n.d.], all).

H.5.2.1.2 Highland Peak Herd Management Area

Caliente common segment 2 would cross the Highland Peak HMA, which covers 550 square kilometers (140,000 acres) to the west of Panaca. The primary water source is in the central portion of the HMA at Bennett Springs, but several small springs are also found on the Highland Peak Range (DIRS 173059-BLM n.d., all). The appropriate management level for the Highland Peak HMA is 364 horses; however, the current population (2007) is approximately 150 horses (DIRS 174047-Bennet 2005, p. 2). Field observations from the winter of 2005 suggest that the eastern end of common segment 1 also supports a very high level of use by horses, and the portion of the segment at Bennett Pass shows evidence of seasonal horse use, which was confirmed during the May 2005 field effort, during which 35 horses were counted in the pass. The Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.8-6) lists the habitat of this HMA as inadequate in the winter and does not rate the forage, space, and

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:	OBSERVERS:		LOCATION:	TRANSECT BEARING:
	GPS FILENAME - START:					
Coordinates	WAYPOINT	UTM N	UTM E	PDOP	WAAS USED?	ELEVATION
START TRANSECT					yes / no	
END TRANSECT					yes / no	
	GPS FILENAME - END (if different):		TRANSECT LENGTH: meters			
SLOPE:	ASPECT:	LANDFORM (elaborate in Notes section): Valley Flat Toe Slope/Alluvial Fan Slope Cliff/Scarp Other		LAND USE: Wilderness Mining Recreation Grazing Transportation Plowed Fields Urban/Developed Other		
ESTIMATED PLANT COMMUNITY:				MANAGEMENT UNIT (if applicable):		
	STALLION PELLET	MARE PELLET	TRACK COUNT			
HORSE						
	PELLET COUNT					
BURRO						
MULE DEER						
BIGHORN						
PRONGHORN						
Wildlife observed/distance from transect:						
Notes:						
Photo, transect start:						
Photo, transect end:						
Photo, supplemental 1:						
Photo, supplemental 2:						

Figure H-6. Data sheet for assessing horse, burro, and big game habitat use.

genetic viability of the HMA; the Plan recommends that this HMA be combined with the Dry Lake and Rattlesnake HMAs.

H.5.2.1.3 Rattlesnake Herd Management Area

The Rattlesnake HMA, covering approximately 290 square kilometers (71,000 acres), is approximately 27 kilometers (17 miles) west of the City of Caliente in the Dry Lake Valley. Caliente common segment 1 would cross a small portion of the northeast corner of the HMA. The HMA has an appropriate management level of one horse to account for incidental use by wild horses from the Dry Lake HMA to the north during years with exceptionally high snowfall. The primary water sources include three springs, small ephemeral reservoirs, and cattle troughs. The 2003 census found no resident horses (DIRS 174332-BLM n.d., all; DIRS 174047-Bennet 2005, p. 2). The 2005 Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.8-7) lists the habitat as inadequate during the summer months and does not rate the forage, water, space, and genetic viability of the HMA. The Draft Ely District Resource Management Plan recommends that this HMA be combined with the Dry Lake and Highland Peak HMAs.

H.5.2.1.4 Dry Lake Herd Management Area

The Dry Lake HMA is in Lincoln County west of the town of Pioche and encompasses approximately 2,000 square kilometers (490,000 acres). Common segment 1 would cross the Dry Lake HMA in Dry Lake Valley and in the North Pahroc Range. The appropriate management level for this HMA is 94 horses. In August 2003, 23 horses were removed from the HMA, and the BLM population estimate is 72 horses. Primary water sources for the HMA are artesian springs and freshwater seeps in the Schell Creek, Pahroc, Bristol, and Fairview Mountain Ranges (DIRS 182069-Nevada Bureau of Land Management 2007, all; DIRS 174047-Bennet 2005, all). The 2005 Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.8-6) rates forage, water, space, habitat, and genetic viability as adequate, and recommends that this HMA be combined with the Rattlesnake and Highland Peak HMAs.

H.5.2.1.5 Seaman Herd Management Area

Common segment 1 would cross the Seaman HMA, which is approximately 56 kilometers (35 miles) south of Lund in both Nye and Lincoln Counties. It encompasses approximately 1,350 square kilometers (338,400 acres) and is currently being managed for a target population of 159 horses (DIRS 174333-BLM n.d., all). A 2004 population estimate indicates that there are 99 horses using the HMA (DIRS 174047-Bennet 2005, p. 2). The resident horses’ summer range is in the Seaman and Grant Mountains in the western portion of the herd management area, and their winter range is in the Coal and White River Valleys. Water sources are very limited (rated as marginal in the 2005 Draft Ely District Resource Management Plan) and emergency removal of horses is anticipated in dry years (DIRS 174333-BLM [n.d.], all). Space is rated as adequate, but habitat is rated as inadequate due to the lack of summer habitat. Forage and genetic viability is unrated in the 2005 Draft District Resource Management Plan, but the Plan recommends removing the herd and eliminating the herd management area status of the land (DIRS 174518-BLM 2005, p. 3.8-7).

H.5.2.1.6 Reveille Herd Management Area

The Reveille HMA is 80 kilometers (50 miles) east of Tonopah and 19 kilometers (12 miles) south of Warm Springs. Common segment 3 would cross this HMA. The HMA covers 510 square kilometers (130,000 acres) and is currently managed for a target population of 138 horses. The 2006 BLM census flight located 78 wild burros in the area (DIRS 182310-Dwyer 2007, all). A significant portion of the Reveille herd has established residency outside the boundaries of the HMA, suggesting that the current target population might not be appropriate for the available habitat (DIRS 173060-BLM [n.d.], all; DIRS 174046-Bennet 2005, all).

H.5.2.1.7 Stone Cabin Herd Management Area

The Stone Cabin HMA is 45 kilometers (28 miles) east of Tonopah and encompasses approximately 1,600 square kilometers (404,000 acres). Caliente common segment 3 would cross this HMA, which is of historic significance to wild horse management. The first wild horse roundup approved by the U.S. Congress occurred here after the passage of the Wild Free-Roaming Horse and Burro Act of 1971 (Public Law 92-195). It is also the historic home of the "Stone Cabin Grey" wild horse type; however, recent horse gathers and drought have reduced the number of horses with "Stone Cabin Grey" characteristics to only a few individuals (DIRS 174330-BLM [n.d.], all). The appropriate management level is 364 horses, and the current population as of 2007 is approximately 150 horses (DIRS 182310-Dwyer 2007, all). DOE field personnel observed evidence of a high level of use by horses during the 2005 field surveys near common segment 3 in the northern portion of Stone Cabin Valley. Personnel observed a herd of at least 12 horses several times from U.S. Highway 6 in Stone Cabin Valley within approximately 3 kilometers (1.9 miles) of the Caliente rail alignment. Personnel also observed 12 horses approximately 1 kilometer (0.62 mile) south of the Caliente rail alignment in this area.

H.5.2.1.8 Saulsbury Herd Management Area

The Saulsbury HMA is 26 kilometers (16 miles) east of Tonopah and is separated into two parcels totaling 570 square kilometers (140,000 acres), with an interconnecting segment of U.S. Forest Service land. Common segment 3 would cross the southern extent of this HMA. The area was intended to be managed under a Memorandum of Understanding between the U.S. Forest Service and the BLM, but it is currently managed as smaller individual units by the agency of jurisdiction. The appropriate management level is 40 horses, and the population as of 2007 is approximately 30 horses (DIRS 182310-Dwyer 2007, all). The resident horses spend their time in both administrative areas (DIRS 174329-BLM [n.d.], all; DIRS 174046-Bennett 2005, all).

H.5.2.1.9 Goldfield Herd Management Area

The Goldfield HMA is east of the community of Goldfield in Nye and Esmeralda Counties. Goldfield alternative segments 1, 3, and 4 along the Caliente rail alignment would cross this HMA. There is a potential quarry site in the northeastern portion of the HMA, adjacent to Goldfield alternative segment 3. The area encompasses 260 square kilometers (64,000 acres) and is in a transitional zone between the Mojave and Great Basin Deserts vegetation types. It provides suitable habitat only for burros, although the appropriate management level is 125 horses and 50 burros. The 2004 population estimate was 15 burros, although unofficial sightings suggest as many as 20. The BLM gathered and removed all resident wild horses in 1995, 1996, and 1997 (DIRS 173062-BLM [n.d.], all; DIRS 174046-Bennet 2005, p. 2). During the 2005 surveys, one burro was observed and evidence of habitat use by burros was noted near the northern end of common segment 4.

H.5.2.1.10 Montezuma Peak Herd Management Area

Goldfield alternative segment 4 would cross the Montezuma Peak HMA, which is west of the community of Goldfield. There is a potential quarry site in the eastern portion of the HMA, adjacent to Goldfield 4. The Montezuma Peak HMA encompasses 305 square kilometers (75,500 acres). The appropriate management level is 157 horses. The 2006 BLM census flight located 58 horses, 18 burros, and 3 mules (DIRS 182310-Dwyer 2007, all; DIRS 173061-BLM [n.d.], all; DIRS 174046-Bennet 2005, all).

H.5.2.1.11 Stonewall Herd Management Area

The Stonewall HMA is west of Lida Junction and south of Goldfield in Nye County. Caliente common segment 4 and both the Bonnie Claire alternative segments would cross the HMA, which encompasses 100 square kilometers (25,000 acres) and provides suitable habitat only for burros, although the appropriate management level is for 50 horses and 25 burros (DIRS 182310-Dwyer 2007, all). A 2006 partial BLM census flight located 17 burros around the Stonewall Falls area. Other sightings have indicated that some of the 34 resident burros from the adjoining Goldfield HMA wander through the Stonewall HMA (DIRS 173063-BLM [n.d.], all; DIRS 174046-Bennet 2005, p. 2). Observations made during the 2005 field surveys along Bonnie Claire alternative segment 2 suggest that burros occasionally use the area. Along Bonnie Claire alternative segment 3, within the Stonewall HMA, field observations suggest a relatively high level of past and present use of this area by burros. Field personnel noted signs of limited use of the area by horses near the northern end of Bonnie Claire 3, and noted evidence of habitat use by burros near the southern end of common segment 4.

H.5.2.1.12 Bullfrog Herd Management Area

The Bullfrog HMA surrounds the town of Beatty in Nye County. Common segment 6 would cross this HMA, which encompasses 520 square kilometers (130,000 acres) and is suitable habitat only for wild burros. Only a portion of the HMA has had an appropriate management level established, which was for 183 burros and 12 horses. The 2006 BLM census flight located 32 burros, though the population is estimated to be approximately 70 (DIRS 182310-Dwyer 2007, all). The burro population in the area is estimated to be 34. Unofficial sightings suggest the presence of wild horses and additional burros (DIRS 173064-BLM 2007, all; DIRS 174046-Bennett 2005, all). During the 2005 field surveys, personnel observed several herds of approximately 13 burros each near common segment 6 in the Crater Flat area. Field personnel noted evidence of burros consistently along common segment 6 south of Beatty Wash, with higher levels of use within the Bullfrog HMA.

H.5.2.2 Mina Rail Alignment

H.5.2.2.1 Horse Mountain Herd Management Area

The Horse Mountain HMA is located at the northern boundary of the Walker River Paiute Reservation in Lyon and Churchill counties. Schurz alternative segment 6 would run adjacent to the southern periphery of the HMA, but would not intersect. The Horse Mountain HMA encompasses approximately 193 square kilometers (47,691 acres). In 2000, there was an estimated population of 95 wild horses in this area and no burros (DIRS 182310-Dwyer 2007, all). Currently, there are no known herds that occupy the Horse Mountain HMA, due to modifications or diversions of water resources that once supported herds (DIRS 181843-Axtell 2007).

H.5.2.2.2 Pilot Mountain Herd Management Area

The Pilot Mountain HMA is located in Mineral and Esmeralda Counties, extending from the Monte Cristo mountain range in the southern boundary of the HMA, and continuing northwest along the Pilot Mountain range to the Gabbs Valley Range. The Pilot Mountain HMA is large, encompassing 1,937 square kilometers (478,641 acres). Mina common segment 1 follows the southwestern boundary of the HMA, but would not intersect any of the designated wild horse and burro habitat. The 2006 estimated population of Pilot Mountain HMA is approximately 286 horses (DIRS 182310-Dwyer 2007, all). There are no known burros (DIRS 181843-Axtell 2007).

H.5.2.2.3 Silver Peak Herd Management Area

The Silver Peak HMA is located in Esmeralda County, directly west of Silver Peak and Montezuma alternative segment 1. The proposed rail alignment would not intersect the designated Silver Peak HMA, but would occur adjacent to the eastern boundary. The Silver Peak HMA is approximately 970 square kilometers (239,691 acres). In 2006, all horses were removed from the HMA due to recurrent drought, starvation, and genetics issues (DIRS 182310 Dwyer 2007, all).

H.5.2.2.4 Goldfield Herd Management Area

The Goldfield HMA is located in Esmeralda and Nye Counties, east of the town of Goldfield. Montezuma alternative segment 2 would intersect this HMA. A 2006 BLM census flight located six horses and no burros; however, burro tracks and scat are evident throughout the HMA. Numbers fluctuate dramatically due to burro movement into the Nevada Test Site. There is an estimated population of about 20 to 30 burros in the Goldfield HMA (DIRS 182310-Dwyer 2007, all).

H.5.2.2.5 Montezuma Peak Herd Management Area

The Montezuma Peak HMA is within the Montezuma Range and borders the Goldfield HMA to the east and the Palmetto HMA to the southwest. Montezuma alternative segments 1, 2, and 3 would intersect or run adjacent to the designated HMA. The Montezuma Peak HMA is about 310 square kilometers (76,602 acres) with an estimated 146 wild horses and 10 burros (DIRS 181843-Axtell 2007). However, a 2006 BLM census flight located 58 horses and 18 burros (DIRS 182310-Dwyer 2007, all). During the December 2006 and March 2007 field surveys, several wild horses were observed in the area near the proposed North Clayton quarry site on the west facing side of the Montezuma Range.

H.5.2.2.6 Stonewall Herd Management Area

The Stonewall HMA is west of Lida Junction and south of Goldfield in Nye County. Caliente common segment 4 and both the Bonnie Claire alternative segments would cross the HMA, which encompasses 100 square kilometers (25,000 acres) and provides suitable habitat only for burros, although the appropriate management level is for 50 horses and 25 burros. Annual counts have not recorded any resident animals, but subsequent sightings have indicated that some of the 34 resident burros from the adjoining Goldfield HMA wander through the Stonewall HMA (DIRS 173063-BLM [n.d.], all; DIRS 174048-Bennet and Thebeau 2005, all). Observations made during the 2005 field surveys along Bonnie Claire alternative segment 2 suggest that burros occasionally use the area. A partial 2006 census flight located 17 burros in the area around Stonewall Fall. Along Bonnie Claire alternative segment 3, within the Stonewall HMA, field observations suggest a relatively high level of past and present use of this area by burros. Field personnel noted signs of limited use of the area by horses near the northern end of Bonnie Claire 3, and noted evidence of habitat use by burros near the southern end of common segment 4.

H.5.2.2.7 Bullfrog Herd Management Area

The Bullfrog HMA surrounds the town of Beatty in Nye County. Common segment 6 would cross this HMA, which encompasses 520 square kilometers (130,000 acres) and is suitable habitat only for wild burros. Only a portion of the HMA has had an appropriate management level established, which was for 183 burros and 12 horses. The burro population in the area is estimated to be 34. A 2006 BLM census flight located 17 burros around the Stonewall Falls area (DIRS 182310-Dwyer 2007, all). Unofficial sightings suggest the presence of wild horses and additional burros (DIRS 173064-BLM 2007, all; DIRS 174046-Bennet 2005, all). During the 2005 field surveys, personnel observed several herds of approximately 13 burros each near common segment 6 in the Crater Flat area. Field personnel noted evidence of burros consistently along common segment 6 south of Beatty Wash, with higher levels of use within the Bullfrog HMA.

H.6 References

181843	Axtell 2007	Westover, M. 2007. "AML's for Garfield, Horse Mountain and Pilot HMAs." Record of conversation from M. Westover (DOE) to J. Axtell (Carson City BLM), May 23, 2007. ACC: MOL.20070721.0002.
174046	Bennet 2005	Bennett, T. 2005. "Wild Horse and Burro Populations on HMA's Administered by the Tonopah BLM Office." Record of conversation from T. Bennett to A. Dumas (BLM/Tonopah), January 19, 2005. ACC: MOL.20050614.0142.
174047	Bennet 2005	Bennett, T. 2005. "Wild Horse and Burro Populations on HMA's Administered by the Ely BLM Office." Record of conversation from T. Bennett to J. Bybee (BLM/Ely), January 19, 2005. ACC: MOL.20050614.0143.
174048	Bennet and Thebeau 2005	Bennett, T. and Thebeau, L. 2005. "Received Maps and Discussed Locations and Ranges of Sensitive Wildlife Species." Record of conversation from T. Bennett and L.Thebeau to B. Hardenbrook (Nevada Department of Wildlife), May 20, 2005. ACC: MOL.20050614.0144.
173057	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Miller Flat and Little Mountain Herd Management Areas, Lincoln County, Nevada." [Las Vegas], Nevada: Bureau of Land Managment. Accessed March 16, 2005. ACC: MOL.20050406.0042. URL: http:www.blm.gov/hma/caliente/miller%20flat2.pdf
173059	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Highland Peak Herd Management Area, Lincoln County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0043. URL: http://www.nv.blm.gov/hma/caliente/highland_peak.pdf
173060	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Reveille Herd Management Area, Nye County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0044. URL: http://www.nv.blm.gov/hma/battle_mountain/reveille.pdf
173061	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Montezuma Peak Herd Management Area, Esmeralda County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0045. URL: http://www.nv.blm.gov/hma/battle_mountain/montezuma%20%20peak.pdf
173062	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Goldfield Herd Management Area, Nye and Esmeralda Counties, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0046. URL: http://www.nv.blm.gov/hma/battle_mountain/goldfield.pdf

173063	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Stonewall Herd Management Area, Nye County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0047. URL: http://www.nv.blm.gov/hma/battle_mountain/stonewall.pdf
174329	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Saulsbury Herd Management Area, Nye County, Nevada. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050808.0384.
174330	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Stone Cabin Herd Management Area Nye County, Nevada. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050808.0385.
174332	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Rattlesnake Herd Management Area Lincoln County, Nevada. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050808.0386.
174333	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. Seaman Herd Management Area Nye and Lincoln Counties, Nevada. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050808.0387.
182069	BLM [n.d.]	BLM (Bureau of Land Management) [n.d.]. "Dry Lake Herd Management Area, Lincoln County, Nevada." Herd Management Areas in Nevada. Reno, Nevada: Bureau of Land Management, Nevada State Office. Accessed July 17, 2007. ACC: MOL.20070806.0004. URL: http://www.nv.blm.gov/hma/alpha_hmas.htm
173224	BLM 1997	BLM (Bureau of Land Management) 1997. Tonopah Resource Management Plan and Record of Decision. Tonopah, Nevada: U.S. Department of the Interior, Bureau of Land Management. ACC: MOL.20050418.0038.
103079	BLM 1998	BLM (Bureau of Land Management) 1998. Proposed Las Vegas Resource Management Plan and Final Environmental Impact Statement. Three volumes. Las Vegas, Nevada: Bureau of Land Management. ACC: MOL.20010724.0319.
179560	BLM 2001	BLM (Bureau of Land Management) 2001. Carson City Field Office Consolidated Resource Management Plan. Carson City, Nevada: U.S. Department of the Interior, Bureau of Land Management. ACC: MOL.20070320.0414.
174518	BLM 2005	BLM (Bureau of Land Management) 2005. Draft - Resource Management Plan/Environmental Impact Statement for the Ely District. Volume 1 (Chapters 1, 2, and 3) and Map Volume. Ely, Nevada: Bureau of Land Management, Ely Field Office. ACC: MOL.20060222.0131; MOL.20060222.0132.
173064	BLM 2007	BLM (Bureau of Land Management) [n.d.]. "Bullfrog Herd Management Area, Nye County, Nevada." [Las Vegas], Nevada: Bureau of Land Management. Accessed March 16, 2005. ACC: MOL.20050406.0048. URL: http://wwww.nv.blm.gov/hma/battle_mountain/bullfrog.pdf

181865	Bradley et al. 2006	Bradley, P.V.; O'Farrell, M.J.; Williams, J.A.; and Newmark, J.E. 2006. The Revised Nevada Bat Conservation Plan. Reno, Nevada: Nevada Bat Working Group. ACC: MOL.20070721.0098.
174674	Carpenter and Murray [n.d.]	Carpenter, A.T. and Murray, T.A. [n.d.]. Element Stewardship Abstract for Bromus Tectorum L (Anisantha Tectorum (L.) Nevski). Arlington, Virginia: The Nature Conservancy. TIC: 257692.
104593	CRWMS M&O 1999	CRWMS M&O 1999. Environmental Baseline File for Biological Resources. B00000000-01717-5700-00009 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990302.0181; MOL.19990330.0560.
182310	Dwyer 2007	Dwyer, M. 2007. "Couple BLM Comments." E-mail from M. Dwyer to raeiscomments, July 2, 2007, with attachments. ACC: MOL.20070815.0065.
174671	Graham and Johnson [n.d.]	Graham, J. and Johnson, W.S. [n.d.]. Managing Common St. Johnswort. Fact Sheet FS-03-14. Reno, Nevada: University of Nevada Reno, Cooperative Extension. TIC: 257805.
174672	Graham and Johnson [n.d.]	Graham, J. and Johnson, W.S. [n.d.]. Managing Spotted Knapweed. Fact Sheet 04-39. Reno, Nevada: University of Nevada Reno, Cooperative Extension. TIC: 257806.
130301	Hickman 1993	Hickman, J.C., ed. 1993. The Jepson Manual: Higher Plants of California. Berkeley, California: University of California Press. TIC: 241854.
182061	Hopkins 2006	Hopkins, M. 2006. Nevada Transportation GIS Baseline Data, Quarterly Update, 09/29/2006. Las Vegas, NV: Bechtel SAIC Company, LLC. ACC: MOL.20070322.0001.
174669	Johnson et al. [n.d.]	Johnson, W.S.; Zimmerman, J.R.; Post, E.; Rowley, P.; and Davis, B. [n.d.]. "Yellow Starthistle is Invading Nevada!" Fact Sheet FS-01-02. Reno, Nevada: University of Nevada Reno, Cooperative Extension. TIC: 257802.
174670	Kadrmas and Johnson [n.d.]	Kadrmas, T. and Johnson, W.S. [n.d.]. Managing Musk Thistle. Fact Sheet FS-02-55. Reno, Nevada: University of Nevada, Reno, Cooperative Extension. TIC: 257801.
174497	Keck Library 2004	[Keck Library] [2004]. [Special Instruction Sheet For Digital Ortho Quads]. [Reno, Nevada: University of Nevada, Reno, Keck Library]. ACC: MOL.20051029.0324.
182067	ListServ 14.5 2007	Brune, R. 2007. "Birds at Ft. Churchil and Weber Reservoir." E-mail from R. Brune to NV Birders, April 21, 2006. ACC: MOL.20070815.0059.
174399	MO9901COV97208.000	MO9901COV97208.000. Coverage: NVLNDCVU. Submittal date: 01/21/1999.
174324	NatureServe 2004	NatureServe 2004. Landcover Descriptions for The Southwest Regional Gap Analysis Project. [Arlington, Virginia]: NatureServe. TIC: 257833.

174543	NDOA 2005	NDOA (Nevada Department of Agriculture) 2005. "Noxious Weed List." Reno, Nevada: Nevada Department of Agriculture, Plant Industry Division. Accessed August 30, 2005. TIC: 257697. URL: http://agri.nv.gov/nwac/PLANT_NoxWeedList.htm
174673	Newman 1992	Newman, D. 1992. Element Stewardship Abstract for Bromus Rubens. Arlington, Virginia: The Nature Conservancy. TIC: 257691.
174412	Ryser 1985	Ryser, F.A., Jr. 1985. Birds of the Great Basin. Great Basin Natural History Series. Reno, Nevada: University of Nevada Press. TIC: 257724.
174414	Stebbins 2003	Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians. 3rd Edition. New York, New York: Houghton Mifflin Company. TIC: 257592.
174498	Taylor 1992	Taylor, R.J. 1992. Sagebrush Country, A Wildflower Sanctuary. Missoula, Montana: Mountain Press Publishing Company. TIC: 257721.
174634	Thebeau and Huenfeld 2005	Thebeau, L. and Huenfeld, R. 2005. "Technical Review of RA-EIS Section 3.7 and Advice on Treatment of Plant Taxonomy." Record of conversation from L. Thebeau (Ageiss) and R. Huenefeld (Ageiss) to K. Ostler (Jason Associates), July 12, 2005. ACC: MOL.20050810.0039.
174505	Torell, Young, and Kvasnicka 2005	Torell, R.; Young, J.A.; and Kvasnicka, B. 2005. Halogeton Poisoning. Fact Sheet: 00-20. Reno, Nevada: University of Nevada, Cooperatvie Extension. TIC: 257665.
181899	USAF 2007	USAF (U.S. Air Force) 2007. "Draft Environmental Assessment for the Integrated Natural Resource Management Plan, Nellis Air Force Base and Nevada Test and Training Range, NV." Nellis Air Force Base - Environment. Nellis Air Force Base, Nevada: U.S. Department of the Air Force. Accessed July, 12, 2007. ACC: MOL.20070719.0378. URL: http://www.nellis.af.mil/library/environmental.asp

APPENDIX I

NOISE AND VIBRATION ASSESSMENT METHODOLOGY

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APPENDIX I

NOISE AND VIBRATION IMPACT ASSESSMENT METHODOLOGY

This appendix provides detailed information on the methodology DOE used to develop the assessment of potential impacts from noise and vibration described in Sections 4.2.8 and 4.3.8 of the Rail Alignment EIS (DOE/EIS-0639D).

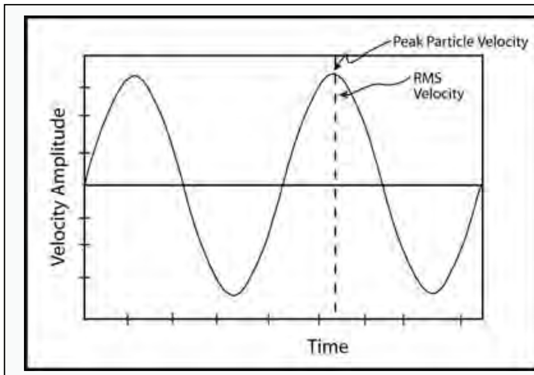
Section **I.4** defines terms shown in ***bold italics***.

I.1 Noise and Vibration Terminology

Noise is considered a source of pollution because it can be a human health hazard. Potential health hazards range from hearing impairment at very high noise levels to annoyance at moderate to high noise levels. Noise is defined as sound waves that are unwanted and perceived as a nuisance by humans. Sound waves are characterized by frequency and measured in ***hertz***; sound pressure level is expressed as ***decibels*** (dB).

With the exception of prohibiting nuisance noise, neither the State of Nevada nor local governments have established numerical noise standards. Many federal agencies use ***day-night average noise levels*** (DNL) as guidelines for land-use compatibility and to assess the impact of noise on people. Noise levels for perceptible frequencies are weighted (***A-weighted decibels*** [dBA]) to simulate the frequency response of the human ear.

Wayside noise refers collectively to train noise generated by steel wheels rolling on steel rail and diesel engine noise. Horn noise refers to the sound of locomotive warning horns, which are sounded at railroad crossings. Horn noise typically dominates over wayside noise at locations near grade crossings. There are three ground-vibration impacts of general concern: annoyance to humans, damage to buildings, and interference with vibration-sensitive activities. There are two measurements for evaluating ground vibration**:** ***peak particle velocity*** and ***root-mean-square velocity***. Peak particle velocity is the maximum instantaneous positive or negative peak of the vibration signal, measured as a distance per time (such as millimeters or inches per second). This measurement has been used historically to evaluate shock-wave type vibrations from actions like blasting, pile driving, and mining activities, and their relationship to building damage. The root-mean-square velocity is an average or smoothed vibration amplitude, commonly measured over 1-second intervals. It is expressed on a log scale in decibels (VdB) referenced to 0.000001 (10^{-6}) inch per second and is not to be confused with noise decibels (DIRS 155970-DOE 2002, p. 3-101). It is more suitable for addressing human annoyance and characterizing background vibration conditions because it better represents the response time of humans to ground vibration signals. A typical background level of ground vibration is



Peak Particle and Root-Mean-Square Vibration Velocity

52 VdB, and the human threshold for the perception of ground vibration is 65 VdB (DIRS 148155-Hanson, Saurenman, and Towers 1998, p. 46.17).

Vibration criteria for structural damage in fragile or extremely fragile buildings have separate structural criteria based on peak particle velocity and an approximation of VdB that have been segregated into impulse and rail impacts. Table I-1 lists these criteria.

Table I-1. Benchmark ground-vibration criteria for buildings and human annoyance.[a]

Category	Frequent events (more than 70 per day) VdB[b]	Infrequent events (fewer than 70 per day): Peak particle velocity (inches per second)[c]	Infrequent events (fewer than 70 per day): VdB	Impact of concern
Annoyance or interference				
Highly sensitive building[d]	65	NA[e]	65	Sensitive equipment
Residential[f]	72	NA	80	Human disturbance
Institutional[g]	75	NA	83	Human disturbance
Structural damage				
Fragile buildings	NA	0.20	Approximately 100 (Impulse) 92 (Rail)	Structural damage
Extremely fragile buildings	NA	0.12	Approximately 95 (Impulse) 88 (Rail)	Structural damage

a. Source: DIRS 177297- Hanson, Towers, and Meister 2006, pp. 8-3 and 12-13.
b. Root-mean-square velocity expressed in decibels (VdB) referenced to 10^{-6} inch per second.
c. To convert to millimeters per second, multiply by 25.4.
d. Buildings with vibration-sensitive equipment (for example, at research institutions and medical facilities).
e. NA = not applicable.
f. Homes or buildings where people sleep.
g. Schools, churches, and office buildings.

I.2 Noise Analysis Methodology

DOE used the following methods to determine if constructing and operating the proposed rail line would result in an increase of the DNL of 3 dBA and if the DNL would equal or exceed 65 dBA:
Noise Models – DOE used a wayside noise model, based on past Surface Transportation Board (STB) noise studies including *Conrail Acquisition Environmental Impact Statement* (DIRS 174622-STB 1997, all) and *Draft Environmental Assessment for the Canadian National/Illinois Central Acquisition Environmental Assessment* (DIRS 174623-Kaiser 1998, all). Section I.2.1 lists the equations for this model. The horn noise model is based on data from *Draft Environmental Impact Statement, Proposed Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings* (DIRS 174551-DOT 1999, all; the 1999 Federal Railroad Administration DEIS). The overall noise model results are sensitive to horn noise, locomotive and rail car noise, train length, and train speed. DOE used wayside reference levels, the horn noise model, and equations shown in this appendix to generate noise contours. Finally, DOE used Cadna (DIRS 178129-DataKustik n.d., all), an environmental noise computer program, to calculate building shielding effects, where appropriate. DOE selected the individual components of the overall noise model because of the size of the noise measurement database, statistical reliability, and other factors.

Measure Ambient Noise – To establish a baseline for determining if there would be a 3 dBA or greater increase in noise, DOE measured ambient noise in the study area at seven representative locations – Caliente, Garden Valley, Goldfield, Silver Springs, Schurz, Mina, and Silver Peak. Substantial train activity already exists in Caliente; therefore, DOE used a combination of modeling and measurements to determine the difference between existing and future noise levels in that area. DOE measured ***ambient noise levels*** using Norsonics 118 octave band analyzers. For low ambient sound environments, DOE used special low-noise 1-inch diameter precision microphones. DOE measured vibration levels with a Rion SA-77 narrow band analyzer and high sensitivity seismic accelerometers.

Estimate or Measure Existing and Future Noise Exposure – DOE estimated noise exposure in terms of the DNL using information on distances and noise propagation paths to sensitive receptors and future operation plans.

Count Noise-Sensitive Receptors – DOE estimated the number of noise-sensitive receptors within the 65 DNL noise contours for the Proposed Action and Shared-Use Option, or where the DNL would increase by at least 3 dBA. DOE used digital aerial photographs and Geographic Information System software to estimate the number of receptors, including residences, schools, and places of worship, within the 65 DNL noise contour for future train volumes. The final result of this analysis was an estimate of the total number of receptors likely to be exposed to a DNL of 65 dBA or greater and the number of receptors where the DNL would increase by at least 3 dBA under the Proposed Action or the Shared-Use Option.

I.2.1 WAYSIDE NOISE MODEL METHODOLOGY

Wayside noise refers collectively to noise the railcars and locomotives would generate. DOE used noise measurements of past STB noise studies (including DIRS 174622-STB 1997, all; DIRS 174623-Kaiser 1998, all) to establish the basis for the wayside noise level projections. Noise from railcars is caused by the steel wheels rolling on the steel rails. This sound is referred to as wheel/rail noise. Wheel/rail noise varies as a function of speed and can increase by as much as 15 dBA if wheels or rails are in poor condition. One of the most common problems that creates additional noise from wheels is the formation of flat surfaces on wheels caused by wheels sliding during hard braking.

The main components of locomotive noise are the exhaust of the diesel engines, cooling fans, general engine noise, and the wheel/rail interaction. Noise associated with the engine exhaust and cooling fans usually dominates; the noise level depends on the throttle setting (most locomotives have eight throttle settings) and not on locomotive speed.

Tests have shown that locomotive noise levels change by about 2 dBA for each step change in throttle setting, meaning that noise levels increase by about 16 dBA as the locomotive throttle is moved from notch one to notch eight (DIRS 174623-Kaiser 1998, all). Because locomotive engineers constantly adjust throttle settings as necessary, only rough estimates of throttle settings are usually available for noise projections. Numerous field measurements of freight train operations indicate that locomotive noise can be projected with reasonable accuracy by assuming a base condition of throttle position six and adjusting noise levels when better information about typical throttle position is known.
Given the maximum train passby sound level of freight cars and a locomotive under a specific set of reference conditions, the noise models allow estimating the maximum train passby sound level, the sound exposure level, the DNL, and other noise metrics for varying distances from the track, varying train speeds, and varying schedules. The standard approach to projecting railcar noise is to model cars as moving, incoherent (in other words, random), dipole line sources, wherein the cars are sources of sound moving in a straight line, which is equal in both directions from the track center line. The basic equations used for the wayside noise model are:

$$SEL_{cars} = L_{eqref} + 10\log(T_{passby}) + 30\log(S/S_{ref})$$

For locomotives, which can be modeled as moving monopole point sources, the corresponding equation is:

$$SEL_{locos} = SEL_{ref} + 10\log(N_{locos}) - 10\log(S/S_{ref})$$

The total train sound exposure level is computed by logarithmically adding SEL_{locos} and SEL_{cars}:

$$DNL_{100'} = SEL + 10\log(N_d + 10*N_n) - 49.4$$

$$DNL = DNL_{100'} + 15\log(100/D)$$

The parameters that apply to the equations above are:

SEL_{cars} = Sound Exposure Level of rail cars

L_{eqref} = Reference Level Equivalent of rail car (passby L_{eq})

T_{passby} = Train passby time, in seconds

S = Train speed, in miles per hour

S_{ref} = Reference train speed

SEL_{locos} = Sound Exposure Level of locomotive

SEL_{ref} = Reference Sound Exposure Level of locomotive

N_{locos} = Number of locomotives

N_d = Number of trains during daytime

N_n = Number of trains during nighttime

D = Distance from tracks, in feet

Table I-2 shows the reference noise levels used in this study.

Table I-2. Reference noise levels.[a]

Description	Average level (dBA)
Horn SEL 1st 0.125 mile[b,c]	107
Horn SEL 2nd 0.125 mile[b,c]	110
Locomotive SEL (40 miles per hour at 100 feet)[d]	95
Rail car L_{eq} (40 miles per hour at 100 feet)[e]	82

a. dBA = A-weighted decibels; L_{eq} = equivalent sound level; SEL = sound exposure level.
b. To convert miles to kilometers, multiply by 1.6093.
c. Source: DIRS 174551-DOT 1999, all.
d. Source: DIRS 174622-STB 1997, all.
e. Source: DIRS 174623-Kaiser 1998, all.

I.2.2 HORN NOISE MODEL METHODOLOGY

The key components in projecting noise exposure from horn noise are the horn sound level, the duration of the horn noise, the distance of the receptor from the tracks, and the number of trains running during daytime and nighttime hours.

The Federal Railroad Administration requires train engineers to sound horns when approaching public grade crossings unless a Quiet Zone has been established. Horn sounding is generally not required at private crossings. Federal Railroad Administration regulations in 49 CFR 229.129 require all lead locomotives to have an audible warning device that produces a minimum sound level of 96 dBA at a distance of 30 meters (100 feet) in front of the locomotive.

Most freight train audible warning devices are air horns. The maximum sound level of the air horns can usually be adjusted to some degree by adjusting the air pressure. Maximum sound levels are typically 105 to 110 dBA at 30 meters (100 feet) in front of the trains, well above the 96 dBA required by the Federal Railroad Administration.

The Federal Railroad Administration finalized its rule on horn noise on April 27, 2005 (*Use of Locomotive Horns at Highway-Rail Grade Crossings; Final Rule (*70 *Federal Register* 21843). This rule essentially provides communities with means to establish quiet zones in which horns are not sounded if sufficient safety measures are installed at grade crossings. The rule will also likely have an effect on horn noise levels nationally because of a number of changes in how horns will be sounded. For example, the rule limits the maximum level to 110 dBA. Previously, there were no maximum horn noise level limits. Additionally, the noise measurement technique used to establish horn noise levels will change and limits on how long horns can be sounded will be implemented. All of these changes will likely result in somewhat lower horn noise levels nationally.

Because of the high noise levels created by train horns, noise exposure is dominated by horn noise near any grade crossing where sounding horns is required. Additional noise sources associated with grade crossings are the grade-crossing bells that start sounding just before the gates are lowered and idling traffic that must wait at the crossing. Such noises are usually insignificant compared to the horn noise. Freight train horn noise levels can vary for a variety of reasons, including the manner in which an engineer sounds the horn. Consequently, it is important to base horn noise reference levels on a large sample size. A substantial amount of horn noise data is available from the 1999 Federal Railroad Administration DEIS (DIRS 174551-DOT 1999, all).

The Federal Railroad Administration data indicate that horn noise levels increase from the point at which the horn is sounded 0.40 kilometer (0.25 mile) from the grade crossing to when it stops sounding at the grade crossing. In the first 0.2-kilometer (0.125-mile) segment, the energy average sound exposure level measured at a distance of 30 meters (100 feet) from the tracks was found to be 107 dBA, and in the second 0.2-kilometer segment, 110 dBA. The 1999 Federal Railroad Administration DEIS (DIRS 174551-DOT 1999, all) simplified the horn noise contour shape as a five-sided polygon, when it is actually a teardrop shape. *Final Environmental Impact Statement, Construction and Operation of a Rail Line from the Bayport Loop in Harris County, Texas* (DIRS 173225-STB 2003, all) discusses this subject in detail. DOE used the more accurate teardrop horn noise contour shape for this analysis. The attenuation or drop-off rate of horn noise is assumed to be 4.5 dBA per doubling of distance away from the tracks (DIRS 174551-DOT 1999, all).

To properly calculate building shielding effects, both wayside and horn noise were characterized by representative frequency spectra. Low-frequency sound can diffract or bend more easily than high-frequency sound over or around buildings or terrain; therefore, it is important to model horn and wayside noise separately according to frequency content. Figures I-1 and I-2 show these representative horn and wayside noise spectra. The relative spectrum shapes and absolute noise levels shown in Table I-2 were used in the modeling.

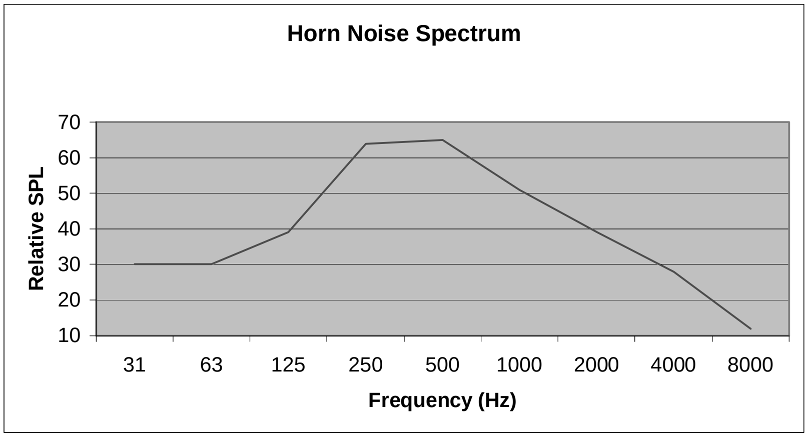


Figure I-1. Horn noise spectrum. (Source: DIRS 173225-STB 2003, p. 4-34. Hz = hertz; SPL = sound pressure level.)

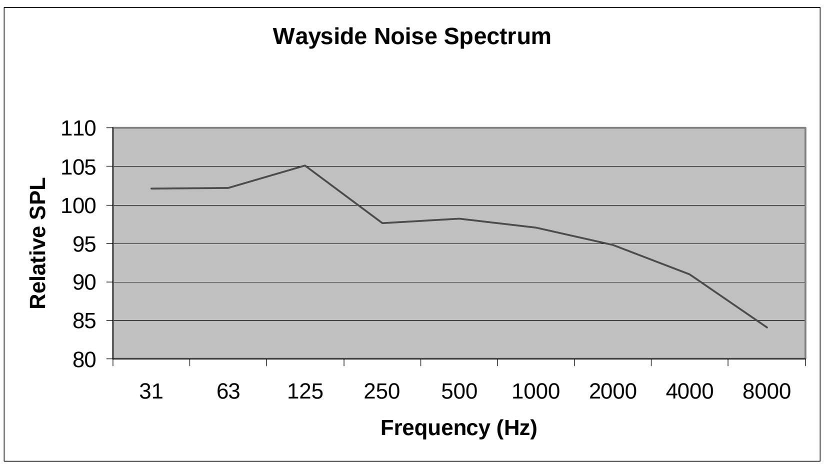


Figure I-2. Wayside noise spectrum. (Source: DIRS 173225-STB 2003, p. 4-34. Hz = hertz; SPL = sound pressure level.)

In general, the tear-drop shapes, shown in the figures in Section 4.2.8 and 4.3.8 of this EIS, are noise contours at grade crossings where horns might be sounded; noise contours shown in other areas are due to wayside noise. DOE used the noise contours in these figures, aerial photographs, and Geographic Information System software to identify and count any receptors that would be exposed to 65 DNL under the Proposed Action or the Shared-Use Option.

Counts of noise-sensitive receptors are approximate for several reasons, including changes in land use since the aerial photographs were taken (1994 to 2007), and difficulties in determining whether a structure is inhabited or uninhabited. In general, the approach was to count any structure within a noise contour as being inhabited. DOE also examined aerial photographs of portions of the proposed rail alignment not shown in these figures. However, these areas are generally uninhabited and no potential receptors were identified.

I.3 Vibration Analysis Methodology

The vibration analysis methodology is based on Federal Transit Administration Methods (DIRS 177297-Hanson, Towers, and Meister 2006, all).

I.3.1 CONSTRUCTION VIBRATION

Vibration due to construction activities, assuming point sources with normal propagation conditions, can be calculated on the basis of the following equation:

$$PPV_{equip} = PPV_{ref} \text{ x } (25/D)^{1.5}$$

Where: PPV_{equip} is the peak particle velocity in inches per second of the equipment adjusted for distance.

PPV_{ref} is the reference vibration level of equipment in inches per second at 25 feet.

D is the distance from the equipment to the receptor.

I.3.2 TRAIN VIBRATION

Vibration levels due to trains were estimated on the basis of generalized ground-surface vibration curves, as shown in Figure I-3.

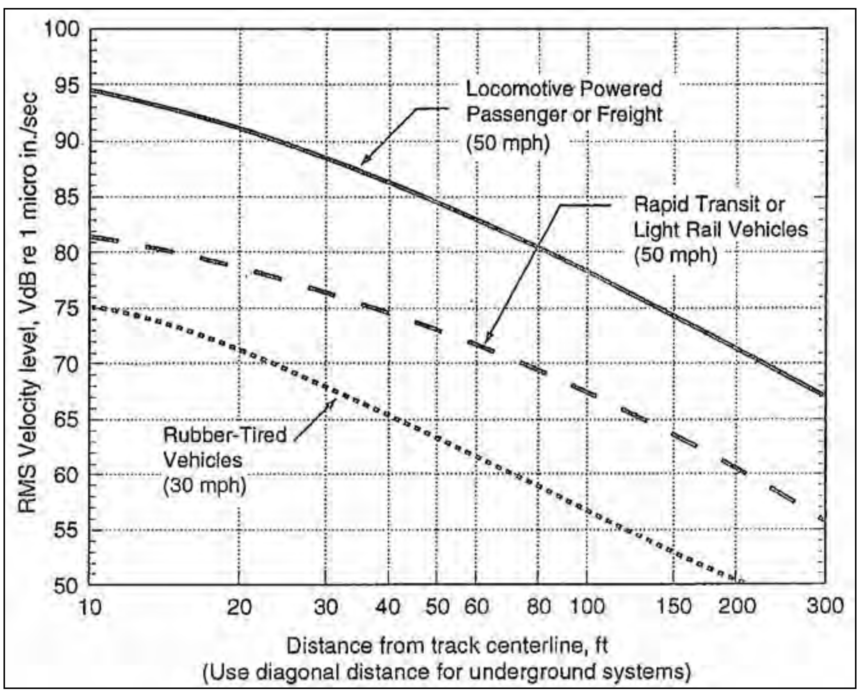


Figure I-3. Generalized ground surface vibration curves. (Source: DIRS 177297-Hanson, Towers, and Meister 2006.)

I.4 Glossary

ambient noise	The sum of all sounds (noise is unwanted sound) at a specific location over a specific time.
day-night average noise level	The energy average of ***A-weighted decibel*** sound levels over 24 hours, which includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the daytime.
decibel (dB)	A standard unit for measuring sound pressure levels based on a reference sound pressure of 0.0002 dyne per square centimeter. This is the smallest sound a human can hear.
decibel, A-weighted (dBA)	A frequency-weighted ***noise*** unit that corresponds approximately to the frequency response of the human ear and thus correlates well with loudness. It is widely used for traffic and industrial noise measurements.
hertz	A unit of frequency equal to one cycle per second.
peak particle velocity	The maximum instantaneous positive or negative peak of the vibration signal, measured as a distance per time (such as millimeters or inches per second). This measurement has been used historically to evaluate shock-wave type vibrations from actions like blasting, pile driving, and mining activities, and their relationship to building damage.
root mean-square velocity	An average or smoothed vibration amplitude, commonly measured over 1-second intervals. It is expressed on a log scale in ***decibels (VdB)*** referenced to 0.000001 (10^{-6}) inch per second and is not to be confused with noise ***decibels***.

I.5 References

178129	DataKustik [n.d.]	DataKustik [n.d.]. Cadna A, Software for Environmental Noise, Computer Aided Noise Abatement. Greifenberg, Germany: DataKustik. TIC: 258792.
155970	DOE 2002	DOE (U.S. Department of Energy) 2002. Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. DOE/EIS-0250. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314; MOL.20020524.0315; MOL.20020524.0316; MOL.20020524.0317; MOL.20020524.0318; MOL.20020524.0319; MOL.20020524.0320.
174551	DOT 1999	DOT (U.S. Department of Transportation) 1999. Proposed Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings. Washington, D.C.: U.S. Department of Transportation, Office of Railroad Development. ACC: MOL.20050824.0327.
148155	Hanson, Saurenman, and Towers 1998	Hanson, C.E.; Saurenman, H.J.; and Towers, D.A. 1998. "Rail Transportation Noise and Vibration." Chapter 46 of Handbook of Acoustical Measurements and Noise Control. Harris, C.M., ed. 3rd Edition. New York, New York: McGraw-Hill. TIC: 250744.

177297	Hanson, Towers, and Meister 2006	Hanson, C.E.; Towers, D.A.; and Meister, L.D. 2006. Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. Washington, D.C.: U.S. Department of Transportation, Federal Transit Administration. ACC: MOL.20060814.0190.
174623	Kaiser 1998	Kaiser, E.K. 1998. "Re: Railroad Control Application, Finance Docket No. 33556 — Canadian National — Control — Illinois Central: Release of Draft Environmental Assessment for Public Review and Comment." Letter from E.K. Kaiser (STB) to Interested Parties, November 9, 1998, with enclosure. ACC: MOL.20050824.0324.
174622	STB 1997	STB (Surface Transportation Board) 1997. Before the Surface Transportation Board, Finance Docket No. 33388, CSX Corporation and CSX Transportation, Inc., Norfolk Southern Corporation and Norfolk Southern Railway Company — Control and Operating Leases/Agreements — Conrail Inc. and Consolidated Rail Corporation. Railroad Control Application, Volume 6A of Environmental Report. CSX/NS-23. Washington, D.C.: Surface Transportation Board. ACC: MOL.20060404.0002.
173225	STB 2003	STB (Surface Transportation Board) 2003. Final Environmental Impact Statement, Construction and Operation of a Rail Line from the Bayport Loop in Harris County, Texas. Decision ID No. 33543. Finance Docket No. 34079. [Washington, D.C.]: Surface Transportation Board. ACC: MOL.20050418.0040.

APPENDIX J

SOCIOECONOMICS

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ACRONYMS AND ABBREVIATIONS

DIRS	Document Input Reference System
DOE	U.S. Department of Energy
EIS	environmental impact statement
FEIS	final environmental impact statement
LOS	level of service
REMI	Regional Economic Models, Inc.
SEIS	supplemental environmental impact statement

APPENDIX J

SOCIOECONOMICS

This appendix provides details to support the analysis results reported in Sections 4.2.9 and 4.3.9 of the Rail Alignment EIS.

Section J.2 defines terms shown in ***bold italics***.

J.1 INTRODUCTION

The U.S. Department of Energy (DOE or the Department) used an economic-demographic forecasting model known as *Policy Insight*, developed by Regional Economic Models, Inc. (REMI®) (DIRS 178610-Bland 2007, all), to generate employment, ***real disposable income***, and ***gross regional product*** data for Lyon, Mineral, Clark, Lincoln, Nye, Esmeralda, and Washoe Counties, and Carson City. *Policy Insight* is an eight-region model, seven of the regions being Lyon, Mineral, Clark, Lincoln, Nye, and Esmeralda Counties, and Washoe County-Carson City. Because of the configuration of the DOE version of the model, Carson City and Washoe County are considered as a single economic entity.

The REMI® model has been in use since 1980 to generate year-by-year estimates of the total regional effects of any specific policy initiative. For this analysis DOE used *Policy Insight*, version 9.0 (DIRS 182251-REMI 2007, all). The model has the following features:

- It is calibrated to local conditions using a relatively large amount of local data.
- It combines several different kinds of analytical tools (including economic-base, input-output, and econometric models).
- It allows users to manipulate an unusually large number of input variables and gives forecasts for an unusually large number of output variables.
- It allows users to generate forecasts for any combination of future years, allowing users special flexibility in analyzing the timing of economic impacts.
- It accounts for business cycles.

The description of existing economic conditions in the Caliente and Mina rail alignments regions of influence and the forecast values of populations, gross regional product, and real disposable income draw on data from version 9.0 of *Policy Insight*. The description implicitly includes revenue from the DOE Payments Equal to Taxes program, described in detail in the *Final* (Yucca Mountain FEIS; DIRS 155970-DOE 2001, p. 3-90), and the *Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain Nye County, Nevada* (Repository SEIS DOE/EIS-0250F-51). Revenue from this program is not described separately. Because the model is based on nationally collected data for which there is a lag between collection and issuance by the national agencies, and another lag before the data are incorporated into the *Policy Insight* model, there is always a gap of approximately 2 to 3 years between the current year and the last history year. The year 2004 is the last history year for the *Policy Insight* model (version 9.0) used in this baseline forecast.

To compensate for this time lag, the model's employment update feature is specifically designed to accommodate new historical data provided by users, which update the model's growth-rate assumptions. *Policy Insight* version 9.0 uses an employment update module that relies on data from the Nevada Department of Education, Training, and Rehabilitation for 2004 through 2006. This version also incorporates information from the latest Clark County population projections prepared by the University of Nevada, Las Vegas (DIRS 178806-CBER 2006, all) and the latest population projections developed by the Nevada State Demographer (DIRS 178807-Hardcastle 2006, all).

Impacts are stated in terms of the number of jobs, gross regional product, real disposable income, and state and local government spending. Direct economic effects are the changes in jobs, gross regional product, and income in sectors that would supply directly needed goods and services, such as heavy-duty equipment, during the proposed railroad construction and operations phase.

Items included as *Policy Insight* inputs include direct employment and costs, as follows:

- Employment in the following sectors:
  - Construction
  - Professional and Technical Services
  - Government Employees – Federal Civilian, State and Local
  - Administrative Support Services
  - Food services
  - Repair and Maintenance
  - Mining (surface mining for quarry sites)
  - Transportation
- For sectors for which wage data for the project are available, wage adjustments on the differential between project wages and model wages are made.
- Costs (increase in demand) for the following sectors are included:
  - Utilities
  - Wholesale Sales
  - Administrative Support Services
  - Construction
  - Mining (surface mining for quarry sites)
  - Accommodations
  - Food Services
  - Repair and Maintenance
  - Professional and Technical Services
  - Transportation

This appendix presents results from runs of *Policy Insight* version 9.0 (DIRS 182251-REMI 2007, all) made in March 2007 (DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all) for the Caliente rail alignment and in April 2007 (DIRS 180689-Bland 2007, all) for the Mina rail alignment. As described in Sections 4.2.9 and 4.3.9 of the Rail Alignment EIS, the *Policy Insight* model forecasts changes to baseline economic and demographic conditions that would be associated with the Proposed Action. For the Caliente rail alignment, DOE modeled two scenarios for this analysis, one with the Nevada Railroad

Control Center and National Transportation Operations Center in Lincoln County (Scenario 1) and one with these facilities in Nye County (Scenario 2). For the Mina rail alignment, DOE modeled two scenarios for this analysis, one with the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County (Scenario 1) and one with these facilities in Nye County (Scenario 2). This appendix provides results for both rail alignments from each scenario for each Nevada county in the socioeconomics region of influence (for the Caliente rail alignment, Lincoln, Nye, Esmeralda, and Clark Counties; for the Mina rail alignment, Lyon, Mineral, Nye, Esmeralda, and Clark Counties, and Washoe County-Carson City).

This appendix also describes the methodology used to quantify impacts to public services, level of service on roadways, and traffic delays at rail-highway grade crossings.

J.1.1 RAILROAD CONSTRUCTION – CALIENTE RAIL ALIGNMENT

Table J-1 lists percent changes to the baseline that would be associated with the Caliente rail alignment construction phase. The table lists data by county, but does not break the data down by scenario for Esmeralda and Clark Counties because the percent changes would be the same under either scenario. Lincoln and Nye Counties would experience slightly different percent changes under the two scenarios. Rail Alignment EIS Section 3.2.9, Table 3-61, lists baseline numbers. Section 4.2.9, Table 4-101, lists absolute changes to the baseline.

Table J-1. Percent changes from baseline during the construction phase – Caliente rail alignment[a] (page 1 of 2).

	Variable				
Year	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
			Lincoln County		
Scenario 1					
2010	0.89	4.56	1.28	4.11	28.36
2011	1.20	4.67	1.62	2.57	17.29
2012	1.42	5.55	1.87	3.01	19.99
2013	1.50	3.36	1.84	2.31	8.64
2014	1.65	2.86	1.91	2.95	3.83
Scenario 2					
2010	0.87	4.42	1.26	4.06	26.18
2011	1.16	4.67	1.61	2.56	17.29
2012	1.41	5.54	1.86	3.00	19.99
2013	1.49	3.35	1.83	2.31	8.64
2014	1.56	2.41	1.80	2.32	3.35
			Nye County		
Scenario 1					
2010	0.12	1.24	0.33	0.89	3.06
2011	0.13	1.08	0.34	0.56	2.44
2012	0.19	1.36	0.40	0.83	3.50
2013	0.23	0.87	0.36	0.62	2.00
2014	0.23	0.40	0.32	0.32	0.67

Table J-1. Percent changes from baseline during the construction phase – Caliente rail alignment[a] (page 2 of 2).

Year	Variable				
	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
Nye County *(continued)*					
Scenario 2					
2010	0.12	1.24	0.33	0.89	3.06
2011	0.13	1.08	0.34	0.56	2.44
2012	0.19	1.38	0.40	0.85	3.57
2013	0.24	0.90	0.37	0.64	2.11
2014	0.24	0.42	0.33	0.33	0.71
Esmeralda County					
2010	0.41	2.73	1.35	7.32	9.47
2011	0.69	2.73	1.79	7.35	1.15
2012	0.91	2.67	2.15	7.57	1.13
2013	0.99	1.92	2.01	4.10	4.47
2014	1.12	1.78	1.95	3.44	1.68
Clark County					
2010	0.02	0.14	0.02	0.17	0.15
2011	0.03	0.14	0.04	0.17	0.15
2012	0.04	0.14	0.05	0.17	0.15
2013	0.05	0.08	0.05	0.10	0.09
2014	0.04	0.04	0.05	0.06	0.05

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.

J.1.2 RAILROAD OPERATIONS – CALIENTE RAIL ALIGNMENT

Tables J-2 through J-5 list impacts associated with the railroad operation**s** phase for the Caliente rail alignment.

Table J-2. Changes from baseline for railroad operations[a] – Caliente rail alignment – Lincoln County (page 1of 4).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County					
2015	102	88	1,001,520	4,148,820	4,414,644
2016	114	89	1,138,761	4,311,450	4,595,292
2017	127	93	1,268,163	4,486,950	6,164,730
2018	136	93	1,375,569	4,609,800	6,415,110
2019	145	94	1,476,657	4,722,120	6,585,930

Table J-2. Changes from baseline for railroad operations[a] – Caliente rail alignment – Lincoln County (page 2 of 4).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2020	153	95	1,560,078	4,819,230	6,781,320
2021	160	95	1,640,340	4,915,170	6,950,970
2022	164	96	1,694,979	4,988,880	7,077,330
2023	167	96	1,734,291	5,048,550	7,176,780
2024	171	96	1,787,643	5,123,430	7,304,310
2025	174	96	1,828,242	5,191,290	7,427,160
2026	177	97	1,865,214	5,260,320	7,557,030
2027	178	97	1,894,113	5,322,330	7,651,800
2028	180	97	1,918,215	5,384,340	7,793,370
2029	181	98	1,947,699	5,451,030	7,933,770
2030	183	98	1,972,620	5,517,720	8,058,960
2031	184	98	1,994,265	5,585,580	8,186,490
2032	185	98	2,014,389	5,655,780	8,288,280
2033	186	99	2,033,109	5,729,490	8,434,530
2034	187	99	2,052,999	5,806,710	8,501,220
2035	187	99	2,068,677	5,882,760	8,542,170
2036	188	99	2,080,026	5,956,470	8,661,510
2037	188	100	2,088,918	6,029,010	8,773,830
2038	187	100	2,093,364	6,102,720	8,877,960
2039	187	100	2,098,863	6,182,280	8,994,960
2040	186	100	2,104,947	6,265,350	9,058,140
2041	185	100	2,101,788	6,342,570	9,009,000
2042	185	100	2,108,808	6,437,340	9,116,640
2043	186	100	2,119,338	6,540,300	9,257,040
2044	185	101	2,122,029	6,638,580	9,390,420
2045	185	101	2,124,252	6,740,370	9,337,770
2046	185	101	2,129,985	6,850,350	9,481,680
2047	186	101	2,140,281	6,973,200	9,637,290
2048	187	101	2,154,906	7,108,920	9,796,410
2049	188	102	2,169,882	7,251,660	9,961,380
2050	189	102	2,187,549	7,400,250	10,129,860
2051	190	102	2,196,324	7,429,933	10,170,492
2052	191	103	2,205,133	7,459,736	10,211,287
2053	191	103	2,213,978	7,489,658	10,252,246
2054	192	104	2,222,859	7,519,700	10,293,369

Table J-2. Changes from baseline for railroad operations[a] – Caliente rail alignment – Lincoln County (page 3 of 4).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2055	193	104	2,231,775	7,549,862	10,334,657
2056	194	105	2,240,727	7,580,146	10,376,111
2057	195	105	2,249,715	7,610,551	10,417,731
2058	195	105	2,258,739	7,641,078	10,459,518
2059	196	106	2,267,799	7,671,727	10,501,472
2060	197	106	2,276,895	7,702,499	10,543,595
2061	198	107	2,286,028	7,733,395	10,585,887
2062	198	107	2,295,198	7,764,415	10,628,348
2063	199	108	2,304,404	7,795,559	10,670,980
2064	200	108	2,313,647	7,826,828	10,713,782
2065	201	108	2,322,928	7,858,222	10,756,757
2066	202	109	2,332,245	7,889,742	10,799,904
2067	202	109	2,341,600	7,921,389	10,843,223
Scenario 2: Assuming Transportation Operations Center and Railroad Control Center in Nye County					
2015	88	66	865,952	2,890,066	3,394,153
2016	93	67	928,200	2,956,782	3,490,084
2017	99	70	990,336	3,055,036	4,990,050
2018	103	70	1,039,719	3,115,884	5,181,956
2019	107	71	1,088,399	3,175,589	5,298,965
2020	110	71	1,127,135	3,229,418	5,447,529
2021	114	71	1,166,568	3,286,739	5,571,557
2022	115	71	1,189,968	3,330,055	5,659,334
2023	116	72	1,205,187	3,366,325	5,724,845
2024	118	72	1,230,927	3,413,134	5,811,434
2025	119	72	1,249,652	3,456,441	5,898,005
2026	120	72	1,267,210	3,502,063	5,991,631
2027	121	72	1,280,072	3,543,030	6,051,292
2028	121	72	1,290,606	3,583,989	6,160,128
2029	122	73	1,305,812	3,629,619	6,265,411
2030	122	73	1,318,695	3,675,240	6,355,484
2031	123	73	1,330,399	3,723,193	6,449,127
2032	123	73	1,342,103	3,773,529	6,518,131
2033	124	73	1,353,799	3,826,170	6,631,586
2034	124	73	1,366,669	3,882,391	6,665,560
2035	125	74	1,377,208	3,937,390	6,674,937
2036	125	74	1,386,568	3,992,380	6,764,992

Table J-2. Changes from baseline for railroad operations[a] – Caliente rail alignment – Lincoln County (page 4 of 4).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2037	125	74	1,394,753	4,047,353	6,849,215
2038	125	74	1,399,438	4,101,190	6,925,300
2039	125	74	1,405,288	4,159,707	7,015,407
2040	125	74	1,412,308	4,221,709	7,049,355
2041	125	74	1,414,648	4,281,414	6,975,610
2042	125	74	1,421,672	4,351,648	7,051,695
2043	125	74	1,432,198	4,428,921	7,159,335
2044	126	75	1,439,222	4,504,979	7,264,635
2045	126	75	1,445,068	4,583,378	7,182,700
2046	126	75	1,453,271	4,667,618	7,295,020
2047	127	75	1,463,796	4,760,031	7,414,429
2048	128	75	1,476,662	4,861,786	7,536,075
2049	129	76	1,489,541	4,967,095	7,662,452
2050	130	76	1,503,585	5,075,913	7,790,034
2051	131	76	1,509,616	5,096,273	7,821,281
2052	131	77	1,515,671	5,116,715	7,852,653
2053	132	77	1,521,751	5,137,239	7,884,151
2054	132	77	1,527,855	5,157,845	7,915,776
2055	133	77	1,533,983	5,178,534	7,947,527
2056	133	78	1,540,136	5,199,306	7,979,405
2057	134	78	1,546,314	5,220,161	8,011,412
2058	134	78	1,552,517	5,241,100	8,043,547
2059	135	79	1,558,744	5,262,122	8,075,810
2060	135	79	1,564,996	5,283,229	8,108,204
2061	136	79	1,571,274	5,304,421	8,140,727
2062	136	80	1,577,576	5,325,698	8,173,380
2063	137	80	1,583,904	5,347,060	8,206,165
2064	138	80	1,590,257	5,368,508	8,239,081
2065	138	81	1,596,636	5,390,041	8,272,129
2066	139	81	1,603,040	5,411,661	8,305,309
2067	139	81	1,609,470	5,433,368	8,338,623

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.
b. Data expressed in dollars.

Table J-3. Changes from baseline for railroad operations[a] – Caliente rail alignment – Nye County (page 1 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County					
2015	143	56	617,270	3,587,624	7,035,854
2016	149	53	647,337	3,463,212	7,037,582
2017	154	54	675,180	3,446,165	7,775,518
2018	159	54	700,701	3,451,968	8,083,646
2019	163	55	724,280	3,483,277	8,349,515
2020	167	56	746,807	3,537,518	8,674,915
2021	171	58	768,362	3,607,239	8,974,574
2022	174	59	788,982	3,682,680	9,252,561
2023	178	61	809,415	3,761,070	9,509,683
2024	181	62	828,678	3,846,761	9,768,114
2025	184	63	846,988	3,930,861	10,025,514
2026	187	64	864,980	4,017,722	10,282,161
2027	190	65	881,781	4,105,752	10,501,982
2028	192	66	898,066	4,198,264	10,771,362
2029	195	67	914,468	4,289,665	11,029,737
2030	197	67	929,901	4,383,487	11,265,186
2031	199	68	944,747	4,482,375	11,504,339
2032	201	69	958,939	4,584,306	11,717,697
2033	203	70	972,732	4,692,086	11,963,537
2034	205	70	987,076	4,797,725	12,139,316
2035	207	71	1,001,103	4,901,715	12,279,437
2036	209	71	1,015,143	5,013,146	12,502,016
2037	211	72	1,030,038	5,130,696	12,736,016
2038	213	73	1,044,967	5,251,487	12,958,873
2039	215	73	1,060,563	5,377,659	13,204,573
2040	218	74	1,076,042	5,503,259	13,380,353
2041	220	74	1,091,321	5,634,252	13,451,389
2042	222	75	1,106,449	5,769,130	13,673,411
2043	224	75	1,121,846	5,913,320	13,930,531
2044	227	76	1,137,359	6,061,852	14,189,047
2045	229	77	1,152,569	6,211,565	14,247,826
2046	232	77	1,168,504	6,370,627	14,505,506
2047	235	78	1,184,451	6,539,107	14,787,421
2048	238	78	1,199,766	6,718,339	15,068,221
2049	240	79	1,216,215	6,904,041	15,349,300
2050	243	80	1,231,530	7,094,751	15,643,473
2051	247	81	1,248,771	7,194,076	15,862,478

Table J-3. Changes from baseline for railroad operations[a] – Caliente rail alignment – Nye County (page 2 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2052	250	82	1,266,254	7,294,792	16,084,549
2053	254	83	1,283,981	7,396,917	16,309,729
2054	257	84	1,301,957	7,500,472	16,538,062
2055	261	86	1,320,184	7,605,477	16,769,591
2056	265	87	1,338,666	7,711,952	17,004,361
2057	268	88	1,357,407	7,819,917	17,242,418
2058	272	89	1,376,410	7,929,394	17,483,808
2059	276	90	1,395,680	8,040,404	17,728,577
2060	280	92	1,415,219	8,152,968	17,967,773
2061	284	93	1,435,032	8,267,108	18,228,444
2062	288	94	1,455,122	8,382,845	18,483,638
2063	292	96	1,475,493	8,500,203	18,742,405
2064	296	97	1,496,150	8,619,204	19,004,794
2065	300	98	1,517,096	8,739,871	19,270,857
2066	304	100	1,538,335	8,862,227	19,540,644
2067	308	101	1,559,871	8,986,296	19,814,209
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	148	59	638,317	3,761,433	7,505,082
2016	154	56	671,990	3,640,104	7,517,835
2017	160	57	703,041	3,625,830	8,266,986
2018	166	58	731,507	3,635,892	8,588,151
2019	170	59	757,786	3,671,694	8,866,845
2020	175	60	782,777	3,731,130	9,205,911
2021	179	62	806,610	3,805,191	9,519,237
2022	183	63	829,378	3,885,921	9,811,269
2023	187	65	851,830	3,969,576	10,083,060
2024	191	66	872,925	4,061,421	10,356,138
2025	194	67	892,979	4,150,809	10,627,461
2026	197	68	912,542	4,243,239	10,897,848
2027	200	69	930,946	4,336,956	11,131,848
2028	203	70	948,659	4,435,119	11,415,456
2029	206	71	966,420	4,532,346	11,687,481
2030	208	72	983,151	4,630,626	11,936,808
2031	210	73	999,110	4,735,107	12,190,230
2032	213	73	1,014,449	4,842,747	12,417,327
2033	215	74	1,029,261	4,955,652	12,677,535
2034	217	75	1,044,611	5,067,855	12,867,075

Table J-3. Changes from baseline for railroad operations[a] – Caliente rail alignment – Nye County (page 3 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2035	219	75	1,059,611	5,178,303	13,021,749
2036	221	76	1,074,598	5,296,005	13,258,791
2037	224	77	1,090,463	5,420,142	13,507,533
2038	226	77	1,106,340	5,548,140	13,745,745
2039	228	78	1,122,908	5,680,584	14,006,304
2040	230	79	1,139,288	5,812,560	14,197,716
2041	233	79	1,155,515	5,951,673	14,283,477
2042	235	80	1,171,509	6,095,817	14,521,689
2043	238	80	1,187,784	6,247,215	14,794,767
2044	240	81	1,204,129	6,403,527	15,067,962
2045	243	81	1,220,252	6,561,126	15,143,778
2046	246	82	1,236,983	6,728,553	15,417,675
2047	249	83	1,253,807	6,905,925	15,716,844
2048	251	83	1,270,023	7,093,242	16,014,141
2049	255	84	1,287,351	7,288,398	16,312,491
2050	258	85	1,303,462	7,490,574	16,623,126
2051	261	86	1,321,710	7,595,440	16,855,846
2052	265	87	1,340,214	7,701,775	17,091,824
2053	269	88	1,358,976	7,809,598	17,331,105
2054	272	90	1,378,002	7,918,930	17,573,737
2055	276	91	1,397,293	8,029,794	17,819,765
2056	280	92	1,416,855	8,142,209	18,069,238
2057	284	94	1,436,691	8,256,198	18,322,203
2058	288	95	1,456,804	8,371,783	18,578,709
2059	292	96	1,477,199	8,488,986	18,838,807
2060	296	98	1,497,880	8,607,830	19,102,546
2061	300	99	1,518,850	8,728,337	19,369,977
2062	304	100	1,540,113	8,850,532	19,641,152
2063	309	102	1,561,674	8,974,437	19,916,124
2064	313	103	1,583,537	9,100,077	20,194,945
2065	317	105	1,605,707	9,227,476	20,477,670
2066	322	106	1,628,186	9,356,659	20,764,352
2067	326	108	1,650,980	9,487,650	21,055,049

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.
b. Data expressed in dollars.

Table J-4. Changes from baseline for railroad operations[a] – Caliente rail alignment – Esmeralda County (page 1 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County					
2015	14	11	124,992	895,739	701,737
2016	15	11	136,313	893,335	728,820
2017	16	11	144,510	894,511	755,607
2018	16	11	152,480	897,486	784,038
2019	17	12	159,981	902,288	813,518
2020	18	12	164,562	908,345	842,297
2021	18	12	170,427	916,626	872,824
2022	18	12	174,891	924,740	903,235
2023	19	12	179,358	933,682	934,366
2024	19	12	183,473	943,101	965,962
2025	19	12	187,003	952,491	997,910
2026	20	12	190,297	962,240	1,030,325
2027	20	13	193,123	972,228	1,063,083
2028	20	13	195,949	984,080	1,096,320
2029	20	13	198,655	995,349	1,130,029
2030	20	13	201,129	1,006,523	1,164,310
2031	20	13	203,601	1,018,011	1,199,533
2032	21	13	205,837	1,029,759	1,235,819
2033	21	13	207,838	1,041,843	1,272,097
2034	21	13	209,722	1,053,825	1,309,553
2035	21	13	211,253	1,065,446	1,346,993
2036	21	13	212,784	1,077,306	1,386,779
2037	21	13	214,314	1,089,716	1,426,590
2038	21	13	215,608	1,102,758	1,466,372
2039	21	13	217,253	1,116,247	1,508,500
2040	21	13	218,662	1,130,344	1,551,804
2041	21	13	219,956	1,144,791	1,595,102
2042	21	13	221,014	1,159,815	1,639,567
2043	21	13	221,836	1,169,539	1,685,205
2044	21	13	222,425	1,178,575	1,730,835
2045	21	13	222,778	1,189,156	1,777,661
2046	21	13	223,013	1,195,033	1,825,631
2047	21	13	223,129	1,212,666	1,874,780
2048	21	13	223,131	1,231,468	1,925,099
2049	21	14	223,013	1,251,441	1,976,596
2050	21	14	222,660	1,258,527	2,028,081
2051	21	14	223,088	1,260,945	2,031,977

Table J-4. Changes from baseline for railroad operations[a] – Caliente rail alignment – Esmeralda County (page 2 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2052	21	14	223,517	1,263,367	2,035,881
2053	21	14	223,946	1,265,795	2,039,793
2054	21	14	224,376	1,268,227	2,043,711
2055	21	14	224,808	1,270,663	2,047,638
2056	21	14	225,239	1,273,104	2,051,572
2057	21	14	225,672	1,275,550	2,055,514
2058	21	14	226,106	1,278,001	2,059,463
2059	21	14	226,540	1,280,456	2,063,419
2060	21	14	226,975	1,282,916	2,067,384
2061	21	14	227,411	1,285,381	2,071,356
2062	21	14	227,848	1,287,851	2,075,535
2063	22	14	228,286	1,290,325	2,079,323
2064	22	14	228,725	1,292,804	2,083,317
2065	22	14	229,164	1,295,288	2,087,320
2066	22	14	229,604	1,297,776	2,091,330
2067	22	14	230,046	1,300,270	2,095,348
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	14	11	125,053	895,279	701,735
2016	15	11	136,330	892,489	728,784
2017	16	11	144,525	893,387	755,563
2018	16	11	152,488	896,190	783,994
2019	17	12	159,981	900,867	813,476
2020	18	12	164,550	906,842	842,263
2021	18	12	170,403	915,050	872,789
2022	18	12	174,852	923,148	903,204
2023	19	12	179,305	932,078	934,331
2024	19	12	183,406	941,478	965,938
2025	19	12	186,921	950,866	997,877
2026	20	12	190,202	960,607	1,030,297
2027	20	13	193,015	970,600	1,063,048
2028	20	13	195,829	982,443	1,096,281
2029	20	13	198,525	993,717	1,129,985
2030	20	13	200,987	1,004,888	1,164,273
2031	20	13	203,450	1,016,392	1,199,496
2032	21	13	205,679	1,028,145	1,235,768
2033	21	13	207,672	1,040,224	1,272,045
2034	21	13	209,549	1,052,208	1,309,498

Table J-4. Changes from baseline for railroad operations[a] – Caliente rail alignment – Esmeralda County (page 3 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2035	21	13	211,074	1,063,834	1,346,936
2036	21	13	212,600	1,075,697	1,386,716
2037	21	13	214,125	1,088,147	1,426,524
2038	21	13	215,416	1,101,202	1,466,302
2039	21	13	217,058	1,114,713	1,508,413
2040	21	13	218,467	1,128,814	1,551,725
2041	21	13	219,759	1,143,266	1,595,204
2042	21	13	220,816	1,158,289	1,639,493
2043	21	13	221,639	1,168,040	1,685,123
2044	21	13	222,228	1,177,088	1,730,761
2045	21	13	222,582	1,187,680	1,777,574
2046	21	13	222,820	1,193,556	1,825,544
2047	21	13	222,938	1,211,162	1,874,689
2048	21	13	222,942	1,229,957	1,924,994
2049	21	14	222,827	1,249,907	1,976,496
2050	21	14	222,477	1,256,975	2,027,980
2051	21	14	222,905	1,259,390	2,031,877
2052	21	14	223,333	1,261,810	2,035,780
2053	21	14	223,762	1,264,234	2,039,692
2054	21	14	224,192	1,266,663	2,043,610
2055	21	14	224,623	1,269,097	2,047,537
2056	21	14	225,054	1,271,535	2,051,471
2057	21	14	225,487	1,273,978	2,055,412
2058	21	14	225,920	1,276,426	2,059,361
2059	21	14	226,354	1,278,878	2,063,317
2060	21	14	226,789	1,281,335	2,067,282
2061	21	14	227,225	1,283,797	2,071,253
2062	21	14	227,661	1,286,263	2,075,223
2063	22	14	228,099	1,288,734	2,079,220
2064	22	14	228,537	1,291,210	2,083,214
2065	22	14	228,976	1,293,691	2,087,217
2066	22	14	229,416	1,296,177	2,091,227
2067	22	14	229,857	1,298,667	2,095,245

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.
b. Data expressed in dollars.

Table J-5. Changes from baseline for railroad operations[a] – Caliente rail alignment – Clark County (page 1 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County					
2015	1008	74	4,087,278	13,340,457	10,872,342
2016	900	23	3,678,726	10,452,897	5,507,307
2017	798	1	3,288,905	8,488,935	2,705,040
2018	709	-3	2,937,741	7,346,898	1,704,924
2019	631	3	2,632,044	6,730,425	1,740,375
2020	563	13	2,364,008	6,533,748	2,320,344
2021	505	24	2,135,695	6,462,261	3,311,451
2022	457	36	1,941,311	6,703,281	4,195,854
2023	416	47	1,778,576	6,998,355	5,338,476
2024	382	57	1,641,522	7,311,096	6,301,620
2025	352	64	1,518,672	7,605,819	7,122,726
2026	326	71	1,416,718	7,909,083	7,801,326
2027	304	76	1,323,059	8,096,283	8,480,511
2028	283	79	1,241,113	8,363,745	8,890,245
2029	264	83	1,167,169	8,613,657	9,390,771
2030	249	85	1,102,362	8,801,676	9,712,170
2031	234	88	1,043,277	8,944,065	10,122,606
2032	222	89	994,196	9,221,355	10,586,511
2033	212	90	953,948	9,408,204	10,818,405
2034	204	91	921,656	9,702,576	11,229,777
2035	199	92	903,825	9,908,145	11,336,130
2036	195	93	885,912	10,140,741	11,640,096
2037	192	94	883,701	10,372,050	11,818,755
2038	192	94	884,871	10,631,439	12,228,957
2039	193	94	893,751	10,783,188	12,335,895
2040	197	94	912,717	11,050,533	12,694,968
2041	200	94	933,941	11,283,363	12,798,981
2042	206	95	958,511	11,568,141	13,173,966
2043	210	96	990,873	11,862,747	13,407,966
2044	218	96	1,023,165	12,256,569	13,830,453
2045	225	98	1,063,413	12,789,270	14,269,437
2046	234	99	1,104,656	13,339,755	14,725,737
2047	242	101	1,150,356	13,960,440	15,287,337
2048	251	105	1,191,715	14,516,424	15,991,209
2049	259	107	1,234,022	15,101,424	16,675,308
2050	267	110	1,267,473	15,927,210	17,496,180
2051	269	111	1,281,157	16,099,174	17,685,084

Table J-5. Changes from baseline for railroad operations[a] – Caliente rail alignment – Clark County (page 2 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2052	272	112	1,294,990	16,272,994	17,876,027
2053	275	113	1,308,972	16,448,691	18,069,032
2054	278	115	1,323,104	16,626,285	18,264,120
2055	281	116	1,337,390	16,805,797	18,461,315
2056	284	117	1,351,829	16,987,247	18,660,640
2057	287	118	1,366,425	17,170,655	18,862,116
2058	290	120	1,381,178	17,356,044	19,065,767
2059	294	121	1,396,090	17,543,435	19,271,617
2060	297	122	1,411,164	17,732,849	19,479,690
2061	300	124	1,426,400	17,924,308	19,690,010
2062	303	125	1,441,801	18,117,834	19,902,600
2063	307	126	1,457,367	18,313,450	20,117,485
2064	310	128	1,473,102	18,511,177	20,334,691
2065	313	129	1,489,007	18,711,040	20,554,241
2066	317	130	1,505,084	18,913,060	20,776,162
2067	320	132	1,521,334	19,117,262	21,000,480
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	1014	81	4,108,478	13,956,345	11,675,781
2016	907	30	3,707,742	11,113,479	6,248,151
2017	807	8	3,324,602	9,194,094	3,427,983
2018	719	3	2,980,142	8,034,273	2,356,614
2019	641	8	2,677,791	7,471,386	2,365,272
2020	575	18	2,415,336	7,230,015	2,972,034
2021	519	29	2,190,369	7,158,411	3,918,330
2022	471	41	2,001,566	7,426,224	4,891,770
2023	431	52	1,841,054	7,703,514	6,017,310
2024	397	62	1,708,469	8,034,156	6,997,770
2025	368	70	1,587,807	8,337,771	7,854,210
2026	343	77	1,487,070	8,650,044	8,586,630
2027	320	81	1,395,576	8,801,442	9,230,130
2028	300	85	1,316,952	9,095,814	9,711,000
2029	282	89	1,244,178	9,327,708	10,211,760
2030	266	91	1,179,360	9,524,736	10,551,060
2031	252	94	1,122,498	9,711,819	10,996,830
2032	240	95	1,073,475	10,015,902	11,497,590
2033	231	97	1,037,673	10,184,733	11,764,350
2034	223	98	1,006,434	10,470,213	12,230,010

Table J-5. Changes from baseline for railroad operations[a] – Caliente rail alignment – Clark County (page 3 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2035	219	99	991,926	10,738,260	12,407,850
2036	215	100	975,195	10,970,856	12,675,780
2037	212	100	972,972	11,237,850	12,889,890
2038	212	101	976,365	11,505,780	13,424,580
2039	213	101	988,650	11,649,105	13,549,770
2040	217	102	1,007,604	11,916,450	13,855,140
2041	221	102	1,031,004	12,193,740	14,066,910
2042	226	103	1,056,744	12,487,410	14,495,130
2043	232	103	1,091,259	12,737,790	14,746,680
2044	239	104	1,123,551	13,130,910	15,205,320
2045	247	105	1,166,022	13,691,340	15,608,970
2046	256	107	1,207,323	14,214,330	16,225,560
2047	264	109	1,250,730	14,835,600	16,787,160
2048	273	113	1,296,594	15,445,170	17,490,330
2049	281	115	1,336,725	16,030,170	18,174,780
2050	289	118	1,374,633	16,837,470	19,138,860
2051	292	120	1,389,475	17,019,262	19,345,499
2052	295	121	1,404,477	17,203,016	19,554,370
2053	298	122	1,419,641	17,388,755	19,765,496
2054	302	123	1,434,968	17,576,498	19,978,901
2055	305	125	1,450,461	17,766,269	20,194,610
2056	308	126	1,466,122	17,958,089	20,412,648
2057	312	128	1,481,951	18,151,980	20,633,041
2058	315	129	1,497,952	18,347,964	20,855,812
2059	318	130	1,514,125	18,546,064	21,080,990
2060	322	132	1,530,473	18,746,304	21,308,598
2061	325	133	1,546,997	18,948,705	21,538,664
2062	329	135	1,563,700	19,153,291	21,771,213
2063	332	136	1,580,583	19,360,086	22,006,274
2064	336	137	1,597,648	19,569,114	22,243,873
2065	340	139	1,614,898	19,780,399	22,484,036
2066	343	140	1,632,333	19,993,965	22,726,793
2067	347	142	1,649,957	20,209,837	22,972,171

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.
b. Data expressed in dollars.

J.1.3 RAILROAD CONSTRUCTION – MINA RAIL ALIGNMENT

Table J-6 lists percent changes to the baseline that would be associated with the Mina rail alignment construction phase. The table lists data by county, but does not break the data down by scenario for Lyon, Esmeralda, and Clark Counties because the percent changes would be the same for under either scenario. Mineral and Nye Counties would experience slightly different percent changes under the two scenarios. Section 3.3.9, Table 3-61, lists baseline numbers. Rail Alignment EIS Section 4.3.9, Table 4-245, lists absolute changes to the baseline. As a sensitivity analysis, the socioeconomic analysis for the Mina rail alignment assesses the impacts of the project's construction phase on the combined area of Washoe County-Carson City. This alternative analysis assumes that 50 percent of the construction workers come from the Washoe County-Carson City area. Table J-7 includes percent changes to the baseline for this combined area.

Table J-6. Percent changes from baseline for railroad construction – Mina rail alignment[a] (page 1 of 2).

	Variable				
Year	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
			Lyon County		
2010	0.00	0.02	0.00	0.02	0.04
2011	0.01	0.02	0.01	0.03	0.02
2012	0.01	0.02	0.01	0.03	0.02
2013	0.01	0.01	0.01	0.02	0.01
2014	0.01	0.01	0.01	0.01	0.01
			Mineral County		
Scenario 1					
2010	0.75	4.87	1.19	3.72	1.63
2011	1.08	5.36	1.53	4.19	13.97
2012	1.36	6.09	1.76	4.47	14.13
2013	1.36	3.47	1.45	2.62	7.21
2014	1.33	2.25	1.32	1.83	1.72
Scenario 2					
2010	0.74	4.78	1.18	3.70	1.52
2011	1.08	5.36	1.52	4.18	13.97
2012	1.35	6.09	1.75	4.47	14.13
2013	1.35	3.47	1.45	2.62	7.21
2014	1.27	1.87	1.27	1.42	1.52
			Nye County		
Scenario 1					
2010	0.04	0.42	0.12	0.29	0.58
2011	0.05	0.34	0.12	0.14	0.36
2012	0.09	0.54	0.16	0.32	0.80
2013	0.14	0.54	0.17	0.38	0.93
2014	0.15	0.19	0.16	0.17	0.27

Table J-6. Percent changes from baseline for railroad construction – Mina rail alignment[a] (page 2 of 2).

Year	Variable				
	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
			Nye County *(continued)*		
Scenario 2					
2010	0.04	0.34	0.13	0.15	0.37
2011	0.10	0.55	0.17	0.33	0.83
2012	0.15	0.56	0.18	0.40	1.02
2013	0.16	0.22	0.17	0.19	0.38
2014	0.15	0.09	0.16	0.12	0.15
			Esmeralda County		
2010	0.45	5.655	2.70	17.63	27.52
2011	0.68	6.136	3.04	17.90	10.03
2012	1.62	13.85	4.36	27.15	56.67
2013	2.46	11.07	4.10	18.78	53.00
2014	3.08	10.70	4.61	15.22	41.35
			Clark County		
2010	0.02	0.14	0.02	0.14	0.13
2011	0.03	0.14	0.03	0.14	0.13
2012	0.04	0.14	0.04	0.14	0.13
2013	0.04	0.06	0.04	0.06	0.06
2014	0.04	0.03	0.04	0.04	0.03

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007 all.

Table J-7. Percent changes from baseline on Washoe County-Carson City for railroad construction – Mina rail alignment[a].

Year	Variable				
	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
			Washoe County-Carson City		
2010	0.03	0.24	0.03	0.24	0.20
2011	0.06	0.24	0.06	0.24	0.21
2012	0.07	0.23	0.08	0.24	0.20
2013	0.07	0.08	0.07	0.09	0.07
2014	0.06	0.05	0.07	0.06	0.04

a. Source: DIRS 181590-Bland 2007, all.

J.1.4 RAILROAD OPERATIONS – MINA RAIL ALIGNMENT

Tables J-8 through J-12 list impacts associated with the railroad operations phase for the Mina rail alignment, and Table J-13 lists the results of the alternative analysis for the combined area of Washoe County-Carson City.

Table J-8. Changes from baseline for railroad operations[a] – Mina rail alignment – Lyon County (page 1 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	8	1	34,972	123,575	54,815
2016	8	1	35,669	121,762	51,188
2017	8	1	36,330	125,120	52,018
2018	8	1	36,956	126,079	52,861
2019	8	1	37,454	127,331	54,534
2020	8	1	37,799	129,425	56,066
2021	8	1	38,251	130,829	58,851
2022	8	1	38,423	132,643	60,945
2023	8	1	38,770	135,568	62,618
2024	8	1	39,187	137,101	64,724
2025	8	1	39,407	140,306	66,807
2026	8	1	39,789	143,372	69,603
2027	8	1	40,068	146,028	71,136
2028	9	1	40,241	148,262	72,809
2029	9	1	40,484	151,609	74,623
2030	9	1	40,693	155,926	76,296
2031	9	1	41,042	158,582	80,344
2032	9	1	41,286	162,630	81,175
2033	9	1	41,460	165,695	81,877
2034	9	1	41,705	169,287	86,054
2035	9	1	42,015	172,493	88,569
2036	9	1	42,260	174,342	89,681
2037	9	1	42,541	177,723	91,213
2038	9	1	43,033	183,866	94,010
2039	9	1	43,477	186,908	95,402
2040	9	1	43,934	190,219	99,017
2041	9	1	44,249	193,916	101,825
2042	9	1	44,706	198,374	103,206
2043	9	1	45,057	200,012	105,721
2044	9	1	45,607	207,558	109,348
2045	9	1	46,238	211,396	113,818
2046	9	1	46,800	218,685	116,602
2047	9	1	47,455	227,390	122,171
2048	9	1	48,075	234,070	123,856
2049	10	1	48,777	243,278	128,876
2050	10	1	49,339	249,959	134,164

Table J-8. Changes from baseline for railroad operations[a] – Mina rail alignment – Lyon County (page 2 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	10	1	50,128	253,958	136,311
2052	10	1	50,930	258,021	138,491
2053	10	1	51,745	262,150	140,707
2054	10	1	52,573	266,344	142,959
2055	10	1	53,414	270,606	145,246
2056	11	1	54,269	274,935	147,570
2057	11	2	55,137	279,334	149,931
2058	11	2	56,019	283,804	152,330
2059	11	2	56,916	288,344	154,767
2060	11	2	57,826	292,958	157,243
2061	11	2	58,752	297,645	159,759
2062	12	2	59,692	302,407	162,315
2063	12	2	60,647	307,246	164,912
2064	12	2	61,617	312,162	167,551
2065	12	2	62,603	317,156	170,232
2066	12	2	63,605	322,231	172,955
2067	13	2	64,622	327,386	175,723
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	8	1	33,543	104,187	43,101
2016	8	1	33,333	99,168	37,241
2017	7	1	33,122	100,148	36,679
2018	7	1	32,876	99,305	36,398
2019	7	1	32,572	99,023	37,798
2020	7	1	32,186	99,303	38,631
2021	7	1	31,975	99,445	40,582
2022	7	1	31,589	100,565	42,257
2023	7	1	31,378	102,517	43,510
2024	7	1	31,272	103,069	45,614
2025	7	1	31,108	104,881	47,007
2026	7	1	30,968	106,553	49,098
2027	7	1	30,897	108,926	49,791
2028	7	1	30,722	110,327	51,193
2029	6	1	30,721	112,978	52,863
2030	6	1	30,581	116,039	54,116
2031	6	1	30,825	118,274	56,770
2032	6	1	30,790	120,509	58,018

Table J-8. Changes from baseline for railroad operations[a] – Mina rail alignment – Lyon County (page 3 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	6	1	30,825	123,011	57,743
2034	6	1	30,895	125,914	61,505
2035	6	1	31,000	128,276	62,210
2036	6	1	31,140	130,126	63,041
2037	6	1	31,351	132,677	64,153
2038	6	1	31,631	136,723	66,388
2039	6	1	31,936	139,760	67,508
2040	6	1	32,251	142,524	70,012
2041	6	1	32,497	144,818	71,416
2042	7	1	32,813	148,445	71,690
2043	7	1	33,059	150,641	74,483
2044	7	1	33,469	155,952	76,437
2045	7	1	34,065	159,785	80,339
2046	7	1	34,521	165,680	82,293
2047	7	1	34,978	171,602	87,028
2048	7	1	35,492	176,885	87,037
2049	7	1	35,984	183,581	91,770
2050	7	1	36,475	189,152	94,837
2051	7	1	36,208	186,510	94,087
2052	7	1	36,788	189,494	95,593
2053	7	1	37,376	192,526	97,122
2054	7	1	37,974	195,607	98,676
2055	8	1	38,582	198,736	100,255
2056	8	1	39,199	201,916	101,859
2057	8	1	39,826	205,147	103,489
2058	8	1	40,464	208,429	105,144
2059	8	1	41,111	211,764	106,827
2060	8	1	41,769	215,152	108,536
2061	8	1	42,437	218,594	110,272
2062	8	1	43,116	222,092	112,037
2063	9	1	43,806	225,645	113,829
2064	9	1	44,507	229,256	115,651
2065	9	1	45,219	232,924	117,501
2066	9	1	45,942	236,651	119,381
2067	9	1	46,678	240,437	121,291

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-9. Changes from baseline for railroad operations[a] – Mina rail alignment – Mineral County (page 1 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	66	63	534,362	3,033,927	2,168,478
2016	68	62	552,813	3,081,312	2,170,584
2017	70	65	575,172	3,185,442	3,698,253
2018	71	64	593,307	3,222,063	3,809,754
2019	73	63	608,283	3,250,260	3,842,514
2020	74	63	618,930	3,274,830	3,915,288
2021	74	62	628,290	3,297,060	3,961,035
2022	75	62	634,257	3,315,780	3,986,424
2023	75	61	638,469	3,333,330	3,997,188
2024	75	61	641,511	3,349,710	4,019,652
2025	74	61	642,330	3,364,920	4,047,498
2026	74	60	641,979	3,380,130	4,081,194
2027	73	60	640,107	3,394,170	4,087,746
2028	73	60	637,767	3,409,380	4,146,246
2029	72	60	634,257	3,423,420	4,194,567
2030	71	59	630,279	3,438,630	4,229,082
2031	70	59	625,716	3,456,180	4,268,043
2032	69	59	621,387	3,474,900	4,280,445
2033	69	59	617,058	3,494,790	4,337,424
2034	68	59	613,548	3,517,020	4,316,013
2035	67	58	610,272	3,539,250	4,266,171
2036	67	58	607,464	3,561,480	4,303,494
2037	66	58	605,826	3,584,880	4,333,563
2038	66	58	604,422	3,609,450	4,360,239
2039	65	58	603,486	3,635,190	4,399,785
2040	65	58	603,018	3,663,270	4,378,842
2041	64	57	602,316	3,690,180	4,252,950
2042	64	57	601,848	3,720,600	4,273,074
2043	64	57	601,497	3,752,190	4,318,353
2044	64	57	601,380	3,786,120	4,367,376
2045	64	57	600,678	3,820,050	4,225,104
2046	63	57	600,093	3,857,490	4,275,531
2047	63	57	599,508	3,897,270	4,327,362
2048	63	57	598,923	3,940,560	4,382,820
2049	63	57	597,987	3,983,850	4,438,863
2050	63	57	596,466	4,027,140	4,496,544

Table J-9. Changes from baseline for railroad operations[a] – Mina rail alignment – Mineral County (page 2 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	62	57	594,075	4,010,998	4,478,521
2052	62	56	591,694	3,994,922	4,460,570
2053	62	56	589,322	3,978,909	4,442,691
2054	62	56	586,960	3,962,961	4,424,884
2055	61	56	584,608	3,947,077	4,407,148
2056	61	55	582,264	3,931,256	4,389,484
2057	61	55	579,931	3,915,499	4,371,890
2058	61	55	577,606	3,899,804	4,354,366
2059	60	55	575,291	3,884,173	4,336,913
2060	60	55	572,985	3,868,605	4,319,530
2061	60	54	570,688	3,853,099	4,302,216
2062	60	54	568,401	3,837,655	4,284,972
2063	59	54	566,123	3,822,273	4,267,797
2064	59	54	563,854	3,806,952	4,250,691
2065	59	53	561,594	3,791,693	4,233,653
2066	59	53	559,343	3,776,495	4,216,684
2067	59	53	557,101	3,761,358	4,199,783
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	58	44	469,946	2,012,871	1,530,465
2016	55	44	453,939	1,997,687	1,519,952
2017	54	46	446,230	2,055,043	3,042,087
2018	53	45	438,170	2,056,248	3,150,949
2019	51	45	430,344	2,057,461	3,182,539
2020	50	45	421,704	2,060,980	3,253,892
2021	49	45	414,341	2,065,651	3,297,165
2022	48	44	406,520	2,071,501	3,319,429
2023	47	44	399,157	2,077,369	3,325,349
2024	46	44	392,385	2,084,424	3,341,677
2025	45	43	385,248	2,091,418	3,362,737
2026	43	43	378,236	2,098,464	3,388,494
2027	42	43	371,099	2,105,501	3,386,154
2028	41	43	364,318	2,113,674	3,435,347
2029	40	43	357,298	2,120,711	3,473,887
2030	39	42	350,759	2,128,919	3,498,544
2031	39	42	344,441	2,139,449	3,527,794
2032	38	42	338,955	2,151,140	3,530,099

Table J-9. Changes from baseline for railroad operations[a] – Mina rail alignment – Mineral County (page 3 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	37	42	334,158	2,164,036	3,576,951
2034	36	42	330,301	2,178,102	3,545,379
2035	36	41	327,029	2,193,347	3,485,691
2036	36	41	324,451	2,207,335	3,512,619
2037	35	41	322,813	2,222,527	3,532,561
2038	35	41	321,652	2,237,737	3,548,837
2039	35	41	321,179	2,254,135	3,578,156
2040	34	41	320,950	2,271,755	3,546,584
2041	34	41	320,720	2,289,287	3,409,764
2042	34	41	320,841	2,309,195	3,419,019
2043	34	40	321,084	2,330,324	3,452,984
2044	34	40	321,669	2,353,742	3,490,459
2045	34	40	321,899	2,377,177	3,337,154
2046	34	40	322,029	2,402,951	3,375,834
2047	34	40	322,033	2,431,031	3,415,544
2048	34	40	321,929	2,461,521	3,458,938
2049	34	40	321,353	2,490,789	3,502,194
2050	34	40	320,304	2,519,986	3,546,654
2051	33	40	318,712	2,508,913	3,532,056
2052	33	40	317,435	2,498,857	3,517,899
2053	33	40	316,163	2,488,841	3,503,798
2054	33	39	314,895	2,478,865	3,489,754
2055	33	39	313,633	2,468,930	3,475,767
2056	33	39	312,376	2,459,034	3,461,835
2057	33	39	311,124	2,449,177	3,447,959
2058	33	39	309,877	2,439,361	3,434,139
2059	32	39	308,635	2,429,583	3,420,375
2060	32	39	307,398	2,419,845	3,406,665
2061	32	38	306,166	2,410,146	3,393,010
2062	32	38	304,939	2,400,485	3,379,411
2063	32	38	303,716	2,390,864	3,365,865
2064	32	38	302,499	2,381,281	3,352,374
2065	32	38	301,286	2,371,736	3,338,937
2066	32	38	300,079	2,362,230	3,325,554
2067	31	37	298,876	2,352,761	3,312,225

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-10. Changes from baseline for railroad operations[a] – Mina rail alignment – Nye County (page 1 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	84	16	362,670	1,558,161	1,743,161
2016	82	13	357,388	1,439,852	1,663,601
2017	81	15	353,392	1,400,823	2,268,491
2018	79	15	349,783	1,371,434	2,413,571
2019	78	15	346,723	1,363,383	2,501,460
2020	77	16	344,483	1,369,094	2,640,551
2021	76	16	343,231	1,385,055	2,752,731
2022	76	17	342,529	1,407,564	2,844,549
2023	75	17	342,880	1,433,916	2,913,439
2024	75	18	343,582	1,464,755	2,988,932
2025	75	18	344,518	1,495,175	3,067,879
2026	75	19	346,004	1,526,904	3,147,300
2027	75	19	347,677	1,558,355	3,191,342
2028	75	19	349,549	1,593,122	3,286,948
2029	75	20	351,737	1,627,191	3,369,739
2030	75	20	354,077	1,660,369	3,432,780
2031	75	20	356,417	1,696,221	3,500,640
2032	75	20	359,108	1,733,661	3,537,189
2033	76	21	361,799	1,774,611	3,620,259
2034	76	21	365,227	1,813,415	3,616,749
2035	76	21	368,655	1,851,327	3,584,601
2036	77	21	372,446	1,895,175	3,643,101
2037	77	21	376,810	1,939,635	3,694,302
2038	78	21	381,559	1,986,575	3,741,381
2039	78	21	386,556	2,031,786	3,801,051
2040	79	22	391,669	2,078,726	3,797,541
2041	80	22	396,817	2,124,635	3,679,650
2042	81	22	402,199	2,173,969	3,717,369
2043	81	22	407,616	2,228,959	3,779,712
2044	82	22	413,279	2,287,125	3,846,681
2045	83	22	418,895	2,342,115	3,712,689
2046	84	23	424,932	2,406,132	3,783,222
2047	85	23	430,829	2,471,985	3,856,599
2048	87	23	437,217	2,546,478	3,930,921
2049	88	23	443,418	2,621,691	4,009,032
2050	89	23	449,268	2,698,074	4,089,708

Table J-10. Changes from baseline for railroad operations[a] – Mina rail alignment – Nye County (page 2 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	90	24	455,557	2,735,847	4,146,963
2052	91	24	461,935	2,774,148	4,205,019
2053	93	24	468,402	2,812,985	4,263,889
2054	94	25	474,959	2,852,366	4,323,582
2055	95	25	481,609	2,892,299	4,384,111
2056	97	26	488,351	2,932,790	4,445,488
2057	98	26	495,188	2,973,849	4,507,724
2058	99	26	502,121	3,015,482	4,570,831
2059	101	27	509,150	3,057,698	4,634,821
2060	102	27	516,278	3,100,505	4,699,708
2061	103	27	523,506	3,143,911	4,765,502
2062	105	28	530,835	3,187,925	4,832,218
2063	106	28	538,266	3,232,556	4,899,868
2064	108	29	545,802	3,277,811	4,968,465
2065	109	29	553,443	3,323,699	5,038,023
2066	111	29	561,191	3,370,230	5,108,554
2067	112	30	569,048	3,417,413	5,180,072
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	87	17	379,045	1,623,843	2,134,782
2016	86	19	379,022	1,590,264	2,751,255
2017	86	19	378,951	1,565,460	2,908,386
2018	85	19	379,220	1,562,652	3,009,591
2019	85	20	379,993	1,572,714	3,161,925
2020	85	20	381,467	1,594,710	3,288,051
2021	85	21	383,304	1,621,971	3,393,117
2022	85	21	386,065	1,654,731	3,476,889
2023	85	22	388,978	1,690,416	3,567,330
2024	85	22	391,938	1,727,271	3,660,228
2025	86	23	395,378	1,764,009	3,753,711
2026	86	23	398,795	1,801,449	3,812,328
2027	86	24	402,340	1,841,346	3,921,138
2028	86	24	406,130	1,882,179	4,018,716
2029	87	24	409,968	1,920,906	4,096,521
2030	87	25	413,712	1,963,026	4,178,538
2031	88	25	417,620	2,005,497	4,228,380
2032	88	25	421,493	2,052,297	4,325,607

Table J-10. Changes from baseline for railroad operations[a] – Mina rail alignment – Nye County (page 3 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	89	25	426,009	2,097,342	4,336,605
2034	89	25	430,478	2,141,685	4,319,055
2035	90	26	435,416	2,191,293	4,391,829
2036	90	26	440,692	2,242,305	4,458,051
2037	91	26	446,378	2,296,242	4,519,593
2038	92	26	452,427	2,349,360	4,595,175
2039	93	26	458,582	2,403,414	4,606,524
2040	94	27	464,666	2,455,830	4,504,266
2041	95	27	471,065	2,515,383	4,557,267
2042	96	27	477,348	2,578,797	4,636,359
2043	97	27	484,029	2,643,615	4,718,727
2044	98	27	490,546	2,707,497	4,599,972
2045	99	28	497,426	2,779,686	4,688,658
2046	100	28	504,329	2,855,853	4,777,695
2047	101	28	511,559	2,937,285	4,870,944
2048	103	28	518,766	3,022,812	4,965,831
2049	104	29	525,564	3,110,328	5,062,941
2050	105	29	532,753	3,159,582	5,138,323
2051	107	29	540,211	3,203,815	5,210,258
2052	108	30	547,774	3,248,668	5,283,201
2053	110	30	555,443	3,294,149	5,357,164
2054	111	31	563,219	3,340,266	5,432,164
2055	113	31	571,104	3,387,029	5,508,213
2056	114	32	579,099	3,434,447	5,585,326
2057	116	32	587,207	3,482,528	5,663,520
2058	118	32	595,427	3,531,283	5,742,808
2059	119	33	603,763	3,580,720	5,823,206
2060	121	33	612,216	3,630,849	5,904,729
2061	123	34	620,787	3,681,680	5,987,394
2062	124	34	629,478	3,733,223	6,071,216
2063	126	35	638,290	3,785,487	6,156,212
2064	128	35	647,226	3,838,483	6,242,397
2065	130	36	656,287	3,892,221	6,329,789
2066	131	36	665,475	3,946,711	6,418,405
2067	19	7	97,912	535,275	1,256,385

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-11. Changes from baseline for railroad operations[a] – Mina rail alignment – Esmeralda County (page 1 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	37	46	333,646	3,537,174	6,485,641
2016	40	47	368,625	3,515,455	6,661,215
2017	44	47	403,848	3,518,072	6,841,384
2018	48	48	440,953	3,536,957	7,029,744
2019	51	50	477,822	3,567,475	7,222,791
2020	54	51	508,146	3,603,793	7,412,327
2021	58	52	544,785	3,649,456	7,610,042
2022	62	53	588,445	3,703,296	7,814,787
2023	66	54	633,748	3,761,814	8,020,707
2024	71	55	676,009	3,820,317	8,228,970
2025	74	56	710,077	3,876,457	8,432,552
2026	77	57	742,037	3,933,781	8,632,637
2027	79	58	772,007	3,991,131	8,836,219
2028	82	59	800,807	4,047,289	9,038,629
2029	84	59	828,436	4,101,124	9,241,057
2030	86	60	851,500	4,154,972	9,443,469
2031	88	61	873,043	4,209,969	9,651,746
2032	89	61	891,191	4,267,340	9,857,664
2033	90	62	907,464	4,324,667	10,062,427
2034	91	63	920,695	4,382,023	10,267,197
2035	92	63	930,298	4,437,045	10,470,785
2036	92	64	937,091	4,493,235	10,674,383
2037	92	64	942,596	4,550,589	10,879,159
2038	92	65	946,230	4,609,159	11,087,421
2039	92	65	950,563	4,668,872	11,294,520
2040	91	65	948,228	4,727,451	11,492,272
2041	90	66	941,446	4,786,011	11,698,200
2042	89	66	929,984	4,843,402	11,899,458
2043	87	66	914,191	4,893,709	12,098,358
2044	85	66	894,069	4,935,859	12,285,571
2045	83	66	874,061	4,983,868	12,484,484
2046	81	66	854,989	5,021,325	12,671,684
2047	79	66	837,320	5,086,893	12,870,597
2048	77	66	819,535	5,153,649	13,057,797
2049	76	66	801,631	5,222,744	13,268,410
2050	74	66	783,259	5,268,395	13,467,319

Table J-11. Changes from baseline for railroad operations[a] – Mina rail alignment – Esmeralda County (page 2 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	74	66	784,764	5,278,517	13,493,193
2052	74	66	786,272	5,288,659	13,519,117
2053	74	66	787,782	5,298,819	13,545,090
2054	74	66	789,296	5,309,000	13,571,114
2055	75	66	790,812	5,319,200	13,597,187
2056	75	66	792,332	5,329,419	13,623,311
2057	75	67	793,854	5,339,658	13,649,485
2058	75	67	795,379	5,349,917	13,675,709
2059	75	67	796,907	5,360,196	13,701,983
2060	75	67	798,438	5,370,494	13,728,308
2061	75	67	799,972	5,380,812	13,754,684
2062	76	67	801,509	5,391,150	13,781,110
2063	76	67	803,049	5,401,508	13,807,587
2064	76	67	804,592	5,411,885	13,834,115
2065	76	68	806,138	5,422,283	13,860,694
2066	76	68	807,687	5,432,700	13,887,323
2067	76	68	809,238	5,443,138	13,914,004
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	37	46	333,664	3,535,969	6,485,513
2016	40	47	368,575	3,513,757	6,661,035
2017	44	47	403,797	3,516,059	6,841,201
2018	48	48	440,893	3,534,774	7,029,571
2019	51	50	477,753	3,565,191	7,222,619
2020	54	51	508,062	3,601,469	7,412,164
2021	58	52	544,686	3,647,117	7,609,883
2022	62	53	588,330	3,700,962	7,814,628
2023	66	54	633,616	3,759,500	8,020,553
2024	71	55	675,859	3,818,040	8,228,830
2025	74	56	709,911	3,874,228	8,432,408
2026	77	57	741,857	3,931,588	8,632,489
2027	79	58	771,814	3,988,966	8,836,060
2028	82	59	800,602	4,045,152	9,038,475
2029	84	59	828,219	4,099,014	9,240,893
2030	86	60	851,273	4,152,890	9,443,310
2031	88	61	872,807	4,207,918	9,651,576
2032	89	61	890,948	4,265,301	9,857,498

Table J-11. Changes from baseline for railroad operations[a] – Mina rail alignment – Esmeralda County (page 3 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	90	62	907,215	4,322,659	10,062,255
2034	91	63	920,441	4,380,039	10,267,018
2035	92	63	930,039	4,435,072	10,470,596
2036	92	64	936,830	4,491,278	10,674,176
2037	92	64	942,333	4,548,656	10,878,954
2038	92	65	945,964	4,607,224	11,087,212
2039	92	65	950,297	4,666,950	11,294,293
2040	91	65	947,962	4,725,511	11,492,045
2041	90	66	941,181	4,784,072	11,697,974
2042	89	66	929,719	4,841,449	11,899,223
2043	87	66	913,928	4,891,799	12,098,123
2044	85	66	893,808	4,933,958	12,285,331
2045	83	66	873,804	4,981,990	12,484,244
2046	81	66	854,737	5,019,456	12,671,444
2047	79	66	837,071	5,085,032	12,870,349
2048	77	66	819,291	5,151,797	13,057,544
2049	76	66	801,392	5,220,887	13,268,166
2050	74	66	783,024	5,266,565	13,467,070
2051	74	66	784,529	5,276,684	13,492,944
2052	74	66	786,036	5,286,822	13,518,867
2053	74	66	787,546	5,296,979	13,544,840
2054	74	66	789,059	5,307,156	13,570,864
2055	75	66	790,575	5,317,352	13,596,937
2056	75	66	792,094	5,327,568	13,623,060
2057	75	67	793,616	5,337,804	13,649,233
2058	75	67	795,141	5,348,059	13,675,457
2059	75	67	796,668	5,358,334	13,701,731
2060	75	67	798,199	5,368,629	13,728,055
2061	75	67	799,733	5,378,943	13,754,430
2062	76	67	801,269	5,389,277	13,780,856
2063	76	67	802,808	5,399,632	13,807,332
2064	76	67	804,351	5,410,006	13,833,860
2065	76	68	805,896	5,420,400	13,860,438
2066	76	68	807,445	5,430,814	13,887,067
2067	76	68	808,996	5,441,247	13,913,748

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-12. Changes from baseline for railroad operations[a] – Mina rail alignment – Clark County (page 1 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	904	63	3,662,945	11,734,492	9,631,874
2016	803	21	3,286,151	9,158,889	5,096,391
2017	710	4	2,925,899	7,489,604	2,839,156
2018	627	2	2,601,864	6,524,786	2,062,276
2019	556	8	2,321,009	6,087,944	2,258,708
2020	494	17	2,075,309	5,908,934	2,811,814
2021	442	28	1,864,709	5,829,197	3,767,271
2022	397	39	1,686,761	6,034,685	4,677,098
2023	359	49	1,535,831	6,364,496	5,712,548
2024	328	58	1,408,192	6,649,976	6,569,597
2025	301	65	1,297,042	6,926,834	7,373,387
2026	277	71	1,203,333	7,185,404	7,998,167
2027	256	75	1,113,532	7,364,716	8,640,789
2028	237	78	1,041,066	7,632,214	9,033,617
2029	220	82	970,737	7,863,874	9,497,229
2030	206	83	910,541	7,997,686	9,818,687
2031	192	85	858,008	8,212,101	10,175,829
2032	181	86	814,554	8,462,481	10,550,534
2033	173	88	778,869	8,649,248	10,872,284
2034	166	88	747,618	8,908,684	11,211,279
2035	161	89	733,122	9,131,721	11,461,964
2036	159	90	719,714	9,381,236	11,764,994
2037	157	91	719,726	9,649,329	11,853,317
2038	156	91	718,544	9,864,013	12,193,214
2039	158	91	730,899	9,988,594	12,456,756
2040	161	91	746,460	10,211,631	12,673,557
2041	164	91	768,807	10,435,534	12,801,017
2042	170	91	791,154	10,622,864	13,152,614
2043	174	92	821,282	10,889,752	13,438,959
2044	181	92	847,946	11,273,512	13,795,517
2045	188	93	883,748	11,764,654	14,222,859
2046	195	95	921,609	12,279,454	14,714,856
2047	202	97	956,284	12,817,654	15,152,717
2048	209	99	990,853	13,350,308	15,784,517
2049	216	101	1,026,484	13,911,300	16,357,208
2050	222	103	1,057,831	14,567,108	17,142,314

Table J-12. Changes from baseline for railroad operations[a] – Mina rail alignment – Clark County (page 2 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	224	105	1,069,252	14,724,387	17,327,397
2052	226	106	1,080,797	14,883,364	17,514,478
2053	229	107	1,092,466	15,044,058	17,703,579
2054	231	108	1,104,261	15,206,486	17,894,722
2055	234	109	1,116,184	15,370,669	18,087,929
2056	236	110	1,128,235	15,536,623	18,283,221
2057	239	111	1,140,416	15,704,370	18,480,623
2058	242	113	1,152,729	15,873,928	18,680,155
2059	244	114	1,165,175	16,045,316	18,881,842
2060	247	115	1,177,755	16,218,555	19,085,707
2061	249	116	1,190,471	16,393,664	19,291,772
2062	252	118	1,203,325	16,570,664	19,500,063
2063	255	119	1,216,317	16,749,575	19,710,602
2064	258	120	1,229,449	16,930,418	19,923,414
2065	260	121	1,242,723	17,113,213	20,138,524
2066	263	123	1,256,141	17,297,982	20,355,957
2067	266	124	1,269,703	17,484,746	20,575,737
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	911	74	3,691,958	12,528,945	10,694,151
2016	813	32	3,326,322	10,060,479	6,194,331
2017	722	15	2,979,452	8,480,394	3,963,843
2018	642	13	2,666,582	7,533,513	3,204,864
2019	573	19	2,394,651	7,114,536	3,365,622
2020	514	28	2,156,766	6,917,625	3,945,474
2021	462	38	1,952,859	6,837,831	4,918,680
2022	419	49	1,781,606	7,061,184	5,837,130
2023	383	59	1,635,134	7,364,214	6,891,300
2024	352	68	1,513,079	7,685,496	7,747,740
2025	325	75	1,404,117	7,989,111	8,569,080
2026	303	81	1,312,740	8,274,474	9,247,680
2027	282	85	1,227,330	8,400,132	9,872,460
2028	264	88	1,155,960	8,694,504	10,300,680
2029	247	91	1,091,259	8,943,948	10,800,270
2030	233	93	1,032,174	9,077,796	11,139,570
2031	220	95	981,864	9,301,149	11,567,790
2032	210	97	938,457	9,578,322	11,997,180

Table J-12. Changes from baseline for railroad operations[a] – Mina rail alignment – Clark County (page 3 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	202	98	907,218	9,747,153	12,300,210
2034	195	99	879,255	10,024,443	12,747,150
2035	191	100	866,970	10,283,130	12,979,980
2036	188	101	853,632	10,497,006	13,300,560
2037	186	102	853,632	10,738,260	13,442,130
2038	186	102	856,908	11,006,190	13,906,620
2039	188	102	869,310	11,140,155	14,134,770
2040	191	102	887,094	11,389,950	14,405,040
2041	195	103	910,494	11,667,240	14,640,210
2042	200	103	934,011	11,881,350	15,045,030
2043	205	104	966,303	12,184,380	15,366,780
2044	212	104	995,202	12,576,330	15,848,820
2045	219	105	1,033,227	13,059,540	16,240,770
2046	228	107	1,071,135	13,582,530	16,857,360
2047	234	109	1,110,213	14,157,000	17,348,760
2048	242	112	1,149,291	14,743,170	18,087,030
2049	250	114	1,184,976	15,339,870	18,677,880
2050	256	117	1,220,778	15,995,070	19,641,960
2051	259	118	1,233,959	16,167,766	19,854,031
2052	262	119	1,247,281	16,342,327	20,068,392
2053	265	121	1,260,748	16,518,773	20,285,068
2054	268	122	1,274,360	16,697,124	20,504,083
2055	270	123	1,288,119	16,877,400	20,725,462
2056	273	124	1,302,027	17,059,623	20,949,232
2057	276	126	1,316,085	17,243,813	21,175,418
2058	279	127	1,330,294	17,429,992	21,404,046
2059	282	129	1,344,657	17,618,181	21,635,142
2060	285	130	1,359,175	17,808,402	21,868,733
2061	288	131	1,373,850	18,000,677	22,104,847
2062	292	133	1,388,683	18,195,027	22,343,510
2063	295	134	1,403,677	18,391,477	22,584,749
2064	298	136	1,418,832	18,590,047	22,828,594
2065	301	137	1,434,151	18,790,761	23,075,070
2066	304	139	1,449,635	18,993,642	23,324,209
2067	308	140	1,465,287	19,198,713	23,576,037

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-13. Changes from baseline for railroad operations[a] – Mina rail alignment – Washoe County-Carson City (page 1 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	313	24	1,434,226	4,404,941	3,276,281
2016	273	9	1,262,376	3,446,060	1,774,516
2017	238	2	1,108,539	2,767,354	1,055,586
2018	208	2	974,079	2,374,445	848,039
2019	182	4	859,158	2,153,210	877,009
2020	160	7	760,382	2,051,420	1,102,386
2021	142	11	677,024	2,037,052	1,383,197
2022	126	15	604,484	2,044,294	1,677,605
2023	113	18	544,175	2,089,078	1,954,672
2024	101	20	490,400	2,122,684	2,178,587
2025	91	23	443,528	2,182,027	2,392,252
2026	82	24	401,453	2,200,115	2,579,979
2027	73	25	362,068	2,213,424	2,695,809
2028	66	26	325,798	2,226,619	2,771,555
2029	59	27	293,506	2,246,725	2,861,212
2030	53	27	264,977	2,275,759	2,937,262
2031	47	28	239,588	2,323,620	3,003,729
2032	43	28	217,592	2,390,310	3,074,666
2033	40	28	201,068	2,447,749	3,138,069
2034	37	29	187,730	2,526,139	3,226,989
2035	35	29	179,909	2,588,695	3,307,064
2036	34	29	174,013	2,662,405	3,342,386
2037	34	29	172,979	2,740,682	3,400,886
2038	34	29	175,687	2,823,210	3,445,124
2039	34	29	179,944	2,858,635	3,490,321
2040	36	29	187,680	2,936,916	3,565,692
2041	38	29	197,789	3,039,444	3,583,476
2042	40	29	208,880	3,144,418	3,672,981
2043	42	29	220,884	3,264,928	3,739,788
2044	44	29	235,135	3,407,450	3,838,887
2045	47	30	250,544	3,569,974	3,949,803
2046	50	31	265,567	3,768,980	4,105,881
2047	52	31	280,940	3,978,515	4,288,986
2048	55	32	296,291	4,239,729	4,499,118
2049	58	33	309,898	4,517,218	4,704,336
2050	60	34	323,610	4,762,590	4,976,010

Table J-13. Changes from baseline for railroad operations[a] – Mina rail alignment – Washoe County-Carson City (page 2 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	61	35	327,610	4,821,460	5,037,518
2052	62	35	331,660	4,881,057	5,099,785
2053	62	35	335,760	4,941,391	5,162,823
2054	63	36	339,910	5,002,470	5,226,640
2055	64	36	344,111	5,064,305	5,291,245
2056	65	37	348,365	5,126,904	5,356,649
2057	66	37	352,671	5,190,277	5,422,862
2058	66	38	357,030	5,254,433	5,489,893
2059	67	38	361,433	5,319,382	5,557,752
2060	68	39	365,911	5,385,134	5,626,451
2061	69	39	370,434	5,451,698	5,695,998
2062	70	40	375,013	5,519,086	5,766,405
2063	71	40	379,648	5,587,306	5,837,683
2064	71	41	384,341	5,656,370	5,909,841
2065	72	41	389,092	5,726,287	5,982,892
2066	73	42	393,901	5,797,069	6,056,845
2067	74	42	398,770	5,868,725	6,131,713
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	313	24	1,433,250	4,398,246	3,231,649
2016	273	8	1,261,260	3,432,671	1,720,961
2017	238	2	1,106,586	2,753,964	995,327
2018	207	1	971,568	2,367,755	783,323
2019	182	3	856,368	2,146,516	821,223
2020	160	7	756,756	2,040,264	1,039,904
2021	141	10	672,840	2,010,276	1,311,786
2022	125	14	599,742	2,024,209	1,597,266
2023	112	17	538,875	2,077,920	1,878,804
2024	100	20	484,542	2,102,599	2,102,706
2025	90	22	437,391	2,157,480	2,307,456
2026	80	24	394,758	2,182,266	2,486,250
2027	72	25	354,816	2,213,424	2,606,544
2028	64	25	318,546	2,222,155	2,695,680
2029	58	26	286,254	2,240,035	2,771,946
2030	51	26	256,887	2,269,064	2,847,996
2031	46	27	231,498	2,319,156	2,910,006
2032	41	27	208,944	2,385,846	2,967,554

Table J-13. Changes from baseline for railroad operations[a] – Mina rail alignment – Washoe County-Carson City (page 3 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	38	27	192,699	2,452,211	3,035,414
2034	35	28	179,361	2,530,601	3,128,796
2035	33	28	170,703	2,604,311	3,199,950
2036	32	28	164,529	2,678,021	3,244,194
2037	32	28	162,936	2,754,071	3,302,694
2038	32	28	165,087	2,841,064	3,342,474
2039	32	28	169,065	2,869,794	3,374,280
2040	34	28	176,247	2,943,611	3,436,290
2041	35	28	185,796	3,028,285	3,454,056
2042	37	28	196,326	3,131,029	3,525,644
2043	39	28	208,611	3,251,539	3,597,014
2044	42	28	222,021	3,391,830	3,687,104
2045	44	29	236,880	3,552,120	3,798,036
2046	47	29	251,064	3,751,129	3,936,314
2047	50	30	266,157	3,951,745	4,114,890
2048	52	31	280,944	4,201,795	4,302,745
2049	55	32	294,003	4,481,510	4,499,084
2050	57	33	306,873	4,717,955	4,739,454
2051	58	33	310,666	4,776,273	4,798,037
2052	58	34	314,506	4,835,311	4,857,345
2053	59	34	318,394	4,895,080	4,917,385
2054	60	34	322,330	4,955,587	4,978,168
2055	61	35	326,314	5,016,842	5,039,703
2056	61	35	330,347	5,078,854	5,101,997
2057	62	36	334,431	5,141,633	5,165,062
2058	63	36	338,565	5,205,188	5,228,907
2059	64	37	342,749	5,269,528	5,293,540
2060	65	37	346,986	5,334,664	5,358,973
2061	65	38	351,275	5,400,604	5,425,214
2062	66	38	355,617	5,467,360	5,492,274
2063	67	38	360,013	5,534,941	5,560,163
2064	68	39	364,463	5,603,358	5,628,891
2065	69	39	368,968	5,672,620	5,698,469
2066	69	40	373,529	5,742,738	5,768,907
2067	70	40	378,146	5,813,723	5,840,215

a. Source: DIRS 181590-Bland 2007, all.
b. Data expressed in dollars.

J.1.5 PUBLIC SERVICES IMPACT ANALYSIS

To estimate potential impacts to public services, DOE assessed the changes to the county or community baseline capacity (assuming no railroad). This assessment, as described in detail in Sections 4.2.9 and 4.3.9 of the Rail Alignment EIS, is a qualitative analysis. To perform the analysis, DOE identified the relevant changes that would affect public services (population changes) and characterized the magnitude of the changes as either a positive or negative impact on public services. The analysis then qualitatively described whether the burden or benefit associated with the change would degrade or supplement the delivery of public services to the county or community. Using this methodology, DOE concluded whether impacts to the various public services in counties and communities would be small, moderate, or large.

J.1.6 TRAFFIC DELAY AT RAIL-HIGHWAY GRADE CROSSINGS

DOE estimated the delay road vehicles would experience at rail-highway grade crossings. For each grade crossing analyzed, DOE calculated the time that a given crossing would be closed for each train event and estimated the average delay per vehicle on that crossing in a 24-hour period. DOE used the following steps in the delay calculation:

<u>Step 1</u>: Calculation of blocked crossing time (T)

$$T = 0.5 + \frac{L}{V \times 88}$$

T	= Blocked crossing time per train event, in minutes.
0.5	= Time necessary for any warning devices (such as gates) to engage and disengage, in minutes. Not all crossings have gates, so blocked crossing times could be overestimated for such cases.
L	= Train length, in feet.
V	= Train speed, in miles per hour.
88	= Conversion factor from miles per hour to feet per minute.

<u>Step 2</u>: Calculation of average crossing delay per vehicle (D)

$$D = \frac{T \times \left[\frac{R_D}{(R_D - R_A)} \right]}{2}$$

D	= Average crossing delay per vehicle, in minutes.
R_D	= Vehicle departure rate[a], in vehicles per hour per lane.
R_A	= Vehicle arrival rate (average daily traffic divided by the number of lanes), in vehicles per hour per lane.
2	= Factor to account for the fact that vehicles do not experience delay for the entire time that crossing is blocked. Vehicles arrive, on average, at the midpoint of the train blocked crossing time.

a. Vehicle departure rate is a measure of the rate at which vehicles can return to free-flow speed from a state where vehicles are stopped. Vehicle departure rates depend on a number of factors such as the presence of warning signals, numbers and types of lanes, width of lanes, road grade, sight distance, curve radius, and traffic type. Because there were not enough data available to characterize each grade crossing, DOE used default values. This analysis assumes 1,800 vehicles per hour , 1,400 vehicles per hour for arterials, 900 vehicles per hour for collectors, and 700 vehicles per hour for local roads (DIRS 176524-TRB 2001, all).

Step 3: Calculation of the number of delayed vehicles per day (N_V)

$$N_V = \frac{T}{1,440} \times N_T \times ADT$$

N_V = Number of delayed vehicles per day.

N_T = Number of daily trains.[a]

ADT = Average daily traffic, in number of vehicles per day in both directions of traffic.

a. If different estimates for average train daily traffic were available, the highest estimate was considered.

Step 4: Calculation of average vehicle delay in a 24-hour period (D_{24}) in minutes

$$D_{24} = \frac{N_V}{ADT} \times D$$

J.1.7 LEVEL OF SERVICE ANALYSIS

The calculation of level of service (LOS) for baseline and adjusted scenarios is based on the methodology included in the Highway Capacity Manual for Class I two-lane highways (DIRS 176524-TRB 2001, Chapter 20). Two-lane highways can be divided in two types: Class I, on which users expect to drive at relatively high speeds; and Class II, on which users do not expect to travel at high speeds (that is, scenic/recreational routes). This section summarizes the complete methodology.

As described in Sections 3.2.9 and 3.3.9 of the Rail Alignment EIS, roadway performance can be characterized in terms of level of service, which is a qualitative ranking of traffic conditions experienced by roadway users. There are six levels of service that can characterize the performance of roadways, with level A representing the best operating conditions (free flow), and level F the worst.

The determination of the level of service of a given roadway is based on factors that affect how users perceive the quality of service they are receiving, such as speed, travel time, freedom to maneuver, traffic interruptions, and comfort. For Class I two-lane highways, level of service is determined in relation to percent of time-spent-following (PTSF) and average travel speed. PTSF is the average percent of travel time vehicles must travel behind slower vehicles due to the inability to pass on a two-lane highway. Table J-14 lists the criteria to determine level of service. If the passenger-car equivalent flow rate is higher than the highway capacity, the facility is oversaturated and the level is F.

Table J-14. Criteria to calculate LOS in Class I two-lane highways.[a]

Level of Service	Percent time-spent-following	Average travel speed (miles per hour)
A	Less than or equal to 35 percent	Greater than 55
B	Between 35 percent and 50 percent	Between 50 and 55
C	Between 50 percent and 65 percent	Between 45 and 50
D	Between 65 percent and 80 percent	Between 40 and 45
E	Greater than 80 percent	Less than or equal to 40

a. Source: DIRS 176524-TRB 2001, Chapter 20.

Calculation of PTSF

The PTSF is estimated based on the demand flow rate (V_p), the directional distribution of traffic, and the percentage of no-passing zones.

$$PTSF = 100 \times (1 - e^{-0.000879Vp}) + f_{d/np} \quad \text{where}$$

PTSF = percent time-spent-following

V_p = demand flow rate

$f_{d/np}$ = adjustment for the combined effect of the directional distribution of traffic and of the percentage of no-passing zones on percent time-spent-following

The flow rate V_p is an adjusted measure of traffic volume (in vehicles per hour), taking into account the percentage of daily traffic that occurs during the peak 15-minute period (peak-hour factor), a grade adjustment factor, and a heavy-vehicle adjustment factor that accounts for the percentage of trucks and recreational vehicles (RVs) on the road.

$$V_p = V / (PHF \times F_G \times F_{HV}) \quad \text{where}$$

V_p = passenger-car equivalent flow rate for peak 15-minute period (veh/h)

V = demand volume for the peak hour (veh/h)

PHF = peak-hour factor

F_G = grade adjustment factor

F_{HV} = heavy-vehicle adjustment factor

In all level of service calculations included in this analysis, the distribution of traffic within the peak hour is assumed to be uniform. Therefore, the peak-hour factor is assumed to be 1. All roadways are also assumed to be flat, so the grade adjustment factor is also 1. The heavy-vehicle adjustment factor varied by roadway segment.

Calculation of average travel speed

The average travel speed (ATS) is estimated from the free flow speed (FFS), the demand flow rate (V_p), and an adjustment factor for the percentage of no-passing zones.

$$ATS = FFS - 0.00776V_p - f_{np} \quad \text{where}$$

ATS = average travel speed (miles per hour)

FFS = Free flow speed (miles per hour)

V_p = demand flow rate (vehicles per hour)

f_{np} = adjustment for percentage of no passing zones

J.2 Glossary

gross regional product	The dollar value of all final goods and services produced in a given year in a specific region (such as the ***region of influence***).
real disposable income	The value of total income received after taxes; it is the income available for spending or saving; also referred to as ***real disposable personal income***.
real disposable personal income	See ***real disposable income***.
region of influence	The physical area that bounds the environmental, sociologic, economic, or cultural features of interest for the purpose of analysis.

J.3 References

178610	Bland 2007	Bland, J. 2007. "Baseline: REMI Policy Insight Version 9, Last History Year 2004." E-mail from J. Bland to E. Gormsen, January 10, 2007, with attachment. ACC: MOL.20070119.0084.
179558	Bland 2007	Bland, J. 2007. "Caliente RR REMI Changes to 2067." E-mail from J. Bland to P. Quick and E. Gormsen, March 1, 2007, with attachment. ACC: MOL.20070320.0418.
180485	Bland 2007	Bland, J. 2007. "Delivery of Revised REMI Runs for Caliente Corridor Rail Spur." E-mail from J. Bland to E. Gormsen and P. Quick, April 18, 2007, with attachment. ACC: MOL.20070427.0078.
180689	Bland 2007	Bland, J. 2007. "REMI Outputs: TCC/NTOC in Mineral County." E-mail from J. Bland to E. Gormsen and P. Quick, April 29, 2007, with attachment. ACC: MOL.20070511.0002.
180690	Bland 2007	Bland, J. 2007. "REMI Outputs - Mina Route - Primary Run." E-mail from J. Bland to E. Gormsen and P. Quick, April 29, 2007, with attachment. ACC: MOL.20070511.0003.
181590	Bland 2007	Bland, J. 2007. "RE: Timing of Analysis." E-mail from J. Bland to P. Quick, June 8, 2007, with attachment. ACC: MOL.20070705.0082.
178806	CBER 2006	CBER (Center for Business and Economic Research) 2006. Population Forecasts: Long-Term Projections for Clark County, Nevada, 2006-2035. Las Vegas, Nevada: University of Nevada, Las Vegas, Center for Business and Economic Research. TIC: 259006.
155970	DOE 2002	DOE (U.S. Department of Energy) 2002. Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. DOE/EIS-0250. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314; MOL.20020524.0315; MOL.20020524.0316; MOL.20020524.0317; MOL.20020524.0318; MOL.20020524.0319; MOL.20020524.0320.
178807	Hardcastle 2006	Hardcastle, J. 2006. Nevada County Population Projections, 2006 to 2026. Reno, Nevada: Nevada State Demographer's Office, Nevada Small Business Development Center. ACC: MOL.20070208.0133.
182251	REMI 2007	REMI Policy Insight V. 9.0.3. 2007. Windows XP. STN: 611543-9.0.3-00.
176524	Transportation Research Board 2001	Transportation Research Board 2001. Highway Capacity Manual 2000. HCM2000. Washington, D.C.: National Research Council, Transportation Research Board. TIC: 258170.

APPENDIX K

RADIOLOGICAL HEALTH AND SAFETY

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APPENDIX K

RADIOLOGICAL HEALTH AND SAFETY

K.1 Radiation and Human Health

K.1.1 RADIATION

Radiation is the emission and propagation of energy through space or through a material in the form of waves or bundles of energy called ***photons***, or in the form of high-energy ***subatomic particles***. Radiation generally results from atomic or subatomic processes that occur naturally. The most common kind of radiation is electromagnetic radiation, which is transmitted as photons. Electromagnetic radiation is emitted over a range of wavelengths and energies. Humans are most commonly aware of visible light, which is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation, which heats material when the material and the radiation interact, and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (which are more penetrating) includes ultraviolet radiation, which causes sunburn, and X-rays and ***gamma radiation***.

Ionizing radiation is radiation that has sufficient energy to displace ***electrons*** from atoms or molecules to create ***ions***. It can be electromagnetic (for example, X-rays or gamma radiation) or subatomic particles (for example, ***alpha***, ***beta***, or ***neutron radiation***). The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in the tissue or organism.

K.1.2 RADIOACTIVITY

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation. Usually the emitted radiation is ionizing radiation. The result of the process, called ***radioactive decay***, is the transformation of an unstable atom (a ***radionuclide***) into a different atom, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radioactive decay produces three main types of ionizing radiation—alpha particles, beta particles, and gamma or X-rays. Neutrons emitted during nuclear fission are another type of ionizing radiation. These types of ionizing radiation can have different characteristics and levels of energy and, thus, varying abilities to penetrate and interact with atoms in the human body. Because each type has different characteristics, each requires different amounts of material to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped by a thin layer of material such as a single sheet of paper. However, if radioactive atoms (called radionuclides) emit alpha particles in the body when they decay, there is a concentrated deposition of energy near the point where the radioactive decay occurs. Shielding beta particles requires thicker layers of material such as several reams of paper or several inches of wood or water. Shielding from gamma rays, which are highly penetrating, requires very thick material such as several inches to several feet of heavy material (for example, concrete or lead). Deposition of the energy by gamma rays is dispersed across the body in contrast to the local energy deposition by an alpha particle. Some gamma radiation will pass through the body without interacting with it. Shielding from neutrons, which are also highly penetrating, requires materials that contain light elements such as hydrogen.

In a nuclear reactor, heavy atoms such as uranium and plutonium can undergo another process, called ***fission***, after the absorption of a subatomic particle (usually a neutron). In fission, a heavy atom splits into two lighter atoms and releases energy in the form of radiation and the kinetic energy of the two new lighter atoms. The new lighter atoms are called ***fission products***. The fission products are usually unstable and undergo ***radioactive decay*** to reach a more stable state.

Some of the heavy atoms might not fission after absorbing a subatomic particle. Rather, a new nucleus is formed that tends to be unstable (like fission products) and undergo radioactive decay.

The radioactive decay of fission products and unstable heavy atoms is the source of the radiation from ***spent nuclear fuel*** and ***high-level radioactive waste*** that makes these materials hazardous in terms of potential human health impacts.

K.1.3 EXPOSURE TO RADIATION AND RADIATION DOSE

Radiation that originates outside of an individual's body is called external or direct radiation. Such radiation can come from an X-ray machine or from radioactive materials that directly emit radiation, such as radioactive waste or radionuclides in soil. Exposure to direct radiation can be mitigated by placing shielding, such as lead, between the source of the radiation and the exposed individual. Internal radiation originates inside a person's body following intake of radioactive material or radionuclides through ingestion or inhalation. Once in the body, the ***fate*** of a radioactive material is determined by its chemical behavior and how it is metabolized. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move rapidly through the gastrointestinal tract or be deposited in the lungs.

Exposure to ionizing radiation is expressed in terms of ***absorbed dose***, which is the amount of energy imparted to matter per unit mass. Often simply called ***dose***, it is a fundamental concept in measuring and quantifying the effects of exposure to radiation. The unit of absorbed dose is the ***rad***. The different types of radiation mentioned above have different effects in damaging the cells of biological systems. ***Dose equivalent*** is a concept that considers the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems, using a radiation-specific quality factor. The unit of dose equivalent is the ***rem***. In quantifying the effects of radiation on humans, other types of concepts are also used. The concept of ***effective dose equivalent*** is used to quantify effects of radionuclides in the body. It involves estimating the susceptibility of the different tissue in the body to radiation to produce a tissue-specific weighting factor. The weighting factor is based on the susceptibility of that tissue to cancer. The sum of the products of each affected tissue's estimated dose equivalent multiplied by its specific weighting factor is the effective dose equivalent. The potential effects from a one-time ingestion or inhalation of radioactive material are calculated over a period of 50 years to account for radionuclides that have long ***half-lives*** and long residence time in the body. The result is called the ***committed effective dose equivalent***. The unit of effective dose equivalent is the rem. Total effective dose equivalent is the sum of the committed effective dose equivalent from radionuclides in the body plus the dose equivalent from radiation sources external to the body (also in rem). All estimates of radiation dose in the Rail Alignment EIS, unless specifically noted otherwise, are total effective dose equivalents, which are quantified in terms of rem or ***millirem*** (mrem).

More detailed information on the concepts of radiation dose and dose equivalent are in publications of the National Council on Radiation Protection and Measurements (DIRS 101857-NCRP 1993, all) and the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) or external exposure to radionuclides (by ***groundshine*** or ***cloudshine*** [immersion]) to radiation dose are called ***dose conversion factors*** or ***dose coefficients***. The International Commission on Radiological Protection and federal agencies such as the U.S. Environmental Protection Agency (EPA) publish these factors (DIRS

172935-ICRP 2001, all; DIRS 175544-EPA 2002, all). They are based on original recommendations of the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The radiation dose to an individual or to a group of people can be expressed as the ***total dose*** received or as a ***dose rate***, which is dose per unit time (usually an hour or a year). ***Collective dose*** is the total dose to an exposed population. ***Person-rem*** is the unit of collective dose. Collective dose is calculated by summing the individual dose to each member of a population. For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 persons × 0.1 rem).

K.1.4 BACKGROUND RADIATION

Nationwide, on average, members of the public are exposed to approximately 360 millirem per year from natural and manmade sources (DIRS 101855-NCRP 1987, p. 53). About 60 millirem per year is from medical radiation and consumer products. About 300 millirem per year is from natural sources (DIRS 100472-NCRP 1987, p. 149). The largest natural sources are radon-222 and its radioactive decay products in homes and buildings, which contribute about 200 millirem per year. Additional natural sources include radioactive material in the earth (primarily the uranium and thorium decay series, and potassium-40) and cosmic rays from space filtered through the atmosphere. With respect to exposures resulting from human activities, the combined doses from weapons testing fallout, consumer and industrial products, and air travel (***cosmic radiation***) account for the remaining approximately 3 percent of the total annual dose. Nuclear fuel cycle facilities contribute less than 0.1 percent (0.05 millirem per year) of the total dose.

K.1.5 IMPACTS TO HUMAN HEALTH FROM EXPOSURE TO RADIATION

Exposures to radiation or radionuclides are often characterized as being acute or chronic. Acute exposures occur over a short period, typically 24 hours or less. Chronic exposures occur over longer periods (months to years); they are usually assumed to be continuous over a period, even though the dose rate might vary. For a given dose of radiation, chronic radiation exposure is usually less harmful than acute exposure because the dose rate (dose per unit time, such as rem per hour) is lower, providing more opportunity for the body to repair damaged cells.

K.1.5.1 Acute Exposures at High Dose Rates

Exposures to high levels of radiation at high dose rates over a short period (less than 24 hours) can result in acute radiation effects. Minor changes in blood characteristics might be noted at doses in the range of 25 to 50 rad. The external symptoms of radiation sickness begin to appear following acute exposures to levels of radiation of about 50 to 100 rad and can include anorexia, nausea, and vomiting. More severe symptoms occur at higher doses and can include death at doses higher than 200 to 300 rad of total body irradiation, depending on the level of medical treatment received. Information on the effects of acute exposures on humans was obtained from studies of the survivors of the Hiroshima and Nagasaki bombings and from studies following a multitude of acute accidental exposures.

Acute exposures have occurred following detonations of nuclear weapons, both in wartime and during weapons testing, and in other events involving testing of nuclear materials. In addition, there is a potential for acute exposures in the event of an accident at an operating nuclear electric generating station, although Nuclear Regulatory Commission regulations require that the electric utilities design their stations such that these events are extremely unlikely. Such exposures could occur only if there were a highly unlikely failure of the containment vessel surrounding the nuclear reactor and a large release of fission products from the generating station following an accident.

In contrast, accidents during the shipment of spent nuclear fuel or high-level radioactive waste do not have the potential to release sufficient fission products to lead to acute exposures that might immediately threaten the life of the surrounding public. This is because the fission product ***source term*** in the spent nuclear fuel would have decayed by a factor of 10,000 or more by the time DOE would ship the material to the proposed repository. Thus, there would not be sufficient energy generated by the fission products in the spent nuclear fuel being shipped to melt the fuel elements and vaporize fission products, as postulated for an accident at an operating nuclear electric generating station.

K.1.5.2 Chronic Exposures at Low Dose Rates

The radiation dose estimates discussed in the Rail Alignment EIS are associated with exposure to radiation at low dose rates. Such exposures can be chronic (continuous or nearly continuous), such as those to workers who are escorts. In some instances, exposures to low levels of radiation would be intermittent (for example, infrequent exposures to an individual from radiation emitted from shipping casks as they are transported). ***Cancer*** induction is the principal potential risk to human health from exposure to low levels of radiation. However, this cancer induction is a statistical process because exposure to radiation conveys only a chance of developing cancer, not a certainty. Furthermore, other causes, such as exposure to chemical agents, can induce cancer in individuals.

K.1.6 DOSE-TO-HEALTH EFFECT CONVERSION FACTORS

Cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. Radiological health impacts are expressed as the incremental changes in the number of expected fatal cancers (referred to as ***latent cancer fatalities***) for populations and as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on dose-to-health-effect conversion factors recommended by the Interagency Steering Committee on Radiation Standards (DIRS 174559-Lawrence 2002, all). The Interagency Steering Committee on Radiation Standards is comprised of eight federal agencies (the Environmental Protection Agency, the Nuclear Regulatory Commission, DOE, the Department of Defense, the Department of Homeland Security, the Department of Transportation, the Occupational Safety and Health Administration, and the Department of Health and Human Services), three federal observer agencies (the Office of Science and Technology Policy, the Office of Management and Budget, and the Defense Nuclear Facilities Safety Board), and two state observer agencies (Illinois and Pennsylvania). The Committee estimated that, for the general population and workers, a collective dose of 1 person-rem would yield 6×10^{-4} excess latent cancer fatalities.

Sometimes, calculations of the number of latent cancer fatalities associated with radiation dose do not yield whole numbers, and, especially in environmental applications, can yield numbers less than 1.0. For example, if each individual in a population of 100,000 received a total radiation dose of 0.001 rem, the collective radiation dose would be 100 person-rem and the corresponding estimated number of latent cancer fatalities would be 0.06 (100,000 persons × 0.001 rem × 0.0006 latent cancer fatalities per person-rem). How should one interpret a nonintegral number of latent cancer fatalities, such as 0.06? The answer is to interpret the result as a statistical estimate. That is, 0.06 is the average number of latent cancer fatalities that would result if the same exposure situation were applied to many different groups of 100,000 people. For most groups, no one would incur a latent cancer fatality from the 0.001 rem radiation dose each member would have received. In a small fraction of the groups (about 6 percent), one latent cancer fatality would result; in exceptionally few groups, two or more latent cancer fatalities would occur. The average number of latent cancer fatalities over all of the groups would be 0.06. The most likely outcome for any single group is zero latent cancer fatalities.

K.1.7 COMPARISON TO OTHER DOSE-TO-HEALTH EFFECT CONVERSION FACTORS

The dose-to-health effect conversion factor recommended by the Interagency Steering Committee on Radiation Standards is higher than the dose-to-health effect conversion factors used in the Yucca Mountain FEIS, 0.0004 latent cancer fatality per person-rem for workers and 0.0005 latent cancer fatality per person-rem for individuals among the general population (DIRS 155970-DOE 2002, p. 3-97). The dose-to-health effect conversion factors are similar to the lethality adjusted cancer risk coefficients published in 2007 by the International Commission on Radiological Protection in ICRP 103: *Recommendations of the ICRP*, 0.00041 per person-rem for workers and 0.00055 per person-rem for individuals among the general population. The dose-to-health effect conversion factor recommended by the Interagency Steering Committee on Radiation Standards is also similar to the dose-to-health effect conversion factors published by the National Research Council in the *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, p. 15), which ranged from 0.00041 to 0.00061 latent cancer fatality per person-rem for solid cancers and 0.000050 to 0.000070 latent cancer fatality per person-rem for leukemia, and the age-specific dose-to-health effect conversion factor published by the Environmental Protection Agency, 0.000575 latent cancer fatality per person-rem (DIRS 153733-EPA 2000, Table 7.3, p. 179).

K.1.8 LINEAR NO-THRESHOLD MODEL

The premise of the Linear No-Threshold Model, as used in radiation health effects research, is that there will be some risk, even at low radiation doses. The use of the Linear No-Threshold Model was reviewed in *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, all). The BEIR VII committee examined materials that included arguments that low doses of radiation are more harmful than the Linear No-Threshold Model would suggest. The BEIR VII committee concluded that radiation health effects research, taken as a whole, does not support this view.

K.1.9 RADIATION HORMESIS

The premise of radiation ***hormesis*** is that a threshold or decrease in effect exists at low radiation doses, and that use of the Linear No-Threshold Model exaggerates the health effects of low levels of ionizing radiation. The issue of radiation hormesis was also reviewed in *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, all). The BEIR VII committee did not accept the hypothesis that the risks are lower than predicted by the Linear No-Threshold Model, that they are nonexistent, or that low doses of radiation might even be beneficial. The BEIR VII committee concluded that there will be some risk, even at low radiation doses.

K.1.10 OTHER RADIATION HEALTH EFFECTS

Other health effects such as nonfatal cancers and genetic effects can occur as a result of chronic exposure to radiation. These other health effects were evaluated by the International Commission on Radiological Protection and are listed in Table K-1.

The dose-to-health effect conversion factors for cancer listed in Table K-1, 0.00041 per person-rem for workers and 0.00055 per person-rem for individuals among the general population, are based on cancer incidence data but include consideration of cancer lethality and life impairment. Table K-1 also lists dose-to-health effect conversion factors for heritable effects, 0.00001 per person-rem for workers and 0.00002 per person-rem for individuals among the general population. The total detriment, 0.00040 per person-rem for workers and 0.00060 per person-rem for individuals among the general population, is consistent with the dose-to-health effect conversion factor recommended by the Interagency Steering Committee on Radiation Standards. While DOE recognizes the existence of health effects other than fatal cancers, the Department has chosen to quantify the impacts in the Rail Alignment EIS in terms of latent cancer fatalities, in part because these other health effects are a small portion of the total detriment from exposure to radiation.

Radiation exposure has also been demonstrated to increase the risk of other diseases, particularly cardiovascular disease, in persons exposed to high therapeutic doses and also atomic bomb survivors exposed to more modest doses.

The issue of health effects other than cancer was reviewed in *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, all). The BEIR VII committee concluded that there was no direct evidence of increased risk of noncancer diseases at low doses, and data were inadequate to quantify this risk if it exists. Radiation exposure has also been shown to increase risks of some benign tumors, but the BEIR VII committee also concluded that data were inadequate to quantify this risk.

Table K-1. Detriment-adjusted nominal risk coefficients for cancer and genetic effects from exposure to radiation.

Population	Cancer (per rem)	Heritable effects (per rem)	Total (per rem)
Whole population	5.5×10^{-4}	2×10^{-5}	6.0×10^{-4}
Adults	4.1×10^{-4}	1×10^{-5}	4.0×10^{-4}

a. Source: ICRP Publication 103: *Recommendations of the ICRP*.

K.1.11 EXPOSURE IN UTERO

Studies of prenatal exposure or exposure in early life to diagnostic X-rays have shown that there is a significantly increased risk of leukemia and childhood cancer following a diagnostic dose of 1 to 2 rem to the embryo or fetus *in utero*. In recognition of this, exposure of declared pregnant workers is specifically addressed in DOE and Nuclear Regulatory Commission radiation protection regulations (10 Code of Federal Regulations [CFR] 835.206 and 10 CFR 20.1208), which limit the exposure of the embryo/fetus to 0.5 rem from the period of conception to birth.

K.2 Transportation Methods and Data

K.2.1 TRANSPORTATION ROUTES

K.2.1.1 Distances and Population Densities

There are many possible segments that could make up the rail alignment from its junction with the Union Pacific Railroad Mainline near Caliente, Nevada, to the repository, or its junction with the Union Pacific Railroad Mainline near Hazen, Nevada, to the repository. For the radiological transportation analyses, DOE composed four specific rail alignments from the possible segments, for both the Caliente and Mina rail corridors: (1) the rail alignment with the highest exposed population, (2) the longest distance rail alignment, (3) the rail alignment with the lowest exposed population, and (4) the shortest distance rail alignment. In addition, DOE evaluated potential radiological impacts to workers and the public at the possible locations of the Staging Yard (Caliente-Indian Cove, Caliente-Upland, Eccles-North, and Hawthorne).

The distances were determined using geographic information system data that described the rail alignment segments. The method used to estimate the population densities within 800 meters (0.5 mile) of the rail segments is described by Johnson and Michelhaugh (DIRS 181276-Johnson and Michelhaugh 2003, Section 2.5). The population densities were determined using 2000 census data for an 800-meter (0.5-mile) band on either side of the rail alignment for urban, rural, and suburban population density zones. Urban areas were defined as areas with a population density greater than 3,326 people per square kilometer. Rural areas were defined as areas with a population density of less than 139 people per square kilometer. Suburban areas were areas with a population density between 139 and 3,326 people per square kilometer. Table K-2 lists the distance and population densities for the rail alignments. There are no urban areas along the rail alignments.

For the four potential Staging Yard locations, the population densities were determined for an 800-meter (0.5-mile) area around the Staging Yard footprint. Three of the potential Staging Yard locations (Eccles-North, Caliente-Upland, and Caliente-Indian Cove) are in Lincoln County. The Staging Yard at Hawthorne would be in Mineral County. Based on 2000 census data, there would be no residents within 800 meters of the Staging Yard at Hawthorne. Table K-3 lists the population densities for the Staging Yard locations.

K.2.1.2 Population Escalation Factors

The population densities presented in Tables K-2 and K-3 are based on 2000 census data. In the radiological transportation analyses, the estimated population impacts were escalated to the year 2067 to account for potential population growth along the rail alignments and near the Staging Yard locations during operation of the proposed railroad. The population escalation factors are based on U.S. Census Bureau 2000 data and population forecasts developed using the Regional Economics Model, Inc., REMI *Policy Insight* model (DIRS 174681-REMI 2004, all), which is updated with population projections to 2024 from the Nevada State Demographer (DIRS 174313-Nevada State Demographer [n.d.], all). Table K-4 lists the escalation factors.

K.2.2 SHIPMENTS

Estimates of shipments of spent nuclear fuel and high-level radioactive waste to the repository have been developed incorporating the use of transport, aging, and disposal canisters and updated cask-handling assumptions at each reactor site. Table K-5 summarizes the number of rail casks that would be shipped to the repository under the Proposed Action. Using these estimates, there would be 9,495 rail casks shipped under the Proposed Action (DIRS 181377-BSC 2007, Section 7). The 9,495 rail casks would be shipped using 2,833 trains.

K.2.3 INCIDENT-FREE TRANSPORTATION

Radiation doses during normal, incident-free transportation of radioactive materials results from exposure of workers and the public to the external radiation field that surrounds the shipping containers. The radiation dose is a function of the number of people exposed, their proximity to the containers, their length of time of exposure, and the intensity of the radiation field surrounding the containers. The intensity of the radiation field around the spent nuclear fuel or high-level radioactive waste shipping container was assumed to be at its regulatory maximum, 10 millirem per hour at 2 meters (80 inches) from the railcar that holds the shipping container [10 CFR 71.47(b)(3)]. In addition, because most spent nuclear fuel and high-level radioactive waste would be placed in canisters before being shipped, the intensity of the radiation field around an empty shipping container was assumed not to contribute to the radiation dose for workers or members of the public.

Table K-2. Distances and population densities for the Caliente and Mina rail alignments (page 1 of 2).

Rail alignment	Segment	Total exposed population	Total distance (km)[b]	County	Urban distance (km)[b]	Suburban distance (km)[b]	Rural distance (km)[a]	Urban density (people/km^2)[c]	Suburban density (people/km^2)[c]	Rural density (people/km^2)[b]
Caliente rail alignment[a]										
Highest population	Caliente	279	538.9	Lincoln	0	0.35	148.75	0	133.65	0.64
				Nye	0	0	358.64	0	0	0.10
				Esmeralda	0	0.12	31.08	0	221.43	0.24
Shortest distance	Caliente	213	527.4	Lincoln	0	0.35	138.81	0	133.65	0.55
				Nye	0	0	384.75	0	0	0.10
				Esmeralda	0	0	3.44	0	0	0
Longest distance	Eccles	112	541.1	Lincoln	0	0	134.88	0	0	0.16
				Nye	0	0	375.02	0	0	0.10
				Esmeralda	0	0.12	31.08	0	221.43	0.24
Lowest population	Eccles	78	530.2	Lincoln	0	0	134.88	0	0	0.16
				Nye	0	0	391.87	0	0	0.10
				Esmeralda	0	0	3.44	0	0	0
Mina rail alignment										
Highest population	Hazen	941	545.8	Churchill	0	0	18.61	0	0	5.76
				Lyon	0	0.88	89.09	0	121.98	4.33
				Mineral	0	0	0154.81	0	0	0.38
				Esmeralda	0	0.11	132.76	0	221.43	0.058
				Nye	0	0	149.55	0	0	0.22
Shortest distance	Hazen	904	520.5	Churchill	0	0	17.70	0	0	6.06
				Lyon	0	0.88	76.01	0	121.98	4.86
				Mineral	0	0	149.23	0	0	0.49
				Esmeralda	0	0	151.06	0	0	0.029
				Nye	0	0	125.67	0	0	0.26

Table K-2. Distances and population densities along the Caliente and Mina rail alignments (page 2 of 2).

Rail alignment	Segment	Total exposed population	Total distance (km)[b]	County	Urban distance (km)[b]	Suburban distance (km)[b]	Rural distance (km)[b]	Urban density (people/km^2)[c]	Suburban density (people/km^2)[c]	Rural density (people/km^2)[c]
Mina rail alignment (*continued*)										
Longest distance	Hazen	901	569.8	Churchill	0	0	32.05	0	0	3.34
				Lyon	0	0.88	85.69	0	121.98	4.49
				Mineral	0	0	145.77	0	0	0.39
				Esmeralda	0	0	175.17	0	0	0.0035
				Nye	0	0	130.24	0	0	0.25
Lowest population	Hazen	878	558.3	Churchill	0	0	17.70	0	0	6.06
				Lyon	0	0.88	75.83	0	121.98	4.87
				Mineral	0	0	163.07	0	0	0.36
				Esmeralda	0	0	175.17	0	0	0.0035
				Nye	0	0	125.67	0	0	0.26

a. There are no urban areas along the Caliente rail alignment.
b. km = kilometers; to convert kilometers to miles, multiply by 0.621371.
c. km^2 = square kilometers; to convert people per square kilometer to people per square mile, multiply by 2.589988.

Table K-3. Population densities near possible locations for the Staging Yard.

Location[a]	Exposed population	Population density (people per square kilometer)[b]
Caliente-Indian Cove	8	1.56
Caliente-Upland	2	0.384
Eccles-North	2	0.234
Hawthorne	0	0

a. The Caliente and Eccles Staging Yard locations would be in Lincoln County, Nevada; the Hawthorne Staging Yard location would be in Mineral County, Nevada.
b. To convert people per square kilometer to people per square mile, multiply by 2.589988.

Table K-4. Population escalation factors.

County	2000 population	Estimated 2067 population	Escalation factor
Churchill	24,157	53,524	2.2157
Esmeralda	1,061	1,084	1.0219
Lincoln	4,165	6,944	1.6673
Lyon	35,685	172,377	4.8305
Mineral	5,071	3,715	0.7327
Nye	32,978	131,075	3.9746

Table K-5. Rail casks that would be shipped to the repository.[a]

Type	Trains	Rail casks
Pressurized-water reactor spent nuclear fuel	1,363	4,047
Boiling-water reactor spent nuclear fuel	929	2,759
Naval spent nuclear fuel	80	400
DOE spent nuclear fuel	74	365
High-level radioactive waste	387	1,924
Totals	2,833	9,495

a. Source: DIRS 181377-BSC 2007, Section 7.

The rail alignment would consist of a single set of tracks with multiple sidings. Rail casks would be shipped to the repository using dedicated trains. For shipments of commercial spent nuclear fuel, there would be three casks containing spent nuclear fuel per train. For shipments of DOE spent nuclear fuel and high-level radioactive waste, there would be five casks per train. In both cases, two buffer railcars, two locomotives, and one escort railcar would be present in the dedicated train. Escorts would also be present in all areas for all rail shipments.

Radiological impacts were determined for members of the public during normal, incident-free transportation of the casks. For members of the public, radiation doses were estimated for people located within 800 meters (0.5 mile) of the rail alignment. These exposures are referred to as off-link radiation doses. Once the train left the Union Pacific Mainline, there would be normally no additional stops en route to the repository, except at the Staging Yard, and the rail alignment will be constructed with the goal of transporting shipments of spent nuclear fuel and high-level radioactive waste from the Staging Yard to the repository without a stop for a crew change (DIRS 180923-Nevada Rail Partners 2007, Section 5.1). Therefore, under normal circumstances, there would be no off-link exposures of members of the public at any en route stops. Members of the public could, however, be exposed while the train was stopped at the Staging Yard.

Exposures of individuals using the rail line are referred to as on-link radiation doses. Two trains would not be able to share the single track simultaneously, and consequently, there would be no on-link radiation doses for any members of the public because no members of the public would be sharing the track with the cask trains.

Two groups of workers would be present on the train en route to the repository, engineers and conductors, referred to as rail workers, and escorts. Engineers and conductors would be located in the train locomotives at least 150 feet from the closest rail cask and would be shielded from radiation exposure by the locomotives; therefore there would be no radiation doses for these workers en route to the repository. Escorts would be situated closer to the casks and would not be shielded by the locomotives, therefore radiation doses have been estimated for these workers en route to the repository.

The train would not stop en route to the repository, therefore there would be no radiation doses from any en route stops for workers. Radiation doses have been estimated for workers located at sidings who could be exposed when a train with casks containing spent nuclear fuel or high-level radioactive waste passed a train carrying empty casks or other materials stopped at a siding. Radiation doses have also been estimated for workers present at the Maintenance-of-Way Trackside Facility who could be exposed when a train with casks containing spent nuclear fuel or high-level radioactive waste passed by the workers en route to the repository. Workers at the Staging Yard would also be exposed to radiation during railcar handling operations. Radiation doses were estimated for two groups of workers at the Staging Yard, workers directly involved in railcar handling operations (involved workers) and workers not directly involved in railcar handling operations (noninvolved workers).

K.2.3.1 Collective Dose Estimation Methodology

Collective radiation doses were estimated based on unit risk factors. Unit risk factors provide an estimate of the radiation doses from transporting one shipment or container of radioactive material over a unit distance of travel in a given population density zone.

Unit risk factors may also provide an estimate of the radiation dose from one container or shipment being stopped at a location such as the Staging Yard, the radiation dose from one container or shipment passing a location such as the Maintenance-of-Way Facility, or the radiation dose from one container or shipment passing a train stopped at a siding. There were five types of unit risk factors used to estimate collective incident-free radiation doses:

- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of casks, the population density in each population zone, and the distance in each population zone.
- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of casks and the distance in each population zone.
- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of casks and the population density around locations such as the Staging Yard.
- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of trains (shipments) and the distance in each population zone.
- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of casks.

The unit risk factors were combined with the cask, shipment, population density, and distance data using the following equations:

$$\text{Incident-Free Dose} = \sum_m \sum_k \sum_j \sum_i C_k \times PD_{j,m} \times D_{j,m} \times EF_m \times URF_{i,j}$$

$$\text{Incident-Free Dose} = \sum_m \sum_k \sum_j \sum_i C_k \times D_{j,m} \times URF_{i,j}$$

$$\text{Incident-Free Dose} = \sum_m \sum_k \sum_j \sum_i C_k \times PD_m \times EF_m \times URF_{i,j}$$

$$\text{Incident-Free Dose} = \sum_m \sum_k \sum_j \sum_i T_k \times D_{j,m} \times URF_{i,j}$$

$$\text{Incident-Free Dose} = \sum_k \sum_j \sum_i C_k \times URF_{i,j}$$

Where:

C_k	=	Number of casks for fuel type k
T_k	=	Number of trains (shipments) for fuel type k
$PD_{j,m}$	=	Population density in population zone j in county m (persons per square kilometer)
PD_m	=	Population density at Staging Yard in county m (persons per square kilometers)
$D_{j,m}$	=	Distance in population zone j in county m (kilometers)
EF_m	=	Population escalation factor for county m
$URF_{i,j}$	=	Unit risk factor for receptor i in population zone j (person-rem per kilometer per persons per square kilometers, person-rem per kilometer, person-rem per person per square kilometers, or person-rem)

The unit risk factors used to estimate radiation doses were estimated using the RADTRAN 5 computer code (DIRS 150898-Neuhauser and Kanipe 2000, all; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, all; DIRS 155970, DOE 2002, p. J-40) and the RISKIND computer code (DIRS 101483-Yuan et al. 1995, all). Both RADTRAN and RISKIND have been verified and validated for estimating incident-free radiation doses during transportation of radioactive material (DIRS 101845-Maheras and Pippen 1995, all; DIRS 177031-Osborn et al. 2005, all; DIRS 102060-Biwer et al. 1997, all).

The incident-free unit risk factors used in the analysis in the Rail Alignment EIS are based on *Transportation Health and Safety Calculation/Analysis Documentation in Support of the Final EIS for Yucca Mountain Repository* (DIRS 157144-Jason Technologies 2001, Tables 4-20 and 4-21) and the following additional assumptions:

- There would be no on-link radiation doses for members of the public, as no members of the public would share the single track with the cask trains.
- There would be no radiation doses at stops for members of the public, workers, or escorts.

- There would be no radiation doses for rail workers (engineers or conductors) en route to the repository. There would, however, be radiation doses for escorts en route to the repository.
- Escorts would be present on the trains in all areas en route to the repository and would also be present at the Staging Yard.
- A train containing commercial spent nuclear fuel would contain 3 casks. A train containing DOE spent nuclear fuel and high-level radioactive waste would contain 5 casks.
- Unit risk factors were estimated for workers located at the Maintenance-of-Way Trackside Facility, workers located at sidings, and noninvolved workers at the Staging Yard.

At the Staging Yard, there would be three groups of involved workers: inspectors, escorts, and rail workers. For the purposes of this analysis, inspectors would be present for 1 hour at a distance of 1 meter from the railcar containing the rail cask (DIRS 157144-Jason Technologies 2001, p. 88). Escorts would be present at a distance of 30 meters (100 feet) from the rail cask for a period of 2 hours. Radiation doses to rail workers were estimated using the time- and distance-weighted "b" factors contained in RADTRAN5 Technical Manual (DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, Appendix B). For noninvolved workers at the Caliente Staging Yard, 65 workers would be present 100 meters (330 feet) from the rail casks for 2 hours. At the Mina Staging Yard, 55 workers would be present 100 meters (330 feet) from the rail casks for 2 hours.

At the Maintenance-of-Way Trackside Facility, 40 workers would be present at the facility 60 meters (200 feet) from the railroad tracks. At sidings, up to 10 workers (an engineer, a conductor, and escorts) would be present 7.62 meters (25 feet) from the railroad tracks. Workers would not be continuously present at sidings. Under the Proposed Action, a loaded cask train could pass an empty cask train or a train containing other materials at a siding up to 53 times for the Caliente rail alignment or 29 times for the Mina rail alignment. Under the Shared-Use Option, a loaded cask train could pass an empty cask train or a train containing other materials at a siding up to 114 times for the Caliente rail alignment or 62 times for the Mina rail alignment. For the Maintenance-of-Way Trackside Facilities and passes at sidings, the train containing loaded spent nuclear fuel or high-level radioactive waste would pass the facility or siding at about 50 kilometers (30 miles) per hour.

Table K-6 contains the unit risk factors for workers and members of the public used in this analysis. Because multiple casks would be shipped in the same train, some unit risk factors depend on the number of casks, while other unit risk factors depend on the number of trains. This is noted in Table K-6.

K.2.3.2 Maximally Exposed Individual Scenarios

Maximally exposed individuals are hypothetical workers and members of the public who would receive the highest radiation doses. Radiation doses for these hypothetical individuals were estimated for cask shipments en route to the repository and for railcar handling activities at the Staging Yards.

The scenarios used to estimate the radiation doses are based on the scenarios analyzed in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section J.1.3.2.2) and the following additional assumptions. For workers, radiation doses were estimated for inspectors, escorts, and Staging Yard workers, including involved workers and noninvolved workers, under several operating scenarios. In the first scenario, a worker located at the Maintenance-of-Way Trackside Facility is exposed to a loaded cask train as it passed the facility en route to the repository. In the second scenario, a worker located at a siding is exposed to a loaded cask as it passed the siding en route to the repository. The assumptions used to evaluate these scenarios are listed in the previous section.

Table K-6. Incident-free unit risk factors.

Receptor	Type of zone or person	Unit risk factor[a]	Unit risk factor[b]
Public			
Off-link (public along rail alignment)	Rural	5.01×10^{-8}	5.08×10^{-8}
(person-rem/km per persons per square kilometer)[c]	Suburban	6.24×10^{-8}	6.33×10^{-8}
(based on number of casks)	Urban	1.04×10^{-7}	1.05×10^{-7}
On-link (public sharing rail alignment)	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of casks)	Urban	0	0
Residents near stops en route to the repository	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of casks)	Urban	0	0
Residents located near Staging Yard (person-rem per persons per square kilometer)[c] (based on number of casks)	Site-specific	1.06×10^{-6}	1.08×10^{-6}
Workers			
En route rail workers (engineers and conductors)	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of trains)	Urban	0	0
En route rail workers at stops	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of casks)	Urban	0	0
En route escorts	Rural	2.08×10^{-4}	2.08×10^{-4}
(person-rem per kilometer)[d]	Suburban	2.59×10^{-4}	2.59×10^{-4}
(based on number of trains)	Urban	4.32×10^{-4}	4.32×10^{-4}
En route escorts at stops	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of casks)	Urban	0	0
Workers at Maintenance-of-Way Trackside Facility (person-rem per pass) (based on number of casks)	Rural	3.72×10^{-6}	3.88×10^{-6}
Workers at Siding (person-rem per pass) (based on number of casks)	Rural	4.50×10^{-5}	4.50×10^{-5}
Workers at Staging Yard (involved)	Escorts	2.08×10^{-2}	2.08×10^{-2}
(person-rem/train or cask)	Inspector	1.70×10^{-2}	1.70×10^{-2}
(escort based on number of trains, inspector and railyard workers based on number of casks)	Railyard workers	1.60×10^{-3}	1.68×10^{-3}
Workers at Staging Yard (noninvolved)	Caliente	1.30×10^{-3}	1.37×10^{-3}
(person-rem/cask) (based on number of casks)	Mina	1.10×10^{-3}	1.16×10^{-3}

a. Unit risk factors for shipments of commercial and DOE spent nuclear fuel and high-level radioactive waste.
b. Unit risk factors for shipments of Naval spent nuclear fuel.
c. To convert person-rem per kilometer per persons per square kilometer to person-rem per mile per persons per square mile, multiply by 0.623171.
d. To convert person-rem per kilometer to person-rem per mile, multiply by 1.609344.

For members of the public, two scenarios were evaluated. In the first scenario, a resident living 18 meters (60 feet) from the rail line is exposed to all loaded casks as they passed by en route to the repository. The passing train is traveling at a speed of 24.2 kilometers (15 miles) per hour. In the second scenario, a resident living near the Staging Yard is exposed to all loaded casks at the Staging Yard for a duration of 2 hours per cask. The distances from the Staging Yard for these residents are listed in Table K-7 and were based on site-specific data around each Staging Yard.

Table K-7. Distance to members of the public around staging yards.

Staging Yard location	Distance (meters)[a]	Type of location
Caliente-Indian Cove	1,600	Residence
Caliente-Upland	400	Residence
Eccles	1,500	Residence
Hawthorne	660	Business

a. To convert meters to feet, multiply by 3.280840.

K.2.4 TRANSPORTATION ACCIDENT RISKS

The radiological dose risks from transporting spent nuclear fuel and high-level radioactive waste could result from: 1) accidents in which there is no breach of the containment provided by the transportation cask, but there is loss of shielding because of lead shield displacement, and 2) accidents that release and disperse radioactive material from the transportation cask. In the Rail Alignment EIS, the risk to the general public from the radiological consequences of transportation accidents is called dose risk. Dose risk is the sum of the products of the probabilities (dimensionless) and the consequences (in person-rem) of all potential transportation accidents. The probability of a single accident is usually determined by historical information on accidents of a similar type and severity. The consequences are estimated by analysis of the quantity of radionuclides likely to be released, potential exposure pathways, potentially affected population, likely weather conditions, and other information.

As an example, the dose risk from a single accident that had a probability of 0.001 (1 chance in 1,000), and would cause a population dose of 20,000 person-rem in a population if it did occur, would be 20 person-rem. If that population was subject to 1,000 similar accident scenarios, the total dose risk would be 20,000 person-rem. Using the conversion factor of 0.0006 latent cancer fatality per person-rem, an analysis would estimate a health and safety risk of 12 latent cancer fatalities from this population dose risk.

Potential accidents ranged from accidents with high probabilities and low consequences to accidents with low probabilities and high consequences. The analyses used the following information to determine the risks of accidents:

- The number of shipments
- The distances and population densities along the rail alignments in rural, suburban, and urban areas
- The kind and amount of radioactive material that would be transported
- Track-class-specific accident rates
- ***Conditional probabilities*** of release and the fraction of cask contents that could be released in accidents

Conditional probability is the probability of an accident of a given severity category, given that an accident occurs.

- Conditional probabilities of amounts of lead shielding displacement that could occur during accidents, and the resulting radiation dose rates
- Exposure scenarios including inhalation, ingestion, groundshine, resuspension, and immersion pathways, Nevada-specific agricultural factors, and neutral atmospheric dispersion factors

As in the incident-free transportation analysis, the RADTRAN 5 computer code (DIRS 150898-Neuhauser and Kanipe 2000, all; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, all; DIRS 155970-DOE 2002, Section J.1.4.2) was used to estimate unit risk factors for each radionuclide of concern in spent nuclear fuel and high-level radioactive waste. RADTRAN has been verified and validated for estimating the accident risks from transporting radioactive material (DIRS 101845-Maheras and Pippen 1995, all; DIRS 177031-Osborn et al. 2005, all). The unit risk factors were combined with radionuclide inventories, number of shipments, accident rates, conditional probabilities of release, ***release fractions***, distance, and population densities to determine the dose risk for populations within 80 kilometers (50 miles) of the rail alignment. For accidents involving loss of shielding, the unit risk factors were also estimated using RADTRAN 5. The methods and data used to estimate the dose risks are based on the following:

> **Release fraction** is the fraction of material released during an accident.

- The distances and population densities reflect specific rail alignments. This is discussed in Section K.2.1.1.
- The number of rail casks to be shipped has been estimated to be 9,495. This is discussed in Section K.2.3.
- Track Class-specific rail accident rates were used in the analysis. This is discussed in Section K.2.4.1.
- The radionuclide inventories are as discussed in Section K.2.4.2.
- Radiation dosimetry has been used to estimate unit risk factors and radiation doses. This is discussed in Section K.2.4.7.
- Health risk conversion factors have been used to estimate the number of latent cancer fatalities. This is discussed in Section K.1.6

Transportation accidents are organized into categories based on the severity of the accident. These categories are known as severity categories.

For the inhalation, immersion, resuspension, and groundshine pathways, the dose risk is given by:

$$\text{Dose Risk} = AR \times \sum_p \sum_n \sum_m \sum_j \sum_i \sum_k PD_{m,p} \times D_{m,p} \times I_{i,n} \times CP_{j,n} \times RF_{i,j,n} \times EF_p \times URF_{i,k}$$

Where:

AR	=	Accident rate (accidents/km)
$PD_{m,p}$	=	Population density in population zone m in county p (people/km^2)
$D_{m,p}$	=	Distance in population zone m in county p (km)
$I_{i,n}$	=	Total inventory of radionuclide i for fuel type n (Ci)
$CP_{j,n}$	=	Conditional probability for severity category j and fuel type n
$RF_{i,j,n}$	=	Release fraction for radionuclide i and severity category j for fuel type n

EF_p = Population escalation factor for county p

$URF_{i,k}$ = Unit risk factor for radionuclide i and pathway k (person-rem/Ci per person/km^2)

For the ingestion pathway, the dose risk is given by:

$$\text{Dose Risk} = AR \times \sum_p \sum_n \sum_j \sum_i D_{rural,p} \times I_{i,n} \times CP_{j,n} \times RF_{i,j,n} \times FTF_i \times URF_i$$

Where:

AR = Accident rate (accidents/km)

$D_{rural,p}$ = Distance in rural population zone in county p (km)

$I_{i,n}$ = Total inventory of radionuclide i for fuel type n (Ci)

$CP_{j,n}$ = Conditional probability for severity category j and fuel type n

$RF_{i,j,n}$ = Release fraction for radionuclide i and severity category j and fuel type n

FTF_i = Food transfer factor for radionuclide i (Ci/Ci deposited) (state-specific)

URF_i = Ingestion unit risk factor for radionuclide i (person-rem/Ci × Ci deposited)

For loss of shielding accidents, the dose risk is given by:

$$\text{Dose Risk} = AR \times \sum_p \sum_n \sum_m \sum_j C_n \times PD_{m,p} \times D_{m,p} \times CP_{j,n} \times EF_p \times URF_{j,n}$$

Where:

AR = Accident rate (accidents/km)

C_n = Number of casks for fuel type n

$PD_{m,p}$ = Population density in population zone m in county p (people/km^2)

$D_{m,p}$ = Distance in population zone m in county p (km)

$CP_{j,n}$ = Conditional probability for severity category j and fuel type n

EF_p = Population escalation factor for county p

$URF_{j,n}$ = Loss of shielding unit risk factor for severity category j and fuel type n (person-rem/km per person/km^2)

K.2.4.1 Transportation Accident Rates

In this analysis, the Department used a combination of rail accident rates based on both train-kilometers and railcar-kilometers to estimate accident dose risks (see Table K-8). These rates were for Track Class 3 and include derailments and collisions (DIRS 180220-Bendixen and Facanha 2007, all).

Enrichment is the fraction of atoms of a specified isotope in a mixture of isotopes of the same element when this fraction exceeds that in the naturally occurring mixture. By convention, uranium enrichment is given on a weight basis.

Decay time is the time since the spent nuclear fuel has been discharged from the reactor.

Burnup is the total energy released per initial unit mass of nuclear fuel as a result of irradiation. The commonly used units of burnup are megawatt-days per metric ton of heavy metal (MWd/MTHM).

Table K-8. Track Class 3 rail accident rates.[a]

Train-based accident rate (accidents per train-kilometer) [b]	Railcar-based accident rate (accidents per railcar-kilometer) [c]
7.5×10^{-7}	1.7×10^{-8}

a. Source: DIRS 180220-Bendixen and Facanha 2007, p. 2.
b. To convert accidents per train-kilometer to accidents per train-mile, multiply by 1.609344.
c. To convert accidents per railcar-kilometer to accidents per railcar-mile, multiply by 1.609344.

K.2.4.2 Radionuclide Inventory

The primary sources of the radionuclide inventory information for the Rail Alignment EIS are:

- *PWR Source Term Generation and Evaluation* (DIRS 169061-BSC 2004, all)
- *BWR Source Term Generation and Evaluation* (DIRS 164364-BSC 2003, all)
- *Source Term Estimates for DOE Spent Nuclear Fuels* (DIRS 169354-DOE 2004, all)
- *Recommended Values for HLW Glass for Consistent Usage on the Yucca Mountain Project* (DIRS 180471-BSC 2007, all)

The radionuclide inventory used in the Rail Alignment EIS represents the radioactivity contained in about 65,600 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste which would be shipped to the repository by rail. The remaining 4,400 MTHM would be shipped to the repository using trucks and is not evaluated in the Rail Alignment EIS. The updated radionuclide inventories are listed in Tables K-9 through K-14.

DOE spent nuclear fuel was organized into 34 groups based on the fuel compound, fuel ***enrichment***, fuel cladding material, and fuel cladding condition (DIRS 171271-DOE 2004, all). The characteristics of the spent nuclear fuel, including percent enrichment, ***decay time***, and ***burnup***, affect the radionuclide inventory and thereby the radiation dose. The descriptions below are for a typical spent nuclear fuel for each group.

- Group 1: Uranium Metal, Zirconium Alloy Clad, Low-Enriched Uranium—This group contains uranium metal fuel compounds with zirconium alloy cladding. The end-of-life effective enrichment ranges from 0.5 to 1.7 percent. The cladding is in fair to poor condition. This group of fuel comprises approximately 2,103 MTHM.
- Group 2: Uranium Metal, Non-Zirconium Alloy Clad, Low-Enriched Uranium—This group contains uranium metal fuel compounds with no known zirconium alloy cladding. The end-of-life effective enrichment ranges from 0.2 to 3.4 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 8 MTHM.

- Group 3: Uranium-Zirconium—This group contains uranium-zirconium alloy fuel compounds with zirconium alloy cladding. The end-of-life effective enrichment ranges from 0.5 to 92.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.66 MTHM.
- Group 4: Uranium-Molybdenum—This group contains uranium-molybdenum alloy fuel compounds with various types of cladding. The end-of-life effective enrichment ranges from 2.4 to 25.8 percent. If present, the cladding is in good to poor condition. This group of fuel comprises approximately 3.9 MTHM.
- Group 5: Uranium Oxide, Intact Zirconium Alloy Clad, Highly Enriched Uranium—This group contains uranium oxide fuel compounds with intact zirconium alloy cladding. The end-of-life effective enrichment ranges from 23.1 to 92.5 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 1 MTHM.
- Group 6: Uranium Oxide, Intact Zirconium Alloy Clad, Medium-Enriched Uranium—This group contains uranium oxide fuel compounds with intact zirconium alloy cladding. The end-of-life effective enrichment ranges from 5 to 6.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 1.9 MTHM.
- Group 7: Uranium Oxide, Intact Zirconium Alloy Clad, Low-Enriched Uranium—This group contains uranium oxide fuel compounds with intact zirconium alloy cladding. The end-of-life effective enrichment ranges from 0.6 to 4.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 89.6 MTHM.
- Group 8: Uranium Oxide, Intact Stainless Steel/Hastelloy Clad, Highly Enriched Uranium—This group contains uranium oxide fuel compounds with intact stainless steel or hastelloy cladding. The end-of-life effective enrichment ranges from 91 to 93.2 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.19 MTHM.
- Group 9: Uranium Oxide, Intact Stainless Steel Clad, Medium-Enriched Uranium—This group contains uranium oxide fuel compounds with intact stainless steel cladding. The end-of-life effective enrichment ranges from 5.5 to 20 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.69 MTHM.
- Group 10: Uranium Oxide, Intact Stainless Steel Clad, Low-Enriched Uranium—This group contains uranium oxide fuel compounds with stainless steel cladding. The end-of-life effective enrichment ranges from 0.2 to 1.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.9 MTHM.
- Group 11: Uranium Oxide, Non-Intact or Declad Non-Aluminum Clad, Highly Enriched Uranium—This group contains uranium oxide fuel compounds with no known aluminum cladding. The end-of-life effective enrichment ranges from 21 to 93.3 percent. If present, the cladding is in poor condition. This group of fuel comprises approximately 0.82 MTHM.
- Group 12: Uranium Oxide, Non-Intact or Declad Non-Aluminum Clad, Medium-Enriched Uranium—This group contains uranium oxide fuel compounds with no known aluminum cladding. The end-of-life effective enrichment ranges from 5.2 to 18.6 percent. If present, the cladding is in poor condition. This group of fuel comprises approximately 0.47 MTHM.
- Group 13: Uranium Oxide, Non-Intact or Declad Non-Aluminum Clad, Low-Enriched Uranium—This group contains uranium oxide fuel compounds with no known aluminum cladding. The end-of-life effective enrichment ranges from 1.1 to 3.2 percent. If present, the cladding is in poor condition. This group of fuel comprises approximately 82.5 MTHM.
- Group 14: Uranium Oxide, Aluminum Clad, Highly Enriched Uranium—This group contains uranium oxide fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges

from 58.1 to 89.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 4.6 MTHM.

- Group 15: Uranium Oxide, Aluminum Clad, Medium-Enriched Uranium and Low-Enriched Uranium—This group contains uranium oxide fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 8.9 to 20 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.29 MTHM.
- Group 16: Uranium-Aluminum, Highly Enriched Uranium—This group contains uranium-aluminum alloy fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 21.9 to 93.3 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 7.5 MTHM.
- Group 17: Uranium-Aluminum, Medium-Enriched Uranium—This group contains uranium-aluminum alloy fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 9 to 20 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 2.6 MTHM.
- Group 18: Uranium-Silicide—This group contains uranium-silicide fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 5.2 to 22 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 7.2 MTHM.
- Group 19: Thorium/Uranium Carbide, TRISO- or BISO-Coated Particles in Graphite—This group contains thorium/uranium carbide fuel compounds with TRISO- or BISO-coated particles. TRISO-coated particles consist of an isotropic pyrocarbon outer layer, a silicon carbide layer, an isotropic carbon layer, and a porous carbon buffer inner layer. BISO-coated particles consist of an isotropic pyrocarbon outer layer and a low density porous carbon buffer inner layer. The end-of-life effective enrichment ranges from 71.4 to 84.4 percent. The coating is in good condition. This group of fuel comprises approximately 24.7 MTHM.
- Group 20: Thorium/Uranium Carbide, Mono-Pyrolytic Carbon-Coated Particles in Graphite—This group contains thorium/uranium carbide fuel compounds with mono-pyrolytic carbon-coated particles. The end-of-life effective enrichment ranges from 80.6 to 93.2 percent. The coating is in poor condition. This group of fuel comprises approximately 1.6 MTHM.
- Group 21: Plutonium/Uranium Carbide, Nongraphite Clad, Not Sodium Bonded—This group contains plutonium/uranium carbide fuel compounds with stainless steel cladding. The end-of-life effective enrichment ranges from 1 to 67.3 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 0.08 MTHM.
- Group 22: Mixed Oxide, Zirconium Alloy Clad—This group contains plutonium/uranium oxide fuel compounds with zirconium alloy cladding. The end-of-life effective enrichment ranges from 1.3 to 21.3 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 1.6 MTHM.
- Group 23: Mixed Oxide, Stainless Steel Clad—This group contains plutonium/uranium and plutonium oxide fuel compounds with stainless steel cladding. The end-of-life effective enrichment ranges from 2.1 to 87.4 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 10.7 MTHM.
- Group 24: Mixed Oxide, Non-Stainless Steel/Non-Zirconium Alloy Clad—This group contains plutonium/uranium oxide fuel compounds with no known stainless steel or zirconium alloy cladding. The end-of-life effective enrichment ranges from 5 to 54.3 percent. The cladding is in poor to nonintact condition. This group of fuel comprises approximately 0.11 MTHM.

- Group 25: Thorium/Uranium Oxide, Zirconium Alloy Clad—This group contains thorium/uranium oxide fuel compounds with zirconium alloy cladding. The end-of-life effective enrichment ranges from 10.1 to 98.4 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 42.6 MTHM.
- Group 26: Thorium/Uranium Oxide, Stainless Steel Clad—This group contains thorium/uranium oxide fuel compounds with stainless steel cladding. The end-of-life effective enrichment ranges from 7.6 to 97.8 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 7.6 MTHM.
- Group 27: Uranium-Zirconium Hydride, Stainless Steel/Incoloy Clad, Highly Enriched Uranium—This group contains uranium-zirconium hydride fuel compounds with stainless steel or incoloy cladding. The end-of-life effective enrichment ranges from 42.5 to 93.2 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.16 MTHM.
- Group 28: Uranium-Zirconium Hydride, Stainless Steel/Incoloy Clad, Medium-Enriched Uranium—This group contains uranium-zirconium hydride fuel compounds with stainless steel or incoloy cladding. The end-of-life effective enrichment ranges from 11.9 to 20 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 1.4 MTHM.
- Group 29: Uranium-Zirconium Hydride, Aluminum Clad, Medium-Enriched Uranium—This group contains uranium-zirconium hydride fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 16.8 to 20 percent. The cladding is in good condition. This group of fuel comprises approximately 0.35 MTHM.
- Group 30: Uranium-Zirconium Hydride, Declad—This group contains uranium-zirconium hydride fuel compounds that have been declad. The end-of-life effective enrichment is about 89.7 percent. This group of fuel comprises approximately 0.03 MTHM.
- Group 31: Metallic Sodium Bonded—This group contains a wide variety of spent nuclear fuel that has the common attribute of containing metallic sodium bonding between the fuel matrix and the cladding. The end-of-life effective enrichment ranges from 0.1 to 93.2 percent. If present, the cladding is in good to poor condition. This group of fuel comprises approximately 59.9 MTHM. This spent nuclear fuel will be treated and will be disposed of as high-level radioactive waste.
- Group 32: Naval Fuel—Naval nuclear fuel is highly robust and designed to operate in a high-temperature, high-pressure environment for many years. This fuel is highly enriched (93 to 97 percent) in uranium-235. In addition, to ensure that the design will be capable of withstanding battle shock loads, the naval fuel material is surrounded by large amounts of zirconium alloy. This group of fuel comprises approximately 65 MTHM.
- Group 33: Canyon Stabilization—This spent nuclear fuel is being treated and will be disposed of as high-level radioactive waste.
- Group 34: Miscellaneous—This group contains spent nuclear fuel that does not fit into other groups. The spent nuclear fuel in this group was generated from numerous reactors of different types. The end-of-life effective enrichment ranges from 14.6 to 90 percent. If present, the cladding is in good to poor condition. This group of fuel comprises approximately 0.44 MTHM.

The DOE spent nuclear fuel radionuclide inventories are in the year 2010 for the amount of spent nuclear fuel that would be shipped in rail casks. These radionuclide inventories were compiled from data contained in *Source Term Estimates for DOE Spent Nuclear Fuels* (DIRS 169354-DOE 2004, Volume II, Appendix C). For naval spent nuclear fuel, the radionuclide inventory is for 400 casks. The single-cask naval spent fuel inventory was compiled from information provided by the Department of the Navy (DIRS

155857-McKenzie 2001, Table 3). Tables K-9 through K-12 list the radionuclide inventories for DOE spent nuclear fuel.

For commercial spent nuclear fuel, the radionuclide inventories are for the amount of spent nuclear fuel that would be shipped in rail casks. For pressurized water reactor spent nuclear fuel, 85,914 spent nuclear fuel assemblies are estimated to be shipped in rail casks (DIRS 181377-BSC 2007, Section 7). For boiling water reactor spent nuclear fuel, 121,932 spent nuclear fuel assemblies are estimated to be shipped in rail casks (DIRS 181377-BSC 2007, Section 7). For the purposes of analysis, all shipping casks were assumed to be full and all trains were assumed to have a full complement of casks. This increases the number of spent nuclear fuel assemblies to 87,057 for pressurized water reactor spent nuclear fuel and 123,537 for boiling water reactor spent nuclear fuel. The representative pressurized water reactor assembly would have a burnup of 60,000 megawatt-days per metric ton of heavy metal (MWd/MTHM), an enrichment of 4 percent, and a decay time of 10 years (DIRS 169061-BSC 2004, all). The representative boiling water reactor assembly would have a burnup of 50,000 MWd/MTHM, an enrichment of 4 percent, and a decay time of 10 years (DIRS 164364-BSC 2003, all). Table K-13 contains the radionuclide inventory for commercial spent nuclear fuel.

The high-level radioactive waste radionuclide inventory is based on 5,316 canisters for Hanford Site high-level radioactive waste, 528 canisters for Idaho National Laboratory high-level radioactive waste, 3,490 canisters of Savannah River Site high-level radioactive waste, and 277 canisters of high-level radioactive waste from West Valley (DIRS 181377-BSC 2007, Section 7). For the purposes of analysis, all shipping casks containing high-level radioactive waste were assumed to be full and all trains were assumed to have a full complement of casks. This increases the amount of high-level radioactive waste to 5,325 canisters for Hanford Site high-level radioactive waste, 550 canisters for Idaho National Laboratory high-level radioactive waste, 3,500 canisters of Savannah River Site high-level radioactive waste, and 300 canisters of high-level radioactive waste from West Valley. Table K-14 lists the radionuclide inventory for high-level radioactive waste.

K.2.4.3 Conditional Probabilities and Release Fractions

In this appendix, DOE spent nuclear fuel is organized into 34 groups based on the fuel compound, fuel matrix, fuel enrichment, fuel cladding material, and fuel cladding condition. Table K-15 lists these spent nuclear fuel groups. Commercial spent nuclear fuel is organized into two groups, pressurized-water-reactor spent nuclear fuel and boiling-water-reactor spent nuclear fuel. High-level radioactive waste is organized into four groups, Idaho high-level waste, Hanford high-level waste, Savannah River high-level radioactive waste, and West Valley high-level radioactive waste. These groups were assigned to a set of 10 conditional probabilities and release fractions known as release fraction groups based on the characteristics and behaviors of the spent nuclear fuel or high-level radioactive waste (see Tables K-16 through K-26). Release fractions were specified for inert gases, volatile constituents such as cesium and ruthenium, particulates, and activation products such as Co-60 that were deposited on the exterior surfaces of the spent nuclear fuel (also known as crud).

For loss of shielding accidents, the Rail Alignment EIS uses unit risk factors for six severity categories of accidents (DIRS 155970-DOE 2002, p. J-54, Table J-19). These unit risk factors are listed in Tables K-27 and K-28.

Tables K-16 through K-26 also list “one-group” release fractions. One-group release fractions are defined as the sum of the products of the conditional probability and release fraction for all six accident severity categories:

$$\text{One Group Release Fraction} = \sum_{\text{Severity Category, i=1}}^{6} \text{Conditional Probability}_i \times \text{Release Fraction}_i$$

Similarly, the one-group unit risk factors listed in Tables K-27 and K-28 are defined as the sum of the products of the conditional probability and unit risk factor for all six accident severity categories:

$$\text{One Group Unit Risk Factor} = \sum_{\text{Severity Category, i=1}}^{6} \text{Conditional Probability}_i \times \text{Unit Risk Factor}_i$$

The conditional probabilities and release fractions listed in Tables K-16 through K-28 would be mostly a direct consequence of error on the part of transport vehicle operators, operators of other vehicles, or persons who maintain vehicles and rights-of-way. The number and severity of the accidents would be minimized through the use of trained and qualified personnel.

Others have argued that other kinds of human error could also contribute to accident consequences: (1) undetected error in the design and certification of transportation packaging (cask) used to ship radioactive material, (2) hidden or undetected defects in the manufacture of these packages, and (3) error in preparing the packages for shipment. DOE has concluded that U.S. Nuclear Regulatory Commission and U.S. Department of Transportation regulations and regulatory practices address the design, manufacture, and use of transportation packaging and are effective in preventing these kinds of human error by requiring:

- Independent Nuclear Regulatory Commission review of designs to ensure compliance with requirements (10 CFR Part 71)
- Nuclear Regulatory Commission-approved and audited quality assurance programs for design, manufacturing, and use of transportation packages

In addition, federal provisions (10 CFR Part 21) provide additional assurance of timely and effective actions to identify and initiate corrective actions for undetected design or manufacturing defects. Furthermore, conservatism in the approach to safety incorporated in the regulatory requirements and practices provides confidence that design or manufacturing defects that might remain undetected or operational deficiencies would not lead to a meaningful reduction in the performance of a package under normal or accident conditions of transportation.

K.2.4.4 Atmospheric Conditions

Because it is not possible to forecast the atmospheric conditions that might exist during an accident, DOE selected neutral weather conditions (Pasquill Stability Class D) for the transportation risk assessments for the Rail Alignment EIS. The accident calculation methodology includes a probabilistic component that includes the atmospheric stability; therefore, DOE assumed neutral conditions. Atmospheric conditions affect the dispersion of radionuclides that could be released during an accident. Neutral weather conditions are typified by moderate wind speeds, vertical mixing within the atmosphere, and good dispersion of atmospheric contaminants. On the basis of observations from National Weather Service surface meteorological stations at 177 locations in the United States, on an annual average, neutral conditions (Pasquill Class C and D) occur 11 percent and 47 percent of the time, respectively. Stable conditions (Pasquill Class E and F) occur 12 percent and 21 percent of the time, respectively. Unstable conditions (Pasquill Class A and B) occur 1 percent and 7 percent of the time, respectively (DIRS 104800-CRWMS M&O 1999, p. 40).

Table K-9. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 1 through 8 (page 1 of 2).[a,b]

	Uranium metal				Uranium oxide			
					Zirconium clad (intact)			Stainless steel/hastelloy clad (intact)
Radionuclide	Zirconium clad LEU Group 1 (Ci)	Non-zirconium clad LEU Group 2 (Ci)	Uranium-zirconium Group 3 (Ci)	Uranium-molybdenum Group 4 (Ci)	HEU Group 5 (Ci)	MEU Group 6 (Ci)	LEU Group 7 (Ci)	HEU Group 8 (Ci)
Ac-227	5.0E-3	5.8E-4	3.0E-3	8.4E-3	5.4E-3	2.9E-5	4.2E-3	1.0E-4
Am-241	7.1E+5	2.1E+4	1.4E+4	1.8E+2	4.6E+2	4.8E+3	3.7E+5	4.6E-1
Am-242m	4.4E+2	3.4E+1	2.2E+0	2.8E-2	8.6E-1	9.7E+0	7.8E+2	3.5E-5
Am-243	3.7E+2	6.4E+0	1.3E+0	1.6E-2	1.8E+0	2.1E+1	1.7E+3	4.1E-6
C-14	1.1E+3	2.0E+3	7.0E+2	1.1E+1	5.3E+1	1.6E+0	6.6E+2	9.5E-1
Cl-36	5.2E-2	3.7E+1	1.2E-3	4.8E-3	2.8E-1	2.7E-2	2.1E+0	5.1E-3
Cm-243	1.7E+1	6.6E+0	3.1E-1	4.0E-3	7.5E-1	8.7E+0	7.6E+2	9.8E-7
Cm-244	6.5E+3	8.9E+1	6.5E+0	8.3E-2	1.5E+2	1.7E+3	1.6E+5	8.9E-6
Co-60	2.7E+4	4.6E+5	4.0E+4	6.8E+2	1.6E+4	1.2E+2	4.7E+4	2.5E+2
Cs-134	1.1E+2	1.5E+2	5.0E+0	1.2E-1	1.8E+0	1.9E+1	2.6E+3	1.0E-2
Cs-135	7.6E+1	1.9E+0	5.0E+0	4.0E+0	7.0E+0	4.9E-1	4.2E+1	1.3E-1
Cs-137	9.3E+6	2.2E+5	9.0E+5	1.3E+5	3.4E+5	4.8E+4	4.9E+6	5.7E+3
Eu-154	5.2E+4	1.2E+3	4.2E+3	6.9E+1	2.3E+2	7.8E+2	9.1E+4	2.4E+0
Eu-155	2.5E+3	7.7E+2	3.9E+2	1.3E+2	1.7E+2	8.5E+1	1.2E+4	2.5E+0
Fe-55	4.7E+1	6.2E+3	3.7E+1	1.7E+0	2.8E+2	6.8E+0	1.1E+3	4.2E+0
H-3	2.6E+4	4.2E+3	1.5E+4	4.9E+2	6.5E+2	7.6E+2	8.7E+4	9.4E+0
I-129	6.5E+0	1.3E-1	4.7E-1	1.1E-1	1.7E-1	3.3E-2	2.9E+0	3.0E-3
Kr-85	2.1E+5	7.5E+3	2.4E+4	3.7E+3	9.6E+3	1.0E+3	1.3E+5	1.5E+2
Np-237	6.4E+1	1.9E+0	3.5E+0	3.3E-1	3.0E-1	3.8E-1	3.1E+1	4.8E-3
Pa-231	1.2E-2	1.1E-3	5.0E-3	1.7E-2	1.0E-2	4.3E-5	6.9E-3	2.0E-4
Pb-210	2.0E-3	3.6E-4	2.7E-3	3.5E-5	3.7E-7	2.7E-6	2.2E-3	3.1E-9
Pm-147	4.7E+3	1.6E+4	6.2E+2	1.1E+2	2.8E+2	5.6E+1	8.9E+3	4.0E+0
Pu-238	1.5E+5	3.6E+3	4.0E+3	6.5E+1	2.9E+2	2.5E+3	2.1E+5	1.2E+0
Pu-239	2.2E+5	7.1E+3	1.2E+4	1.8E+3	2.0E+2	3.9E+2	4.0E+4	2.8E+0

Table K-9. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 1 through 8 (page 2 of 2).[a,b]

	Uranium metal				Uranium oxide			
					Zirconium clad (intact)			Stainless steel/hastelloy clad (intact)
Radionuclide	Zirconium clad LEU Group 1 (Ci)	Non-zirconium clad LEU Group 2 (Ci)	Uranium-zirconium Group 3 (Ci)	Uranium-molybdenum Group 4 (Ci)	HEU Group 5 (Ci)	MEU Group 6 (Ci)	LEU Group 7 (Ci)	HEU Group 8 (Ci)
Pu-240	1.7E+5	3.5E+3	5.2E+3	7.1E+1	7.3E+1	5.1E+2	4.4E+4	3.6E-1
Pu-241	4.5E+6	1.4E+5	9.1E+4	1.1E+3	3.5E+3	3.2E+4	3.2E+6	2.7E+0
Pu-242	1.1E+2	1.9E+0	1.3E+0	1.6E-2	1.9E-1	2.2E+0	1.7E+2	8.2E-6
Ra-226	5.6E-3	9.7E-4	7.4E-3	9.4E-5	1.0E-6	7.3E-6	6.0E-3	8.2E-9
Ra-228	4.9E-4	2.4E-5	7.4E-4	1.1E-5	1.9E-6	1.8E-7	5.7E-4	3.4E-8
Ru-106	4.4E-3	1.1E+3	2.1E-4	2.9E-5	2.1E-3	2.6E-1	5.1E+2	6.3E-7
Se-79	8.4E+1	3.1E+0	7.8E+0	1.5E+0	3.1E+0	4.2E-1	3.9E+1	5.5E-2
Sn-126	6.6E+0	2.5E+0	7.5E+0	3.4E+0	2.7E+0	8.5E-1	7.2E+1	4.8E-2
Sr-90	6.7E+6	1.6E+5	7.9E+5	1.1E+5	3.2E+5	3.2E+4	3.4E+6	5.4E+3
Tc-99	2.8E+3	5.9E+1	2.8E+2	4.2E+1	1.1E+2	1.3E+1	1.2E+3	1.9E+0
Th-229	1.8E-3	1.8E-4	2.7E-3	3.8E-5	3.7E-6	4.0E-6	2.3E-3	6.4E-8
Th-230	5.6E-1	8.8E-2	6.7E-1	8.6E-3	9.6E-5	6.9E-4	5.5E-1	7.3E-7
Th-232	4.9E-4	2.4E-5	7.5E-4	1.1E-5	1.9E-6	1.8E-7	5.8E-4	3.5E-8
Tl-208	3.0E-2	2.0E-2	2.9E-2	8.7E-4	5.5E-3	6.0E-3	5.1E-1	8.8E-5
U-232	8.2E-2	5.4E-2	7.8E-2	2.3E-3	1.5E-2	1.6E-2	1.4E+0	2.4E-4
U-233	3.9E-1	3.9E-2	5.7E-1	8.0E-3	8.0E-4	8.5E-4	5.0E-1	1.3E-5
U-234	1.4E+3	1.9E+2	1.5E+3	1.9E+1	2.6E-1	1.7E+0	1.2E+3	1.6E-3
U-235	4.8E+1	8.2E-2	6.0E-3	2.0E+0	9.9E-1	2.0E-1	2.3E+0	3.9E-1
U-236	9.7E+1	2.8E+0	1.7E+1	1.3E+0	3.7E+0	2.6E-1	3.3E+1	6.7E-2
U-238	7.0E+2	2.1E+0	3.3E-1	1.0E+0	2.1E-2	6.0E-1	3.0E+1	4.7E-3

a. LEU = low enriched uranium; MEU = medium enriched uranium; HEU = high enriched uranium.
b. Source: Compiled from data contained in DIRS 169354-DOE 2004, Volume II, Appendix C.

Table K-10. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 9 through 16 (page 1 of 2).[a,b]

	Uranium oxide							Uranium-aluminum
	Stainless steel clad (intact)		Not aluminum clad nonintact or declad			Aluminum clad		
Radionuclide	HEU Group 9 (Ci)	LEU Group 10 (Ci)	HEU Group 11 (Ci)	MEU Group 12 (Ci)	LEU Group 13 (Ci)	HEU Group 14 (Ci)	MEU and LEU Group 15 (Ci)	HEU Group 16 (Ci)
Ac-227	1.4E-4	9.5E-4	5.6E-3	8.5E-4	4.2E-3	8.8E-4	1.3E-5	1.0E-3
Am-241	1.1E+0	1.8E+4	1.9E+4	1.5E+3	4.7E+4	4.9E+3	4.8E+1	5.2E+3
Am-242m	1.1E-4	8.8E+0	3.8E+1	3.0E+0	1.1E+2	9.9E-1	1.6E-2	1.6E+0
Am-243	1.2E-5	4.5E+0	3.7E+1	6.5E+0	2.3E+2	1.5E+1	5.4E-2	1.8E+1
C-14	2.7E+0	1.9E+3	2.8E+2	1.5E+1	8.5E+1	1.6E-2	2.1E-4	3.0E-1
Cl-36	1.5E-2	3.6E+1	5.2E+0	8.4E-2	6.5E-1	1.7E-25	4.7E-28	2.7E-4
Cm-243	4.2E-6	1.4E+0	2.0E+0	2.7E+0	1.1E+2	2.5E+0	7.9E-3	3.7E+0
Cm-244	4.9E-5	6.3E+1	3.9E+2	5.3E+2	2.6E+4	2.1E+3	1.7E+0	3.3E+3
Co-60	1.1E+4	4.4E+5	1.0E+5	1.6E+4	8.1E+4	5.1E+1	1.1E+0	3.6E+2
Cs-134	1.7E+2	5.2E+0	6.8E+2	7.1E+0	4.4E+2	7.4E+4	1.3E+4	1.3E+6
Cs-135	3.6E-1	1.1E+0	1.8E+0	2.0E+0	1.4E+1	5.5E+0	1.2E-1	9.7E+0
Cs-137	2.4E+4	1.6E+5	1.0E+5	1.3E+5	1.2E+6	3.2E+6	9.6E+4	6.9E+6
Eu-154	3.2E+1	8.1E+2	3.0E+3	3.3E+2	1.7E+4	5.9E+4	2.5E+3	2.1E+5
Eu-155	1.3E+2	2.4E+2	6.1E+2	2.0E+2	3.4E+3	2.0E+4	1.1E+3	1.1E+5
Fe-55	8.5E+3	4.6E+3	3.5E+4	1.1E+3	5.4E+3	4.6E+3	1.9E+2	3.7E+4
H-3	7.3E+1	3.9E+3	7.3E+2	5.1E+2	1.4E+4	7.5E+3	3.3E+2	2.3E+4
I-129	8.7E-3	9.7E-2	4.4E-2	5.6E-2	5.7E-1	1.1E+0	2.7E-2	2.0E+0
Kr-85	1.4E+3	4.4E+3	4.8E+3	5.2E+3	4.2E+4	1.8E+5	8.9E+3	6.0E+5
Np-237	1.4E-2	1.7E+0	4.5E-1	1.9E-1	4.1E+0	2.2E+1	3.4E-1	3.4E+1
Pa-231	3.4E-4	2.0E-3	7.3E-3	2.0E-3	9.9E-3	2.7E-3	4.6E-5	3.5E-3
Pb-210	2.4E-9	3.5E-4	5.5E-5	8.4E-7	1.2E-5	6.4E-5	1.4E-6	8.7E-5
Pm-147	7.5E+3	1.7E+3	3.0E+4	1.0E+3	6.6E+3	1.4E+5	7.1E+4	4.2E+6
Pu-238	3.9E+0	3.1E+3	7.1E+3	8.0E+2	2.9E+4	7.8E+4	7.2E+2	1.1E+5
Pu-239	8.0E+0	5.7E+3	9.7E+2	1.6E+2	4.4E+3	7.4E+2	1.5E+1	1.3E+3

Table K-10. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 9 through 16 (page 2 of 2).[a,b]

	Uranium oxide							Uranium-aluminum
	Stainless steel clad (intact)		Not aluminum clad nonintact or declad			Aluminum clad		
Radionuclide	HEU Group 9 (Ci)	LEU Group 10 (Ci)	HEU Group 11 (Ci)	MEU Group 12 (Ci)	LEU Group 13 (Ci)	HEU Group 14 (Ci)	MEU and LEU Group 15 (Ci)	HEU Group 16 (Ci)
Pu-240	1.0E+0	2.3E+3	6.7E+2	1.6E+2	5.5E+3	4.1E+2	8.8E+0	7.1E+2
Pu-241	1.8E+1	1.2E+5	1.1E+5	1.0E+4	5.2E+5	1.0E+5	2.2E+3	2.3E+5
Pu-242	2.4E-5	1.4E+0	5.6E+0	6.7E-1	2.3E+1	1.5E+0	1.3E-2	2.0E+0
Ra-226	8.5E-9	9.4E-4	1.5E-4	2.3E-6	4.2E-5	2.9E-4	4.8E-6	3.6E-4
Ra-228	9.2E-8	1.9E-5	1.4E-3	5.6E-7	4.3E-6	1.9E-8	2.3E-10	1.2E-6
Ru-106	3.8E+2	2.1E+0	1.6E+3	3.3E-2	2.7E-1	1.6E+3	5.1E+3	3.6E+5
Se-79	1.6E-1	2.7E+0	7.9E-1	9.5E-1	8.3E+0	1.9E+1	4.7E-1	3.4E+1
Sn-126	1.4E-1	2.0E+0	6.9E-1	9.8E-1	1.2E+1	1.7E+1	4.2E-1	3.0E+1
Sr-90	2.3E+4	1.2E+5	9.6E+4	1.2E+5	9.3E+5	3.0E+6	9.2E+4	6.5E+6
Tc-99	5.6E+0	4.7E+1	2.8E+1	3.3E+1	2.8E+2	6.2E+2	1.5E+1	1.1E+3
Th-229	1.0E-7	1.7E-4	4.0E-3	1.8E-6	3.4E-5	7.6E-6	1.1E-7	9.7E-6
Th-230	1.2E-6	8.6E-2	1.3E-2	2.2E-4	5.3E-3	5.2E-2	9.1E-4	6.8E-2
Th-232	9.9E-8	1.9E-5	1.4E-3	5.7E-7	4.4E-6	2.9E-8	4.2E-10	1.5E-6
Tl-208	2.9E-4	1.3E-2	2.0E-1	3.3E-3	7.6E-2	7.0E-2	1.6E-3	1.2E-1
U-232	8.0E-4	3.6E-2	5.4E-1	9.0E-3	2.1E-1	1.9E-1	4.7E-3	3.4E-1
U-233	3.7E-5	3.6E-2	8.2E-1	4.5E-4	9.7E-3	4.2E-3	7.8E-5	6.7E-3
U-234	4.4E-3	1.9E+2	2.9E+1	5.4E-1	1.7E+1	2.3E+2	6.6E+0	4.3E+2
U-235	2.7E-1	1.8E-1	2.4E+0	1.3E-1	4.6E+0	7.8E+0	6.2E-2	1.3E+1
U-236	1.9E-1	2.6E+0	9.8E-1	1.1E+0	7.5E+0	2.4E+1	5.6E-1	4.2E+1
U-238	1.9E-1	2.6E-1	3.6E-1	1.3E-1	2.7E+1	1.3E-1	8.3E-2	3.2E-1

a. LEU = low enriched uranium; MEU = medium enriched uranium; HEU = high enriched uranium.
b. Source: Compiled from data contained in DIRS 169354-DOE 2004, Volume II, Appendix C.

Table K-11. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 17 through 24 (page 1 of 2).[a,b]

			Thorium/uranium carbide		Plutonium/ uranium carbide	Mixed oxide		
Radionuclide	Uranium-aluminum MEU Group 17 (Ci)	Uranium silicide Group 18 (Ci)	TRISO or BISO particles in graphite Group 19 (Ci)	Mono-pyrolytic carbon particles Group 20 (Ci)	Not graphite nonsodium bonded Group 21 (Ci)	Zirconium clad Group 22 (Ci)	Stainless steel clad Group 23 (Ci)	Non-stainless steel non-zirconium clad Group 24 (Ci)
Ac-227	6.1E-5	2.7E-4	2.6E+0	2.3E-1	2.1E-8	1.6E-1	4.2E-2	4.9E-3
Am-241	1.9E+3	8.6E+3	2.3E+3	1.8E+2	8.9E+2	5.8E+5	2.5E+5	3.0E+4
Am-242m	1.3E+0	6.1E+0	2.2E+0	1.4E-1	1.7E+1	1.2E+3	2.1E+3	2.8E+2
Am-243	1.1E+0	4.4E+0	4.0E+1	2.7E+0	9.0E-1	1.1E+3	4.4E+2	6.1E+1
C-14	3.0E-2	1.2E+0	2.0E+1	1.4E+0	2.2E-1	8.3E+3	2.6E+3	3.7E+2
Cl-36	2.5E-5	1.2E-3	9.2E-1	6.2E-2	2.9E-6	1.6E+2	4.9E+1	7.0E+0
Cm-243	4.3E-1	2.0E+0	3.0E+1	1.5E+0	4.9E+0	7.7E+1	5.8E+2	7.4E+1
Cm-244	3.3E+1	1.3E+2	9.0E+3	3.8E+2	2.1E+1	1.2E+4	7.7E+3	1.2E+3
Co-60	3.0E+1	9.1E+2	2.3E+3	2.7E+1	8.9E+1	1.9E+6	3.5E+6	6.4E+5
Cs-134	1.3E+5	2.6E+5	3.7E+3	1.5E+1	2.0E+2	9.4E+1	4.1E+4	5.1E+3
Cs-135	1.3E+0	4.8E+0	2.1E+1	1.4E+0	4.0E-1	3.2E+1	4.9E+1	6.4E+0
Cs-137	9.1E+5	2.5E+6	1.5E+6	7.8E+4	1.6E+4	1.5E+6	2.3E+6	3.2E+5
Eu-154	2.4E+4	9.2E+4	3.9E+4	9.3E+2	3.0E+2	8.6E+4	1.1E+5	1.8E+4
Eu-155	1.1E+4	3.7E+4	5.9E+3	6.3E+1	3.8E+2	5.3E+3	6.7E+4	9.0E+3
Fe-55	1.0E+4	4.7E+4	1.6E+0	5.3E-3	2.6E+1	2.0E+4	4.8E+5	5.5E+4
H-3	3.3E+3	8.8E+3	6.9E+3	2.3E+2	6.0E+1	1.7E+4	1.7E+4	2.7E+3
I-129	2.4E-1	6.6E-1	8.7E-1	5.9E-2	1.1E-2	7.8E-1	1.3E+0	1.7E-1
Kr-85	8.7E+4	2.2E+5	7.9E+4	2.3E+3	4.7E+2	4.2E+4	8.5E+4	1.2E+4
Np-237	2.3E+0	4.7E+0	1.1E+1	7.3E-1	2.5E-2	1.1E+1	5.6E+0	7.6E-1
Pa-231	3.4E-4	1.2E-3	4.1E+0	2.8E-1	5.7E-8	2.0E-1	6.1E-2	8.7E-3
Pb-210	1.0E-6	1.2E-5	7.3E-4	8.3E-5	4.1E-9	1.6E-3	3.2E-4	1.1E-5
Pm-147	7.5E+5	1.8E+6	5.2E+3	1.7E+1	1.1E+3	1.9E+3	2.2E+5	2.8E+4
Pu-238	4.8E+3	8.8E+3	1.5E+5	9.5E+3	2.2E+2	1.5E+5	3.8E+4	3.0E+3

Table K-11. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 17 through 24 (page 2 of 2).[a,b]

			Thorium/uranium carbide		Plutonium/ uranium carbide	Mixed oxide		
Radionuclide	Uranium-aluminum MEU Group 17 (Ci)	Uranium silicide Group 18 (Ci)	TRISO or BISO particles in graphite Group 19 (Ci)	Mono-pyrolytic carbon particles Group 20 (Ci)	Not graphite nonsodium bonded Group 21 (Ci)	Zirconium clad Group 22 (Ci)	Stainless steel clad Group 23 (Ci)	Non-stainless steel non-zirconium clad Group 24 (Ci)
Pu-239	1.3E+3	6.7E+3	1.2E+2	7.9E+0	1.0E+3	2.2E+4	1.5E+5	0.0E+0
Pu-240	7.1E+2	3.5E+3	2.2E+2	1.6E+1	8.4E+2	1.3E+4	1.1E+5	3.9E+3
Pu-241	1.0E+5	4.9E+5	3.1E+4	1.1E+3	2.3E+4	1.3E+6	4.2E+6	2.6E+4
Pu-242	4.5E-1	2.0E+0	3.4E+0	2.3E-1	2.7E-1	1.3E+2	4.4E+1	1.8E+0
Ra-226	9.0E-6	4.7E-5	1.2E-3	1.6E-4	1.5E-8	4.4E-3	9.2E-4	5.1E-5
Ra-228	1.2E-7	4.9E-6	7.8E-1	5.4E-2	8.1E-13	4.1E-2	1.2E-2	1.7E-3
Ru-106	6.4E+4	1.7E+5	6.5E-1	7.9E-2	5.9E+1	7.4E-1	1.2E+4	1.5E+3
Se-79	4.1E+0	1.1E+1	1.8E+1	1.2E+0	8.5E-2	1.4E+1	1.3E+1	1.7E+0
Sn-126	3.7E+0	1.0E+1	1.9E+1	1.3E+0	3.7E-1	1.3E+1	4.0E+1	5.2E+0
Sr-90	8.6E+5	2.3E+6	1.5E+6	7.4E+4	5.8E+3	1.4E+6	1.2E+6	1.7E+5
Tc-99	1.4E+2	3.9E+2	2.9E+2	1.9E+1	3.3E+0	4.8E+2	4.8E+2	6.2E+1
Th-229	5.5E-7	5.1E-6	5.8E+0	6.2E-1	1.6E-8	1.2E-1	2.9E-2	2.7E-3
Th-230	3.6E-3	8.4E-3	1.2E-1	1.1E-2	3.1E-6	4.0E-1	9.6E-2	9.1E-3
Th-232	1.4E-7	6.4E-6	2.5E+0	1.7E-1	1.2E-12	4.1E-2	1.3E-2	1.8E-3
Tl-208	9.8E-3	1.7E-2	5.8E+2	3.5E+1	4.3E-3	6.0E+0	2.5E+0	3.7E-1
U-232	2.9E-2	4.8E-2	1.6E+3	9.4E+1	1.2E-2	1.6E+1	6.7E+0	1.0E+0
U-233	5.0E-4	4.3E-3	1.8E+3	1.2E+2	2.5E-6	2.5E+1	7.7E+0	1.1E+0
U-234	3.7E+1	4.7E+1	2.4E+2	1.7E+1	2.2E-2	8.7E+2	2.7E+2	3.9E+1
U-235	4.4E-1	1.2E+0	3.6E+0	2.4E-1	1.9E-4	4.0E+1	1.2E+1	1.8E+0
U-236	4.7E+0	1.2E+1	7.4E+0	5.0E-1	1.1E-3	1.6E+1	5.1E+0	7.3E-1
U-238	7.9E-1	2.2E+0	4.5E-2	3.0E-3	1.8E-2	8.0E+0	5.0E+0	3.9E-1

a. LEU = low enriched uranium; MEU = medium enriched uranium; HEU = high enriched uranium.
b. Source: Compiled from data contained in DIRS 169354-DOE 2004, Volume II, Appendix C.

Table K-12. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 25 through 34 (page 1 of 3).[a,b]

	Thorium/uranium oxide		Uranium/zirconium hydride					
			Stainless steel/incoloy clad		Aluminum clad			
Radionuclide	Zirconium clad Group 25 (Ci)	Stainless steel clad Group 26 (Ci)	HEU Group 27 (Ci)	MEU Group 28 (Ci)	MEU Group 29 (Ci)	Declad Group 30 (Ci)	Naval spent nuclear fuel Group 32[c] (Ci)	Miscellaneous Group 34 (Ci)
Ac-227	3.9E+1	7.4E+0	2.1E-5	6.5E-5	2.1E-5	2.7E-4	3.9E-2	5.0E-3
Am-241	1.1E+2	7.1E+3	3.8E+2	1.1E+2	3.0E+1	1.1E+2	2.0E+4	2.7E+3
Am-242m	7.3E-1	1.6E+1	8.2E-1	7.2E-2	1.9E-2	3.3E-2	1.8E+2	6.9E+0
Am-243	1.5E-1	1.5E+1	1.1E+0	7.7E-3	2.4E-3	4.2E-3	2.7E+2	1.5E+1
C-14	4.4E+1	1.2E+2	4.4E+0	6.7E+0	4.4E-1	3.6E+0	6.4E+3	3.9E+1
Cf-252	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	4.8E-4	0.0E+0
Cl-36	8.5E-1	2.2E+0	9.3E-2	1.5E-1	4.3E-4	8.0E-2	2.8E+2	7.0E-1
Cm-242	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	5.6E+2	0.0E+0
Cm-243	1.8E-1	1.0E+0	1.1E+0	8.8E-3	2.4E-3	1.7E-3	3.2E+2	8.1E-1
Cm-244	9.8E+0	2.2E+2	1.1E+2	8.2E-2	2.6E-2	8.6E-3	2.5E+4	5.4E+1
Cm-245	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.9E+0	0.0E+0
Cm-246	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	5.6E-1	0.0E+0
Cm-247	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	3.8E-6	0.0E+0
Cm-248	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	1.0E-5	0.0E+0
Co-60	1.5E+3	9.5E+4	2.3E+4	5.8E+4	2.2E+2	9.8E+1	1.5E+6	1.1E+4
Co-60 (Crud)	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.3E+3	0.0E+0
Cs-134	3.5E+2	1.1E+1	9.8E+3	4.0E+3	7.1E+2	7.0E-4	3.4E+7	8.8E+1
Cs-135	1.3E+1	2.6E+0	6.9E-1	1.7E+0	3.2E-1	9.1E-1	1.8E+3	4.4E+0
Cs-137	8.8E+5	1.4E+5	8.0E+4	1.4E+5	2.4E+4	2.8E+4	1.8E+8	2.1E+5
Eu-154	9.1E+3	3.2E+3	2.7E+3	7.1E+2	1.0E+4	1.2E+1	0.0E+0	5.1E+2
Eu-155	1.3E+3	3.0E+2	9.8E+2	1.3E+3	3.1E+3	1.6E+0	0.0E+0	2.3E+3
Fe-55	1.6E+1	3.8E+3	1.2E+4	3.4E+4	6.0E+1	1.4E-1	0.0E+0	3.7E+2
H-3	1.8E+3	5.5E+2	2.5E+2	5.2E+2	8.5E+1	2.5E+1	5.6E+5	1.1E+3
I-129	7.5E-1	1.3E-1	2.5E-2	3.8E-2	7.4E-3	2.1E-2	4.8E+1	1.1E-1
Kr-85	5.6E+4	5.8E+3	5.8E+3	1.2E+4	1.9E+3	3.9E+2	1.4E+7	1.3E+4

Table K-12. Radionuclide inventories in the year 2010 for DOE pent nuclear fuel groups 25 through 34 (page 2 of 3).[a,b]

	Thorium/uranium oxide		Uranium/zirconium hydride					
			Stainless steel/incoloy clad		Aluminum clad			
Radionuclide	Zirconium clad Group 25 (Ci)	Stainless steel clad Group 26 (Ci)	HEU Group 27 (Ci)	MEU Group 28 (Ci)	MEU Group 29 (Ci)	Declad Group 30 (Ci)	Naval spent nuclear fuel Group 32[c] (Ci)	Miscellaneous Group 34 (Ci)
Nb-93m	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	1.4E+3	0.0E+0
Nb-94	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	7.2E+4	0.0E+0
Ni-59	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.5E+4	0.0E+0
Ni-63	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	3.1E+6	0.0E+0
Np-237	5.9E-2	1.5E-1	4.2E-1	6.5E-2	1.5E-2	3.7E-2	6.4E+2	3.6E-1
Pa-231	5.7E+1	9.1E+0	5.3E-5	2.3E-4	5.6E-5	4.4E-4	2.1E-1	1.2E-2
Pb-210	5.6E-3	1.1E-3	1.9E-8	1.2E-9	9.8E-10	2.0E-8	3.6E-4	7.7E-6
Pd-107	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.4E+1	0.0E+0
Pm-147	1.7E+3	2.3E+2	1.8E+4	9.3E+4	1.4E+4	4.1E-1	0.0E+0	2.2E+4
Pu-238	2.2E+2	2.9E+3	1.8E+3	5.3E+1	1.3E+1	2.1E+1	4.8E+6	8.6E+2
Pu-239	1.3E+1	3.8E+2	4.9E+1	2.9E+2	5.7E+1	1.6E+2	4.8E+3	2.1E+3
Pu-240	7.6E+0	2.7E+2	4.0E+1	1.1E+2	2.3E+1	6.0E+1	5.6E+3	1.9E+2
Pu-241	1.1E+3	7.1E+4	1.1E+4	4.9E+3	1.0E+3	3.3E+2	1.6E+6	1.7E+4
Pu-242	1.9E-2	2.2E+0	1.7E-1	1.2E-2	3.1E-3	6.6E-3	3.2E+1	7.2E-1
Ra-226	6.8E-3	1.7E-3	7.8E-8	5.4E-9	3.0E-9	4.8E-8	2.2E-3	2.0E-5
Ra-228	2.2E+0	3.5E-1	7.3E-7	1.0E-5	2.0E-6	7.2E-6	7.2E-5	3.1E-4
Rh-102	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	1.1E+1	0.0E+0
Ru-106	1.8E-2	3.5E-3	1.4E+3	4.0E+3	6.4E+2	9.7E-11	2.4E+6	3.9E+1
Se-79	1.7E+1	2.9E+0	4.5E-1	6.8E-1	1.3E-1	3.7E-1	1.4E+2	1.6E+0
Sm-151	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	5.6E+5	0.0E+0
Sn-126	1.9E+1	3.2E+0	4.2E-1	6.3E-1	1.2E-1	3.5E-1	4.8E+2	3.6E+0
Sr-90	8.9E+5	1.4E+5	7.5E+4	1.3E+5	2.3E+4	2.5E+4	1.8E+8	1.9E+5
Tc-99	1.5E+2	3.1E+1	1.4E+1	2.3E+1	4.4E+0	1.3E+1	2.8E+4	4.5E+1
Th-229	2.2E+1	4.9E+0	5.1E-6	9.0E-6	2.7E-6	2.2E-5	3.8E-3	1.8E-3
Th-230	4.9E-1	9.0E-2	1.6E-5	1.2E-6	4.1E-7	3.7E-6	7.2E-1	1.9E-3

Table K-12. Radionuclide inventories in the Year 2010 for DOE spent nuclear fuel groups 25 through 34 (page 3 of 3).[a,b]

	Thorium/uranium oxide		Uranium/zirconium hydride					
			Stainless steel/incoloy clad		Aluminum clad			
Radionuclide	Zirconium clad Group 25 (Ci)	Stainless steel clad Group 26 (Ci)	HEU Group 27 (Ci)	MEU Group 28 (Ci)	MEU Group 29 (Ci)	Declad Group 30 (Ci)	Naval spent nuclear fuel Group 32[c] (Ci)	Miscellaneous Group 34 (Ci)
Th-232	4.5E+0	8.0E-1	8.5E-7	1.3E-5	2.4E-6	7.2E-6	9.2E-5	2.7E-2
Tl-208	7.2E+3	1.1E+3	5.0E-3	8.7E-4	1.9E-4	3.4E-4	0.0E+0	4.5E-1
U-232	2.0E+4	2.9E+3	1.4E-2	2.5E-3	5.3E-4	9.1E-4	2.2E+2	1.2E+0
U-233	1.4E+4	2.5E+3	2.4E-3	6.3E-3	1.3E-3	3.5E-3	1.2E+0	8.7E+1
U-234	3.9E+2	7.4E+1	1.2E-1	8.7E-3	2.1E-3	8.1E-3	6.0E+3	4.4E+0
U-235	3.0E-2	5.3E-1	2.1E-1	5.0E-1	1.3E-1	2.6E-2	1.2E+2	2.1E-1
U-236	6.3E-2	2.2E-1	4.7E-1	6.6E-1	1.3E-1	3.6E-1	1.0E+3	1.3E+0
U-238	1.8E-3	1.1E-1	1.6E-2	3.9E-1	9.7E-2	1.5E-2	4.8E-1	8.6E-2
Zr-93	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	4.4E+3	0.0E+0

a. LEU = low enriched uranium; MEU = medium enriched uranium; HEU = high enriched uranium.
b. Source: Compiled from data contained in DIRS 169354-DOE 2004, Volume II, Appendix C.
c. Radionuclide inventory is for 400 casks. Single cask Naval spent fuel inventory is from DIRS 155857-McKenzie 2001, Table 3.
Note: There would be no shipments of group 31 or group 33 spent nuclear fuel under the Proposed Action.

Table K-13. Radionuclide inventories for commercial spent nuclear fuel shipped in rail casks.[a]

Radionuclide	Pressurized water reactor commercial spent nuclear fuel assembly inventory (Ci)[b]	Pressurized water reactor commercial spent nuclear fuel total inventory (Ci)[b]	Boiling water reactor commercial spent nuclear fuel assembly inventory (Ci)[c]	Boiling water reactor commercial spent nuclear fuel total inventory (Ci)[c]
Am-241	1.28E+03	1.11E+08	3.73E+02	4.61E+07
Am-242m	7.99E+00	6.96E+05	2.88E+00	3.56E+05
Am-243	3.93E+01	3.42E+06	8.63E+00	1.07E+06
C-14	4.35E-01	3.79E+04	1.69E-01	2.09E+04
Cd-113m	2.34E+01	2.03E+06	6.23E+00	7.69E+05
Ce-144	6.99E+01	6.09E+06	1.73E+01	2.14E+06
Cm-242	6.60E+00	5.75E+05	2.38E+00	2.94E+05
Cm-243	2.48E+01	2.16E+06	5.55E+00	6.86E+05
Cm-244	5.85E+03	5.09E+08	9.23E+02	1.14E+08
Cm-245	8.16E-01	7.10E+04	9.07E-02	1.12E+04
Cm-246	4.07E-01	3.54E+04	4.26E-02	5.26E+03
Co-60	2.17E+03	1.89E+08	1.14E+02	1.41E+07
Co-60 (Crud)	1.69E+01	1.47E+06	5.66E+01	6.99E+06
Cs-134	5.43E+03	4.73E+08	1.31E+03	1.62E+08
Cs-137	7.16E+04	6.23E+09	2.41E+04	2.98E+09
Eu-154	3.01E+03	2.62E+08	7.79E+02	9.62E+07
Eu-155	6.42E+02	5.59E+07	1.93E+02	2.39E+07
Fe-55 (Crud)	2.09E+02	1.82E+07	9.84E+01	1.22E+07
H-3	3.05E+02	2.66E+07	1.05E+02	1.30E+07
I-129	2.76E-02	2.40E+03	9.22E-03	1.14E+03
Kr-85	3.39E+03	2.95E+08	1.17E+03	1.45E+08
Np-237	2.94E-01	2.56E+04	8.74E-02	1.08E+04
Pm-147	6.06E+03	5.28E+08	2.11E+03	2.61E+08
Pu-238	3.98E+03	3.46E+08	1.02E+03	1.26E+08
Pu-239	1.75E+02	1.52E+07	5.41E+01	6.68E+06
Pu-240	3.63E+02	3.16E+07	1.27E+02	1.57E+07
Pu-241	5.64E+04	4.91E+09	1.57E+04	1.94E+09
Pu-242	2.48E+00	2.16E+05	7.08E-01	8.75E+04
Ru-106	4.04E+02	3.52E+07	9.05E+01	1.12E+07
Sb-125	5.20E+02	4.53E+07	1.45E+02	1.79E+07
Sr-90	4.51E+04	3.93E+09	1.66E+04	2.05E+09
U-232	3.61E-02	3.14E+03	8.74E-03	1.08E+03
U-234	5.24E-01	4.56E+04	2.39E-01	2.95E+04
U-236	1.77E-01	1.54E+04	7.45E-02	9.20E+03
U-238	1.46E-01	1.27E+04	6.24E-02	7.71E+03
Y-90	4.51E+04	3.93E+09	1.66E+04	2.05E+09

a. Sources: DIRS 169061-BSC 2004, all; DIRS 164364-BSC 2003, all.
b. Total inventory for pressurized water reactor spent nuclear fuel shipped in rail casks is based on 87,057 assemblies (calculated from rail shipments and cask capacities from DIRS 181377-BSC 2007, Section 7.
c. Total inventory for boiling water reactor spent nuclear fuel shipped in rail casks is based on 123,537 assemblies (calculated from rail shipments and cask capacities from DIRS 181377-BSC 2007, Section 7.

Table K-14. Radionuclide inventories for high-level radioactive waste (page 1 of 2).

Radionuclide	Hanford high-level radioactive waste[a] (Ci)	Idaho high-level radioactive waste[b] (Ci)	Savannah River Site high-level radioactive waste[c] (Ci)	West Valley high-level radioactive waste[d] (Ci)
Ac-227	0.00E+00	7.38E+01	0.00E+00	4.92E+01
Am-241	5.41E+03	1.08E+05	7.98E+05	4.58E+04
Am-242	7.86E-03	0.00E+00	0.00E+00	6.56E+02
Am-242m	7.86E-03	0.00E+00	4.55E+02	6.58E+02
Am-243	6.42E-03	1.13E+01	1.29E+03	6.10E+02
Ba-137m	4.76E+06	2.80E+07	2.18E+08	4.80E+06
C-14	1.29E-02	0.00E+00	0.00E+00	0.00E+00
Cd-113m	0.00E+00	7.79E+03	8.96E-08	0.00E+00
Ce-144	0.00E+00	0.00E+00	6.30E+03	0.00E+00
Cf-249	0.00E+00	0.00E+00	1.25E+01	0.00E+00
Cf-251	0.00E+00	0.00E+00	2.87E+01	0.00E+00
Cm-242	7.86E-03	0.00E+00	0.00E+00	5.43E+02
Cm-243	3.99E-04	8.28E+00	1.45E+03	0.00E+00
Cm-244	1.24E-02	1.57E+02	6.51E+06	6.15E+03
Cm-245	1.71E-06	0.00E+00	5.22E+02	0.00E+00
Cm-246	4.02E-08	0.00E+00	1.52E+02	0.00E+00
Cm-247	1.43E-14	0.00E+00	5.99E-03	0.00E+00
Cm-248	4.32E-15	0.00E+00	0.00E+00	0.00E+00
Co-60	3.98E+02	1.87E+03	2.50E+06	0.00E+00
Cs-134	6.75E+01	6.71E+02	8.40E+05	0.00E+00
Cs-135	7.53E+01	0.00E+00	9.17E+02	1.93E+02
Cs-137	4.90E+06	2.80E+07	2.33E+08	5.08E+06
Eu-152	0.00E+00	7.74E+02	0.00E+00	0.00E+00
Eu-154	2.08E+04	5.03E+04	5.88E+06	0.00E+00
Eu-155	1.41E+02	1.82E+03	2.35E+03	0.00E+00
H-3	6.70E+03	0.00E+00	0.00E+00	0.00E+00
I-129	2.61E+00	3.61E+01	2.57E-01	0.00E+00
Nb-93m	6.42E+02	2.00E+03	5.15E+02	2.03E+02
Nb-94	2.48E-03	0.00E+00	0.00E+00	0.00E+00
Ni-59	0.00E+00	1.03E+03	7.56E+02	1.19E+02
Ni-63	0.00E+00	9.06E+04	4.94E+04	9.64E+03
Np-237	2.85E+00	1.06E+02	1.19E+02	3.55E+01
Np-238	0.00E+00	0.00E+00	0.00E+00	2.97E+00
Np-239	0.00E+00	0.00E+00	0.00E+00	6.10E+02
Pa-231	0.00E+00	2.05E+02	0.00E+00	4.91E+01
Pd-107	0.00E+00	0.00E+00	4.52E+00	0.00E+00
Pm-147	9.15E+03	0.00E+00	1.70E+07	0.00E+00
Pr-144	0.00E+00	0.00E+00	6.30E+03	0.00E+00
Pu-238	5.04E+04	3.42E+03	2.08E+07	5.19E+03
Pu-239	8.37E+02	5.20E+04	1.72E+05	1.56E+03
Pu-240	7.26E+02	9.25E+03	1.17E+05	1.11E+03
Pu-241	2.98E+04	6.10E+04	1.22E+07	2.67E+04
Pu-242	1.58E+00	7.53E-01	3.89E+02	3.04E-03
Ra-226	2.60E-03	6.78E-02	0.00E+00	0.00E+00
Ra-228	0.00E+00	1.58E+01	0.00E+00	2.07E+00

Table K-14. Radionuclide inventories for high-level radioactive waste (page 2 of 2).

Radionuclide	Hanford high-level radioactive waste[a] (Ci)	Idaho high-level radioactive waste[b] (Ci)	Savannah River Site high-level radioactive waste[c] (Ci)	West Valley high-level radioactive waste[d] (Ci)
Ru-106	0.00E+00	1.51E+00	1.65E+04	0.00E+00
Sb-125	2.72E+02	1.86E+03	0.00E+00	0.00E+00
Sb-126	0.00E+00	0.00E+00	0.00E+00	7.59E+00
Sb-126m	0.00E+00	0.00E+00	0.00E+00	5.42E+01
Se-79	0.00E+00	9.19E+01	2.07E+02	0.00E+00
Sm-151	0.00E+00	2.46E+06	4.27E+05	5.08E+04
Sn-126	4.12E+01	4.36E+02	1.08E+02	5.42E+01
Sr-90	6.01E+06	3.06E+07	2.67E+08	2.89E+06
Tc-99	1.58E+03	2.24E+04	5.46E+04	8.90E+02
Th-229	0.00E+00	1.51E+00	3.07E-01	7.51E-03
Th-230	1.72E-01	0.00E+00	2.76E-02	3.28E-04
Th-232	4.48E-08	6.02E+00	3.30E+00	2.54E+00
Tl-208	0.00E+00	0.00E+00	0.00E+00	6.65E-01
U-232	2.75E-03	3.01E+01	1.29E+00	0.00E+00
U-233	2.76E-04	3.84E+02	9.63E+01	6.10E+00
U-234	4.28E+01	1.66E+02	2.84E+02	2.65E+00
U-235	2.73E-01	6.78E+00	2.10E+00	2.15E-05
U-236	7.12E-01	4.52E+00	2.64E+01	4.58E-04
U-237	0.00E+00	0.00E+00	0.00E+00	6.40E-01
U-238	1.36E-02	1.50E+02	1.81E+02	0.00E+00
Y-90	6.01E+06	3.06E+07	2.67E+08	2.89E+06
Zr-93	0.00E+00	3.62E+03	6.58E+02	2.03E+02

a. The Hanford high-level radioactive waste radionuclide inventory represents the radionuclide inventory in 5,325 canisters (DIRS 181377-BSC 2007, Section 7; DIRS 180471-BSC 2007, Table 8).
b. The Idaho high-level radioactive waste radionuclide inventory represents the radionuclide inventory in 550 canisters (DIRS 181377-BSC 2007, Section 7; DIRS 180471-BSC 2007, Table 19).
c. The Savannah River Site high-level radioactive waste radionuclide inventory represents the radionuclide inventory in 3,500 canisters (DIRS 181377-BSC 2007, Section 7; DIRS 180471-BSC 2007, Table 3).
d. The West Valley high-level radioactive waste radionuclide inventory represents the radionuclide inventory in 300 canisters (DIRS 181377-BSC 2007, Section 7; DIRS 180471-BSC 2007, Table 17.

Table K-15. Spent nuclear fuel groups, spent nuclear fuel descriptions, and release fraction groups (page 1 of 2).

Spent nuclear fuel group	Description	Release fraction group
1	Uranium metal, zirconium clad, low enriched uranium	1
2	Uranium metal, non-zirconium clad, low enriched uranium	1
3	Uranium-zirconium	1
4	Uranium-molybdenum	1
5	Uranium oxide, zirconium clad (intact), high enriched uranium	2
6	Uranium oxide, zirconium clad (intact), medium enriched uranium	2
7	Uranium oxide, zirconium clad (intact), low enriched uranium	2
8	Uranium oxide, stainless steel/hastelloy clad (intact), high enriched uranium	2
9	Uranium oxide, stainless steel clad (intact), high enriched uranium	2

Table K-15. Spent nuclear fuel groups, spent nuclear fuel descriptions, and release fraction groups (page 2 of 2).

Spent nuclear fuel group	Description	Release fraction group
10	Uranium oxide, stainless steel clad (intact), low enriched uranium	2
11	Uranium oxide, non-aluminum clad (nonintact or declad), high enriched uranium	3
12	Uranium oxide, non-aluminum clad (nonintact or declad), medium enriched uranium	3
13	Uranium oxide, non-aluminum clad (nonintact or declad), low enriched uranium	3
14	Uranium oxide, aluminum clad, high enriched uranium	3
15	Uranium oxide, aluminum clad, medium enriched uranium and low enriched uranium	3
16	Uranium-aluminum, high enriched uranium	4
17	Uranium-aluminum, medium enriched uranium	4
18	Uranium silicide	4
19	Thorium/uranium carbide, TRISO- or BISO-coated particles in graphite	5
20	Thorium/uranium carbide, mono-pyrolytic carbon-coated articles in graphite	6
21	Plutonium/uranium carbide, nongraphite clad, not sodium bonded	3
22	Mixed oxide, zirconium clad	2
23	Mixed oxide, stainless steel clad	2
24	Mixed oxide, non-stainless steel/non-zirconium clad	2
25	Thorium/uranium oxide, zirconium clad	2
26	Thorium/uranium oxide, stainless steel clad	2
27	Uranium-zirconium hydride, stainless steel/incoloy clad, high enriched uranium	7
28	Uranium-zirconium hydride, stainless steel/incoloy clad, medium enriched uranium	7
29	Uranium-zirconium hydride, aluminum clad, medium enriched uranium	7
30	Uranium-zirconium hydride, aluminum clad, declad	7
31[a]	Metallic sodium bonded	–
32	Naval spent nuclear fuel	Navy
33[a]	Canyon stabilization	–
34	Miscellaneous	1
PWR	Pressurized water reactor	PWR
BWR	Boiling water reactor	BWR
HLW	Hanford, Idaho, Savannah River Site, and West Valley high-level radioactive waste	HLW

a. Under the Proposed Action in the Rail Alignment EIS, there would be no shipments of DOE groups 31 and 33 spent nuclear fuel.

Table K-16. Accident severity categories, conditional probabilities, and release fractions for commercial pressurized water reactor spent nuclear fuel (PWR Release Fraction Group).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.96E-1	5.87E-9	1.34E-7	1.34E-7	1.37E-3
3	4.91E-5	8.39E-1	1.68E-5	2.52E-7	2.52E-7	9.44E-3
4	5.77E-7	8.00E-1	8.71E-6	1.32E-5	1.32E-5	4.42E-3
5	1.10E-7	8.35E-1	3.60E-5	1.37E-5	1.37E-5	5.36E-3
6	8.52E-10	8.47E-1	5.71E-5	4.63E-5	1.43E-5	1.59E-2
one-group	--	4.93E-5	8.34E-10	2.67E-11	2.67E-11	5.20E-7

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-26.

Table K-17. Accident severity categories, conditional probabilities, and release fractions for commercial boiling water reactor spent nuclear fuel (BWR Release Fraction Group).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	2.35E-2	7.04E-10	1.47E-8	1.47E-8	5.59E-4
3	4.91E-5	8.39E-1	1.68E-5	2.52E-7	2.52E-7	9.44E-3
4	5.77E-7	8.00E-1	8.71E-6	1.32E-5	1.32E-5	4.42E-2
5	1.10E-7	8.37E-1	4.12E-5	1.82E-5	1.82E-5	5.43E-3
6	8.52E-10	8.45E-1	7.30E-5	5.94E-5	1.96E-5	1.60E-2
one-group	--	4.27E-5	8.35E-10	2.26E-11	2.26E-11	5.11E-7

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-27.

Table K-18. Accident severity categories, conditional probabilities, and release fractions for naval spent nuclear fuel (Navy Release Fraction Group).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99996	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	4.02E-5	1.52E-2	4.55E-9	9.10E-9	9.10E-9	1.37E-3
3	6.32E-6	8.39E-2	1.68E-6	2.52E-8	2.52E-8	9.44E-3
4	1.22E-7	8.00E-2	8.98E-7	1.34E-6	1.34E-6	4.47E-2
5	1.51E-8	9.44E-2	4.00E-6	1.80E-6	1.80E-6	5.36E-3
6	1.66E-10	9.04E-2	5.49E-6	4.67E-6	1.93E-6	2.86E-2
one-group	--	1.15E-6	1.10E-11	7.17E-13	7.16E-13	1.20E-7

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-46.

Table K-19. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 1, 2, 3, 4, and 34 (Release Fraction Group 1).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	2.84E-4	1.71E-6	3.91E-7	1.10E-8	2.96E-5
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	2.13E-3	2.36E-6	3.55E-6	3.55E-6	1.18E-2
5	1.10E-7	4.00E-3	7.87E-5	1.77E-5	9.68E-8	1.61E-4
6	8.52E-10	4.68E-2	9.63E-4	2.47E-4	2.73E-6	7.17E-3
one-group	--	1.27E-8	7.69E-11	1.93E-11	2.49E-12	8.00E-9

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-33.

Table K-20. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 5, 6, 7, 8, 9, 10, 22, 23, 24, 25, and 26 (Release Fraction Group 2).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.96E-1	5.87E-9	1.34E-7	1.34E-7	1.37E-3
3	4.91E-5	8.39E-1	1.68E-5	2.52E-7	2.52E-7	9.44E-3
4	5.77E-7	8.00E-1	8.71E-6	1.32E-5	1.32E-5	4.42E-3
5	1.10E-7	8.35E-1	3.60E-5	1.37E-5	1.37E-5	5.36E-3
6	8.52E-10	8.47E-1	5.71E-5	4.63E-5	1.43E-5	1.59E-2
one-group	--	4.93E-5	8.34E-10	2.67E-11	2.67E-11	5.20E-7

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-26.

Table K-21. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 11, 12, 13, 14, 15, and 21 (Release Fraction Group 3).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.15E-4	3.44E-10	7.15E-9	7.15E-9	2.38E-5
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	2.13E-3	2.36E-6	3.55E-6	3.55E-6	1.18E-2
5	1.10E-7	4.00E-3	3.14E-7	9.68E-8	9.68E-8	1.61E-4
6	8.52E-10	1.67E-2	2.68E-6	2.29E-6	2.04E-6	6.15E-3
one-group	--	6.12E-9	1.41E-12	2.34E-12	2.34E-12	7.78E-9

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-35.

Table K-22. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 16, 17, and 18 (Release Fraction Group 4).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	2.84E-4	8.53E-5	1.10E-8	1.10E-8	4.11E-5
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	2.13E-3	2.36E-6	3.55E-6	3.55E-6	1.18E-2
5	1.10E-7	4.00E-3	3.53E-3	9.68E-8	9.68E-8	4.26E-4
6	8.52E-10	4.68E-2	2.92E-2	2.73E-6	2.73E-6	1.03E-2
one-group	--	1.27E-8	3.72E-9	2.49E-12	2.49E-12	8.48E-9

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-39.

Table K-23. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel group 19 (Release Fraction Group 5).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.02E-4	6.12E-11	6.12E-11	6.12E-11	0.00E+0
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	4.77E-3	7.89E-8	7.89E-8	7.89E-8	0.00E+0
5	1.10E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
6	8.52E-10	1.70E-3	2.84E-8	2.62E-8	2.62E-8	0.00E+0
one-group	--	6.70E-9	4.79E-14	4.79E-14	4.79E-14	0.00E+0

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-41.

Table K-24. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel group 20 (Release Fraction Group 6).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	5.14E-1	3.70E-7	3.70E-7	3.70E-7	0.00E+0
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	4.77E-1	7.89E-6	7.89E-6	7.89E-6	0.00E+0
5	1.10E-7	7.64E-1	6.32E-6	5.73E-7	5.73E-7	0.00E+0
6	8.52E-10	7.45E-1	7.57E-6	5.82E-6	3.02E-6	0.00E+0
one-group	--	2.02E-5	1.96E-11	1.89E-11	1.89E-11	0.00E+0

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-43.

Table K-25. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 27, 28, 29, and 30 (Release Fraction Group 7).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.15E-4	3.44E-8	7.15E-7	7.15E-7	2.38E-5
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	2.13E-3	2.36E-4	3.55E-4	3.55E-4	1.18E-2
5	1.10E-7	1.97E-2	1.97E-2	8.99E-5	1.93E-6	7.15E-4
6	8.52E-10	7.98E-2	7.91E-2	5.43E-4	1.76E-4	8.58E-3
one-group	--	7.91E-9	2.37E-9	2.43E-10	2.33E-10	7.84E-9

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-45.

Table K-26. Accident severity categories, conditional probabilities, and release fractions for Idaho, Hanford, and Savannah River Site high-level radioactive waste (HLW Release Fraction Group).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	0.00E+0	6.22E-8	6.22E-8	6.22E-8	0.00E+0
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	0.00E+0	7.89E-6	7.89E-6	7.89E-6	0.00E+0
5	1.10E-7	0.00E+0	9.29E-8	9.29E-8	9.29E-8	0.00E+0
6	8.52E-10	0.00E+0	2.74E-6	2.74E-6	2.74E-6	0.00E+0
one-group	--	0.00E+0	6.97E-12	6.97E-12	6.97E-12	0.00E+0

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-48.

Table K-27. Accident severity categories, conditional probabilities, and unit risk factors for loss of shielding accidents for steel-lead-steel rail casks.[a]

Accident severity category	Conditional probability	Unit risk factor (person-rem per people/km^2)[b]
1	0.9999	3.86E-5
2	6.44E-6	7.22E-3
3	4.90E-5	2.03E-3
4	4.46E-7	1.24E-2
5	2.37E-5	2.41E-3
6	5.18E-9	2.97E-2
one-group	--	3.88E-5

a. Source: DIRS 155970-DOE 2002, Table J-19.
b. To convert person-rem per people/km^2 to person-rem per people/mile^2, multiply by 0.38610.

Table K-28. Accident severity categories, conditional probabilities, and unit risk factors for loss of shielding accidents for monolithic steel rail casks.[a]

Accident severity category	Conditional probability	Unit risk factor (person-rem per people/km^2)[b]
1	1.0000	3.86E-5
2	0	3.86E-5
3	0	3.86E-5
4	0	3.86E-5
5	0	3.86E-5
6	0	3.86E-5
one-group	--	3.86E-5

a. Source: DIRS 155970-DOE 2002, Table J-19.
b. To convert person-rem per people/km^2 to person-rem per people/mile^2, multiply by 0.38610.

K.2.4.5 Population Density Zones

DOE used three population density zones (urban, rural, and suburban) for the transportation risk assessment. The Department defined urban areas as areas with a population density greater than 3,326 people per square kilometer; rural areas as areas with a population density less than 139 people per square kilometer; and suburban areas as areas with a population density between 139 and 3,326 people per square kilometer. The Department based the actual population densities, which Table K-2 lists, on 2000 census data. The radiological impacts were escalated to the year 2067 using the escalation factors listed in Table K-4.

K.2.4.6 Exposure Pathways

DOE calculated radiological doses for an individual located near the scene of the accident and for populations within 80 kilometers (50 miles) of the accident. Dose calculations considered a variety of exposure pathways, including inhalation and direct exposure (immersion or cloudshine) from the passing cloud, ingestion of contaminated food, direct exposure (groundshine) from radioactivity deposited on the ground, and inhalation of resuspended radioactive particles from the ground (resuspension).

K.2.4.7 Unit Risk Factors and Radiation Dosimetry

As discussed in this section, DOE estimated the radiation doses from transportation accidents using unit risk factors. The Department estimated unit risk factors using the RADTRAN 5 computer code (DIRS 150898-Neuhauser and Kanipe 2000, all; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, all) for five pathways: (1) ingestion, (2) inhalation, (3) immersion, (4) resuspension, and (5) groundshine. Table K-29 lists the unit risk factors.

DOE estimated the unit risk factors listed in Table K-29 using the ICRP inhalation and ingestion dose coefficients (DIRS 172935-ICRP 2001, all) and the EPA groundshine and immersion dose coefficients (DIRS 175544-EPA 2002, all). These dose coefficients are based on the recommendations by the International Commission on Radiological Protection in ICRP Publication 60 (DIRS 101836-ICRP 1991, all) and incorporate the dose coefficients from ICRP Publication 72 (DIRS 152446-ICRP 1996, all). For each radionuclide, the dose coefficients used to estimate the unit risk factors in Table K-29 are listed in DIRS 176975-BMI 2006, Table 5 and include radioactive progeny (DIRS 176975-BMI 2006, Table 2). The lung absorption type and the value for the fractional absorption to blood from the small intestine (f_1) for each radionuclide are also listed in DIRS 176975-BMI 2006, Table 5.

Incident-free transportation unit risk factors are calculated using the RADTRAN 5 and RISKIND computer codes. These unit risk factors are estimates of the radiation dose from transporting one cask containing spent nuclear fuel or high-level radioactive waste over a unit distance (for example, 1 kilometer) through an area having a population density of one person per unit of area (for example, 1 person per square kilometer). As in the incident-free transportation analysis, using unit risk factors simplifies the analysis of transportation risks and also improves its transparency and traceability.

For transportation accidents, unit risk factors provide estimates of:

- The radiation dose to an average person in a surrounding unit area (for example, a population density of one person per square kilometer) that could result if one curie of a specified radionuclide were released;
- The dose to a general population from ingestion of contaminated food from the accidental release of one curie of a specified radionuclide. The unit risk factor includes the assumption that all contaminated food is consumed.

For transportation accidents where a portion of a cask's radiation shield was damaged or lost (loss-of-shielding accidents), and for cases in which the cask's shield might remain intact, unit risk factors provide estimates of the resulting radiation dose to a person in a surrounding unit area after an accident.

K.2.4.8 Accidents Involving Hazardous Chemicals

DOE would ship spent nuclear fuel and high-level radioactive waste on the proposed rail line using dedicated trains, and hazardous chemical cargos would not be present on the same train as the spent nuclear fuel or high-level radioactive waste. In addition, trains carrying other materials to or from the repository would pull off onto sidings to let cask trains pass, which would greatly reduce the potential for accidents, including those involving hazardous chemicals.

Table K-29. Unit risk factors used in the transportation risk assessment (page 1 of 3).

Radionuclide	Physical form	Ingestion pathway unit risk factor (person-rem/ Ci × Ci deposited)	Inhalation pathway unit risk factor (person-rem/ Ci per people/km^2) [a]	Immersion pathway unit risk factor (person-rem/ Ci per people/km^2)	Resuspension pathway unit risk factor (person-rem/ Ci per people/km^2)	Groundshine pathway unit risk factor (person-rem/ Ci per people/km^2)
Ac-227 plus progeny	Particulates	2.12E+6	6.34E+0	3.75E-6	2.76E+1	2.21E-1
Am-241	Particulates	3.50E+5	2.98E+0	1.45E-7	1.36E+1	1.98E-2
Am-242m plus progeny	Particulates	3.33E+5	2.63E+0	1.37E-7	1.19E+1	1.46E-2
Am-243 plus progeny	Particulates	3.51E+5	2.92E+0	1.90E-6	1.33E+1	1.77E-1
Be-10	Particulates	1.92E+3	2.50E-3	2.97E-8	1.14E-2	3.00E-3
C-14	Inert gas	1.01E+3	3.91E-6	4.98E-9	0.00E+0	0.00E+0
Cd-113m	Particulates	4.02E+4	2.21E-3	1.95E-8	9.37E-3	6.33E-4
Ce-144 plus progeny	Particulates	9.19E+3	2.55E-3	7.39E-7	5.09E-3	7.00E-3
Cf-252	Particulates	1.57E+5	1.42E+0	7.85E-10	4.69E+0	5.21E-5
Cl-36	Cesium	1.63E+3	5.18E-4	3.57E-8	2.37E-3	9.85E-3
Cm-242	Particulates	2.10E+4	3.69E-1	8.67E-10	5.18E-1	1.74E-5
Cm-243	Particulates	2.62E+5	2.21E+0	1.14E-6	9.73E+0	6.35E-2
Cm-244	Particulates	2.10E+5	1.92E+0	7.33E-10	8.28E+0	2.76E-4
Cm-245	Particulates	3.67E+5	2.98E+0	7.56E-7	1.36E+1	7.06E-2
Cm-246	Particulates	3.67E+5	2.98E+0	6.69E-10	1.36E+1	5.04E-4
Cm-247 plus progeny	Particulates	3.33E+5	2.76E+0	3.20E-6	1.26E+1	2.83E-1

Table K-29. Unit risk factors used in the transportation risk assessment (page 2 of 3).

Radionuclide	Physical form	Ingestion pathway unit risk factor (person-rem/ Ci × Ci deposited)	Inhalation pathway unit risk factor (person-rem/ Ci per people/km^2) [a]	Immersion pathway unit risk factor (person-rem/ Ci per people/km^2)	Resuspension pathway unit risk factor (person-rem/ Ci per people/km^2)	Groundshine pathway unit risk factor (person-rem/ Ci per people/km^2)
Cm-248	Particulates	1.35E+6	1.07E+1	5.08E-10	4.86E+1	3.88E-4
Co-58	Particulates	1.29E+3	1.49E-4	9.60E-6	1.10E-4	1.09E-2
Co-60	Particulates	5.95E+3	2.21E-3	2.56E-5	8.45E-3	3.97E-1
Co-60	Crud	5.95E+3	2.21E-3	2.56E-5	8.45E-3	3.97E-1
Cs-134	Cesium	3.32E+4	4.68E-4	1.52E-5	1.44E-3	1.21E-1
Cs-135	Cesium	3.50E+3	4.90E-5	2.05E-9	2.24E-4	2.37E-5
Cs-137 plus progeny	Cesium	2.27E+4	3.26E-4	5.50E-6	1.44E-3	3.04E-1
Eu-154	Particulates	3.50E+3	3.76E-3	1.24E-5	1.54E-2	3.05E-1
Eu-155	Particulates	5.60E+2	4.90E-4	4.63E-7	1.85E-3	8.80E-3
Fe-55	Particulates	5.77E+2	2.71E-5	0.00E+0	8.99E-5	0.00E+0
Fe-59	Particulates	3.15E+3	2.63E-4	1.21E-5	1.30E-4	8.21E-3
H-3	Inert gas	3.15E+1	1.71E-5	0.00E+0	0.00E+0	0.00E+0
I-129	Cesium	1.92E+5	2.55E-3	6.11E-8	1.17E-2	1.72E-2
Kr-85	Inert gas	0.00E+0	0.00E+0	4.60E-7	0.00E+0	0.00E+0
Mn-54	Particulates	1.24E+3	1.07E-4	8.26E-6	2.24E-4	3.28E-2
Nb-93m	Particulates	2.10E+2	3.63E-5	6.57E-10	1.54E-4	2.44E-4
Nb-94	Particulates	2.97E+3	7.81E-4	1.55E-5	3.57E-3	1.31E+0
Nb-95	Particulates	1.01E+3	1.07E-4	7.51E-6	4.27E-5	4.22E-3
Ni-59	Particulates	1.10E+2	9.24E-6	0.00E+0	4.22E-5	0.00E+0
Ni-63	Particulates	2.62E+2	3.42E-5	0.00E+0	1.54E-4	0.00E+0
Np-237 plus progeny	Particulates	1.94E+5	1.63E+0	2.04E-6	7.46E+0	1.86E-1
Pa-231	Particulates	1.24E+6	2.42E+0	3.38E-7	1.10E+1	3.33E-2
Pb-210 plus progeny	Particulates	3.31E+6	3.19E-1	6.52E-8	1.39E+0	1.79E-2
Pd-107	Particulates	6.47E+1	4.19E-5	0.00E+0	1.91E-4	0.00E+0
Pm-147	Particulates	4.55E+2	3.48E-4	1.87E-9	1.15E-3	2.77E-6
Pu-238	Particulates	4.02E+5	1.14E+0	7.56E-10	5.13E+0	4.63E-4
Pu-239	Particulates	4.37E+5	1.14E+0	7.51E-10	5.19E+0	2.50E-4
Pu-240	Particulates	4.37E+5	1.14E+0	7.39E-10	5.19E+0	5.27E-4
Pu-241	Particulates	8.40E+3	1.21E-2	1.37E-11	5.15E-2	6.40E-7
Pu-242	Particulates	4.21E-5	1.07E+0	6.28E-10	4.86E+0	4.37E-4
Ra-226 plus progeny	Particulates	4.90E+5	2.52E-1	1.80E-5	1.15E+0	1.47E+0
Ra-228 plus progeny	Particulates	1.21E+6	1.86E-1	9.66E-6	7.21E-1	1.74E-1
Rh-102	Particulates	4.55E+3	1.21E-3	2.09E-5	4.09E-3	2.16E-1
Ru-106 plus progeny	Ruthenium	1.22E+4	2.00E-3	2.28E-6	4.56E-3	1.62E-2
Sb-125 plus progeny	Particulates	2.27E+3	3.96E-4	4.04E-6	1.32E-3	4.25E-2
Se-79	Particulates	5.07E+3	7.81E-5	8.49E-10	3.57E-4	1.45E-5
Sm-151	Particulates	1.71E+2	2.84E-4	5.32E-12	1.28E-3	2.63E-6
Sn-126 plus progeny	Particulates	8.87E+3	2.02E-3	1.94E-5	9.20E-3	1.73E+0
Sr-90 plus progeny	Particulates	5.37E+4	2.67E-3	1.92E-7	1.18E-2	6.07E-2
Tc-99	Particulates	1.12E+3	2.84E-4	6.17E-9	1.30E-3	5.69E-5
Th-228 plus progeny	Particulates	2.51E+5	3.07E+0	1.65E-5	9.18E+0	1.11E-1
Th-229 plus progeny	Particulates	1.07E+6	6.11E+0	3.01E-6	2.79E+1	3.05E-1
Th-230	Particulates	3.67E+5	9.95E-1	3.21E-9	4.54E+0	5.61E-4
Th-232	Particulates	4.02E+5	1.78E+0	1.57E-9	8.11E+0	3.99E-4

Table K-29. Unit risk factors used in the transportation risk assessment (page 3 of 3).

Radionuclide	Physical form	Ingestion pathway unit risk factor (person-rem/ Ci × Ci deposited)	Inhalation pathway unit risk factor (person-rem/ Ci per people/km^2) [a]	Immersion pathway unit risk factor (person-rem/ Ci per people/km^2)	Resuspension pathway unit risk factor (person-rem/ Ci per people/km^2)	Groundshine pathway unit risk factor (person-rem/ Ci per people/km^2)
U-232	Particulates	5.77E+5	2.63E+0	2.54E-9	1.18E+1	5.76E-4
U-233	Particulates	8.92E+4	6.82E-1	3.05E-9	3.11E+0	5.28E-4
U-234	Particulates	8.57E+4	6.68E-1	1.32E-9	3.05E+0	5.14E-4
U-235 plus progeny	Particulates	8.28E+4	6.05E-1	1.50E-6	2.76E+0	1.37E-1
U-236	Particulates	8.22E+4	6.18E-1	8.32E-10	2.82E+0	4.43E-4
U-238 plus progeny	Particulates	8.47E+4	5.68E-1	3.49E-7	2.59E+0	1.04E-1
Zr-93	Particulates	1.92E+3	7.10E-4	0.00E+0	3.24E-3	0.00E+0

a. To convert person-rem/Ci per people/km^2 to person-rem/Ci per people/mile^2, multiply by 0.386102.

K.2.4.9 Criticality During Accidents

Criticality is the term used to describe an uncontrolled nuclear chain reaction. U.S. Nuclear Regulatory Commission regulations at 10 CFR 71 require that the casks used to ship spent nuclear fuel and high-level radioactive waste be able to survive accident conditions, such as immersion in water, without undergoing a criticality. To meet this requirement, casks are typically designed so that even if water were to fill the cask and the cask contained unirradiated nuclear fuel (the most reactive case from the perspective of a criticality), a criticality would not occur.

K.2.4.10 Aircraft Crash

An aircraft crash into a spent nuclear fuel or high-level radioactive waste cask would be extremely unlikely because the probability of a crash into such a relatively small object, whether stationary or moving, is extremely remote. Nevertheless, DOE analyzed the consequences of an accident in which a large commercial aircraft or a military aircraft is hypothesized to directly hit a cask (DIRS 155970-DOE 2002, Section J.3.3.1). The analysis showed that the heavy shield wall of a cask could not be breached by the penetrating force of the aircraft's center shaft. With the exception of engines, the relatively light structures of an aircraft would be much less capable of causing damage to a cask. A resulting fire would not be sustainable or able to engulf a cask long enough to breach the integrity of the cask.

System malfunctions or material failures that could result in either an accidental release of ordnance or release of a practice weapon were discussed in the *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (DIRS 103472-USAF 1999), and the *Final Environmental Impact Statement, Withdrawal of Public Lands for Range Safety and Training Purposes, Naval Air Station Fallon, Nevada* (DIRS 148199-USN 1998). The Special Nevada Report (DIRS 153277-SAIC 1991) states that the probability of dropped ordnance resulting in injury, death, or property damage ranges from about 1 in 1 billion to 1 in 1 trillion per dropped ordnance incident, with an average of about 1 in 10 billion per dropped ordnance incident. Less than one accidentally dropped ordnance incident is estimated per year for all flight operations over the Nellis Air Force Range (now called the Nevada Test and Training Range) and Naval Air Station Fallon. All of these analyses are incorporated in the Rail Alignment EIS by reference. Spent nuclear fuel transportation would not affect the risk from dropped ordnance or aircraft crashes. The Rail Alignment EIS does not evaluate radiological consequences of an impact of accidentally dropped ordnance on a shipping cask because the probability of such an event (about 1 in 10 billion per year) is so extremely low that it is not reasonably foreseeable.

Accordingly, DOE believes there would be no need for associated mitigation measures and no impacts on military operations.

K.2.4.11 Baltimore Tunnel Fire

On July 18, 2001, a freight train carrying hazardous (non-nuclear) materials derailed and caught fire while passing through the Howard Street railroad tunnel in downtown Baltimore, Maryland. The possible impacts of this fire were evaluated by the Nuclear Regulatory Commission in *Spent Nuclear Fuel Transportation Package Response to the Baltimore Tunnel Fire Scenario* (DIRS 182014-Adkins et al. 2006, all).

This study evaluated the response of the three transportation casks, the HOLTEC Model No. HI-STAR 100, the TransNuclear Model No. TN-68, and the Nuclear Assurance Corporation (NAC) Legal Weight Truck (LWT), to the conditions that existed during the fire. This study concluded that larger transportation packages resembling the HI-STAR 100 and TN-68 would withstand a fire with thermal conditions similar to those that existed in the Baltimore tunnel fire event with only minor damage to peripheral components. This is due to their sizable thermal inertia and design specifications in compliance with currently imposed regulatory requirements.

For the TN-68 and the NAC LWT, the maximum temperatures predicted in the regions of the lid and the vent and drain ports exceed the seals' rated service temperatures, making it possible for a small release to occur, due to crud that might spall off the surfaces of the fuel rods. While a release is not expected to occur for these conditions, any release that could occur would be very small due to a number of factors. These include (1) the tight clearances maintained between the lid and cask body by the closure bolts, (2) the low pressure differential between the cask interior and exterior, (3) the tendency of such small clearances to plug, and (4) the tendency of crud particles to settle or plate out.

The radiological consequences of the package responses to the Baltimore tunnel fire were also evaluated. The analysis indicates that the regulatory dose rate limits specified in 10 CFR 71.51 for accident conditions would not be exceeded by releases or direct radiation from any of these packages in this fire scenario. All three packages are designed to maintain regulatory dose rate limits even with a complete loss of neutron shielding. While highly unlikely, the NAC LWT could experience some decrease in gamma shielding due to slump in the lead as a consequence of this fire scenario, but a conservative analysis shows that the regulatory dose rate limits would not be exceeded.

The results of this evaluation also strongly indicate that neither spent nuclear fuel particles nor fission products would be released from a spent fuel shipping cask carrying intact spent nuclear fuel involved in a severe tunnel fire such as the Baltimore Tunnel Fire. None of the three cask designs analyzed for the Baltimore Tunnel fire scenario (TN-68, HI-STAR 100, and NAC LWT) experienced internal temperatures that would result in rupture of the fuel cladding. Therefore, radioactive material (spent nuclear fuel particles or fission products) would be retained within the fuel rods.

There would be no release from the HI-STAR 100, because the inner welded canister remains leak tight. While a release is unlikely, the potential releases calculated for the TN-68 rail cask and the NAC LWT truck cask indicate that any release of crud from either cask would be very small—less than an A_2 quantity. The release of an A_2 quantity is approximately equivalent to a radiation dose of 5 rem.

The Nuclear Regulatory Commission also evaluated the response of the NAC LWT cask to the conditions present during the Caldecott Tunnel fire in *Spent Fuel Transportation Package Response to the Caldecott Tunnel Fire Scenario* (DIRS 181841-Adkins et al. 2007, all). This fire took place on April 7, 1982, when a tank truck and trailer carrying 8,800 gallons of gasoline was involved in an accident in the Caldecott Tunnel on State Route 24 near Oakland, California. The tank trailer overturned and subsequently caught fire. This event is one of the most severe of the five major highway tunnel fires involving shipments of hazardous material that have occurred world-wide since 1949.

This study concluded that small transportation casks similar to the NAC LWT cask would probably experience degradation of some seals in this severe accident scenario. The maximum temperatures predicted in the regions of the cask lid and the vent and drain ports exceed the rated service temperature of the tetrafluoroethylene (TFE) or Viton seals, making it possible for a small release to occur due to crud that might spall off the surfaces of the fuel rods. However, any release is expected to be very small due to a number of factors. These include (1) the metallic lid seal does not exceed its rated service temperature and therefore can be assumed to remain intact, (2) the tight clearances maintained by the lid closure bolts, (3) the low pressure differential between the cask interior and exterior, (4) the tendency for solid particles to plug small clearance gaps and narrow convoluted flow paths such as the vent and drain ports, and (5) the tendency of crud particles to settle or plate out and consequently not be available for release.

The radiological consequences of the package response to the Caldecott Tunnel fire were also evaluated. The results of this evaluation strongly indicate that neither spent nuclear fuel particles nor fission products would be released from a spent fuel shipping cask involved in a severe tunnel fire such as the Caldecott Tunnel fire. The NAC LWT cask design analyzed for the Caldecott Tunnel fire scenario does not reach internal temperatures that could result in rupture of the fuel cladding. Therefore, radioactive material (spent nuclear fuel particles or fission products) would be retained within the fuel rods. The potential release calculated for the NAC LWT cask in this scenario indicates that any release of crud from the cask would be very small—less than an A_2 quantity.

K.2.5 SEVERE TRANSPORTATION ACCIDENTS

In addition to analyzing the radiological risks of transporting spent nuclear fuel and high-level radioactive waste, the consequences of severe transportation accidents were assessed. Severe transportation accidents with frequencies of about 1×10^{-7} per year are considered to be maximum reasonably foreseeable transportation accidents.

In the Rail Alignment EIS, DOE assumed that these severe accidents could occur anywhere along the rail alignment. There are no urban areas along the Caliente rail alignment or the Mina rail alignment. However, there are suburban areas and rural areas. Suburban areas are defined as areas with a population density between 139 and 3,326 people per square mile. Rural areas were defined as areas with a population density less than 139 people per square mile. For the Caliente rail alignment, using alignment-specific 2000 Census population data escalated to the year 2067, the average population density in suburban areas along the rail alignment ranged from 223 to 226 people per square kilometer (see Table K-30). The average population density in rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (see Table K-30). For the Mina rail alignment, using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the rail alignment ranged from 542 to 589 people per square kilometer (see Table K-31). The average population density in rural areas, escalated to the year 2067, ranged from 3.94 to 4.33 people per square kilometer (see Table K-31). Radiation doses were estimated out to 80 kilometers (50 miles) using these population densities.

DOE used the following assumptions to estimate the consequences of these accidents (DIRS 157144-Jason Technologies 2001, Section 5.3.3.3):

- A release height of the plume of 10 meters (33 feet) for both fire- and impact-related accidents. In the case of an accident with a fire, a 10-meter release height with no plume rise from the buoyancy of the plume due to fire conditions yields higher estimates of consequences than accounting for the buoyancy of the plume from the fire (DIRS 157144-Jason Technologies 2001, p. 176).

- A breathing rate for individuals of 10,400 cubic meters per year (367,000 cubic feet per year). This breathing rate was estimated from data contained in ICRP Publication 23 (DIRS 101074-ICRP 1975, page 346).
- All material released is assumed to be aerosolized and respirable (DIRS 157144-Jason Technologies 2001, p. 177). The deposition velocity for respirable material was 0.01 meters/sec.
- A short-term exposure time to airborne contaminants of 2 hours.
- A long-term exposure time to contamination deposited on the ground of 1 year, with no interdiction or cleanup.
- Consequences were determined using low wind speeds and stable atmospheric conditions (a wind speed of 0.89 meters per second and Class F stability). The severe accident scenario calculation methodology does not include a probabilistic component that includes the atmospheric stability, therefore stable conditions were assumed. Atmospheric conditions affect the dispersion of radionuclides that could be released from a severe accident. The atmospheric concentrations estimated from these atmospheric conditions would be exceeded only 5 percent of the time. Using these atmospheric conditions instead of neutral atmospheric conditions and moderate wind speeds reduces the probability associated with an accident scenario and increases the consequences associated with an accident scenario.
- Consequences were determined for a single rail cask containing 21 pressurized water reactor spent nuclear fuel assemblies.
- The spent nuclear fuel assembly has a burnup of 60 MWd/MTHM, an enrichment of 4 percent, and a decay time of 10 years (DIRS 169061-BSC 2004, all). The radionuclide inventory for a single spent nuclear fuel assembly is listed in Table K-13.

Table K-30. Projected population densities along the Caliente rail alignment in 2067.

Alignment	Escalated urban population density (people/km^2)[a,b]	Escalated suburban population density (people/km^2)	Escalated rural population density (people/km^2)
Highest population	--	224	0.585
Shortest distance	--	223	0.528
Longest distance	--	226	0.353
Lowest population	--	--	0.346

a. To convert people/km^2 to people/mile^2, multiply by 2.589988.
b. Note that there are no urban areas along the rail alignments.

Table K-31. Projected population densities along the Mina rail alignment in 2067.

Alignment	Escalated urban population density (people/km^2)[a,b]	Escalated suburban population density (people/km^2)	Escalated rural population density (people/km^2)
Highest population	--	549	4.19
Shortest distance	--	589	4.25
Longest distance	--	542	4.33
Lowest population	--	589	3.94

a. To convert people/km^2 to people/mile^2, multiply by 2.589988.
b. Note that there are no urban areas along the rail alignments.

DOE estimated radiation doses using the RISKIND computer code (DIRS 101483-Yuan et al. 1995, all) and determined them for the inhalation, groundshine, immersion, and resuspension pathways. RISKIND has been verified and validated for estimating radiation doses from transportation accidents involving radioactive material (DIRS 101845-Maheras and Pippen 1995, all; DIRS 102060-Biwer et al. 1997, all). Radiation doses were estimated using the ICRP inhalation dose coefficients (DIRS 172935-ICRP 2001, all) and the EPA groundshine and immersion dose coefficients (DIRS 175544-EPA 2002, all). These dose coefficients are based on the recommendations by the International Commission on Radiological Protection in ICRP Publication 60 (DIRS 101836-ICRP 1991, all) and incorporate the dose coefficients from ICRP Publication 72 (DIRS 152446-ICRP 1996, all). Table K-32 lists these dose coefficients. The dose coefficients include radioactive progeny (DIRS 176975-BMI 2006, Table 2). The lung absorption type and the value for the fractional absorption from the small intestine (f_1) for each radionuclide are listed in DIRS 176975-BMI 2006, Table 4.

DOE used release fraction and conditional probability data to estimate the consequences of severe transportation accidents (DIRS 152476-Sprung et al. 2000, p. 7-76). The following list describes the 20 accident severity categories involving releases of radioactive material from steel-lead-steel rail casks.

- Case 20: Case 20 is a long-duration (many hours), high-temperature fire that would engulf a cask.
- Cases 19, 18, 17, and 16: Case 19 is a high-speed (more than 120 miles per hour) impact into a hard object such as a train locomotive severe enough to cause failure of cask seals and puncture through the cask's shield wall. The impact would be followed by a very long duration (many hours), high-temperature engulfing fire. Case 18, Case 17, and Case 16 are accidents that would also involve very long duration fires, failures of cask seals, and punctures of cask walls. However, these accidents would be progressively less severe in terms of impact speeds. The impact speeds range from 90 to 120 miles for Case 18, 60 to 90 miles per hour for Case 17, and 30 to 60 miles per hour for Case 16.
- Cases 15, 12, 9, and 6: Case 15 is a high-speed (more than 120 miles per hour) impact into a hard surface such as granite severe enough to cause failure of cask seals. The impact would be followed by a long duration (many hours), high-temperature engulfing fire. Case 12, Case 9, and Case 6 are also accidents that would involve long duration fires, and failures of cask seals. However, these accidents would be progressively less severe in terms of impact speeds ranging from 90 to 120 miles for Case 12, 60 to 90 miles per hour for Case 9, and 30 to 60 miles per hour for Case 6.

Table K-32. RISKIND dose coefficients (page 1 of 3).

Radionuclide	Groundshine pathway dose conversion factor (rem-m^2/Ci-s)[a]	Immersion pathway dose conversion factor (rem-m^3/Ci-s)[b]	Inhalation pathway dose conversion factor (rem/Ci)	Ingestion pathway dose conversion factor (rem/Ci)
Ac-227 plus progeny	1.73E-03	6.45E-02	3.30E+08	4.47E+06
Am-241	8.62E-05	2.50E-03	1.55E+08	7.40E+05
Am-242m plus progeny	7.71E-05	2.80E-03	1.37E+08	7.04E+05
Am-243 plus progeny	7.47E-04	3.26E-02	1.52E+08	7.43E+05
Be-10	1.26E-05	5.11E-04	1.30E+05	4.07E+03
C-14	4.74E-08	9.62E-06	2.29E+01	2.15E+03
Cd-113m	6.55E-06	3.35E-04	1.15E+05	8.51E+04
Ce-144 plus progeny	6.72E-04	1.27E-02	1.33E+05	1.94E+04
Cf-252	1.94E-06	1.35E-05	7.40E+07	3.33E+05
Cl-36	4.14E-05	6.14E-04	2.70E+04	3.44E+03

Table K-32. RISKIND dose coefficients (page 2 of 3).

Radionuclide	Groundshine pathway dose conversion factor (rem-m^2/Ci-s)[a]	Immersion pathway dose conversion factor (rem-m^3/Ci-s)[b]	Inhalation pathway dose conversion factor (rem/Ci)	Ingestion pathway dose conversion factor (rem/Ci)
Cm-242	2.60E-06	1.49E-05	1.92E+07	4.44E+04
Cm-243	4.37E-04	1.96E-02	1.15E+08	5.55E+05
Cm-244	2.38E-06	1.26E-05	9.99E+07	4.44E+05
Cm-245	2.98E-04	1.30E-02	1.55E+08	7.77E+05
Cm-246	2.13E-06	1.15E-05	1.55E+08	7.77E+05
Cm-247 plus progeny	1.19E-03	5.50E-02	1.44E+08	7.03E+05
Cm-248	1.63E-06	8.73E-06	5.55E+08	2.85E+06
Co-58	3.42E-03	1.65E-01	7.77E+03	2.74E+03
Co-60	8.51E-03	4.40E-01	1.15E+05	1.26E+04
Co-60 (crud)	8.51E-03	4.40E-01	1.15E+05	1.26E+04
Cs-134	5.48E-03	2.62E-01	2.44E+04	7.03E+04
Cs-135	9.95E-08	3.52E-05	2.55E+03	7.40E+03
Cs-137 plus progeny	2.03E-03	9.45E-02	1.70E+04	4.81E+04
Eu-154	4.33E-03	2.13E-01	1.96E+05	7.40E+03
Eu-155	1.98E-04	7.96E-03	2.55E+04	1.18E+03
Fe-55	0.00E+00	0.00E+00	1.41E+03	1.22E+03
Fe-55 (crud)	0.00E+00	0.00E+00	1.41E+03	1.22E+03
Fe-59	4.07E-03	2.08E-01	1.37E+04	6.66E+03
H-3	0.00E+00	0.00E+00	9.99E+01	6.66E+01
I-129	7.25E-05	1.05E-03	1.33E+05	4.07E+05
Kr-85	3.89E-05	8.88E-04	0.00E+00	0.00E+00
Mn-54	2.92E-03	1.42E-01	5.55E+03	2.63E+03
Nb-93m	2.52E-06	1.13E-05	1.89E+03	4.44E+02
Nb-94	5.51E-03	2.66E-01	4.07E+04	6.29E+03
Nb-95	2.69E-03	1.29E-01	5.55E+03	2.15E+03
Ni-59	0.00E+00	0.00E+00	4.81E+02	2.33E+02
Ni-63	0.00E+00	0.00E+00	1.78E+03	5.55E+02
Np-237 plus progeny	7.81E-04	3.50E-02	8.51E+07	4.10E+05
Pa-231	1.40E-04	5.81E-03	1.26E+08	2.63E+06
Pb-210 plus progeny	1.38E-04	1.12E-03	1.66E+07	7.00E+06
Pd-107	0.00E+00	0.00E+00	2.18E+03	1.37E+02
Pm-147	1.04E-07	3.21E-05	1.81E+04	9.62E+02
Pu-238	2.32E-06	1.30E-05	5.92E+07	8.51E+05
Pu-239	1.05E-06	1.29E-05	5.92E+07	9.25E+05
Pu-240	2.22E-06	1.27E-05	5.92E+07	9.25E+05
Pu-241	6.36E-09	2.35E-07	6.29E+05	1.78E+04
Pu-242	1.84E-06	1.08E-05	5.55E+07	8.88E+05

Table K-32. RISKIND dose coefficients (page 3 of 3).

Radionuclide	Groundshine pathway dose conversion factor (rem-m^2/Ci-s)[a]	Immersion pathway dose conversion factor (rem-m^3/Ci-s)[b]	Inhalation pathway dose conversion factor (rem/Ci)	Ingestion pathway dose conversion factor (rem/Ci)
Ra-226 plus progeny	6.24E-03	3.10E-01	1.31E+07	1.04E+06
Ra-228 plus progeny	3.47E-03	1.66E-01	9.68E+06	2.55E+06
Rh-102	7.47E-03	3.59E-01	6.29E+04	9.62E+03
Ru-106 plus progeny	1.28E-03	3.92E-02	1.04E+05	2.59E+04
Sb-125 plus progeny	1.53E-03	6.95E-02	2.06E+04	4.80E+03
Se-79	6.11E-08	1.46E-05	4.07E+03	1.07E+04
Sm-151	1.31E-08	9.14E-08	1.48E+04	3.63E+02
Sn-126 plus progeny	7.28E-03	3.33E-01	1.05E+05	1.88E+04
Sr-90 plus progeny	4.13E-04	3.30E-03	1.39E+05	1.14E+05
Tc-99	2.40E-07	1.06E-04	1.48E+04	2.37E+03
Th-228 plus progeny	5.32E-03	2.83E-01	1.60E+08	5.30E+05
Th-229 plus progeny	1.28E-03	5.16E-02	3.18E+08	2.27E+06
Th-230	2.36E-06	5.51E-05	5.18E+07	7.77E+05
Th-232	1.68E-06	2.69E-05	9.25E+07	8.51E+05
U-232	2.99E-06	4.37E-05	1.37E+08	1.22E+06
U-233	2.22E-06	5.25E-05	3.55E+07	1.89E+05
U-234	2.17E-06	2.27E-05	3.48E+07	1.81E+05
U-235 plus progeny	5.76E-04	2.57E-02	3.15E+07	1.75E+05
U-236	1.86E-06	1.43E-05	3.22E+07	1.74E+05
U-238 plus progeny	4.50E-04	6.63E-03	2.96E+07	1.79E+05
Zr-93	0.00E+00	0.00E+00	3.70E+04	4.07E+03

a. To convert rem-m^2/Ci-s to rem-ft^2/Ci-s, multiply by 10.763910.
b. To convert rem-m^3/Ci-s to rem-ft^3/Ci-s, multiply by 35.314667.

- Cases 14, 11, 8, and 5: Case 14 is a high-speed (more than 120 miles per hour) impact into a hard surface such as granite severe enough to cause failure of cask seals. The impact would be followed by a high-temperature engulfing fire that burned for hours. Case 11, Case 8, and Case 5 are also accidents that would involve fires that would burn for hours, and failures of cask seals. However, these accidents would be progressively less severe in terms of impact speeds ranging from 90 to 120 miles for Case 11, 60 to 90 miles per hour for Case 8, and 30 to 60 miles per hour for Case 5.

- Cases 13, 10, 7, and 4: Case 13 is a high-speed (more than 120 miles per hour) impact into a hard surface such as granite severe enough to cause failure of cask seals. The impact would be followed by an engulfing fire lasting more than ½ hour up to a few hours. Case 10, Case 7, and Case 4 are accidents that would involve long duration fires, and failures of cask seals. However, these accidents are progressively less severe in terms of impact speeds ranging from 90 to 120 miles for Case 10, 60 to 90 miles per hour for Case 7, and 30 to 60 miles per hour for Case 4.

- Cases 3, 2, and 1: Case 3 is a high-speed (more than 120 miles per hour) impact into a hard surface such as granite severe enough to cause failure of cask seals—no fire. Case 2 and Case 1 are accidents that would also not involve fire but would have progressively lower impact speeds - 90 to 120 miles for Case 2 and 60 to 90 miles per hour for Case 1.

Each of the 20 accident cases listed above has an associated conditional probability of occurrence (DIRS 152476-Sprung et al. 2000, p. 7-76). These conditional probabilities were combined with the distances along the Caliente and Mina rail alignments and the accident rates discussed in Section K.2.5.1 to estimate the frequency of occurrence for each accident case. These frequencies are listed in Table K-33.

Cases 1, 4, and 20 have frequencies greater than 1×10^{-7} per year. Case 20 is estimated to have the highest consequences of these three accident cases (DIRS 155970-DOE 2002, Table J-22). Therefore, Case 20 is considered to be the maximum reasonably foreseeable transportation accident. Table K-34 lists the release fractions and conditional probabilities for this accident (DIRS 152476-Sprung et al. 2000, p. 7-76).

Table K-33. Annual frequencies for accident severity cases.

Accident severity case	Annual frequency (accidents per year)
1	1×10^{-7}
2	$7 \times 10^{-9} – 8 \times 10^{-9}$
3	6×10^{-11}
4	4×10^{-7}
5	1×10^{-8}
6	$1 \times 10^{-9} – 2 \times 10^{-9}$
7	$8 \times 10^{-10} – 9 \times 10^{-10}$
8	$2 \times 10^{-11} – 3 \times 10^{-11}$
9	3×10^{-12}
10	6×10^{-11}
11	2×10^{-12}
12	2×10^{-13}
13	5×10^{-13}
14	1×10^{-14}
15	2×10^{-15}
16	$5 \times 10^{-12} – 6 \times 10^{-12}$
17	3×10^{-15}
18	2×10^{-16}
19	2×10^{-18}

K.2.6 TRANSPORTATION SABOTAGE

In the Rail Alignment EIS, DOE assumed that a sabotage event could occur anywhere along the Caliente or Mina rail alignment. Radiation doses have been estimated out to 80 kilometers (50 miles) from each rail alignment using the population densities listed in Tables K-30 and K-31.

DOE used the following assumptions to estimate the consequences of transportation sabotage events (DIRS 157144-Jason Technologies 2001, Section 5.3.4.2):

- A breathing rate for individuals of 10,400 cubic meters per year (367,000 cubic feet per year). This breathing rate was estimated from data contained in ICRP Publication 23 (DIRS 101074-ICRP 1975, p. 346).
- A short-term exposure time to airborne contaminants of 2 hours.
- A long-term exposure time to contamination deposited on the ground of 1 year, with no interdiction or cleanup.
- Because it is not possible to estimate the specific atmospheric conditions that would exist during a sabotage event, consequences were determined using moderate wind speeds and neutral atmospheric conditions (a wind speed of 4.47 meters per second and Class D stability).
- The release of both respirable and nonrespirable material was evaluated. The deposition velocity for respirable material was 0.01 meter per second. The deposition velocity for nonrespirable material was 0.1 meter per second.
- It is expected that in a sabotage event, there would be an initial explosive release involving releases of radioactive material at varying release heights. For 4 percent of the release, a release height of 1 meter was estimated; for 16 percent of the release, a release height of 16 meters was estimated; for 25 percent of the release, a release height of 32 meters was estimated; for 35 percent of the release, a release height of 48 meters was estimated; and for 20 percent of the release, a release height of 64 meters was estimated.

DOE plans to operate the repository using a primarily canistered approach that calls for packaging most commercial spent nuclear fuel in TAD canisters, which would hold 21 pressurized-water reactor spent nuclear fuel assemblies. In the Rail Alignment EIS, DOE chose to estimate the consequences of a rail sabotage event based on the radionuclide inventory in 26 pressurized-water reactor spent nuclear fuel assemblies, which overestimated consequences by about 24 percent in comparison to the inventory in 21 pressurized-water reactor spent nuclear fuel assemblies. The radionuclide inventory for a single spent nuclear fuel assembly in this cask is listed in Table K-13.

In the Yucca Mountain FEIS, DOE evaluated the consequences of sabotage events using the release fraction data contained in Luna et al. (1999) (DIRS 104918-Luna, Neuhauser, and Vigil 1999, all; DIRS 155970-DOE 2002, Section 6.2.4.2.3). For rail casks, a sabotage event using the high energy density device denoted HEDD1 yielded the largest radiation doses. Additional data from sabotage experiments conducted in Germany were used by DOE to update the release fractions for HEDD1 (DIRS 181279-Luna 2006, all) used to estimate the consequences of sabotage events in the Rail Alignment EIS. Table K-35 lists these release fractions.

Radiation doses for the sabotage event scenario were estimated using the RISKIND computer code (DIRS 101483-Yuan et al. 1995, all). RISKIND has been verified and validated for estimating radiation doses from releases of radioactive material during transportation (DIRS 101845-Maheras and Pippen 1995, all; DIRS 102060-Biwer et al. 1997, all). Radiation doses were determined for the inhalation, groundshine, immersion, and resuspension pathways. Radiation doses were estimated using the ICRP inhalation dose coefficients (DIRS 172935-ICRP 2001, all) and the EPA groundshine and immersion dose coefficients (DIRS 175544-EPA 2002, all). These dose coefficients are based on the recommendations by the International Commission on Radiological Protection in ICRP Publication 60 (DIRS 101836-ICRP 1991, all) and incorporate the dose coefficients from ICRP Publication 72 (DIRS 152446-ICRP 1996, all). These dose coefficients are listed in Table K-33.

Table K-34. Conditional probabilities and release fractions for severe accident cases.[a]

Severe accident case	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
20	4.91×10^{-5}	0.84	1.7×10^{-5}	2.5×10^{-7}	2.5×10^{-7}	9.4×10^{-3}

a. Source: DIRS 152476-Sprung et al. 2000, p. 7-76.

Table K-35. Release fractions for transportation sabotage event.[a]

Material	Release fraction					
	Particulates	Ruthenium[b]	Cesium[c]	Iodine[c]	Gas	Crud
Respirable	7.19×10^{-7}	7.19×10^{-7}	7.15×10^{-6}[d]	7.15×10^{-6}[d]	4.05×10^{-4}[d]	5.17×10^{-7}
Nonrespirable	1.75×10^{-4}	1.75×10^{-4}				5.16×10^{-8}

a. Source: DIRS 181279-Luna 2006, all.
b. Ruthenium is modeled as particulate.
c. Cesium and iodine are modeled as volatiles.
d. All cesium, iodine, and gases were assumed to be respirable.

K.2.7 RESULTS FOR THE CALIENTE RAIL ALIGNMENT

K.2.7.1 Incident-Free Impacts

This section presents the radiological impacts of incident-free transportation for workers and members of the public. Impacts are presented for rail workers and escorts en route to the repository, for workers located at the Maintenance-of-Way Trackside Facility and at sidings, for workers at the Staging Yard, and for members of the public along the rail alignment and near the Staging Yard under the Proposed Action and the Shared-Use Option.

K.2.7.1.1 Workers and Members of the Public En Route to the Repository

K.2.7.1.1.1 Workers. During the shipment of spent nuclear fuel and high-level radioactive waste from the Caliente or Eccles Interchange Facility to the repository, workers would be exposed to direct radiation from 9,495 shipping casks.

Table K-36 lists the collective radiation doses and impacts for these workers. Because dedicated trains would be used for transporting spent nuclear fuel and high-level radioactive waste from Caliente or Eccles to the repository and under normal circumstances there would be no en route stops between the Staging Yard and the repository, therefore there would be no radiation doses at stops for rail workers (engineers and conductors) or escorts. Because rail workers would be working in the cab of the locomotive and situated at a distance of at least 150 feet from the nearest cask, and would be shielded from radiation by the locomotive, there would be no radiation doses for these workers while en route to the repository.

The collective radiation dose for these workers is estimated to be 310 to 320 person-rem, with longer alignments having higher estimated radiation doses. The radiation doses would be the same for the Proposed Action and the Shared-Use Option. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.19 or about 1 chance in 5. For perspective, in the United States the lifetime risk of dying from cancer is about 1 in 5.

For workers who could be exposed to radiation when cask trains pass by the Maintenance-of-Way Trackside facility, the collective radiation dose was estimated to be 0.035 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 2.1×10^{-5} or about 1 chance in 40,000. The impacts for these workers would be the same for the Proposed Action and the Shared-Use Option. In addition, the impacts for these workers would not depend on the length of the rail alignment.

For workers exposed when a train containing loaded casks passed a train containing empty casks or other materials at a siding, the collective radiation dose is estimated to be 0.0024 person-rem for the Proposed Action and 0.0051 person-rem for the Shared-Use Option. The radiation dose is higher for the Shared-Use Option because there would be increased rail traffic and therefore more opportunities for a train to be passed at a siding and workers exposed. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 1.4×10^{-6} for the Proposed Action and 3.0×10^{-6} for the Shared-Use Option, corresponding to about 1 chance in 700,000 and about 1 chance in 300,000.

The total collective radiation dose for all workers exposed en route to the repository is estimated to range from 310 to 320 person-rem. The radiation dose for escorts accounts for over 99 percent of the total radiation dose to workers. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.19.

Table K-37 lists the maximally exposed individual radiation doses and impacts for all workers. The maximally exposed worker would be an escort. This worker is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and a person working for up to 50 years escorting shipments. The probability of a latent cancer fatality for this worker is estimated to be 0.015 or about 1 chance in 60.

An individual worker at the Maintenance-of-Way Trackside facility was estimated to receive a radiation dose of 8.8×10^{-4} rem over 50 years of operations and assuming that the worker was exposed to all loaded casks that passed the facility. The probability of a latent cancer fatality for this worker is estimated to be 5.3×10^{-7}, or about 1 chance in 1,800,000.

An individual worker at a siding passed by loaded cask trains was estimated to receive a radiation dose of 2.4×10^{-4} rem for the Proposed Action and 5.1×10^{-4} rem for the Shared-Use Option over 50 years of operations and assuming that the worker was exposed to all loaded casks that passed a siding. The probability of a latent cancer fatality for this worker is estimated to be 1.4×10^{-7} (1 chance in 7,100,000) for the Proposed Action and 3.0×10^{-7} (1 chance in 3,300,000) for the Shared-Use Option.

K.2.7.1.1.2 Members of the Public. During the shipment of spent nuclear fuel and high-level radioactive waste from the Caliente or Eccles Interchange Facility to the repository, members of the public along the rail alignment could be exposed to direct radiation from 9,495 shipping casks.

Table K-36 lists the collective radiation doses and impacts for members of the public. Because dedicated trains would be used for transporting spent nuclear fuel and high-level radioactive waste from Caliente or Eccles to the repository and there would be no en route stops under normal circumstances, there would be no radiation doses at stops for members of the public. In addition, because two trains could not share the single railroad track simultaneously, there would be no on-link radiation doses for members of the public.

The collective radiation dose for members of the public exposed along the rail alignment (off-link) is estimated to range from 0.087 to 0.21 person-rem, with rail alignments having higher exposed populations also having higher estimated radiation doses. These radiation doses are based on the population in the year 2000 escalated to the year 2067. The radiation doses for members of the public would be the same for the Proposed Action and the Shared-Use Option. In the exposed population, the probability of a latent cancer fatality is estimated to range from 5.2×10^{-5} to 1.3×10^{-4}, or about 1 chance in 19,000 to about 1 chance in 7,000. For perspective, in the United States the lifetime risk of dying from cancer is about 1 in 5.

Table K-37 lists the maximally exposed individual radiation doses and impacts for members of the public. The maximally exposed individual would be a resident who lives 18 meters (60 feet) from the rail line. This individual would be exposed to each of 9,495 shipping casks as they passed by en route to the repository. The radiation dose for this individual is estimated to be 0.0078 rem over the course of a shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 4.7×10^{-6} or 1 chance in 200,000.

K.2.7.1.2 Workers and Members of the Public at the Staging Yard

K.2.7.1.2.1 Workers. When shipping casks arrive at the Staging Yard, the railcars containing the shipping cask would be removed from the train, an inspection conducted, and the railcar transferred to the train to be transported to the repository. The escorts that had accompanied the shipping cask from its point of origin would also be present during this inspection. These railcar handling, escort, and inspection workers would be exposed to direct radiation from 9,495 shipping casks over 50 years of transporting spent nuclear fuel and high-level radioactive waste to the repository. Noninvolved workers at the Staging Yard would also be exposed to direct radiation from the casks.

Table K-38 lists the collective radiation doses and impacts for these workers. Because operations at the three potential Staging Yard locations at Caliente-Indian Cove, Caliente-Upload, and Eccles-North would be similar, the radiation doses to workers at each Staging Yard would be the same. In addition, the

Table K-36. Incident-free collective radiation doses and latent cancer fatalities for en route workers and members of the public for the Caliente rail alignment (page 1 of 2).

		Collective radiation dose (person-rem)										
Rail alignment	Interchange location	En route rail workers[a]	En route rail workers at stops	En route escorts	En route escorts at stops	MOW[b] Trackside Facility workers	Workers located at sidings	Total en route workers	Off-link public along route	On-link public along route	Stops public along route	Total public along route
Proposed Action												
Highest population	Caliente	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0024	3.2E+2	2.1E-1	0.0E+0	0.0E+0	2.1E-1
Shortest distance	Caliente	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0024	3.1E+2	1.8E-1	0.0E+0	0.0E+0	1.8E-1
Longest distance	Eccles	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0024	3.2E+2	1.1E-1	0.0E+0	0.0E+0	1.1E-1
Lowest population	Eccles	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0024	3.1E+2	8.7E-2	0.0E+0	0.0E+0	8.7E-2
Shared-Use Option												
Highest population	Caliente	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0051	3.2E+2	2.1E-1	0.0E+0	0.0E+0	2.1E-1
Shortest distance	Caliente	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0051	3.1E+2	1.8E-1	0.0E+0	0.0E+0	1.8E-1
Longest distance	Eccles	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0051	3.2E+2	1.1E-1	0.0E+0	0.0E+0	1.1E-1
Lowest population	Eccles	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0051	3.1E+2	8.7E-2	0.0E+0	0.0E+0	8.7E-2

Table K-36. Incident-free collective radiation doses and latent cancer fatalities for en route workers and members of the public for the Caliente rail alignment (page 2 of 2).

		Latent cancer fatalities										
Alignment	Interchange Location	En route rail workers[a]	En route rail workers at stops	En route escorts	En route escorts at stops	MOW[b] Trackside Facility workers	Workers located at sidings	Total en route workers	Off-link public along route	On-link public along route	Stops public along route	Total public along route
Proposed Action												
Highest population	Caliente	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.4E-6	1.9E-1	1.3E-4	0.0E+0	0.0E+0	1.3E-4
Shortest distance	Caliente	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.4E-6	1.9E-1	1.1E-4	0.0E+0	0.0E+0	1.1E-4
Longest distance	Eccles	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.4E-6	1.9E-1	6.4E-5	0.0E+0	0.0E+0	6.4E-5
Lowest population	Eccles	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.4E-6	1.9E-1	5.2E-5	0.0E+0	0.0E+0	5.2E-5
Shared-Use Option												
Highest population	Caliente	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	3.0E-6	1.9E-1	1.3E-4	0.0E+0	0.0E+0	1.3E-4
Shortest distance	Caliente	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	3.0E-6	1.9E-1	1.1E-4	0.0E+0	0.0E+0	1.1E-4
Longest distance	Eccles	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	3.0E-6	1.9E-1	6.4E-5	0.0E+0	0.0E+0	6.4E-5
Lowest population	Eccles	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	3.0E-6	1.9E-1	5.2E-5	0.0E+0	0.0E+0	5.2E-5

a. Rail workers are engineers and conductors.
b. MOW = Maintenance-of-Way.

Table K-37. Incident-free maximally exposed individual radiation doses and latent cancer fatalities for en route workers and members of the public for the Caliente rail alignment.

Severe accident case	Radiation dose (rem)	Latent cancer fatalities
Proposed Action		
Workers		
Escort (one year of operation)	0.50	0.00030
Escort (50 years of operations)	25	0.015
Worker at Maintenance-of-Way Trackside Facility	8.8E-04	5.3E-07
Worker at siding	2.4E-4	1.4E-7
Members of the public		
Resident near rail line	7.8E-3	4.7E-6
Shared-Use Option		
Workers		
Escort (one year of operation)	0.50	0.00030
Escort (50 years of operations)	25	0.015
Worker at Maintenance-of-Way Trackside Facility	8.8E-04	5.3E-07
Worker at siding	5.1E-4	3.0E-7
Members of the public		
Resident near rail line	7.8E-3	4.7E-6

Table K-38. Incident-free collective radiation doses and latent cancer fatalities at the Caliente and Eccles Staging Yards for workers and members of the public.

	Collective radiation dose (person-rem)			
Staging Yard location	Involved workers at Staging Yard	Noninvolved workers at Staging Yard	Total workers at Staging Yard	Public near Staging Yard
Proposed Action and Shared-Use Option				
Caliente-Indian Cove	2.4E+2	1.2E+1	2.5E+2	2.6E-2
Caliente-Upland	2.4E+2	1.2E+1	2.5E+2	6.4E-3
Eccles-North	2.4E+2	1.2E+1	2.5E+2	3.9E-3
	Latent cancer fatalities			
Staging Yard location	Involved workers at Staging Yard	Noninvolved workers at Staging Yard	Total workers at Staging Yard	Public near Staging Yard
Proposed Action and Shared-Use Option				
Caliente-Indian Cove	1.4E-1	7.4E-3	1.5E-1	1.6E-5
Caliente-Upland	1.4E-1	7.4E-3	1.5E-1	3.9E-6
Eccles-North	1.4E-1	7.4E-3	1.5E-1	2.4E-6

radiation dose to workers at the Staging Yard would be the same for the Proposed Action and the Shared-Use Option because the number of shipping casks handled at the Staging Yard would be the same for the Proposed Action and the Shared-Use Option.

The collective radiation dose for involved workers at the Staging Yard is estimated to be 240 person-rem. These radiation doses are in large part dependent on the time that a cask spent in the Staging Yard, which is estimated to be 2 hours, and on the close proximity of the inspector to the cask, which is estimated to be 1 meter. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.14.

The collective radiation dose for noninvolved workers at the Staging Yard is estimated to be 12 person-rem. These radiation doses are in large part dependent on the time that a noninvolved worker is assumed to spend in the Staging Yard, which is estimated to be 2 hours, at an estimated distance of 100 meters from the casks. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0074.

The total collective radiation dose for involved and noninvolved workers at the Staging Yards is estimated to be 250 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.15.

Table K-39 lists the maximally exposed individual radiation doses and impacts for workers at each potential Staging Yard location. The maximally exposed worker would be an inspector, rail worker, or escort. This individual is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit at repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) for a person working for up to 50 years at the Staging Yard. The probability of a latent cancer fatality for this worker is estimated to be 0.015 or about 1 chance in 60.

Table K-39. Incident-free maximally exposed individual radiation doses and latent cancer fatalities at the Caliente and Eccles Staging Yards for workers and members of the public.

Proposed Action and Shared-Use Option	Radiation dose (rem)	Latent cancer fatalities
Workers		
Escort, rail worker, or inspector (one year of operation)	0.50	0.00030
Escort, rail worker, or inspector (50 years of operations)	25	0.015
Members of the public - resident near Staging Yard		
Caliente-Indian Cove	3.0E-6	1.8E-9
Caliente-Upland	2.7E-3	1.6E-6
Eccles-North	3.4E-6	2.1E-9

K.2.7.1.2.2 Members of the Public. Members of the public near the Caliente-Indian Cove, Caliente-Upland, or Eccles-North Staging Yard could be exposed to direct radiation from 9,495 shipping casks over 50 years of transporting spent nuclear fuel and high-level radioactive waste to the repository.

Table K-38 lists the collective radiation doses and impacts for these members of the public. The collective radiation dose for members of the public is estimated to range from 0.0039 to 0.026 person-rem. These radiation doses are based on the population in the year 2000 escalated to the year 2067. The highest radiation dose is for the Caliente-Indian Cove Staging Yard location, which also has the highest exposed population. The lowest radiation dose is for the Eccles-North Staging Yard location, which has the lowest exposed population. In the exposed populations around the Staging Yards, the probability of a latent cancer fatality is estimated to range from 2.4×10^{-6} to 1.6×10^{-5}, or about 1 chance in 400,000 to about 1 chance in 60,000.

Table K-39 lists the maximally exposed individual radiation doses and impacts for members of the public near the potential Staging Yard locations at Caliente-Indian Cove, Caliente-Upland, and Eccles-North. The maximally exposed individual at the Caliente-Indian Cove Staging Yard would be a resident who lives 1,600 meters (5,200 feet) from the Staging Yard. This individual would be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 3.0×10^{-6} rem over the shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 1.8×10^{-9}, or about 1 chance in 550,000,000.

The maximally exposed individual at the Caliente-Upland Staging Yard would be a resident who lives 400 meters (1,300 feet) from the Staging Yard. This individual would be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 2.7×10^{-3} rem over the shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 1.6×10^{-6}, or about 1 chance in 600,000.

The maximally exposed individual at the Eccles-North Staging Yard would be a resident who lives 1,500 meters (4,900 feet) from the Staging Yard. This individual would be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 3.4×10^{-6} rem over the shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 2.1×10^{-9}, or about 1 chance in 480,000,000.

K.2.7.1.3 Summary of Incident-Free Impacts

Table K-40 lists the incident-free collective radiation doses and impacts for workers en route to the repository, workers and members of the public located along the rail alignment route, involved and noninvolved workers at the Staging Yards, and members of the public near the Staging Yards for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for en route workers and workers along the rail alignment route is estimated to range from 310 to 320 person-rem. For involved and noninvolved workers at the Staging Yards, the total collective radiation dose is estimated to be 250 person-rem. The total collective radiation dose for all workers (en route, along the rail alignment, and at the Staging Yards) is estimated to be 560 to 570 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.34. The impacts for these workers would be the same for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for members of the public along the Caliente rail alignment exposed to radiation from cask trains en route to the repository was estimated to range from 0.087 to 0.21 person-rem. For members of the public near the Staging Yards, the total collective radiation dose is estimated to range from 0.0039 to 0.026 person-rem. The total collective radiation dose for all members of the public (along the rail alignment route and near the Staging Yards) is estimated to range from 0.091 to 0.24 person-rem. These radiation doses are based on the population in the year 2000 and escalated to the year 2067, and vary depending upon the location of the Staging Yard. The radiation doses are highest for those rail alignments and Staging Yard locations where the exposed populations are the highest. In the exposed population, the probability of a latent cancer fatality is estimated to range from 5.5×10^{-5} to 1.4×10^{-4}. The impacts for these members of the public would be the same for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for all workers and members of the public is estimated to be 560 to 570 person-rem. Over 99 percent of the radiation dose is to workers, less than 1 percent of the radiation dose is to members of the public. In the exposed population of workers and members of the public, the probability of a latent cancer fatality 0.34.

Table K-40. Summary of incident-free collective radiation doses and latent cancer fatalities for workers and members of the public for the Caliente rail alignment.

Rail alignment	Staging Yard location	Collective radiation dose (person-rem)						
		Total workers en route and along route	Total workers at Staging Yard	Total workers	Total public along route	Total public near Staging Yard	Total public	Total public and worker
Proposed Action and Shared-Use Option								
Highest population	Caliente-Indian Cove	3.2E+2	2.5E+2	5.7E+2	2.1E-1	2.6E-2	2.4E-1	5.7E+2
Highest population	Caliente-Upland	3.2E+2	2.5E+2	5.7E+2	2.1E-1	6.4E-3	2.2E-1	5.7E+2
Shortest distance	Caliente-Indian Cove	3.1E+2	2.5E+2	5.6E+2	1.8E-1	2.6E-2	2.1E-1	5.6E+2
Shortest distance	Caliente-Upland	3.1E+2	2.5E+2	5.6E+2	1.8E-1	6.4E-3	1.9E-1	5.6E+2
Longest distance	Eccles-North	3.2E+2	2.5E+2	5.7E+2	1.1E-1	3.9E-3	1.1E-1	5.7E+2
Lowest population	Eccles-North	3.1E+2	2.5E+2	5.6E+2	8.7E-2	3.9E-3	9.1E-2	5.6E+2
Highest population	Caliente-Indian Cove	1.9E-1	1.5E-1	3.4E-1	1.3E-4	1.6E-5	1.4E-4	3.4E-1
Highest population	Caliente-Upland	1.9E-1	1.5E-1	3.4E-1	1.3E-4	3.9E-6	1.3E-4	3.4E-1
Shortest distance	Caliente-Indian Cove	1.9E-1	1.5E-1	3.4E-1	1.1E-4	1.6E-5	1.2E-4	3.4E-1
Shortest distance	Caliente-Upland	1.9E-1	1.5E-1	3.4E-1	1.1E-4	3.9E-6	1.1E-4	3.4E-1
Longest distance	Eccles-North	1.9E-1	1.5E-1	3.4E-1	6.4E-5	2.4E-6	6.6E-5	3.4E-1
Lowest population	Eccles-North	1.9E-1	1.5E-1	3.4E-1	5.2E-5	2.4E-6	5.5E-5	3.4E-1

K.2.7.2 Transportation Accident Risks

This section presents the radiological transportation accident risks of shipping spent nuclear fuel and high-level radioactive waste from the Interchange Facility at Caliente or Eccles to the repository for the Proposed Action and the Shared-Use Option. Transportation risks were quantified in terms of dose risk, which is the sum of the products of the probabilities (dimensionless) and consequences (collective radiation doses in units of person-rem) of all potential transportation accidents. Transportation risks were also quantified in terms of latent cancer fatalities.

Table K-41 lists the dose risks for the four rail alignments evaluated in the Rail Alignment EIS. The dose risks are estimated to range from 1.1×10^{-3} to 2.2×10^{-3} person-rem. The rail alignments that have the higher exposed populations also have the higher dose risks. Also, because the number of shipping casks transported from Caliente or Eccles to the repository would be the same for the Proposed Action and for the Shared-Use Option, the dose risks are the same for the Proposed Action and Shared-Use Option. In the exposed populations along the rail alignments, the probability of a latent cancer fatality is estimated to range from 6.7×10^{-7} to 1.3×10^{-6}, or about 1 chance in 1,400,000 to about 1 chance in 700,000.

K.2.7.3 Severe Transportation Accidents

This section presents the consequences of severe transportation accidents, known as maximum reasonably foreseeable transportation accidents, that could occur during the shipment of spent nuclear fuel and high-level radioactive waste to the repository from the Interchange Facility at Caliente or Eccles for the Proposed Action and the Shared-Use Option.

Because it is not possible to forecast the atmospheric conditions that might exist during a severe accident, consequences were determined using low wind speeds and stable atmospheric conditions (a wind speed of 0.89 meters per second and Class F stability). The severe accident scenario calculation methodology does not include a probabilistic component that includes the atmospheric stability, therefore stable conditions were assumed. The atmospheric concentrations estimated from these conditions would be exceeded only 5 percent of the time.

For the four rail alignments described in Table K-30, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments ranged from 223 to 226 people per square kilometer (577 to 585 people per square mile) near Caliente and Goldfield. The average population density along rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (0.896 to 1.51 people per square mile).

Table K-42 lists the impacts of the maximum reasonably foreseeable accident. This accident has a frequency of about 6×10^{-7} per year. If the maximum reasonably foreseeable accident were to occur in a suburban area, the population radiation dose would be 770 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 0.46. If the maximum reasonably foreseeable accident were to occur in a rural area, the collective radiation dose would be 2 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 1.2E-3.

In either a suburban area or rural area, the radiation dose from the maximum reasonably foreseeable transportation accident for the maximally exposed individual located 330 meters from the accident would be 34 rem. The probability of an LCF for that individual is estimated to be 0.020.

Table K-41. Radiological transportation accident risks for the Caliente rail alignment.

Rail alignment	Staging Yard location	Dose risk[a] (person-rem)	Latent cancer fatalities (LCFs)
Proposed Action and Shared-Use Option			
Highest population	Caliente	2.2E-3	1.3E-6
Shortest distance	Caliente	1.9E-3	1.1E-6
Longest distance	Eccles	1.3E-3	7.6E-7
Lowest population	Eccles	1.1E-3	6.7E-7

a. Dose risk is the sum of the products of the probabilities and consequences in person-rem of all potential transportation accidents.

The radiation dose to a first responder would range from 0.14 to 2.0 rem. The probability of an LCF for this first responder is estimated to range from 8.2×10^{-5} to 0.0012.

Recovering rail casks loaded with spent nuclear fuel or high-level radioactive waste would use methods commonly used to recover railcars and locomotives following accidents. The capability to lift such weights exists and would be deployed as required. Railroads use emergency response contractors with

Table K-42. Consequences of the maximum reasonably foreseeable accident in suburban and rural areas along the Caliente rail alignment.[a]

	Suburban area[b]	Rural area[c]
Proposed Action and Shared-Use Option		
Population radiation dose (person-rem)	770	2.0
Latent cancer fatalities	0.46	1.2E-3
Maximally exposed individual (rem)	34	34
Probability of latent cancer fatality	0.020	0.020
First responder radiation dose (rem)	0.14 – 2.0	0.14 – 2.0
Probability of latent cancer fatality	8.2×10^{-5} – 0.0012	8.2×10^{-5} – 0.0012

a. Consequences based on low wind speeds and stable atmospheric conditions.
b. Population density in the suburban area is 226 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.
c. Population density in the rural area is 0.585 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.

the capability to lift derailed locomotives that could weigh as much as 150 tons. Difficult recoveries of equipment as heavy as spent nuclear fuel casks have been accomplished and DOE anticipates that if such a recovery was necessary, it would be accomplished using methods and equipment similar to those used in prior difficult recoveries.

K.2.7.4 Transportation Sabotage

This section presents the consequences of a sabotage event for shipments of spent nuclear fuel and high-level radioactive waste to the repository from the Interface with the Union Pacific Mainline on the Caliente alternative segment or the Eccles alternative segment.

For the four rail alignments described in Table K-30, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments ranged from 223 to 226 people per square kilometer (577 to 586 people per square mile), near Caliente and Goldfield. The average population density along rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (0.896 to 1.51 people per square mile).

Table K-43 lists the consequences of a potential sabotage event. The consequences would be the same for the Proposed Action and the Shared-Use Option. If the sabotage event occurred in a suburban area, the collective radiation dose is estimated to be 1,800 person-rem. In the exposed population, the number of latent cancer fatalities is estimated to be 1.1.

If the sabotage event occurred in a rural area, the collective radiation dose is estimated to be 4.7 person-rem. In the exposed population, the risk of a latent cancer fatality is estimated to be 0.0028.

If the sabotage event were to occur in either a suburban area or rural area, the maximally exposed individual would be located 100 meters (330 feet) from the sabotage event, at the location of maximum downwind air concentration. The radiation dose for the maximally exposed individual is estimated to be 27 rem. The probability of a latent cancer fatality for this individual is estimated to be 0.016.

Table K-43. Consequences of a sabotage event in suburban and rural areas along the Caliente rail alignment.[a]

	Suburban area[b]	Rural area[c]
Proposed Action and Shared-Use Option		
Population radiation dose (person-rem)	1,800	4.7
Latent cancer fatalities	1.1	0.0028
Maximally exposed individual (rem)	27	27
Probability of latent cancer fatality	0.016	0.016

a. Consequences based on moderate wind speeds and neutral atmospheric conditions.
b. Population density in the suburban area is 226 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.
c. Population density in the rural area is 0.585 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.

K.2.8 RESULTS FOR THE MINA RAIL ALIGNMENT

K.2.8.1 Incident-Free Impacts

This section presents the radiological impacts of incident-free transportation for workers and members of the public. Impacts for the Proposed Action and the Shared-Use Option are presented for rail workers and escorts en route to the repository, for workers located at the Maintenance-of-Way Trackside Facility and at sidings, for workers at the Staging Yard at Hawthorne, and for members of the public along the rail alignment and near the Staging Yard at Hawthorne.

K.2.8.1.1 Workers and Members of the Public En Route to the Repository

K.2.8.1.1.1 Workers. During the shipment of spent nuclear fuel and high-level radioactive waste from Hazen, Nevada to the repository, workers would be exposed to direct radiation from 9,495 shipping casks.

Table K-44 lists the collective radiation doses and impacts for these workers. Because dedicated trains would be used for transporting spent nuclear fuel and high-level radioactive waste from Hazen to the repository and under normal circumstances there would be no en route stops between Hazen and the repository, therefore there would be no radiation doses at stops for rail workers (engineers and conductors) or escorts. Because rail workers would be working in the cab of the locomotive and situated at a distance of at least 150 feet from the nearest cask, and would be shielded from radiation by the locomotive, there would be no radiation doses for these workers while en route to the repository.

The collective radiation dose for workers is estimated to be 310 to 340 person-rem, with longer alignments having higher estimated radiation doses. The radiation doses would be the same for the Proposed Action and the Shared-Use Option. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.18 to 0.20 or about 1 chance in 5. For perspective, in the United States the lifetime risk of dying from cancer is about 1 in 5.

For workers who could be exposed to radiation when cask trains pass by the Maintenance-of-Way Trackside Facility, the collective radiation dose is estimated to be 0.035 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 2.1×10^{-5} or about 1 chance in 40,000. The impacts for these workers would be the same for the Proposed Action and the Shared-Use Option. In addition, the impacts for these workers would not depend on the length of the rail alignment.

For workers exposed when a train containing loaded casks passed a train containing empty casks or other materials at a siding, the collective radiation dose is estimated to be 0.0013 person-rem for the Proposed Action and 0.0028 person-rem for the Shared-Use Option. The radiation dose is higher for the Shared-Use Option because there would be increased rail traffic and therefore more opportunities for a train to be passed at a siding and workers exposed. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 7.7×10^{-7} for the Proposed Action and 1.7×10^{-6} for the Shared-Use Option, corresponding to about one chance in 1,200,000 to about one chance in 500,000.

The total collective radiation dose for all workers exposed en route to the repository is estimated to range from 310 to 340 person-rem. The radiation dose for escorts accounts for over 99 percent of the total radiation dose to workers. In the exposed population of workers, the probability of a latent cancer fatality is estimated to range from 0.18 to 0.20.

Table K-45 lists the maximally exposed individual radiation doses and impacts for all workers. The maximally exposed worker would be an escort. This worker is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and a person working for up to 50 years escorting shipments. The probability of a latent cancer fatality for this worker is estimated to be 0.015 or about 1 chance in 60.

An individual worker at the Maintenance-of-Way Trackside Facility was estimated to receive a radiation dose of 8.8×10^{-4} rem over 50 years of operations and assuming that the worker was exposed to all loaded casks that passed the facility. The probability of a latent cancer fatality for this worker is estimated to be 5.3×10^{-7}, or about 1 chance in 1,800,000.

An individual worker at a siding passed by loaded cask trains was estimated to receive a radiation dose of 1.3×10^{-4} rem for the Proposed Action and 2.8×10^{-4} rem for the Shared-Use Option over 50 years of operations and assuming that the worker was exposed to all loaded casks that passed a siding. The probability of a latent cancer fatality for this worker is estimated to be 7.7×10^{-8} (1 chance in 12,000,000) for the Proposed Action and 1.7×10^{-7} (1 chance in 5,800,000) for the Shared-Use Option.

K.2.8.1.1.2 Members of the Public. During the shipment of spent nuclear fuel and high-level radioactive waste from Hazen, Nevada, to the repository, members of the public along the rail alignment could be exposed to direct radiation from 9,495 shipping casks.

Table K-44 lists the collective radiation doses and impacts for members of the public along the rail alignment. Because dedicated trains would be used for transporting spent nuclear fuel and high-level radioactive waste from Hazen to the repository and there would be no en route stops under normal circumstances, there would be no radiation doses at stops for members of the public. In addition, because two trains could not share the single railroad track simultaneously, there would be no on-link radiation doses for members of the public.

The collective radiation dose for members of the public exposed along the rail alignment (off-link) is estimated to be 1.4 person-rem, for all rail alignments. These radiation doses are based on the population in the year 2000 escalated to the year 2067. The radiation doses for members of the public would be the same for the Proposed Action and the Shared-Use Option. In the exposed population, the probability of a latent cancer fatality is estimated to range from 8.1×10^{-4} to 8.5×10^{-4}, or about 1 chance in 1,000. For perspective, in the United States the lifetime risk of dying from cancer is about 1 in 5.

Table K-45 lists the maximally exposed individual radiation doses and impacts for members of the public. The maximally exposed individual would be a resident who lives 18 meters (60 feet) from the rail line. This individual would be exposed to each of 9,495 shipping casks as they passed by en route to the repository. The radiation dose for this individual is estimated to be 0.0078 rem over the course of a shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 4.7×10^{-6} or 1 chance in 200,000.

K.2.8.1.2 Workers and Members of the Public at the Staging Yard

K.2.8.1.2.1 Workers. When shipping casks arrive at the Staging Yard at Hawthorne, the railcars containing the shipping cask would be removed from the train, an inspection conducted, and the railcar transferred to the train to be transported to the repository. The escorts that had accompanied the shipping cask from its point of origin would also be present during this inspection. These railcar handling, escort, and inspection workers would be exposed to direct radiation from 9,495 shipping casks over 50 years of transporting spent nuclear fuel and high-level radioactive waste to the repository. Noninvolved workers at the Staging Yard would also be exposed to direct radiation from the casks.

Table K-46 lists the collective radiation doses and impacts for these workers. The radiation dose to workers at the Staging Yard would be the same for the Proposed Action and the Shared-Use Option because the number of shipping casks handled at the Staging Yard would be the same for the Proposed Action and Shared-Use Option.

The collective radiation dose for involved workers at the Staging Yard is estimated to be 240 person-rem. These radiation doses are in large part dependent on the time that a cask spent in the Staging Yard, which is estimated to be 2 hours, and on the close proximity of the inspector to the cask, which is estimated to be 1 meter. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.14.

The collective radiation dose for noninvolved workers at the Staging Yard is estimated to be 10 person-rem. These radiation doses are in large part dependent on the time that a noninvolved worker is assumed to spend in the Staging Yard, which is estimated to be 2 hours, at an estimated distance of 100 meters from the casks. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0063.

Table K-44. Incident-free collective radiation doses and latent cancer fatalities for en route workers and members of the public for the Mina rail alignment (page 1 of 2).

Rail alignment	Interchange location	Collective radiation dose (person-rem)										
		En route rail workers[a]	En route rail workers at stops	En route escorts	En route escorts at stops	MOW[b] Trackside Facility workers	Workers located at sidings	Total en route workers	Off-link public along route	On-link public along route	Stops public along route	Total public along route
Proposed Action												
Highest population	Hazen	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0013	3.2E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Shortest distance	Hazen	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0013	3.1E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Longest distance	Hazen	0.0E+0	0.0E+0	3.4E+2	0.0E+0	3.5E-2	0.0013	3.4E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Lowest population	Hazen	0.0E+0	0.0E+0	3.3E+2	0.0E+0	3.5E-2	0.0013	3.3E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Shared-Use Option												
Highest population	Hazen	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0028	3.2E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Shortest distance	Hazen	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0028	3.1E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Longest distance	Hazen	0.0E+0	0.0E+0	3.4E+2	0.0E+0	3.5E-2	0.0028	3.4E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Lowest population	Hazen	0.0E+0	0.0E+0	3.3E+2	0.0E+0	3.5E-2	0.0028	3.3E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0

Table K-44. Incident-free collective radiation doses and latent cancer fatalities for en route workers and members of the public for the Mina rail alignment (page 2 of 2).

		Latent cancer fatalities										
Alignment	Interchange location	En route rail workers[a]	En route rail workers at stops	En route escorts	En route escorts at stops	MOW[b] Trackside Facility workers	Workers located at sidings	Total en route workers	Off-link public along route	On-link public along route	Stops public along route	Total public along route
Proposed Action												
Highest population	Hazen	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	7.7E-7	1.9E-1	8.5E-4	0.0E+0	0.0E+0	8.5E-4
Shortest distance	Hazen	0.0E+0	0.0E+0	1.8E-1	0.0E+0	2.1E-5	7.7E-7	1.8E-1	8.2E-4	0.0E+0	0.0E+0	8.2E-4
Longest distance	Hazen	0.0E+0	0.0E+0	2.0E-1	0.0E+0	2.1E-5	7.7E-7	2.0E-1	8.3E-4	0.0E+0	0.0E+0	8.3E-4
Lowest population	Hazen	0.0E+0	0.0E+0	2.0E-1	0.0E+0	2.1E-5	7.7E-7	2.0E-1	8.1E-4	0.0E+0	0.0E+0	8.1E-4
Shared-Use Option												
Highest population	Hazen	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.7E-6	1.9E-1	8.5E-4	0.0E+0	0.0E+0	8.5E-4
Shortest distance	Hazen	0.0E+0	0.0E+0	1.8E-1	0.0E+0	2.1E-5	1.7E-6	1.8E-1	8.2E-4	0.0E+0	0.0E+0	8.2E-4
Longest distance	Hazen	0.0E+0	0.0E+0	2.0E-1	0.0E+0	2.1E-5	1.7E-6	2.0E-1	8.3E-4	0.0E+0	0.0E+0	8.3E-4
Lowest population	Hazen	0.0E+0	0.0E+0	2.0E-1	0.0E+0	2.1E-5	1.7E-6	2.0E-1	8.1E-4	0.0E+0	0.0E+0	8.1E-4

a. Rail workers were engineers and conductors.
b. MOW = Maintenance-of-Way.

Table K-45. Incident-free maximally exposed individual radiation doses and latent cancer fatalities for en route workers and members of the public for the Mina rail alignment.

Severe accident case	Radiation dose (rem)	Latent cancer fatalities
Proposed Action		
Workers		
Escort (one year of operation)	0.50	0.00030
Escort (50 years of operations)	25	0.015
Worker at Maintenance-of-Way Trackside Facility	8.8E-04	5.3E-07
Worker at siding	1.3E-4	7.7E-8
Members of the public		
Resident near rail line	7.8E-3	4.7E-6
Shared-Use Option		
Workers		
Escort (one year of operation)	0.50	0.00030
Escort (50 years of operations)	25	0.015
Worker at Maintenance-of-Way Trackside Facility	8.8E-04	5.3E-07
Worker at siding	2.8E-4	1.7E-7
Members of the public		
Resident near rail line	7.8E-3	4.7E-6

Table K-46. Incident-free collective radiation doses and latent cancer fatalities at the Staging Yard at Hawthorne for workers and members of the public.

	Collective radiation dose (person-rem)			
Staging Yard location	Involved workers at Staging Yard	Noninvolved workers at Staging Yard	Total workers at Staging Yard	Public near Staging Yard
Proposed Action and Shared-Use Option				
Mina - Hawthorne	2.4E+2	1.0E+1	2.5E+2	0.0E+0
	Latent cancer fatalities			
Staging Yard location	Involved workers at Staging Yard	Noninvolved workers at Staging Yard	Total workers at Staging Yard	Public near Staging Yard
Proposed Action and Shared-Use Option				
Mina - Hawthorne	1.4E-1	6.3E-3	1.5E-1	0.0E+0

The total collective radiation dose for involved and noninvolved workers at the Staging Yard is estimated to be 250 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.15.

Table K-46 lists the maximally exposed individual radiation doses and impacts for workers at the Staging Yard. The maximally exposed worker would be an inspector, rail worker, or escort. This individual is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit at repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) for a person working for up to 50 years at the Staging Yard. The probability of a latent cancer fatality for this worker is estimated to be 0.015 or about 1 chance in 60.

K.2.8.1.2.2 Members of the Public. Members of the public near the Staging Yard at Hawthorne could be exposed to direct radiation from 9,495 shipping casks over 50 years of transporting spent nuclear fuel and high-level radioactive waste to the repository.

Tables K-46 and K-47 list the radiation doses and impacts for these members of the public. Based on 2000 census data, there is no resident population within 800 meters of the Staging Yard. Therefore, the collective radiation dose for members of the public is estimated to zero. There is, however, a business located 660 meters (2,100 feet) from the Staging Yard. The radiation dose for a person at this business is estimated to be 0.00018 rem, assuming that an individual was exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The probability of a latent cancer fatality for this individual is estimated to be 1.1×10^{-7}, or about 1 chance in 9,000,000.

Table K-47. Incident-free maximally exposed individual radiation doses and latent cancer fatalities at the Staging Yard at Hawthorne for workers and members of the public.

	Radiation dose (rem)	Latent cancer fatalities
Proposed Action and Shared-Use Option		
Workers		
Escort, rail worker, or inspector (one year of operation)	0.50	0.00030
Escort, rail worker, or inspector (50 years of operations)	25	0.015
Members of the public		
Business near Staging Yard	1.8E-4	1.1E-7

K.2.8.1.3 Summary of Incident-Free-Impacts

Table K-48 lists the incident-free collective radiation doses and impacts for workers en route to the repository, workers and members of the public located along the rail alignment route, involved and noninvolved workers at the Staging Yard at Hawthorne, and members of the public near the Staging Yard at Hawthorne for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for en route workers and workers along the rail alignment route is estimated to range from 310 to 340 person-rem. For involved and noninvolved workers at the Staging Yard at Hawthorne, the total collective radiation dose is estimated to be 250 person-rem. The total collective radiation dose for all workers (en route, along the rail alignment, and at the Staging Yard) is estimated to be 550 to 580 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.33 to 0.35. The impacts for these workers would be the same for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for members of the public along the Mina rail alignment exposed to radiation from cask trains en route to the repository was estimated to be 1.4 person-rem. Since there are no members of the public near the Staging Yard at Hawthorne, the total collective radiation dose for members of the public near the Staging Yards is zero. The total collective radiation dose for all members of the public (along the rail alignment route and near the Staging Yard) is estimated be 1.4 person-rem. These radiation doses are based on the population in the year 2000 and escalated to the year 2067. In the exposed population, the probability of a latent cancer fatality is estimated to range from 8.1×10^{-4} to

Table K-48. Summary of incident-free collective radiation doses and latent cancer fatalities for workers and members of the public for the Mina rail alignment.

		Collective radiation dose (person-rem)						
Rail alignment	Staging Yard location	Total workers en route and along route	Total workers at Staging Yard	Total workers	Total public along route	Total public near Staging Yard	Total public	Total public and worker
Proposed Action and Shared-Use Option								
Highest population	Hawthorne	3.2E+2	2.5E+2	5.7E+2	1.4E+0	0.0E+0	1.4E+0	5.7E+2
Shortest distance	Hawthorne	3.1E+2	2.5E+2	5.5E+2	1.4E+0	0.0E+0	1.4E+0	5.5E+2
Longest distance	Hawthorne	3.4E+2	2.5E+2	5.8E+2	1.4E+0	0.0E+0	1.4E+0	5.8E+2
Lowest population	Hawthorne	3.3E+2	2.5E+2	5.8E+2	1.4E+0	0.0E+0	1.4E+0	5.8E+2
Highest population	Hawthorne	1.9E-1	1.5E-1	3.4E-1	8.5E-4	0.0E+0	8.5E-4	3.4E-1
Shortest distance	Hawthorne	1.8E-1	1.5E-1	3.3E-1	8.2E-4	0.0E+0	8.2E-4	3.3E-1
Longest distance	Hawthorne	2.0E-1	1.5E-1	3.5E-1	8.3E-4	0.0E+0	8.3E-4	3.5E-1
Lowest population	Hawthorne	2.0E-1	1.5E-1	3.5E-1	8.1E-4	0.0E+0	8.1E-4	3.5E-1

8.5×10^{-4}. The impacts for these members of the public would be the same for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for all workers and members of the public is estimated to range from 550 to 580 person-rem. Over 99 percent of the radiation dose is to workers, less than 1 percent of the radiation dose is to members of the public. In the exposed population of workers and members of the public, the probability of a latent cancer fatality is estimated to range from 0.33 to 0.35.

K.2.8.2 Transportation Accident Risks

This section presents the radiological transportation accident risks of shipping spent nuclear fuel and high-level radioactive waste from Hazen, Nevada to the repository for the Proposed Action and the Shared-Use Option. Transportation risks were quantified in terms of dose risk, which is the sum of the products of the probabilities (dimensionless) and consequences (collective radiation doses in units of person-rem) of all potential transportation accidents. Transportation risks were also quantified in terms of latent cancer fatalities.

Table K-49 lists the dose risks for the four rail alignments evaluated in the Rail Alignment EIS. The dose risks are estimated to range from 1.2×10^{-2} to 1.3×10^{-2} person-rem. The rail alignments that have the higher exposed populations also have the higher dose risks. Also, because the number of shipping casks transported from Mina to the repository would be the same for the Proposed Action and for the Shared-Use Option, the dose risks are the same for the Proposed Action and Shared-Use Option. In the exposed populations along the tail alignments, the probability of a latent cancer fatality is estimated to range from 7.4×10^{-6} to 7.7×10^{-6}, or about 1 chance in 100,000.

K.2.8.3 Severe Transportation Accidents

This section presents the consequences of severe transportation accidents, known as maximum reasonably foreseeable transportation accidents, that could occur during the shipment of spent nuclear fuel and high-level radioactive waste to the repository from Hazen, Nevada, for the Proposed Action and the Shared-Use Option.

Because it is not possible to forecast the atmospheric conditions that might exist during a severe accident, consequences were determined using low wind speeds and stable atmospheric conditions (a wind speed of 0.89 meters per second and Class F stability). The severe accident scenario calculation methodology does not include a probabilistic component that includes the atmospheric stability, therefore stable conditions were assumed. The atmospheric concentrations estimated from these conditions would be exceeded only 5 percent of the time.

For the four rail alignments described in Table K-31, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments ranged from 542 to 589 people per square kilometer (1,400 to 1,530 people per square mile), near Silver Springs, Nevada. The average population density along rural areas, escalated to the year 2067, ranged from 3.94 to 4.33 people per square kilometer (10.2 to 11.2 people per square mile).

Table K-50 lists the impacts of the maximum reasonably foreseeable accident. This accident has a frequency of about 7×10^{-7} per year. If the maximum reasonably foreseeable accident were to occur in a suburban area, the population radiation dose would be 2000 person-rem. In the exposed population, it is estimated that there could be 1.2 latent cancer fatalities. If the maximum reasonably foreseeable accident

Table K-49. Radiological transportation accident risks for the Mina rail alignment.

Rail alignment	Staging Yard location	Dose risk[a] (person-rem)	Latent cancer fatalities (LCFs)
Proposed Action and Shared-Use Option			
Highest population	Mina	1.3E-2	7.7E-6
Shortest distance	Mina	1.2E-2	7.4E-6
Longest distance	Mina	1.3E-2	7.6E-6
Lowest population	Mina	1.2E-2	7.4E-6

a. Dose risk is the sum of the products of the probabilities and consequences in person-rem of all potential transportation accidents.

Table K-50. Consequences[a] of severe accident case scenarios in suburban and rural areas for the Mina rail alignment.

	Suburban area[b]	Rural area[c]
Proposed Action and Shared-Use Option		
Population radiation dose (person-rem)	2,000	15
Latent cancer fatalities	1.2	8.9×10^{-3}
Maximally exposed individual (rem)	34	34
Probability of latent cancer fatality	0.020	0.020
First responder radiation dose (rem)	0.14 – 2.0	0.14 – 2.0
Probability of latent cancer fatality	8.2×10^{-5} – 0.0012	8.2×10^{-5} – 0.0012

a. Consequences based on low wind speeds and stable atmospheric conditions.
b. Population density in the suburban area is 589 people per square kilometer. To convert people per square kilometer to people per square mile, multiply by 2.589988.
c. Population density in the low population density rural area is 4.33 people per square kilometer. To convert people per square kilometer to people per square mile, multiply by 2.589988.

were to occur in a rural area, the collective radiation dose would be 15 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 8.9E-3.

In either a suburban area or rural area, the radiation dose from the maximum reasonably foreseeable transportation accident for the maximally exposed individual located 330 meters from the accident would be 34 rem. The probability of an LCF for that individual is estimated to be 0.020.

The radiation dose to a first responder would range from 0.14 to 2.0 rem. The probability of an LCF for this first responder is estimated to range from 8.2×10^{-5} to 0.0012.

Recovering rail casks loaded with spent nuclear fuel or high-level radioactive waste would use methods commonly used to recover railcars and locomotives following accidents. The capability to lift such weights exists and would be deployed as required. Railroads use emergency response contractors with the capability to lift derailed locomotives that could weigh as much as 150 tons. Difficult recoveries of equipment as heavy as spent nuclear fuel casks have been accomplished and DOE anticipates that if such a recovery was necessary, it would be accomplished using methods and equipment similar to those used in prior difficult recoveries.

K.2.8.4 Transportation Sabotage

This section presents the consequences of a potential sabotage event for shipments of spent nuclear fuel and high-level radioactive waste to the repository from Hazen, Nevada, for the Proposed Action and the Shared-Use Option.

For the four rail alignments described in Table K-31, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments ranged from 542 to 589 people per square kilometer (1,400 to 1,530 people per square mile), near Silver Springs, Nevada. The average population density along rural areas, escalated to the year 2067, ranged from 3.94 to 4.33 people per square kilometer (10.2 to 11.2 people per square mile).

Table K-51 lists the consequences of a potential sabotage event. The consequences would be the same for the Proposed Action and the Shared-Use Option. If the sabotage event occurred in a suburban area, the collective radiation dose is estimated to be 4,700 person-rem. In the exposed population, the number of latent cancer fatalities is estimated to be 2.8.

If the sabotage occurred in a rural area, the collective radiation dose is estimated to be 35 person-rem. In the exposed population, the risk of a latent cancer fatality is estimated to be 0.021.

If the sabotage event were to occur in either a suburban area or rural area, the maximally exposed individual would be located 100 meters (330 feet) from the sabotage event, at the location of maximum downwind air concentration. The radiation dose for the maximally exposed individual is estimated to be 27 rem. The probability of a latent cancer fatality for this individual is estimated to be 0.016.

Table K-51. Consequences of a sabotage event in suburban and rural areas – Mina rail alignment.[a]

	Suburban area[b]	Rural area[c]
Proposed Action and Shared-Use Option		
Population radiation dose (person-rem)	4,700	35
Latent cancer fatalities	2.8	0.021
Maximally exposed individual (rem)	27	27
Probability of latent cancer fatality	0.016	0.016

a. Consequences based on moderate wind speeds and neutral atmospheric conditions.
b. Population density in the suburban area is 589 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.
c. Population density in the low population density rural area is 4.33 per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.

K.3 Transportation Topical Areas

This section discusses additional topics identified during the scoping process for the Nevada Rail Corridor SEIS, the Rail Alignment EIS, and the Repository SEIS.

K.3.1 COST OF CLEANUP

According to the Nuclear Regulatory Commission report *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000, pp. 7 to 76), in more than 99.99 percent of accidents radioactive material would not be released from the cask. After initial safety precautions had been taken, the cask would be recovered and removed from the accident scene. Because no radioactive material would be released, based on reported experience with two previous accidents (DIRS 156110-FEMA 2000, Appendix G, Case 4 and Case 5), the economic costs of these accidents would be minimal.

For the 0.01 percent of accidents severe enough to cause a release of radioactive material from a cask, a number of interrelated factors would affect costs of cleaning up resulting radioactive contamination after the accident. Factors included are the severity of the accident and the initial level of contamination; the weather at the time and following; the location and size of the affected land area and how the land is used; the standard established for the allowable level of residual contamination following cleanup and the decontamination method used; and the technical requirements for and location for disposal of contaminated materials.

Because it would be necessary to specify each of the factors to estimate clean up costs, any estimate for a single accident would be highly uncertain and speculative. Nonetheless, to provide a gauge of the costs that could be incurred, DOE examined past studies of costs of cleanup following hypothetical accidents that would involve uncontrolled releases of radioactive materials.

A study of the impacts of transporting radioactive materials conducted by the Nuclear Regulatory Commission in 1977 estimated that costs could range from about $1 million to $100 million for a transportation accident that involved a 600-curie release of a long-lived radionuclide (DIRS 101892-NRC 1977, Table 5-11). These estimates would be about 3 times higher if escalated for inflation from 1977 to the present. In 1980, Finley et al. estimated that costs could range from about $90 million to $2 billion for a severe spent nuclear fuel transportation accident in an urban area (DIRS 155054-Finley et al 1980, Table 6-9). Sandquist et al. (DIRS 154814-Sandquist et al 1985, Table 3-7) estimated that costs could range from about $200,000 to $620 million. In this study, Sandquist estimated that contamination would affect between 0.063 to 4.3 square kilometers (16 to 1,100 acres). A study by Chanin and Murfin (DIRS 152083-Chanin and Murfin 1996, Chapter 6) estimated the costs of cleanup following a transportation accident in which plutonium would be dispersed. This study developed cost estimates for cleaning up and remediating farmland, urban areas, rangeland, and forests. The estimates ranged from $38 million to $400 million per square kilometer that would need to be cleaned up. The study also evaluated the costs of expedited cleanups in urban areas for light, moderate, and heavy contamination levels. These estimates ranged from $89 million to $400 million per square kilometer.

The National Aeronautics and Space Administration studied potential accidents for the Cassini mission, which used a plutonium powered electricity generator. The Agency estimated costs of cleaning up radioactive material contamination on land following potential launch and reentry accidents. The estimate for the cost following a launch accident ranged from $7 million to $70 million (DIRS 155551-NASA 1995, Chapter 4) with an estimated contaminated land area of about 1.4 square kilometers (350 acres). The Agency assumed cleanup costs would be $5 million per square kilometer if removal and disposal of contaminated soil were not required and $50 million per square kilometer if those activities were required. For a reentry accident that would occur over land, the study estimated that the contaminated land area could range from about 1,500 to 5,700 square kilometers (370,000 to 1.4 million acres) (DIRS 155551-NASA 1995, Chapter 4) with cleanup costs possibly exceeding a total of $10 billion. In a more recent study of potential consequences of accidents that could involve the Cassini mission, NASA estimated that costs could range from $7.5 million to $1 billion (DIRS 155550-NASA 1997, Chapter 4). The contaminated land area associated with these costs ranged from 1.5 to 20 square kilometers (370 to 4,900 acres). As in the 1995 study, these estimates were based on cleanup costs in the range of $5 million to $50 million per square kilometer.

Using only the estimates provided by these studies, the costs of cleanup following a severe transportation accident involving spent nuclear fuel where radioactive material was released could be in the range from $300,000 (after adjusting for inflation from 1985 to the present) to $10 billion. Among the reasons for this wide range are different assumptions made regarding the factors that must be considered: 1) the severity of the assumed accident and resulting contamination levels, 2) accident location and use of affected land areas, 3) meteorological conditions, 4) cleanup levels and decontamination methods, and 5) disposal of contaminated materials. However, the extreme high estimates of costs are based on assumptions that all factors combine in the most disadvantageous way to create a “worst case.” Such worst cases are not reasonably foreseeable. Conversely, estimates as low as $300,000 may also not be realistic for all of the direct and indirect costs of cleaning up following an accident severe enough to cause a release of radioactive materials.

To gauge the range of costs that it could expect for severe accidents in transporting spent nuclear fuel to a Yucca Mountain repository, DOE considered the amount of radioactive material that could be released in the maximum reasonably foreseeable accident and compared this to the estimates of releases used by the various studies discussed above. During the maximum reasonably foreseeable accident, about 30 curies (mostly cesium) would be released. This is about 50 times less than used by Sandquist in his study (1,630 curies) and 20 times less than the release used in the estimates provided by the Nuclear Regulatory Commission in 1977 (600 curies). The estimated frequency for an accident this severe to occur is about 6 or 7 times in 10 million years. Based on the prior studies (where estimated releases exceeded those estimated in this appendix for a maximum reasonably foreseeable accident) and the amount of radioactive material that could be released in a maximum reasonably foreseeable accident, the Department believes that the cost of cleaning up following such an accident could be a few million dollars. Nonetheless, as stated above, the Department also believes that estimates of such costs contain great uncertainty and are speculative; they could be less or 10 times greater depending on the contributing factors.

For perspective, the current insured limit of responsibility for an accident involving releases of radioactive materials to the environment is $10.26 billion (see Appendix L).

Opposing View: Costs of Cleanup

The State of Nevada has provided analyses that assert that the costs of cleanup could be much higher than the estimates discussed in the Rail Alignment EIS, up $189.7 billion for accidents involving rail casks (DIRS 181756-Lamb, Resnikoff and Moore 2001, p. 48) and up to $299.4 billion for sabotage involving a rail cask (DIRS 181892-Lamb, Hintermann and Resnikoff 2002, p. 15).

DOE believes that these extremely high estimates of costs are based on assumptions that all factors combine in the most disadvantageous way to create a “worst case.” Such worst cases are not reasonably foreseeable.

K.3.2 UNIQUE LOCAL CONDITIONS

In scoping comments on the Rail Alignment EIS, the State of Nevada stated that the unique local conditions in Nevada require special consideration in the transportation accident analysis. In the Rail Alignment EIS, DOE does analyze a range of accidents that reflect the range of reasonably foreseeable “real-life conditions.” Real-life conditions that would involve various types of collisions, various natural disasters, specific locations (such as mountain passes), or various infrastructure accidents (such as track failure) in effect constitute a combination of cask failure mechanisms, impact velocities, and temperature ranges, which the Rail Alignment EIS does evaluate. Because it is impossible to predict what real-life conditions might be involved in any accidents that could occur, DOE has described the maximum reasonably foreseeable accident in terms of cask failure mechanisms and accident forces, and to ensure that the analysis accounts for all reasonably foreseeable real-life conditions. Accident scenarios are modeled in this fashion to accommodate the almost infinite number of variables that any given accident could involve.

K.3.3 COMPREHENSIVE RISK ASSESSMENT

The State of Nevada recommended that comprehensive risk assessment should be used as a substitute for probabilistic risk assessment in the transportation analysis.

The methods used to calculate transportation impacts are state-of-the-art. As a consequence, DOE believes that the Rail Alignment EIS adequately analyzes the environmental impacts that could result from shipping spent nuclear fuel and high-level waste. DOE believes the Rail Alignment EIS fulfills all legal obligations required for an EIS and a "comprehensive risk assessment" is neither required nor necessary.

K.3.4 USE OF NUREG/CR-6672 TO ESTIMATE ACCIDENT RELEASES

The evaluations of the radiological impacts of transportation accidents presented in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 6) are based on data presented in NUREG/CR-6672 *Reexamination of Spent Nuclear Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000) on conditional probabilities for the occurrence of severe accidents and on corresponding fractions of cask contents that could be released in such accidents.

In September of 1977, the Nuclear Regulatory Commission (NRC or the Commission) issued a generic EIS (*Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170 [DIRS 101892-NRC 1977]). That EIS addressed environmental impacts associated with the transport of all types of radioactive material by all transport modes (road, rail, air, and water), and provided the basis under NEPA for the NRC to issue general licenses for transportation of radioactive material under 10 CFR 71. Based in part on the findings of NUREG-0170, the Commission concluded that "present regulations are adequate to protect the public against unreasonable risk from the transport of radioactive materials" (46 *Federal Register* 21629, April 13, 1981) and stated that "regulatory policy concerning transportation of radioactive materials be subject to close and continuing review."

In 1996 the NRC decided to reexamine the risks associated with the shipment of spent power reactor fuel by truck and rail to determine whether the estimates of environmental impacts in NUREG-0170 remained valid. According to the Commission, the reexamination was initiated (1) because many spent fuel shipments are expected to be made during the next few decades, (2) because these shipments will be made to facilities along routes and in casks not specifically examined by NUREG-0170, and (3) because the risks associated with these shipments can be estimated using new data and improved methods of analysis. In 2000, the Commission published the results of the reexamination in a report prepared by the Sandia National Laboratories, *Reexamination of Spent Nuclear Fuel Shipment Risk Estimates* (NUREG/CR-6672).

Some have been critical of NUREG/CR-6672; for example, see *Review of NUREG/CR-6672, Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 181884-Lamb and Resnikoff 2000, all) and *Worst Case Credible Nuclear Transportation Accidents: Analysis for Urban and Rural Nevada* (DIRS 181756-Lamb, Resnikoff, and Moore 2001, Appendix A). However, the Commission has stated that many of the purported methodological flaws appear to be related to differing views regarding assumptions and that critical comments do not appear to recognize that many of the assumptions used overstated risks (DIRS 181603-Shankman 2001).

Supporting the NRC's assessment, in its review of NUREG/CR-6672 (see *Going the Distance? The Safe Transport of Spent Nuclear and High-Level Radioactive Waste in the United States* [DIRS 182032-National Research Council 2006]), the National Academy of Sciences Committee on Transportation of Radioactive Waste noted that the conservative assumptions used were reasonable for producing bounding estimates of accident consequences.

Conversely, the Committee indicated less confidence regarding the analysis of overall transport risks presented in the report. Here the Committee noted that the truck and rail routes used in the analyses were based on realistic, not bounding, characteristics. The Committee considered "many other uncertainties" and ultimately concluded that the overall results of the "Sandia analyses are likely to be neither realistic nor bounding and 'probably' overestimate transport risks."

Based on the review by the National Academy of Sciences and NRC comments, DOE has concluded that NUREG/CR-6672 represents the best available information for use in estimating the consequences of transportation accidents involving spent nuclear fuel and high-level waste and has used NUREG/CR-6672 in the Rail Alignment EIS.

K.4 Glossary

absorbed dose	A measure of the energy deposited in a medium by ionizing radiation. It is equal to the energy deposited per unit mass of medium
alpha particle	A positively charged particle ejected spontaneously from the nuclei of some ***radioactive*** elements. It is identical to a helium ***nucleus*** and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See ***ionizing radiation.***
atomic number	The number of ***protons*** in an atom's ***nucleus***.
beta particle	A negatively charged ***electron*** or positively charged positron emitted from a ***nucleus*** during ***decay***. Beta decay usually refers to a ***radioactive*** transformation of a ***nuclide*** by electron emission, in which the ***atomic number*** increases by 1 and the mass number remains unchanged. In positron emission, the atomic number decreases by 1 and the mass number remains unchanged. See ***ionizing radiation.***
burnup	The total energy released per initial unit mass of nuclear fuel as a result of irradiation. The commonly used units of burnup are megawatt-days per metric ton of heavy metal (MWd/MTHM).
collective dose	See ***population dose***.
committed effective dose equivalent	Dose delivered to specified organs or tissues over a specified period of time following an acute intake of a radionuclide by ingestion, inhalation, or dermal absorption. Time period over which committed doses are calculated normally is 50 year for intakes by adult or from age at intake to age 70 for intakes by other age groups.
conditional probability	the probability of an accident of a given severity category, given that an accident occurs.
cosmic radiation	A variety of high-energy particles including ***protons*** that bombard the Earth from outer space. They are more intense at higher altitudes than at sea level, where the Earth's atmosphere is most dense and provides the greatest protection.
decay (radioactive)	The process in which one ***radionuclide*** spontaneously transforms into one or more different radionuclides called ***decay products***.
decay product	A ***nuclide*** resulting from the radioactive decay of a parent isotope or precursor nuclide.
decay time	The time since the spent nuclear fuel has been discharged from the reactor.

dose (radioactive)	The amount of ***radioactive*** energy taken into (absorbed by) living tissues. See ***effective dose equivalent***.
dose equivalent	(1) The number (corrected for background) zero and above that is recorded as representing an individual's ***dose*** from external ***radiation*** sources or internally deposited ***radioactive*** materials; (2) the product of the absorbed dose in ***rads*** and a quality factor; (3) the product of the absorbed dose, the quality factor, and any other modifying factor. The ***dose equivalent*** quantity is used for comparing the biological effectiveness of different kinds of radiation (based on the quality of radiation and its spatial distribution in the body) on a common scale; it is expressed in ***rem***.
dose rate	The ***dose*** per unit time.
effective dose equivalent	Often referred to simply as ***dose***, it is an expression of the ***radiation*** dose received by an individual from external radiation and from ***radionuclides*** internally deposited in the body.
electron	A stable elementary particle that is the negatively charged constituent of ordinary matter.
enrichment	The fraction of atoms of a specified isotope in a mixture of isotopes of the same element when this fraction exceeds that in the naturally occurring mixture. By convention, uranium enrichment is given on a weight basis.
gamma ray	The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. See ***ionizing radiation.***
hormesis	A dose response phenomenon characterized by a low dose stimulation, high dose inhibition, resulting in either a J-shaped or an inverted U-shaped dose response.
ion	An atom or group of atoms that carries a positive or negative charge as a result of having lost or gained one or more electrons.
ionizing radiation	(1) ***Alpha particles***, ***beta particles***, ***gamma rays***, ***X-rays***, ***neutrons***, high-speed ***electrons***, high-speed ***protons***, and other particles capable of producing ions. (2) Any ***radiation*** capable of displacing electrons from an atom or molecule, thereby producing ions.
irradiation	***Exposure*** to ***radiation***.
millirem	A unit of radiation dose that is equivalent to one one-thousandth of a rem.
neutron radiation	See ***ionizing radiation***.
nucleus	The central, positively charged, dense portion of an atom. Also known as ***atomic nucleus***.
nuclide	An atomic ***nucleus*** specified by its ***atomic weight***, ***atomic number***, and energy state; a ***radionuclide*** is a ***radioactive*** nuclide.
person-rem	A unit used to measure the ***radiation exposure*** to an entire group and to compare the effects of different amounts of radiation on groups of people; it is the product of the average ***dose equivalent*** (in ***rem***) to a given organ or tissue multiplied by the number of persons in the population of interest.

photon	Quantum of electromagnetic radiation, having no charge or mass, that exhibits both particle and wave behavior, such as a ***gamma*** or ***x-ray***.
proton	An elementary particle that is the positively charged component of ordinary matter and, together with the ***neutron***, is a building block of all ***atomic*** nuclei.
population dose	A summation of the ***radiation doses*** received by individuals in an exposed population; equivalent to ***collective dose***; expressed in ***person-rem***.
rad	A unit of absorbed radiation dose in terms of energy. One rad equals 100 ergs of energy absorbed per gram of tissue.
radiation	The emitted particles or ***photons*** from the nuclei of radioactive atoms. Some elements are naturally ***radioactive***; others are induced to become radioactive by ***irradiation*** in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.
radioactive	Emitting ***radioactivity***.
radionuclide	See ***nuclide***.
release fraction	The fraction of material released during an accident.
rem	A unit of ***dose equivalent***. The dose equivalent in rems equals the absorbed dose in ***rads*** in tissue multiplied by the appropriate quality factor and possibly other modifying factors. Derived from roentgen equivalent man, referring to the dosage of ionizing ***radiation*** that will cause the same biological effect as one roentgen of ***X-ray*** or ***gamma ray*** exposure. One rem equals 0.01 sievert.
source term	Types and amounts of ***radionuclides*** that are the source of a potential release of ***radioactivity***.
subatomic particles	Any particle smaller than an atom.
total dose	The radiation dose to an individual or a group of people.
X-rays	Penetrating electromagnetic ***radiation*** having a wavelength much shorter than that of visible light. X-rays are identical to ***gamma rays*** but originate outside the ***nucleus***, either when the inner orbital ***electrons*** of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.

K.5 REFERENCES

182014	Adkins et al. 2006	Adkins, H.E., Jr.; Cuta, J.M.; Koeppel, B.J.; Guzman, A.D.; and Bajwa, C.S. 2006. Spent Fuel Transportation Package Response to the Baltimore Tunnel Fire Scenario. NUREG/CR-6886, Rev. 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20070724.0369.
181841	Adkins et al. 2007	Adkins, H.E., Jr.; Koeppel, B.J.; Cuta, J.M.; Guzman, A.D.; and Bajwa, C.S. 2007. Spent Fuel Transportation Package Response to the Caldecott Tunnel Fire Scenario. NUREG/CR-6894, Rev. 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20070724.0370.

180220	Bendixen and Facanha 2007	Bendixen, L. and Facanha, C. 2007. "Rail Accident Rate Calculation Methodology." Technical memo from L. Bendixen (ICF International) and C. Facanha (ICF International), to M. West (Potomac-Hudson Engineering), March 30, 2007. ACC: MOL.20070412.0014.
102060	Biwer et al. 1997	Biwer, B.M.; Arnish, J.J.; Kamboj, S.; and Chen, S.Y. 1997. RISKIND Verification and Benchmark Comparisons. ANL/EAD/TM-74. Argonne, Illinois: Argonne National Laboratory. TIC: 243692.
176975	BMI 2006	BMI (Battelle Memorial Institute) 2006. ICRP-60 and ICRP-72 RADTRAN 5 and RISKIND Dose Conversion Factors. Calculation Report Number: BCO-003. [Columbus, Ohio]: Battelle Memorial Institute. ACC: MOL.20060515.0089.
164364	BSC 2003	BSC (Bechtel SAIC Company) 2003. BWR Source Term Generation and Evaluation. 000-00C-MGR0-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20030723.0001; ENG.20050815.0024.
169061	BSC 2004	BSC (Bechtel SAIC Company) 2004. PWR Source Term Generation and Evaluation. 000-00C-MGR0-00100-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20040524.0007; ENG.20050815.0020; ENG.20050822.0006.
174942	BSC 2005	BSC (Bechtel SAIC Company) 2005. Project Design Criteria Document. 000-3DR-MGR0-00100-000 REV 005. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20050826.0001.
180471	BSC 2007	BSC (Bechtel SAIC Company) 2007. Recommended Values for HLW Glass for Consistent Usage on the Yucca Mountain Project. 000-00A-MGR0-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20070330.0013.
181377	BSC 2007	BSC (Bechtel SAIC Company) 2007. Calculation of Transportation Data for SEIS Analyses. 000-00C-G000-01300-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20070523.0036.
152083	Chanin and Murfin 1996	Chanin, D.I. and Murfin, W.B. 1996. Site Restoration: Estimation of Attributable Costs From Plutonium-Dispersal Accidents. SAND96-0957. Albuquerque, New Mexico: Sandia National Laboratories. TIC: 248778.
104800	CRWMS M&O 1999	CRWMS M&O 1999. Environmental Baseline File for National Transportation. B00000000-01717-5705-00116 REV 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990608.0033.

155970	DOE 2002	DOE (U.S. Department of Energy) 2002. Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. DOE/EIS-0250. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314; MOL.20020524.0315; MOL.20020524.0316; MOL.20020524.0317; MOL.20020524.0318; MOL.20020524.0319; MOL.20020524.0320.
169354	DOE 2004	DOE (U.S. Department of Energy) 2004. Source Term Estimates for DOE Spent Nuclear Fuels. DOE/SNF/REP-078, Rev. 1. Three volumes. Idaho Falls, Idaho: U.S. Department of Energy, Idaho Operations Office. ACC: MOL.20040524.0451.
171271	DOE 2004	DOE (U.S. Department of Energy) 2004. General Description of Database Information Version 5.0.1. DOE/SNF/REP-094, Rev. 0. Idaho Falls, Idaho: U.S. Department of Energy, Idaho Operations Office. ACC: MOL.20040812.0117.
153733	EPA 2000	EPA (U.S. Environmental Protection Agency) 2000. Cancer Risk Coefficients for Environmental Exposure to Radionuclides. EPA 402-C-99-001. Federal Guidance Report No. 13. CD Supplement. [Washington, D.C.]: U.S. Environmental Protection Agency. TIC: 249372.
175544	EPA 2002	EPA (U.S. Environmental Protection Agency) 2002. Federal Guidance Report 13, CD Supplement, Cancer Risk Coefficients for Environmental Exposure to Radionuclides, EPA. EPA-402-C-99-001, Rev. 1. [Washington, D.C.]: U.S. Environmental Protection Agency. ACC: MOL.20051013.0016.
156110	FEMA 2000	FEMA (Federal Emergency Management Agency) 2000. Guidance for Developing State, Tribal, and Local Radiological Emergency Response Planning and Preparedness for Transportation Accidents. FEMA REP-5, Rev. 02. [Washington, D.C.]: Federal Emergency Management Agency. ACC: MOL.20020204.0280.
155054	Finley et al. 1980	Finley, N.C.; Aldrich, D.C.; Daniel, S.L.; Ericson, D.M.; Henning-Sachs, C.; Kaestner, P.C.; Ortiz, N.R.; Sheldon, D.D.; Taylor, J.M.; and Herreid, S.F. 1980. Transportation of Radionuclides in Urban Environs: Draft Environmental Assessment. NUREG/CR-0743. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: NN1.19881102.0029.
101074	ICRP 1975	ICRP (International Commission on Radiological Protection) 1975. Report of the Task Group on Reference Man: A Report Prepared by a Task Group of Committee 2 of the International Commission on Radiological Protection. ICRP Number 23. Tarrytown, New York: Elsevier. ACC: MOL.20000516.0124.
101836	ICRP 1991	ICRP (International Commission on Radiological Protection) 1991. “1990 Recommendations of the International Commission on Radiological Protection.” Volume 21, No. 1-3 of Annals of the ICRP. ICRP Publication 60. New York, New York: Pergamon Press. TIC: 235864.

152446	ICRP 1996	ICRP (International Commission on Radiological Protection) 1996. Age-Dependent Doses to Members of the Public from Intake of Radionuclides: Part 5 Compilation of Ingestion and Inhalation Dose Coefficients. Volume 26, No. 1 of Annals of the ICRP. Smith, H., ed. ICRP Publication 72. New York, New York: Pergamon Press. TIC: 235870.
172935	ICRP 2001	ICRP (International Commission on Radiological Protection) 2001. The ICRP Database of Dose Coefficients: Workers and Members of the Public. ICRP Publication 72. [New York, New York]: Elsevier. TIC: 255638.
157144	Jason Technologies 2001	Jason Technologies 2001. Transportation Health and Safety Calculation/Analysis Documentation in Support of the Final EIS for Yucca Mountain Repository. CAL-HSS-ND-000003. Las Vegas, Nevada: Jason Technologies. ACC: MOL.20020209.0097.
181276	Johnson and Michelhaugh 2003	Johnson, P.E. and Michelhaugh, R.D. 2003. Transportation Routing Analysis Geographic Information System (TRAGIS) User's Manual. ORNL/NTRC-006, Rev. 0. Oak Ridge, Tennessee: Oak Ridge National Laboratory. ACC: MOL.20070712.0024.
181884	Lamb and Resnikoff 2000	Lamb, M. and Resnikoff, M. 2000. Review of NUREG/CR-6672, Reexamination of Spent Fuel Shipment Risk Estimates. [New York, New York]: Radioactive Waste Management Associates. TIC: 259659.
181892	Lamb, Hintermann, and Resnikoff 2002	Lamb, M.; Hintermann, B.; and Resnikoff, M. 2002. Potential Consequences of a Successful Sabotage Attack on a Spent Fuel Shipping Container: An Analysis of the Yucca Mountain EIS Treatment of Sabotage. New York, New York: Radioactive Waste Management Associates. TIC: 259556.
181756	Lamb, Resnikoff, and Moore 2001	Lamb, M.; Resnikoff, M.; and Moore, R. 2001. Worst Case Credible Nuclear Transportation Accidents: Analysis for Urban and Rural Nevada. New York, New York: Radioactive Waste Management Associates. TIC: 259574.
174559	Lawrence 2002	Lawrence, A. 2002. “Radiation Risk Estimation from Total Effective Dose Equivalents (TEDEs).” Memorandum from A. Lawrence (DOE) to distribution, August 9, 2002, with attachments. ACC: MOL.20050815.0190.
181279	Luna 2006	Luna, R.E. 2006. “Release Fractions from Multi-Element Spent Fuel Casks Resulting from HEDD Attack.” WM'06 Conference, February 26-March 2, 2006, Tucson, AZ. [Tucson, Arizona: WM Symposia]. TIC: 259643.
104918	Luna, Neuhauser, and Vigil 1999	Luna, R.E.; Neuhauser, K.S.; and Vigil, M.G. 1999. Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments. SAND99-0963. Albuquerque, New Mexico: Sandia National Laboratories. ACC: MOL.19990609.0160.

101845	Maheras and Pippen 1995	Maheras, S.J. and Pippen, H.K. 1995. Validation of the Transportation Computer Codes HIGHWAY, INTERLINE, RADTRAN 4, and RISKIND. DOE/ID-10511. [Idaho Falls], Idaho: U.S. Department of Energy, Idaho Operations Office. ACC: MOL.20010721.0039.
155857	McKenzie 2001	McKenzie, J.M. 2001. Response to Request for the NNPP (Naval Nuclear Propulsion Program) to Submit Information on a Variety of Topics, Including Overall Activity by Nuclide, a Technical Support Document for Transportation Analysis for a Naval Spent Nuclear Fuel and Special Case Waste, and an Update of Naval Spent Nuclear Fuel Shipments to the INEEL since 1998. Letter from J.M. McKenzie (Department of the Navy) to J.R. Dyer (DOE/YMSCO), August 20, 2001, with attachments. ACC: MOL.20011009.0042.
155551	NASA 1995	NASA (National Aeronautics and Space Administration) 1995. Final Environmental Impact Statement for the Cassini Mission. Washington, D.C.: National Aeronautics and Space Administration, Solar System Exploration Division. ACC: MOL.20010802.0223.
155550	NASA 1997	NASA (National Aeronautics and Space Administration) 1997. Final Supplemental Environmental Impact Statement for the Cassini Mission. Washington, D.C.: National Aeronautics and Space Administration, Office of Space Science. ACC: MOL.20010802.0218.
181250	National Research Council 2006	National Research Council. 2006. Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2. Washington, D.C.: National Academies Press. TIC: 257529.
182032	National Research Council 2006	National Research Council 2006. Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States. Washington, D.C.: National Academies Press. TIC: 259563.
100472	NCRP 1987	NCRP (National Council on Radiation Protection and Measurements) 1987. Exposure of the Population in the United States and Canada From Natural Background Radiation. NCRP Report No. 94. Bethesda, Maryland: National Council on Radiation Protection and Measurements. TIC: 101308.
101855	NCRP 1987	NCRP (National Council on Radiation Protection and Measurements) 1987. Ionizing Radiation Exposure of the Population of the United States. NCRP Report No. 93. Bethesda, Maryland: National Council on Radiation Protection and Measurements. TIC: 229033.
101857	NCRP 1993	NCRP (National Council on Radiation Protection and Measurements) 1993. Risk Estimates for Radiation Protection. NCRP Report No. 115. Bethesda, Maryland: National Council on Radiation Protection and Measurements. TIC: 232971.
150898	Neuhauser and Kanipe 2000	Neuhauser, K.S. and Kanipe, F.L. 2000. RADTRAN 5, User Guide. SAND2000-1257. Albuquerque, New Mexico: Sandia National Laboratories. TIC: 249356.

155430	Neuhauser, Kanipe, and Weiner 2000	Neuhauser, K.S.; Kanipe, F.L.; and Weiner, R.F. 2000. RADTRAN 5, Technical Manual. SAND2000-1256. Albuquerque, New Mexico: Sandia National Laboratories. ACC: MOL.20010724.0159.
180923	Nevada Rail Partners 2007	Nevada Rail Partners 2007. Operations and Maintenance Report Caliente Rail Corridor, Task 15: Operations & Maintenance Planning Support, Rev. 02. Document No. NRP-R-SYSW-OM-0001-02. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20070507.0002.
174313	Nevada State Demographer [n.d.]	Nevada State Demographer [n.d.]. Nevada County Population Projections 2004 to 2024. Reno, Nevada: Nevada State Demographer, Nevada Department of Taxation. ACC: MOL.20050725.0384.
101892	NRC 1977	NRC (U.S. Nuclear Regulatory Commission) 1977. Final Environmental Impact Statement on the Transportation of Radioactive Materials by Air and Other Modes. NUREG-0170. Two volumes. Washington, D.C.: U.S. Nuclear Regulatory Commission. TIC: 221616.
177031	Osborn et al. 2005	Osborn, D.M.; Weiner, R.F.; Mills, G.S.; and Hamp, S.C. 2005. Verification and Validation of RADTRAN 5.5. SAND2005-1274. Albuquerque, New Mexico: Sandia National Laboratories. ACC: MOL.20060629.0148.
174681	REMI 2004	REMI (Regional Economic Models, Inc.) 2004. Policy Insight. Version 6.0.100. Amherst, Massachuetts: Regional Economic Models, Inc. ACC: MOL.20040612.1302.
153277	SAIC 1991	SAIC (Science Application International Corporation) 1991. Special Nevada Report, September 23, 1991. Las Vegas, Nevada: Science Application International Corporation. ACC: NNA.19920131.0361.
154814	Sandquist et al. 1985	Sandquist, G.M.; Rogers, V.C.; Sutherland, A.A.; and Merrell, G.B. 1985. Exposures and Health Effects from Spent Fuel Transportation. RAE-8339/12-1. Salt Lake City, Utah: Rogers and Associates Engineering. TIC: 200593.
181603	Shankman 2001	Shankman, S.F. 2001. "Clark County Comments on NUREG/CR-6672." Letter from S. Shankman (NRC) to M. Williams (Clark County Board of Commissioners), February 7, 2001. ACC: MOL.20070705.0087.
152476	Sprung et al. 2000	Sprung, J.L.; Ammerman, D.J.; Breivik, N.L.; Dukart, R.J.; Kanipe, F.L.; Koski, J.A.; Mills, G.S.; Neuhauser, K.S.; Radloff, H.D.; Weiner, R.F.; and Yoshimura, H.R. 2000. Reexamination of Spent Fuel Shipment Risk Estimates. NUREG/CR-6672. Two volumes. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20001010.0217.
103472	USAF 1999	USAF (U.S. Air Force) 1999. Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement. Washington, D.C.: U.S. Department of the Air Force. ACC: MOL.20010726.0068.

148199	USN 1998	USN (U.S. Department of the Navy) 1998. Final Environmental Impact Statement (FEIS) for the Withdrawal of Public Lands for Range Safety and Training Purposes at Naval Air Station (NAS) Fallon, Nevada. Fallon, Nevada: U.S. Department of the Navy. ACC: MOL.20010726.0066.
101483	Yuan et al. 1995	Yuan, Y.C.; Chen, S.Y.; Biwer, B.M.; and LePoire, D.J. 1995. RISKIND - A Computer Program for Calculating Radiological Consequences and Health Risks from Transportation of Spent Nuclear Fuel. ANL/EAD-1. Argonne, Illinois: Argonne National Laboratory. ACC: HQV.19930517.0008.

APPENDIX L

SUPPLEMENTAL TRANSPORTATION INFORMATION

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SUPPLEMENTAL TRANSPORTATION INFORMATION

L.1 Introduction

The U.S. Department of Energy (DOE or the Department) developed this appendix to provide general background information on transportation-related topics. Although this information is not essential for analysis of potential impacts from the transportation of spent nuclear fuel and high-level radioactive waste to a repository at Yucca Mountain, Nevada, it will help readers to understand how the transportation system would operate within the regulatory framework for the transportation of these materials. Section L.2 discusses transportation regulations, Section L.3 describes the components of a transportation system, and Section L.4 discusses operational practices. Section L.5 describes cask safety and testing. Section L.6 discusses emergency response, and Section L.7 describes available assistance for state, local, and American Indian tribal governments for emergency response planning. Section L.8 discusses DOE plans for transportation security, and Section L.9 describes potential liability under the Price-Anderson Act.

Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following irradiation, the component elements of which have not been separated by reprocessing. In this document, the term refers to the special nuclear material, byproduct material, source material, and other radioactive materials associated with fuel assemblies and includes commercial spent nuclear fuel (including mixed-oxide fuel) from civilian nuclear power reactors, and DOE spent nuclear fuel from DOE and non-DOE production reactors, naval reactors, test and experimental reactors, and research reactors. Naval spent nuclear fuel shipments to the repository would be conducted under the authority of Presidential Executive Order 12344 and Public Law 106-65 and would be in compliance with applicable sections of the Code of Federal Regulations (CFR).

Most nuclear power reactors use solid uranium dioxide ceramic pellets of low-enriched uranium for fuel. The pellets are sealed in strong metal tubes, which are bundled together to form a nuclear fuel assembly. Depending on the type of reactor, typical fuel assemblies can be as long as 4.9 meters (16 feet) and weigh up to 540 kilograms (1,200 pounds). After a period in a reactor, the fuel is no longer efficient for the production of power and the assembly is removed from the reactor. After removal, the assembly (now called spent nuclear fuel) is highly radioactive and requires heavy shielding and remote handling to protect workers and the public.

High-level radioactive waste is the highly radioactive material that resulted from the reprocessing of spent nuclear fuel; it includes liquid waste that was produced directly in reprocessing and any solid material from such liquid waste that contains fission products in sufficient concentrations. High-level radioactive waste also includes other highly radioactive material that the U.S. Nuclear Regulatory Commission (NRC), consistent with existing law, has determined by rule to require permanent isolation. Immobilized surplus weapons-usable plutonium is part of the high-level radioactive waste inventory. All high-level radioactive waste would be in a solid form before DOE would ship it to Yucca Mountain.

L.2 Transportation Regulations

The shipment of spent nuclear fuel and high-level radioactive waste is highly regulated. For transportation of these materials to Yucca Mountain, DOE would meet or exceed U.S. Department of Transportation and NRC rules. DOE would also work with states, local government officials, federally recognized American Indian tribes, utilities, the transportation industry, and other interested parties in a cooperative manner to develop the transportation system.

The Hazardous Materials Transportation Act, as amended (49 United States Code [U.S.C.] 1801 *et seq.*), directs the U.S. Department of Transportation to develop transportation safety standards for hazardous materials, including radioactive materials. Title 49 of the Code of Federal Regulations contains U.S. Department of Transportation standards and requirements for the packaging, transporting, and handling of radioactive materials for all modes of transportation. NRC sets additional design and performance standards for packages that carry materials with higher levels of radioactivity.

The Nuclear Waste Policy Act, as amended (42 U.S.C. 10101 *et seq.*; NWPA), requires that all shipments of spent nuclear fuel and high-level radioactive waste to Yucca Mountain be in NRC-certified casks and in accordance with NRC regulations related to advance notification of state and local governments. In addition, DOE has committed to notification of American Indian tribal governments for these shipments (DIRS 171934-DOE 2002, p. 23). NRC rules do not require notification of local authorities, which is the responsibility of the individual state governments. This section discusses the key regulations that govern the transportation of spent nuclear fuel and high-level radioactive waste.

L.2.1 PACKAGING

The primary means for the protection of people and the environment during radioactive materials shipment is the use of radioactive materials packages that meet U.S. Department of Transportation and NRC requirements. Packages are selected based on activity, type, and form of the material to be shipped. All spent nuclear fuel and high-level radioactive waste shipments to Yucca Mountain would be in Type B casks, which have the most stringent design standards to prevent release of radioactive materials under normal conditions of transport and during hypothetical accidents (Section L.4.10 discusses accident conditions). NRC regulates and certifies the design, manufacture, testing, and use of Type B packages under regulations in 10 CFR Part 71. All shippers must properly package radioactive materials so that external radiation levels do not exceed regulatory limits. The packaging protects handlers, transporters, and the public from exposure to dose rates in excess of recognized safe limits. Regulations in 10 CFR 71.47 and 49 CFR 173.441 prescribe the external radiation standards for all packages. For shipments to the repository, the limiting radiation dose limit would be 10 millirem per hour at any point 2 meters (6.6 feet) from the outer edge of the railcar or truck trailer.

L.2.2 MARKING, LABELING, AND PLACARDING

U.S. Department of Transportation regulations in 49 CFR require that shippers meet specific hazard communication requirements in marking and labeling packages that contain radioactive materials and other hazardous materials. Markings, labels, and placards identify the hazardous contents to emergency responders in the event of an incident.

Markings provide the proper shipping name, a four-digit hazardous materials number, the shipper's name and address, gross weight, and type of packaging; other important information labels on opposite sides of a package identify the contents and radioactivity level. Shippers of radioactive materials use one of three labels—Radioactive White I, Yellow II, or Yellow III—as shown in Figure L-1. The use of a particular label is based on the radiation level at the surface of the package and the transport index. The transport index, determined in accordance with 49 CFR 173.403, is a number on the label of a package that indicates the degree of control the carrier must exercise during shipment. Packaging that previously contained Class 7 (radioactive) materials and has been emptied of its contents as much as practicable is exempted from marking requirements. However, 49 CFR 173.428 requires the application of an Empty label (not shown) to the cask.

Figure L-1 also shows a Fissile label, which shippers must apply to each package with fissile material (a material that is capable of sustaining a chain reaction of nuclear fission). Such labels, where applicable, must be affixed adjacent to the labels for radioactive materials. The Fissile label includes the Criticality Safety Index, which indicates how many fissile packages can be grouped together on a conveyance.

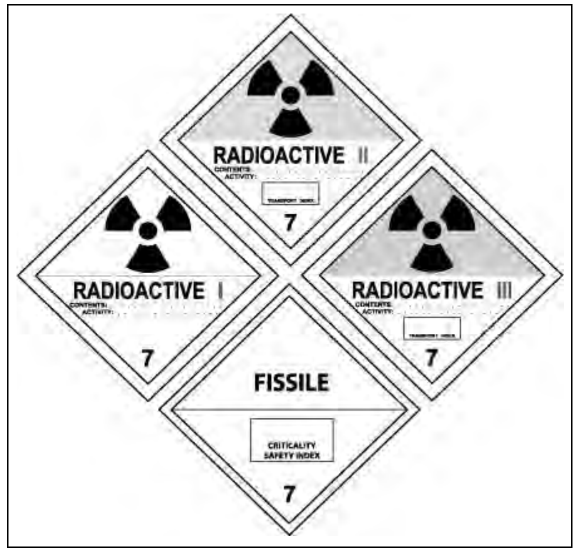

Figure L-1. Radioactive material shipment labels.

Shipments of spent nuclear fuel and high-level radioactive waste are usually classified as Highway Route-Controlled Quantities of Radioactive Materials, and 49 CFR 172.403(c) requires Radioactive Yellow-III labels for them regardless of the radiation dose rate. For Radioactive Yellow III shipments, 49 CFR 172.504 requires radioactive hazard communication placards (Figure L-2) on each side and each end of a freight container, transport vehicle, or railcar. In addition, for Highway Route-Controlled Quantities of Radioactive Materials shipments the placard must be on a white square background with a black border (49 CFR 172.507 through 172.527). In addition to the placard, a vehicle might have a United Nations Identification Number near the placard. The United Nations assigns these four-digit numbers, which shippers commonly use throughout the world to aid in the quick identification of materials in bulk containers. The number appears on either an orange plane or on a plain white square-on-point configuration similar to a placard. The usual identification number for spent nuclear fuel is UN3328.

Figure L-2. Radioactive hazard communication placard.

L.2.3 SHIPPING PAPERS

The shipper prepares shipping papers and gives them to the carrier. These documents contain additional details about the cargo and include a signed certification that the material is properly classified and in proper condition for transport. Shipping papers also contain emergency information that includes contacts and telephone numbers. Highway carriers must keep shipping papers readily available during transport for inspection by appropriate officials such as state or federal inspectors.

L.2.4 ROUTING

U.S. Department of Transportation regulations classify spent nuclear fuel and high-level radioactive waste as Highway Route-Controlled Quantities of Radioactive Materials shipments. Carriers of these materials are required to use preferred routes, which include interstate highway systems or alternative routes selected by state or tribal routing authorities in accordance with U.S. Department of Transportation regulations. Preferred routes generally use beltways and bypasses around cities to avoid highly populated urban centers.

States and tribes can designate alternative preferred routes by following U.S. Department of Transportation regulations for designation and performing a comparative route analysis that adequately considers overall risk to the public. Factors for the analysis can include accident rates, traffic counts, distance, vehicle speeds, population density, land use, timeliness, and availability of emergency response capabilities. States must also document required consultation with affected neighboring jurisdictions. U.S. Department of Transportation highway routing regulations preempt any conflicting routing requirements that state, local, or tribal governments might issue, such as prohibitions on radioactive waste shipments through local nuclear-free zones.

No federal routing rules govern spent nuclear fuel and high-level radioactive waste shipments by rail. Because railroads are privately owned and operated, route selection would involve discussions between DOE and the chosen railroad companies and other stakeholders. Key factors for selection of rail routes include time and distance in transit, the track class and capacity, operational input from carriers, and infrastructure capabilities.

The U.S. Department of Homeland Security and U.S. Department of Transportation issued rulemaking proposals in relation to railroad routing for radioactive materials shipments for security purposes on December 21, 2006; Section L.2.9 discusses the proposals.

L.2.5 ADVANCE NOTIFICATION

DOE Manual 460.2-1, *Radioactive Material Transportation Practices* (DIRS 171934-DOE 2002, all), which implements DOE Order 460.1B, Packaging and Transportation Safety, and NRC regulations (10 CFR 71.97 and 73.37), requires written notice to governors, or their designees, before shipment of spent nuclear fuel and high-level radioactive waste through their states. If sent by regular mail, the notice must be postmarked at least 7 days before the shipment; for messenger service, it must arrive 4 days before. The notification must contain the name, address, and telephone number of the shipper, the carrier, and the receiver; a description of the shipment; a list of the routes within the state; the estimated date and time of departure from the point of origin; the estimated date and time of entry into the state; and a statement on safeguarding schedule information. Federal regulations allow states to release certain advance information to local officials on a need-to-know basis. As required by Section 180 of the NWPA, all shipments to a repository would comply with NRC regulations on advance notification of state and local governments. In the event of a change in schedule that differs more than 6 hours from what was in the notification to the governor or their designee, DOE would provide the state with the new schedule by telephone. Although current regulations do not require notification of tribal authorities, DOE policy is to inform tribes of spent nuclear fuel and high-level radioactive waste shipments that would pass through their jurisdictions (DIRS 171934-DOE 2002, p. 23).

NRC issued an Advance Notice of Proposed Rulemaking (64 *Federal Register* [*FR*] 71331) on December 21, 1999, to invite early input from affected parties and the public on advance notification to American Indian tribes of spent nuclear fuel and high-level waste shipments. Although the Commission approved a rulemaking plan, it put the rulemaking on hold pending review of Commission rules in response to the events of September 11, 2001. NRC is coordinating the schedule for this rulemaking with other security rulemaking activities. The current schedule would result in a proposed rule in about 2010.

L.2.6 RAILROAD SAFETY PROGRAM

The Rail Safety Act of 1970 (Public Law 91-458) authorized states to work with the Federal Railroad Administration to enforce federal railroad safety regulations. States can enforce federal standards for track, signal and train control, motive power and equipment, and operating practices. In 1992, the State Safety Participation regulations (49 CFR Part 212) were revised to permit states to perform hazardous materials inspections of rail shipments. The Grade Crossing Signal System Safety regulations (49 CFR Part 234) were revised to authorize federal and state signal inspectors to ensure that railroad owners or operators were properly testing, inspecting, and maintaining automated warning devices at grade crossings. Before state participation can begin, each state agency must enter into a multiyear agreement with the Federal Railroad Administration for the exercise of specified authority. This agreement can delegate investigative and surveillance authority in relation to all or any part of federal railroad safety laws.

L.2.7 PERSONNEL TRAINING

U.S. Department of Transportation regulations require proper training for anyone involved in the preparation or transportation of hazardous materials, including radioactive materials. In accordance with 49 CFR Part 397, Subpart D, operators of vehicles that transport Highway Route-Controlled Quantities of Radioactive Materials receive special training that covers the properties and hazards of the materials, associated regulations, and applicable emergency procedures. In addition, DOE Orders require that driver or crew training covers operation of the specific package tie-down systems, cask recovery procedures, use of radiation detection instruments, use of satellite tracking systems and other communications equipment, adverse weather and safe parking procedures, public affairs awareness, first responder awareness (29 CFR 1910.120 [q]), and radiation worker "B" (or equivalent) training.

The U.S. Department of Transportation also requires training specific to the mode of transportation. Highway carriers are responsible for the development and maintenance of a qualification and training program that meets Department of Transportation requirements. Rail carriers must comply with Federal Railroad Administration regulations. Rail carriers are responsible for training and qualification of their crews, which includes application of 49 CFR Part 240 for locomotive engineer certification. If DOE decided to provide federal rail crews for waste shipments on the national rail system, the carriers would require a pilot, who would be an engineer familiar with the rail territory, unless the federal engineer was qualified on that route. The Federal Railroad Administration requires recurrent and function-specific training for personnel who perform specific work, such as train crews, dispatchers, and signal maintainers. In addition, the regulations require that each employee receives training that specifically addresses the job function.

L.2.8 OTHER REQUIREMENTS

Organizations that represent different transportation modes often establish mode-specific standards. For example, all North American shipments by rail that change carriers must meet Association of American Railroads interchange rules. Equipment in interchanges must also meet the requirements of the *Association of American Railroads Field Manual of the A.A.R. Interchange Rules* (DIRS 175727-AAR 2005, all).

On May 1, 2003, the Association released Standard S-2043, *Performance Specification for Trains Used To Carry High-Level Radioactive Material* (DIRS 166338-AAR 2003, all) to establish performance guidelines and specifications for trains that carry spent nuclear fuel or high-level radioactive waste. These guidelines apply to the individual railcars within the train, and they promote communication between railroads, spent nuclear fuel and high-level radioactive waste shippers, and railcar suppliers. The objectives of this standard are (1) to provide a cask, railcar, and train system that ensures safe transportation of casks in the railroad operating environment and allows timetable speeds with limited restrictions and (2) to use the best available technology to minimize the chances of derailment in transportation. This standard reflects the current technical understanding of the railroad industry in relation to optimum vehicle performance through application of current and prospective new railcar technologies. On December 20, 2005, the Association adopted two appendixes to AAR S-2043: Appendix A, "Maintenance Standards and Recommended Practices for Trains Used To Carry High-Level Radioactive Material," and Appendix B, "Operating Standard for Trains Used To Carry High-Level Radioactive Material" (DIRS 166338-AAR 2003, all). Changes and additions to this standard can be expected as specific vehicles are developed. All future changes will be based on the achievement of optimum performance within acceptable expectations for safe operations.

Association of American Railroads Circular No. OT-55, *Recommended Railroad Operating Practices for Transportation of Hazardous Materials* (DIRS 155658-AAR 2000, all), provides recommendations on operating practices that are adopted by Association of American Railroads and American Short Line and Regional Railroad Association members in the United States for these shipments. The current revision of the circular became effective July 17, 2006; its recommendations cover road operating practices, yard operating practices, storage and separation distances, transportation community awareness and emergency response program implementation, criteria for shipper notification, time-sensitive materials, and special provisions for spent nuclear fuel and high-level radioactive waste.

The Commercial Vehicle Safety Alliance has developed inspection procedures and out-of-service criteria for commercial highway vehicles that transport shipments of transuranic elements and Highway Route-Controlled Quantities of Radioactive Materials shipments (Section L.4.9). Under these procedures, each state through which a shipment passed would inspect each shipment to the repository, and a shipment would not begin or continue until inspectors determined that the vehicle and its cargo were free of defects.

Trucks that carry spent nuclear fuel or high-level radioactive waste and weigh over 36,300 kilograms (80,000 pounds) would exceed federal commercial vehicle weight limits for nondivisible loads (which cannot be separated into smaller loads). Most states require transportation companies to obtain permits when their vehicles exceed weight limits to control time and place of movement. Local jurisdictions also often require overweight permits. The criteria for the permitting process are not uniform among different jurisdictions. A number of factors affect issuance of these permits including traffic volumes and patterns, protection of state highways and structures such as bridges, zoning and general characteristics of the route, and safety of the motoring public.

L.2.9 PROPOSED RAIL REGULATIONS

The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration, in consultation with the Federal Railroad Administration, has proposed revision of the current requirements in the Hazardous Materials Regulations applicable to the safe and secure transportation of hazardous materials by rail at 49 CFR Parts 172 and 174 (71 *FR* 76834; December 21, 2006). The proposed rulemaking includes "Radioactive Materials" and "Class 7- Highway Route-Controlled Quantities of Radioactive Materials." The proposal would require rail carriers to compile annual data on specified shipments of hazardous materials, to use the data to analyze safety and security risks along rail transportation routes where those materials are transported, to assess alternative routes, and to make routing decisions based on those assessments. The Pipeline and Hazardous Materials Safety Administration has also proposed clarifications of the current security plan requirements to address en route storage, delays in transit, delivery notification, and additional security inspection requirements for hazardous materials shipments.

The Transportation Security Administration has proposed new security requirements for 49 CFR Parts 1520 and 1580 for freight railroad carriers; intercity, commuter, and short-haul passenger train service providers; rail transit systems; and rail operations at certain, fixed-site facilities that ship or receive specified hazardous materials by rail (71 *FR* 76852; December 21, 2006). The proposal would codify the scope of the existing inspection program and require regulated parties to allow Transportation Safety Administration and Department of Homeland Security officials to enter, inspect, and test property, facilities, and records relevant to rail security. This proposed rule would also require regulated parties to designate rail security coordinators and to report significant security concerns to the Department of Homeland Security.

In addition, the Transportation Security Administration has proposed that freight rail carriers and certain facilities that handle hazardous materials be able, on request, to report location and shipping information to the Administration and that they should implement chain-of-custody requirements to ensure a positive and secure exchange of specified hazardous materials (71 *FR* 76852, December 21, 2006). The proposal would clarify and extend the sensitive security information protections to cover certain information associated with rail transportation.

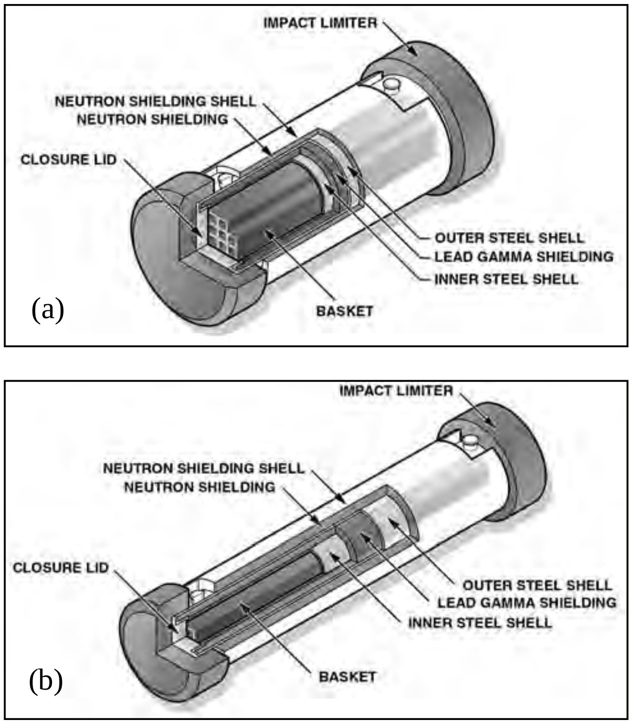

Figure L-3. Generic rail cask (a) and truck cask (b) for spent fuel.

L.3 Transportation System Components

The DOE transportation system would consist of hardware (shipping containers, handling equipment, railcars, and truck trailers), a transportation operations center, a Cask Maintenance Facility, and the Nevada rail line.

L.3.1 SHIPPING CONTAINERS

As required by the NWPA, the designs of the shipping casks for transportation of the spent nuclear fuel and high-level radioactive waste would be NRC-certified. The casks would be sealed containers that could weigh up to 180 metric tons (200 tons). The casks would consist of layers of steel and lead or other materials, which would provide shielding against the radiation from the waste and prevent the materials from escaping to the environment in the event of an incident.

The open end of the cylindrical cask would be sealed with a heavy lid. Impact limiters on each end of the cask would absorb most of the impact force and provide protection of the container and its contents in the event of an incident. Figure L-3 illustrates generic rail and truck casks.

DOE would procure NRC-certified casks from private industry. As required by Section 137 of the NWPA, DOE would use private industry to the fullest extent possible for each aspect of transportation. The Department has a preference for maximizing the use of existing cask designs rather than developing new ones. Existing cask designs would have to be modified to accommodate TAD canisters before NRC certification.

L.3.2 RAILCARS

The trains DOE would use to transport spent nuclear fuel and high-level radioactive waste to the repository would typically use locomotives, escort cars, one or more loaded cask railcars, and buffer railcars that would separate the cask railcars from occupied locomotives and escort railcars.

L.3.3 TRANSPORTATION OPERATIONS CENTER

The functions of a transportation operations center would include coordination between shipping sites and the repository, planning and scheduling of shipments, coordination with carriers, notifications to states and American Indian tribes, monitoring and tracking of shipments, en route communications, emergency management, and security coordination.

L.3.4 CASK MAINTENANCE FACILITY

Owners of rail and highway transportation casks and the associated equipment (for example, personnel barriers and impact limiters) must maintain them in proper condition to satisfy the requirements in their NRC certificates of compliance. The Cask Maintenance Facility would periodically remove casks from service and perform maintenance and inspection. The activities at the Cask Maintenance Facility would include but not be limited to testing, repair, minor decontamination, and approved modifications. The Cask Maintenance Facility would also serve as the primary recordkeeping facility for the cask fleet equipment.

L.3.5 TRANSPORT SERVICES

The U.S. freight railroad system consists of seven Class 1 railroads (mainline), 31 regional railroads, and over 500 local railroads (line-haul railroads smaller than regional railroads). Some origin sites of spent nuclear fuel and high-level radioactive waste have rail services, while others do not. DOE would use short-line or Class 1 railroads to transport casks from the origin sites. There are numerous short-line railroads that operate one or more relatively small sections of track that connect to the Class 1 rail network. Origin sites without rail service would require alternative intermodal delivery from the origin site to a nearby rail transfer facility, either by barge using a nearby dock or by heavy-haul truck using local highways.

At some sites with limited cask handling capability, DOE could use overweight trucks for smaller casks. After loading and preparation, DOE would pick up the cask and deliver it directly to the repository using the public highway network.

DOE would construct a branch rail line to transport casks from a Union Pacific mainline railroad in Nevada to the repository site, and the Department would contract the operation and maintenance of the branch rail line.

L.4 Operational Practices

DOE has adopted as policy the practices that were developed in consultation with stakeholders and are outlined in DOE Manual 460.2-1 (DIRS 171934-DOE 2002, all). The Manual establishes 14 standard transportation practices for Departmental programs to use in the planning and execution of shipments of radioactive materials including radioactive waste. It provides a standardized process and framework for planning and for interacting with state and tribal authorities and transportation contractors and carriers.

L.4.1 STAKEHOLDER INTERACTIONS

The Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions (DIRS 172433-DOE 2003, all) guides state and tribal government interactions, some of which are already underway. During planning and actual transportation operations, stakeholders are and would be involved in planning for route identification, funding approaches for emergency response planning and training, understanding safeguards and security requirements, operational practices, communications, and information access.

DOE is working collaboratively with states through State Regional Group committees, whose members are state officials responsible for transportation policy, law enforcement, emergency response, and oversight of hazardous materials shipments, and with American Indian tribal governments to assist them to prepare for the shipments.

In addition to coordination with State Regional Groups and tribal governments, a national cooperative effort is underway as part of the Transportation External Coordination Working Group, which involves a broad range of stakeholder organizations that routinely interact with DOE to provide input and recommendations on transportation planning and program information. DOE works with states, tribes, and industry to guide and focus emergency training, coordination with local officials, and other activities to prepare for shipments to the repository.

DOE is preparing a comprehensive national spent fuel transportation plan that accommodates stakeholder concerns to the extent practicable. The plan will outline the challenges and strategies for the development and implementation of the system required to transport the waste to Yucca Mountain.

L.4.2 ROUTE PLANNING PROCESS

An initial step in the planning process to ship spent nuclear fuel and high-level radioactive waste to Yucca Mountain is to identify a national suite of routes, both rail and highway. Stakeholder groups in the DOE program are participating in this process by examining potential routing criteria in the route identification process. State Regional Groups, tribal governments, transportation associations, industry, federal agencies, and local government organizations are some of the groups that work collaboratively with DOE in this process. DOE is performing and would perform the work through a Topic Group of the Transportation External Coordination Working Group, which would seek broader public input and collect comments on routing criteria and the process for development of a set of routes. The process includes consideration of industry practices, DOE requirements, and analysis of regional routes that states have previously evaluated in the process to identify a preliminary set of routes. Public involvement is an essential element of a safe, efficient, and flexible transportation system.

L.4.3 PLANNING AND MOBILIZATION

DOE would use the methods and requirements this section describes to establish the baseline operational organization and practices for route identification, fleet planning and acquisition, carrier interactions, and operations.

DOE would develop a Transportation Operations Plan to provide the basis for planning shipments. This plan would describe the operational strategy and delineate the steps to ensure compliance with applicable regulatory and DOE requirements. It would include information on organizational roles and responsibilities, shipment materials, projected shipping windows, estimated numbers of shipments, carriers, packages, sets of routes, prenotification procedures, safe parking arrangements, tracking systems, security arrangements, public information, and emergency preparedness, response, and recovery.

The Department would develop individual site plans to include the information necessary to ship from specific sites that included roles and responsibilities of the participants in the shipping campaign, shipment materials, schedules, number of shipments, types and number of casks and other equipment, carriers, routes, in-transit security arrangements, safe parking arrangements for rail and truck shipments, communications including prenotification, public information, tracking, contingency planning, and emergency preparedness, response, and recovery.

In addition, DOE would issue an Annual Shipment Projection at least 6 months to a year in advance of the beginning of a shipment year and would identify the sites from which it would ship spent nuclear fuel and high-level radioactive waste in a given calendar year, the expected characteristics and quantities of waste to be delivered by each site, types of casks, and anticipated numbers of casks and shipments. The Annual Shipment Projection would not define specific shipment schedules or routes, but DOE would use it for schedule and route planning.

L.4.4 DEDICATED TRAIN SERVICE POLICY

On July 18, 2005, in a policy statement (DIRS 182833-Golan 2005, all), DOE decided that dedicated train service would be the usual manner of rail shipment of commercial and DOE spent nuclear fuel and high-level radioactive waste to Yucca Mountain. Dedicated indicates train service for one commodity (in this case, spent nuclear fuel and high-level radioactive waste). Past and current shipping campaigns have used dedicated train service to address issues of safety, security, cost, and operations. Analyses indicate that the primary benefit of dedicated train service would be significant cost savings over the lifetime of transportation operations. The added cost of dedicated train service would be offset by reductions in fleet size and its attendant operations and maintenance costs. In addition, the shorter times in transit and shorter layovers at switching yards would enhance safety and security. Use of dedicated train service would provide greater operational flexibility and efficiency because of the reduced transit time and greater predictability in routing and scheduling.

L.4.5 TRACKING AND COMMUNICATION

DOE would provide authorized state and tribal governments with the capability and training to monitor shipments to the repository through their jurisdictions using a satellite tracking system, such as the Transportation Tracking and Communication System, that would provide continuous, centralized monitoring and communications capability (DIRS 172433-DOE 2003, p. 5). Trained personnel could use such a system to monitor shipment progress and communicate with the dispatch center. A transportation operations center would be in contact with the carriers and the escorts throughout each shipment. In addition, all truck and rail escort cars would have communications equipment. The train control center would manage rail communications and signaling on the branch Nevada rail line.

DOE would develop detailed backup procedures to ensure safe operations in the event that the tracking system was temporarily unavailable. The procedures would be based on a telephone call-in system for operators to report shipment locations to DOE on a regular basis and before crossing state and tribal borders.

L.4.6 TRANSPORTATION OPERATIONAL CONTINGENCIES

DOE would obtain weather forecasts along routes as part of preshipment planning, notification, and dispatching. At the time of departure, current weather conditions, the weather forecast, and expected travel conditions would have to be acceptable for safe operations. If these conditions were not acceptable, DOE could delay the shipment until travel conditions became acceptable or reroute the shipment.

Shipments would not travel during severe weather or other adverse conditions that could make travel hazardous. DOE would obtain route conditions and construction information that could temporarily affect the planned route through consultation with the railroads and states along the planned route.

DOE would receive input from states and tribes on weather conditions through the satellite tracking system known as TRANSCOM, which they would also use to monitor shipments. Rail carriers use train control and monitoring systems to identify the locations of trains and to make informed decisions to avoid or minimize potentially adverse weather or track conditions. Truck dispatch centers and the transportation operations center would coordinate on weather conditions while shipments were en route.

Continuous communications with a transportation operations center would provide advance warning of potential adverse conditions along the route. If the shipment encountered unanticipated severe weather, the operators would contact this center to coordinate routing to a safe stopping area if it became necessary to delay the shipment until conditions improved.

L.4.7 CARRIER PERSONNEL QUALIFICATIONS

Carriers would develop and maintain qualification and training programs that met U.S. Department of Transportation requirements for drivers, operators, and security personnel. For truck drivers, qualifications include being at least 21 years of age, meeting physical standards, having a commercial driver's license, and successfully completing a road driving test in the shipment vehicle. In addition, drivers must have training on the properties and hazards of the shipment materials as well as the procedures to follow in the event of an emergency. Locomotive engineers must meet the Locomotive Engineer Certification requirements of 49 CFR Part 240, which include completion of an approved training program (Section L.2.7 addresses other training requirements),

L.4.8 NOTICE OF SHIPMENTS

The NRC requires advance notice, en route status, and other pertinent shipment information on DOE shipments (10 CFR Parts 71 and 73). Section L.2.5 addresses advance notification requirements. DOE and other stakeholders would use this information to support coordination of repository receipt operations, to support emergency response capabilities, to identify weather or road conditions that could affect shipments, to identify safe stopping locations, to schedule inspections, and to coordinate appropriate public information programs.

L.4.9 INSPECTIONS

To ensure safety, DOE would inspect shipments when they left their point of origin and when they arrived at the repository to verify vehicle safety and radiological safety of the shipping casks. These inspections would include radiological surveys of radioactive material packages to ensure that they met the radiation level limits of 49 CFR 173.441 and surface contamination limits of 49 CFR 173.443. DOE would inspect rail shipments in accordance with 49 CFR 174.9 and the Federal Railroad Administration High-Level Nuclear Waste Rail Transportation Inspection Policy in Appendix A of *Safety Compliance Oversight Plan for Rail Transportation of High-Level Radioactive Waste and Spent Nuclear Fuel* (DIRS 156703-DOT 1998, all), which includes motive power, signals, track conditions, manifests, and crew credentials. DOE would inspect highway shipments using the enhanced standards of the Commercial Vehicle Safety Alliance, which provide uniform inspection procedures for radiological requirements, drivers, shipping papers, vehicles, and casks (DIRS 175725-CVSA 2005, all).

Although DOE would minimize the number of stops to the extent practicable, under federal regulations states and tribes could order additional inspections when shipments entered their respective jurisdictions. DOE would attempt to coordinate those inspections with normal crew change locations whenever possible.

L.4.10 PROCEDURES FOR OFF-NORMAL CONDITIONS

Off-normal conditions are potentially adverse conditions that do not relate to accidents, incidents, or emergencies. They include but are not limited to mechanical breakdowns, fuel problems, tracking system failure, and illness, injury, or other incapacity of a member of the truck, train, or escort crew. DOE would require carriers to provide operators with specific written procedures that define detailed actions for off-normal events. Procedures would address notifications, deployment of appropriate hazard warnings, security, medical assistance, operator or escort replacement, and maintenance, repair, replacement, or recovery of equipment, as appropriate. Procedures would also cover selection of alternative routes and safe parking areas.

L.4.11 POSTSHIPMENT RADIOLOGICAL SURVEYS

DOE would visually inspect and radiologically survey the external surfaces of a cask after shipment in accordance with U.S. Department of Transportation, DOE, and NRC regulations. Receiving facility operators would survey each cask and transporter on arrival (before unloading) and determine if there was radiological contamination in excess of the applicable limits. The inspections would include the cask, tie-downs, and associated hardware to determine if physical damage occurred during transit.

L.4.12 SHIPMENT OF EMPTY TRANSPORT CASKS

Except before their first use, shipments of all empty transportation casks would comply with the requirements of the NRC certificate of compliance or 49 CFR 173.428, which addresses empty radioactive materials packages, whichever was applicable. DOE would ship casks that did not meet the criteria for “empty” in accordance with the applicable U.S. Department of Transportation hazardous materials regulations. Advance shipment notifications and en route inspections would not apply to the shipment of empty transportation casks; however, DOE would use dedicated train service to realize the cost benefits of a decreased fleet requirement.

L.5 Cask Safety

The purpose of the NRC regulations for transportation of spent nuclear fuel and high-level radioactive waste (10 CFR Part 71) is to protect the public health and safety from normal and off-normal conditions of transport and to safeguard and secure shipments of these materials. Over the years, NRC has amended its regulations to be compatible with the latest editions of the International Atomic Energy Agency and other standards (see 69 FR 3698, January 26, 2004).

In addition to the standard testing discussed below, NRC has committed to a package performance study for the full-scale testing of a spent nuclear fuel package of the kind DOE would likely use. The Commission approved the proposed test in June 2005 (DIRS 182896-Viette-Cook 2005, all; DIRS 182897-Reyes 2005, all). According to the proposal, the package would contain surrogate fuel elements and be mounted on a railcar placed at 90 degrees to a simulated rail crossing. The rail package would be subjected to a collision with a locomotive and several freight cars at 96 kilometers (60 miles) per hour. NRC is formulating the study to give the public greater confidence in the movement of spent nuclear fuel, to provide information on the methods and processes of transportation system qualification, and to validate the applicability of NRC regulations.

Regulations in 10 CFR Part 71 require that casks for shipping spent nuclear fuel and high-level radioactive waste must be able to meet specified radiological performance criteria for normal transport and for transport under severe accident conditions. Meeting these requirements is an integral part of the safety assurance process for transportation casks. The ability of a design to withstand these conditions can be demonstrated by comparing designs to similar casks, engineering analyses (such as computer-simulated tests), or by scale-model or full-scale testing. As shown in Figure L-4, these hypothetical accident conditions include, in sequence, a 9-meter (30-foot) drop onto an unyielding flat surface, a 1-meter (40-inch) drop onto a vertical steel bar, exposure of the entire package to fire for 30 minutes, and immersion in 0.9 meter (3 feet) of water. In addition, an undamaged cask must be able to survive submersion in the equivalent pressure of 15 and 200 meters (50 and 650 feet) of water.

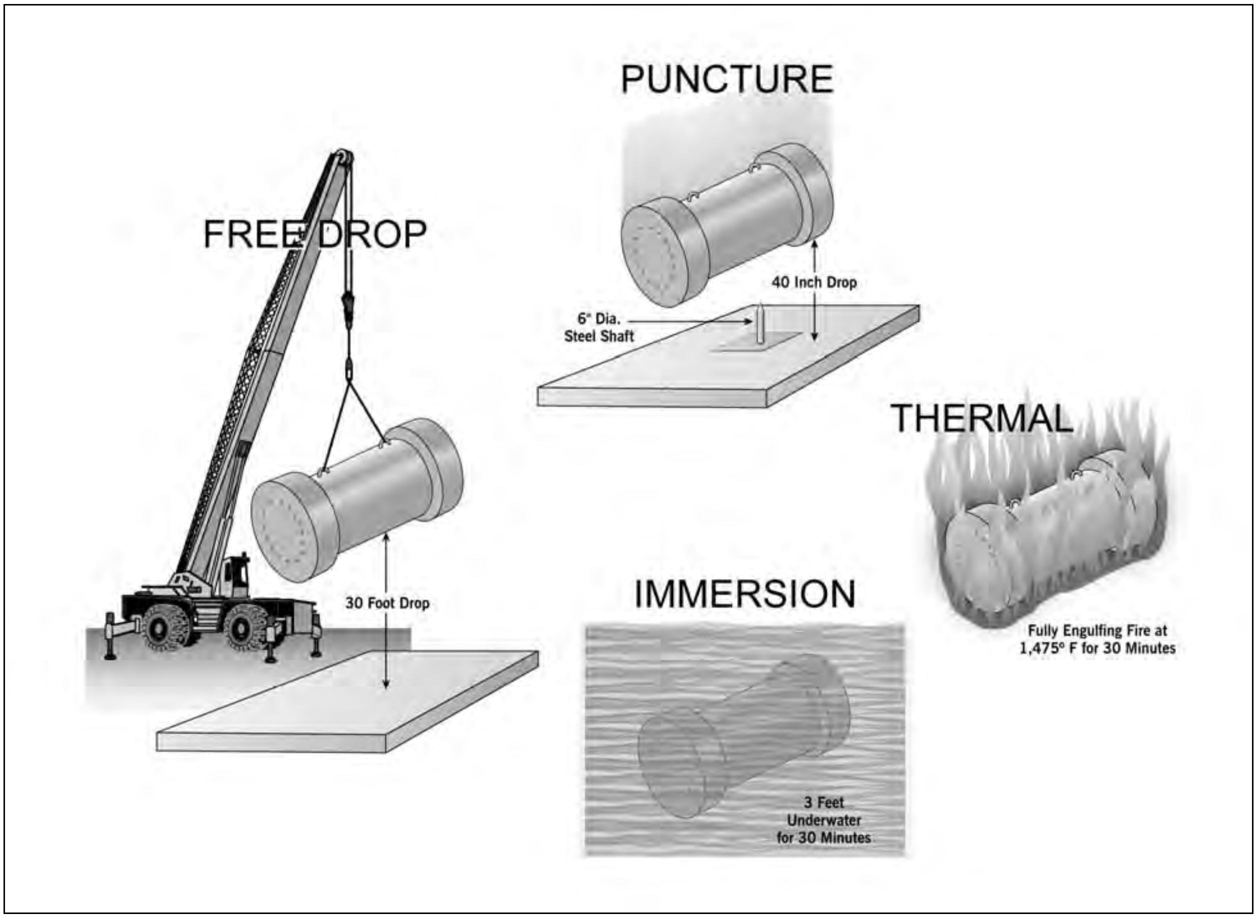

Figure L-4. Hypothetical accident conditions.

For most accidents more severe than those the hypothetical accident conditions simulate, NRC studies (DIRS 152476-Sprung et al. 2000, all; DIRS 181841-Adkins et al. 2007, all; DIRS 182014-Adkins et al. 2006, all) show that the radiological criteria for containment, shielding, and subcriticality would still be satisfied. The studies also show that for the few severe incidents in which these criteria could be exceeded, only containment and shielding would be affected, and the regulatory criteria could be exceeded only slightly. Based on the analyses of the *Final Environmental Impact Statement for a Geological Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DIRS 155970-DOE 2002, all), casks would continue to contain spent nuclear fuel and high-level radioactive waste fully in more than 99.99 percent of all incidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to the release of radioactive materials). The following sections discuss each of these packaging performance criteria.

L.5.1 NINE-METER DROP ONTO AN UNYIELDING SURFACE

The first set of accident conditions in the sequence simulates impact and evaluation of a 9-meter (30-foot) free fall onto an unyielding surface with the cask striking the target in the most damaging orientation. The free fall results in a final velocity of 48 kilometers (30 miles) per hour. Although this velocity is less than the expected speed of interstate highway traffic, it is severe because the target surface is unyielding. This results in the cask absorbing all the energy of the drop, which is approximately equivalent to a 96-kilometer (60-mile)-per-hour impact with a medium hardness surface (such as shale or other relatively soft rock) and a 150-kilometer (90-mile)-per-hour impact with a soft surface (such as tillable soil).

L.5.2 ONE-METER DROP ONTO A STEEL BAR

The second set of accident conditions simulates a cask hitting a rod or bar-like object that could be present in an accident. This requires evaluation for a 1-meter (40-inch) drop onto a 15-centimeter (6-inch)-diameter rod on an unyielding surface. The cask must be in the orientation in which maximum damage would be likely. In addition, the bar must be long enough to cause maximum damage to the cask. This evaluates several impacts in which different parts of a cask strike the bar either by simulation or physical testing.

L.5.3 FIRE

The third set of accident conditions simulates a fire that occurs after the two impacts. This involves a hydrocarbon fire with an average flame temperature of 800°C (1,475°F) and requires the cask to be fully engulfed in the flame for 30 minutes.

L.5.4 WATER IMMERSION

The final set of accident conditions in the sequence is shallow immersion. The cask must be immersed in 0.9 meter (3 feet) of water. The purpose of this test is to ensure that water cannot leak into the cask after having passed through the challenges.

An undamaged version of the cask must also be able to survive immersion in the equivalent of 15 meters (50 feet) of water at a pressure of about 1,500 grams per square centimeter (22 pounds per square inch) to test for leakage. Furthermore, shipping casks for more than 1 million curies of radioactivity must be able to survive water pressure of about 20,000 grams per square centimeter (290 pounds per square inch) for 1 hour without collapsing, buckling, or leaking. That pressure is equivalent to a depth of about 200 meters (650 feet).

L.5.5 ACCEPTANCE CRITERIA

To be judged successful in meeting all but the 200-meter (650-foot) submersion requirement, a cask must not release more than limited amounts of radioactive material in 1 week. These release limits are set for each radionuclide based on dispersivity and toxicity. In addition, the cask must not emit radiation at a dose rate of greater than 1 rem per hour at a distance of 1 meter (3.3 feet) from the cask surface. Last, the contents of the cask must not be capable of undergoing a nuclear chain reaction, or criticality, as a result of the hypothetical accident conditions.

L.5.6 USE OF MODELS

Manufacturers can demonstrate the ability of a cask to survive these hypothetical accident conditions in several ways. They can subject a full-size model of the cask to the sequences, use smaller models of the casks (typically half- or quarter-scale), compare the cask design to previously licensed designs, or analyze the hypothetical accident scenarios with computer models. NRC approves what level of physical testing or analysis is necessary for each cask design. Because NRC generally accepts the results of scale-model testing, more expensive full-scale testing rarely occurs, although NRC sometimes requires such tests for specific cask components. For example, NRC could accept quarter-scale drop tests for a particular cask design but full-scale tests of the cask's impact limiters. Computer analysis could be sufficient for meeting the hypothetical fire and criticality control criteria.

L.6 Emergency Response

L.6.1 ROLES AND RESPONSIBILITIES

States and tribes along shipping routes have the primary responsibility for the protection of the public and environment in their jurisdictions. If an emergency that involved a DOE radioactive materials shipment occurred, incident command would be established based on the procedures and policies of the state, tribe, or local jurisdiction. When requested by civil authorities, DOE would provide technical advice and assistance including access to teams of experts in radiological monitoring and related technical areas. DOE staffs eight Regional Coordinating Offices 24 hours a day, 365 days a year with teams of nuclear engineers, health physicists, industrial hygienists, public affairs specialists, and other professionals (Section L.6.2 contains further detail on the DOE role). Under NWPA Section 180(c), DOE must provide technical assistance and funds to states for training for public safety officials of appropriate units of local government and American Indian tribes through whose jurisdiction DOE plans to transport spent nuclear fuel or high-level radioactive waste. Training must cover procedures for safe routine transportation of these materials as well as for emergency response situations.

DOE would require selected carriers to provide drivers and train crews with specific written procedures that defined detailed actions for an emergency or incident that involved property damage, injury, or the release or potential release of radioactive materials. Procedures would comply with U.S. Department of Transportation guidelines for emergency response in the 2004 *Emergency Response Guidebook* (DIRS 175728-DOT 2004, all) and would address emergency assistance to injured crew or others who were involved in identification and assessment of the situation, notification and communication requirements, securing of the site and controlling access, and technical help to first responders.

L.6.2 FEDERAL COORDINATION

The Department of Homeland Security coordinates the overall Federal Government response to radiological Incidents of National Significance in accordance with Homeland Security Presidential Directive 5 (DIRS 182271-DHS 2003, all) and the *National Response Plan* (DIRS 175729-DHS 2004, all). Based on Directive 5 criteria, an Incident of National Significance is an actual or potential high-impact event that requires a coordinated and effective response by, and appropriate combination of, federal, state, local, tribal, nongovernmental, or private-sector entities to save lives and minimize damage, and to provide the basis for long-term community recovery and mitigation activities.

In Directive 5, the President designates the Secretary of Homeland Security as the Principal Federal Official for domestic incident management and empowers the Secretary to coordinate federal resources used in response to terrorist attacks, major disasters, or other emergencies in specific cases (DIRS 182271-DHS 2003, all). The Directive establishes a single, comprehensive National Incident Management System that unifies federal, state, territorial, tribal, and local lines of government into one coordinated effort. This system encompasses much more than the Incident Command System, which is nonetheless a critical component of the National Incident Management System. That system also provides a common foundation for training and other preparedness efforts, communicating and sharing information with other responders and with the public, ordering resources to assist with a response effort, and integrating new technologies and standards to support incident management. The Incident Command System uses as its base the local first responder protocols; that use does not eliminate the required agreements and coordination among all levels of government.

In Directive 5 (DIRS 182271-DHS 2003, all), the President directed the development of the new *National Response Plan* (DIRS 175729-DHS 2004, all) to align federal coordination structures, capabilities, and resources into a unified approach to domestic incident management. The Plan is built on the template of the National Incident Management System. The Plan provides a comprehensive, all-hazards approach to domestic incident management. All federal departments and agencies must adopt the National Incident Management System and use it in their individual domestic incident management and emergency prevention, preparedness, response, recovery, and mitigation activities, as well as in support of all actions taken to assist state or local entities.

DOE supports the Department of Homeland Security as the coordinating agency for incidents that involve the transportation of radioactive materials by or for DOE. DOE is otherwise responsible for the radioactive material, facility, or activity in the incident. DOE is part of the Unified Command, which is an application of the Incident Command System for when there is more than one agency with incident jurisdiction or when incidents cross political jurisdictions. DOE coordinates the federal radiological response activities as appropriate. Agencies work together through the designated members of the Unified Command, often the senior person from agencies or disciplines that participate in the Unified Command, to establish a common set of objectives and strategies.

DOE, as the transporter of radiological material, would notify state and tribal authorities and the Homeland Security Operations Center. The Department of Homeland Security and DOE coordinate federal response and recovery activities for the radiological aspects of an incident. DOE reports information and intelligence in relation to situational awareness and incident management to the Homeland Security Operations Center.

The Department of Homeland Security and DOE are responsible for coordination of security activities for federal response operations. While spent nuclear fuel and high-level radioactive waste shipments are in transit, state, local, and tribal governments could provide security for a radiological transportation incident that occurred on public lands. The Department of Homeland Security, with DOE as the coordinating agency, approves issuance of all technical data to state, local, and tribal governments.

The Interagency Modeling and Atmospheric Assessment Center, is responsible for production, coordination, and dissemination of consequence predictions for an airborne hazardous material release. The Center generates the single federal prediction of atmospheric dispersions and their consequences using the best available resources.

Federal monitoring and assessment activities are coordinated with state, local, and tribal governments. Federal agency plans and procedures for implementation of this activity are designed to be compatible with the radiological emergency planning requirements for state and local governments, specific facilities, and existing memoranda of understanding and interagency agreements.

DOE maintains national and regional coordination offices at points of access to federal radiological emergency assistance. Requests for Radiological Assessment Program teams go directly to the DOE Emergency Operations Center in Washington, D.C. If the situation requires more assistance than a team can provide, DOE alerts or activates additional resources. DOE can respond with additional resources including the Aerial Measurement System to provide wide-area radiation monitoring and Radiation Emergency Assistance Center/Training Site medical advisory teams. Some participating federal agencies have radiological planning and emergency responsibilities as part of their statutory authority, as well as established working relationships with state counterparts. The monitoring and assessment activity, which DOE coordinates, does not alter these responsibilities but complements them by providing coordination of the initial federal radiological monitoring and assessment response activities.

The U.S. Department of Homeland Security and DOE, as the coordinating agency, oversee the development of Federal Protective Action Recommendations. In this capacity, they provide advice and assistance to state, tribal, and local governments, which can include advice and assistance on measures to avoid or reduce exposure of the public to radiation from a release of radioactive material and advice on emergency actions such as sheltering and evacuation.

State, local, and tribal governments are encouraged to follow closely the *National Response Plan* (DIRS 175729-DHS 2004, all), the Nuclear/Radiological Incident Annex, and the National Incident Management System protocols and procedures. As established, all federal, state, local and tribal responders agree to and follow the Incident Command System.

L.7 Technical Assistance and Funding for Training of State and American Indian Public Safety Officials

The NWPA requires DOE to provide technical assistance and funds to states and American Indian tribes for training public safety officials of appropriate units of local governments through whose jurisdictions the Department plans to transport spent nuclear fuel or high-level radioactive waste. Section 180(c) further provides that training must cover procedures for safe routing and emergency response situations. Section 180(c) encompasses all modes of transportation, and funding would come from the Nuclear Waste Fund. Once implemented, this program would provide funding and technical assistance to train firefighters, law enforcement officers, and other public safety officials in preparation for repository shipments through their jurisdictions.

To implement this requirement in the 1990s, DOE published four Federal Register notices to solicit public comment on its approach to implementing Section 180(c). DOE responded to the comments in subsequent notices through April 1998. In 2004, the changes in homeland security and DOE transportation practices made it timely for DOE to renew efforts to develop Section 180(c) policy and implementation procedures. DOE evaluated changes in emergency preparedness and funding for responders since 1998 as well as emergency preparedness grant programs that began after September 11, 2001. The evaluation considered programs the Department of Homeland Security and the Federal Emergency Management Agency developed and relevant DOE funding and emergency response training efforts such as the Waste Isolation Pilot Plant and Foreign Research Reactor transportation programs.

The revisitation of Section 180(c) implementation began with the formation of a Transportation External Coordination Working Group Topic Group in April 2004. DOE also worked with State Regional Groups and the Tribal Issues Topic Group of the Transportation External Coordination Working Group to solicit stakeholder input on the policy. Topic Group members wrote issue papers on specific Section 180(c) topics such as allowable activities, funding allocation method, timing and eligibility, and definitions. From these materials, DOE developed a draft policy that it issued in a Federal Register notice on July 23, 2007 (72 *FR* 40139) to request additional comments from stakeholders and the public. DOE plans to conduct a pilot test of the program and then issue the final Section 180(c) policy.

Under the proposed policy, DOE would make two grants available to eligible state and tribal governments. An initial assessment and planning grant would be available about 4 years before shipments through a jurisdiction began. Once the state or tribe completed the assessment and planning grant activities, they would be eligible for the training grant every year that shipments traveled through their jurisdiction.

L.8 Transportation Security

Transportation safeguards and security are among the highest DOE priorities as it plans for shipments of spent nuclear fuel and high-level radioactive waste to Yucca Mountain. DOE would build the security program for the shipments on the successful security program it developed and has successfully used in past decades for shipments of spent nuclear fuel to DOE facilities from foreign and domestic reactors.

An effective security program must protect members of the public near transportation routes as well as minimize potential threats to workers, and it must include security elements appropriate to each phase of transportation. DOE would continually test security procedures to identify improvements in the security system throughout transportation operations. The key elements of a secure transportation program include physical security systems, information security, materials control and accounting, personnel security, security program management, and emergency response capabilities.

DOE is working closely with other federal agencies including NRC and the Department of Homeland Security to understand and mitigate potential threats to shipments. In addition to domestic efforts, the Department is a member of the International Working Group on Sabotage for Transport and Storage Casks, which investigates the consequences of a potential act of sabotage and explores opportunities to enhance the physical protection of casks. As a result of these efforts, DOE would modify its methods and systems as appropriate between now and the time of shipments.

In coordination with other federal agencies, DOE is working with other stakeholders including state, local, and tribal governments; industry associations such as the Association of American Railroads, and technical advisory and oversight organizations such as the National Academies of Science and the Nuclear Waste Technical Review Board. This enables DOE to take advantage of the experience and practical recommendations of experts on a broad range of security-related technical, procedural, and operational matters.

L.9 Liability

The Price-Anderson Act (Section 170 of the Atomic Energy Act, as amended [42 U.S.C. 2011 *et seq.*]) provides indemnification for liability for nuclear incidents that apply to the proposed Yucca Mountain repository. The following sections address specific details or provisions of the Act.

L.9.1 THE PRICE-ANDERSON ACT

In 1957, Congress enacted the Price-Anderson Act as an amendment to the Atomic Energy Act to encourage the development of a commercial nuclear industry and to ensure prompt and equitable compensation in the event of a nuclear incident. The Price-Anderson Act establishes a system of financial protection for persons who could be liable for and persons who could be injured by a nuclear incident. The purposes of the Act are (1) to encourage growth and development of the nuclear industry through the increased participation of private industry and (2) to protect the public by ensuring that funds are available to compensate victims for damages and injuries sustained in the event of a nuclear incident. Congress renewed and amended the indemnification provisions in 1966, 1969, 1975, and 1988. The 1988 Price-Anderson Amendments Act extended the Act for 14 years until August 1, 2002 (Public Law 100-408, 102 Stat. 1066). Since then, Congress has extended the Act until December 31, 2025, and increased liability to $10.26 billion for an extraordinary nuclear occurrence (that is, any nuclear incident that causes substantial damage), subject to increase for inflation.

L.9.2 INDEMNIFICATION UNDER THE PRICE-ANDERSON ACT

For each shipper, DOE must include an agreement of indemnification in each contract that involves the risk of a nuclear incident. This indemnification (1) provides omnibus coverage of all persons who could be legally liable, (2) fully indemnifies all legal liability up to the statutory limit on such liability (currently $10.26 billion for a nuclear incident in the United States), (3) covers all DOE contractual activity that could result in a nuclear incident in the United States, (4) is not subject to the usual limitation on the availability of appropriated funds, and (5) is mandatory and exclusive.

L.9.3 COVERED AND EXCLUDED INDEMNIFICATION

The Price-Anderson Act indemnifies liability arising out of, or resulting from, a nuclear incident or precautionary evacuation, including all reasonable additional costs incurred by a state or a political subdivision of a state, in the course of responding to a nuclear incident or a precautionary evacuation. It excludes (1) claims under state or federal worker compensation acts of indemnified employees or persons who are at the site of, and in connection with, the activity where the nuclear incident occurs, (2) claims that arise out of an act of war, and (3) claims that involve certain property on the site.

L.9.4 PRICE-ANDERSON ACT DEFINITION OF A NUCLEAR INCIDENT

A nuclear incident is any occurrence, including an extraordinary nuclear occurrence, that causes bodily injury, sickness, disease, death, loss of or damage to property, or loss of use of property, that arises out of or results from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material (42 U.S.C. 2014).

L.9.5 PROVISIONS FOR PRECAUTIONARY EVACUATION

A precautionary evacuation is an evacuation of the public within a specified area near a nuclear facility or the transportation route in the case of an incident that involves transportation of source material, special nuclear material, byproduct material, spent nuclear fuel, high-level radioactive waste, or transuranic waste. It must be the result of an event that is not classified as a nuclear incident but poses an imminent danger of injury or damage from the radiological properties of such nuclear materials and causes an evacuation. The evacuation must be initiated by an official of a state or a political subdivision of a state who is authorized by state law to initiate such an evacuation and who reasonably determined that such an evacuation was necessary to protect the public health and safety.

L.9.6 AMOUNT OF INDEMNIFICATION

The Price-Anderson Act establishes a system of private insurance and federal indemnification to ensure compensation for damage or injuries suffered by the public in a nuclear incident. The current amount of $10.26 billion reflects a threshold level beyond which Congress would review the need for additional payment of claims in the case of a nuclear incident with catastrophic damage. The limit for incidents that occur outside the United States is $500 million, and the nuclear material must be owned by, and used by or under contract with, the United States.

L.9.7 INDEMNIFICATION OF TRANSPORTATION ACTIVITIES

DOE indemnifies any nuclear incident that arises in the course of any transportation activities in connection with a DOE contractual activity, including transportation of nuclear materials to and from DOE facilities.

L.9.8 COVERED NUCLEAR WASTE ACTIVITIES

The indemnification specifically includes nuclear waste activities that DOE undertakes in relation to the storage, handling, transportation, treatment, disposal of, or research and development on spent nuclear fuel, high-level radioactive waste, or transuranic waste. It would cover liability for incidents that could occur while wastes were in transit from nuclear power plants, at a storage facility, or at Yucca Mountain.

If a DOE contractor or other indemnified person was liable for the nuclear incident or a precautionary evacuation that resulted from its contractual activities, that person would be indemnified for that liability. While DOE tort liability would be determined under the Federal Tort Claims Act (28 U.S.C. Sections 1346(b), 1402(b), 2401(b), and 2671 through 2680), the Department would use contractors to transport spent nuclear fuel and high-level radioactive waste and to construct and operate a repository. Moreover, if public liability arose out of activities that the Nuclear Waste Fund supported, the Fund would pay compensation up to the maximum amount of protection. The NWPA established the fund to support federal activities for the disposal of spent nuclear fuel and high-level radioactive waste.

L.9.9 INDEMNIFICATION FOR STATE, AMERICAN INDIAN, AND LOCAL GOVERNMENTS

State, American Indian, and local governments are persons in the sense that they might be indemnified if they incur legal liability. The Price-Anderson Act defines a person as including "(1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency other than [DOE or the Nuclear Regulatory] Commission, any state or any political subdivision of, or any political entity within a state, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing" (42 U.S.C. 2214). A state or a political subdivision of a state could be entitled to indemnification for legal liability, which would include all reasonable additional costs of responding to a nuclear incident or an authorized precautionary evacuation. In addition, indemnified persons could include contractors, subcontractors, suppliers, shippers, transporters, emergency response workers, health professional personnel, workers, and victims.

L.9.10 PROCEDURES FOR CLAIMS AND LITIGATION

Numerous provisions ensure the prompt availability and equitable distribution of compensation, which would include emergency assistance payments, consolidation and prioritization of claims in one federal court, channeling of liability to one source of funds, and waiver of certain defenses in the event of a large incident. The Price-Anderson Act authorizes payments for immediate assistance after a nuclear incident. In addition, it provides for the establishment of coordinated procedures for the prompt handling, investigation, and settlement of claims that result from a nuclear incident.

L.9.11 FEDERAL JURISDICTION OVER CLAIMS

The U.S. District Court for the district in which a nuclear incident occurred would have original jurisdiction "with respect to any [suit asserting] public liability...without regard to the citizenship of any party or the amount in controversy" [42 U.S.C. 2210(n)]. If a case was brought in another court, it would be removed to the U.S. District Court with jurisdiction upon motion of a defendant, NRC, or DOE.

L.9.12 CHANNELING LIABILITY TO ONE SOURCE OF FUNDS

The Price-Anderson Act channels the indemnification (that is, the payment of claims that arise from the legal liability of any person for a nuclear incident) to one source of funds. This economic channeling eliminates the need to sue all potential defendants or to allocate legal liability among multiple potential defendants. Economic channeling results from the broad definition of indemnified persons to include any person who could be legally liable for a nuclear incident. Therefore, regardless of individual legal liability for a nuclear incident that resulted from a DOE contractual activity or NRC-licensed activity, the indemnity will pay the claim.

In the hearings on the original Act, "the question of protecting the public was raised where some unusual incident, such as negligence in maintaining an airplane motor, should cause an airplane to crash into a reactor and thereby cause damage to the public. Under this bill, the public is protected and the airplane company can also take advantage of the indemnification and other proceedings" (DIRS 155789-DOE 1999, p. 12).

L.9.13 LEGAL LIABILITY UNDER STATE TORT LAW

The Price-Anderson Act does not define legal liability, but the legislative history clearly indicates that state tort law determines the covered legal liabilities (DIRS 155789-DOE 1999, p. A-6). In 1988, public liability action was defined to state explicitly that "the substantive rules for decision in such action shall be derived from the law of the state in which the nuclear incident involved occurs, unless such law is inconsistent with the provisions of [Section 2210 of Title 42]" (42 U.S.C. 2014).

L.9.14 PROVISIONS WHERE STATE TORT LAW MAY BE WAIVED

The Price-Anderson Act includes provisions to minimize protracted litigation and to eliminate the need to prove the fault of or to allocate legal liability among various potential defendants. Certain provisions of state law may be superseded by uniform rules that the Act prescribes, such as a limitation on punitive damages. In the case of an extraordinary nuclear occurrence, the Act imposes strict liability by requiring the waiver of any defenses in relation to conduct of the claimant or fault of any indemnified person. Such waivers would result, in effect, in strict liability, the elimination of charitable and governmental immunities, and the substitution of a 3-year discovery rule in place of statutes of limitations that would normally bar all suits after a specified number of years.

L.9.15 COVERAGE AVAILABLE FOR INCIDENTS IF THE PRICE-ANDERSON ACT DOES NOT APPLY

If an incident does not involve the actual release of radioactive materials or a precautionary evacuation is not authorized, Price-Anderson Act indemnification does not apply. If the indemnification does not apply, liability is determined under state law, as it would be for any other type of transportation incident. Private insurance could apply. As noted above, however, the Act would cover all DOE contracts for transportation of spent nuclear fuel and high-level radioactive waste to a repository for nuclear incidents and precautionary evacuations. Indemnified persons under that DOE contractual activity would include the contractors, subcontractors, suppliers, state, American Indian, and local governments, shippers and transporters, emergency response workers, and all other workers and victims.

Carriers would have private insurance to cover liability from a nonnuclear incident and for environmental restoration for such incidents. The Motor Carrier Act (42 U.S.C. 10927) and its implementing regulations (49 CFR Part 387) require all motor vehicles that carry spent nuclear fuel or high-level radioactive waste to maintain financial responsibility of at least $5 million. Federal law does not require rail, barge, or air carriers of radioactive materials to maintain liability coverage, but these carriers often voluntarily cover such insurance. Private insurance policies often exclude coverage of nuclear incidents. Therefore, private insurance policies generally apply only to the extent that the Price-Anderson Act is not applicable.

L.10 National Academy of Sciences Findings and Recommendations

In 2006, the National Academy of Sciences Committee on Transportation of Radioactive Waste issued *Going the Distance? The Safe Transport of Spent Nuclear and High-Level Radioactive Waste in the United States* (DIRS 182032-National Research Council 2006, all). The following sections provide the findings and recommendations from this report that are relevant to the Rail Alignment EIS along with a discussion of the DOE position on or approach to the aspects of the findings and recommendations.

L.10.1 TRANSPORTATION SAFETY AND SECURITY

Principal Academy Finding on Transportation Safety

> The committee could identify no fundamental technical barriers to the safe transport of spent nuclear fuel and high-level radioactive waste in the United States. Transport by highway (for small-quantity shipments) and by rail (for large-quantity shipments) is, from a technical viewpoint, a low-radiological-risk activity with manageable safety, health, and environmental consequences when conducted with strict adherence to existing regulations. However, there are a number of social and institutional challenges to the successful initial implementation of large-quantity shipping programs that will require expeditious resolution as described in this report. Moreover, the challenges of sustained implementation should not be underestimated.

DOE agrees that the transportation of spent nuclear fuel and high-level radioactive waste has a low radiological risk with manageable safety. DOE also agrees that there are social and institutional challenges, but the Department believes it would meet these challenges successfully through a process that has transportation safety as its priority.

Principal Academy Finding on Transportation Security

> Malevolent acts against spent fuel and high-level waste shipments are a major technical and societal concern, especially following the September 11, 2001, terrorist attacks on the United States. The committee judges that some of its recommendations for improving transportation safety might also enhance transportation security. The Nuclear Regulatory Commission is undertaking a series of security studies, but the committee was unable to perform an in-depth technical examination of transportation security because of information constraints.

Academy Recommendation

> An independent examination of the security of spent fuel and high-level waste transportation should be carried out prior to the commencement of large-quantity shipments to a federal repository or to interim storage. This examination should provide an integrated evaluation of the threat environment, the response of packages to credible malevolent acts, and operational security requirements for protecting spent fuel and high-level waste while in transport. This examination should be carried out by a technically knowledgeable group that is independent of the government and free from institutional and financial conflicts of interest. This group should be given full access to the necessary classified documents and Safeguards Information to carry out this task. The findings and recommendations from this examination should be made available to the public to the fullest extent possible.

Transportation safeguards and security are among DOE's highest priorities as it plans for shipments of spent nuclear fuel and high-level radioactive waste to the proposed repository. The Department would build the security program for the repository shipments on the security program that it has developed and successfully used in past decades for shipments of spent nuclear fuel to DOE facilities from foreign and domestic reactors.

An effective security program must protect members of the public near transportation routes as well as potential threats to workers, and it must include security elements appropriate to each phase of transportation. Continual testing of security procedures would result in improvements in the security system through completion of transportation operations for Yucca Mountain. The most important elements of a secure transportation program include physical security systems, information security, materials control and accounting, personnel security, security program management, and emergency response capabilities.

DOE is working closely with other Federal agencies including the NRC, and the U.S. Department of Homeland Security, and the Transportation Security Agency to understand and eliminate potential threats to repository shipments. In addition to its domestic efforts, the Department is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the consequences of a potential act of sabotage and is exploring opportunities to enhance the physical protection of casks. As a result of these efforts, DOE would modify its methods and systems as appropriate between now and the time of shipments.

In coordination with other Federal agencies, DOE is working with other stakeholders including state, tribal, and local governments; industry associations such as the Association of American Railroads and technical advisory and oversight organizations such as the National Academy of Sciences and the Nuclear Waste Technical Review Board. This allows DOE to take advantage of the experience and practical recommendations of experts on a broad range of security-related technical, procedural, and operational matters.

L.10.2 TRANSPORTATION RISK

Academy Finding

> There are two types of transportation risk: health and safety risks and social risks. The health and safety risks arise from the potential exposure of transportation workers as well as other people who travel, work, or live near transportation routes to radiation that may be emitted or released from these loaded packages. Social risks arise from social processes and human perceptions and can have both direct socioeconomic impacts and perception-based impacts.
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> There are two potential sources of radiological exposures from transporting spent fuel and high-level waste: (1) radiation shine from spent fuel and high-level waste transport packages under normal transport conditions; and (2) potential increases in radiation shine and release of radioactive materials from transport packages under accident conditions that are severe enough to compromise fuel element and package integrity. The radiological risks associated with the transportation of spent fuel and high-level waste are well understood and are generally low, with the possible exception of risks from releases in extreme accidents involving very long duration, fully engulfing fires. While the likelihood of such extreme accidents appears to be very small, their occurrence cannot be ruled out based on historical accident data for other types of hazardous material shipments. However, the likelihood of occurrence and consequences can be reduced further through relatively simple operational controls and restrictions and route-specific analyses to identify and mitigate hazards that could lead to such accidents.

Academy Recommendation

> To address radiological risk, the NAS stated there were clear transportation operations and safety advantages to be gained from shipping older (i.e. radiologically and thermally cooler) spent fuel first.
>
> Transportation planners and managers should undertake detailed surveys of transportation routes to identify potential hazards that could lead to or exacerbate extreme accidents involving very long duration, fully engulfing fires. Planners and managers should also take steps to avoid or mitigate such hazards before the commencement of shipments or shipping campaigns.

The Rail Alignment EIS evaluated the radiological risks of transportation accidents and found these risks to be very low, as did the Yucca Mountain FEIS. In addition, NRC has evaluated the response of spent nuclear fuel casks to the environments that existed during the Baltimore tunnel fire and the Caldecott tunnel fire, which would be representative of long duration, fully engulfing fires. These evaluations show that releases of radioactive material during these types of events, if they occurred at all, would be very small. Based on recommendations from the NRC, the Association of American Railroads has modified its operating standards to prohibit trains that carry flammable materials from being in a tunnel at the same time as a train that carries spent fuel. This administrative adjustment addresses some of the concerns of the Academy.

An initial step in the planning process to ship spent nuclear fuel and high-level radioactive waste to the Yucca Mountain repository would be to identify a national suite of rail and highway routes. Stakeholder groups in the DOE transportation program are participating in this process by examining routing criteria that DOE could use in the route identification process. State Regional Groups, American Indian tribes, transportation associations, industry, Federal agencies, and local government organizations are some of the groups that work collaboratively with DOE in this process.

Academy Finding

> The social risks for spent fuel and high-level waste transportation pose important challenges to the successful implementation of programs for transporting spent fuel and high-level waste in the United States. Such risks have received substantially less attention than health and safety risks, and some are difficult to characterize. Current research and practice suggest that transportation planners and managers can take early proactive steps to characterize, communicate, and manage the social risks that arise from their operations. Such steps may have additional benefits: they may increase the openness and transparency of transportation planning and programs; build community capacity to mitigate these risks; and possibly increase trust and confidence in transportation programs.

Academy Recommendation

> Transportation implementers should take early and proactive steps to establish formal mechanisms for gathering high-quality and diverse advice about social risks and their management on an ongoing basis. The committee makes two recommendations for the establishment of such mechanisms for the Department of Energy’s program to transport spent fuel and high-level waste to a federal repository at Yucca Mountain: (1) expand the membership and scope of an existing advisory group (Transportation External Coordination Working Group; see Chapter 5) to obtain outside advice on social risk, including impacts and management; and (2) establish a transportation risk advisory group

> that is explicitly designed to provide advice on characterizing, communicating, and mitigating the social, security, and health and safety risks that arise from the transportation of spent fuel and high-level waste to a federal repository or interim storage. This group should be comprised of risk experts and practitioners drawn from the relevant technical and social science disciplines and should be convened under the Federal Advisory Committee Act or a similar arrangement to enhance the openness of its operations. Its members should receive security clearances to facilitate access to appropriate transportation security information. The existing federal Nuclear Waste Technical Review Board, which will cease operations no later than one year after the Department of Energy begins disposal of spent fuel or high-level waste in a repository, could be broadened to serve this function.

DOE has reviewed the Academy recommendation on involving social scientists in the Transportation External Coordination Working Group and on expert panels, and the Department has contacted some panel members to explore opportunities for future studies. DOE has sponsored studies by social scientists in the past on risk perception about transportation of radioactive materials and adjusted its programs to focus on local officials and support for emergency planning and training as a result. The Department needs to update this study and is in the process of reviewing literature to understand gaps in research to address some of the most pressing transportation issues. In addition, DOE has proposed a topic group within the Transportation External Coordination Working Group to address social risks. The Working Group membership has not yet indicated if that is an area they want to focus on at this time.

L.10.3 CURRENT CONCERNS ABOUT TRANSPORTATION OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

L.10.3.1 Package Performance

Academy Finding

> Transportation packages play a crucial role in the safety of spent fuel and high-level radioactive waste shipments by providing a robust barrier to the release of radiation and radioactive material under both normal transport and accident conditions. International Atomic Energy Agency package performance standards and associated Nuclear Regulatory Commission regulations are adequate to ensure package containment effectiveness over a wide range of transport conditions, including most credible accident conditions. However, recently published work suggests that extreme accident scenarios involving very long duration, fully engulfing fires might produce thermal loading conditions sufficient to compromise containment effectiveness. The consequences of such thermal loading conditions for containment effectiveness are the subject of ongoing investigations by the Nuclear Regulatory Commission and other parties, and this work is improving the understanding of package performance. Nonetheless, additional analyses and experimentation are needed to demonstrate a bounding-level understanding of package performance in response to very long duration, fully engulfing fires for a representative set of package designs.

Academy Recommendation

> The Nuclear Regulatory Commission should build on recent progress in understanding package performance in very long duration fires. To this end, the agency should undertake additional analyses of very long duration fire scenarios that bound expected

real world accident conditions for a representative set of package designs that are likely to be used in future large-quantity shipping programs. The objectives of these analyses should be to:

- Understand the performance of package barriers (spent fuel cladding and package seals);
- Estimate the potential quantities and consequences of any releases of radioactive material; and
- Examine the need for regulatory changes (e.g., package testing requirements) or operational changes (e.g., restrictions on trains carrying spent fuel) either to help prevent accidents that could lead to such fire conditions or to mitigate their consequences.

Strong consideration should also be given to performing well-instrumented tests for improving and validating the computer models used for carrying out these analyses, perhaps as part of the full-scale test planned by the Nuclear Regulatory Commission for its package performance study. Based on the results of these investigations, the Commission should implement operational controls and restrictions on spent fuel and high-level radioactive waste shipments as necessary to reduce the chances that such fire conditions might be encountered in service. Such effective steps might include, for example, additional operational restrictions on trains carrying spent fuel and high-level radioactive waste to prevent co-location with trains carrying flammable materials in tunnels, in rail yards, and on sidings.

As Section L.10.2 notes, NRC has addressed operating restrictions for tunnels by working with the Association of American Railroads to adjust rail operating practices. In addition, DOE has committed to supporting the NRC Package Performance Study to better understand severe accidents.

Academy Finding

The committee strongly endorses the use of full-scale testing to determine how packages will perform under both regulatory and credible extra-regulatory conditions. Package testing in the United States and many other countries is carried out using good engineering practices that combine state-of-the-art structural analyses and physical tests to demonstrate containment effectiveness. Full-scale testing is a very effective tool both for guiding and validating analytical engineering models of package performance and for demonstrating the compliance of package designs with performance requirements. However, deliberate full-scale testing of packages to destruction through the application of forces that substantially exceed credible accident conditions would be marginally informative and is not justified given the considerable costs for package acquisitions that such testing would require.

Academy Recommendation

Full-scale package testing should continue to be used as part of integrated analytical, computer simulation, scale-model, and testing programs to validate package performance.

> Deliberate full-scale testing of packages to destruction should not be required as part of this integrated analysis or for compliance demonstrations.

DOE would use NRC-certified casks for transportation of spent nuclear fuel and high-level radioactive waste to the proposed repository. Cask vendors would supply these NRC-certified casks to DOE under contractual requirements. To obtain the certificate, the vendors would conduct testing as NRC specifies.

L.10.3.2 Route Selection for Research Reactor Spent Fuel Transport

Academy Finding

> The Department of Energy's procedures for selecting routes within the United States for shipments of foreign research reactor spent fuel appear on the whole to be adequate and reasonable. These procedures are risk informed; they make use of standard risk assessment methodologies in identifying a suite of potential routes and then make final route selections by taking into account security, state and tribal preferences, and information from states and tribes on local transport conditions. The Department of Energy's procedures reflect the agency's position (which is consistent with Department of Transportation regulations) that the states are competent and responsible for selecting highway routes. For rail route selection, the Department of Energy's practice of negotiating routes with carriers in consultation with states is analogous to its interaction with states on highway routing.

Academy Recommendation

> The Department of Energy should continue to ensure the systematic, effective involvement of states and tribal governments in its decisions involving routing and scheduling of foreign and DOE research reactor spent fuel shipments.

For shipments to the repository, DOE would use its Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions (DIRS 172433-DOE 2003, all) to guide interactions with state and tribal governments. During planning and actual transportation operations, DOE would involve these stakeholders in route identification, funding approaches for emergency response planning and training, understanding safeguards and security requirements, operational practices, and communications and information access.

DOE is working collaboratively with states through State Regional Group committees (whose members are state officials responsible for transportation policy, law enforcement, emergency response, and oversight of hazardous materials shipments) and with American Indian tribal governments to assist them to prepare for the shipments.

In addition to State Regional Group and tribal coordination, a national cooperative effort is underway as part of the Transportation External Coordination Working Group and its various Topic Groups, which involves a broad range of stakeholder organizations that routinely interact with DOE to provide input and recommendations on transportation planning and program information. States, tribes, and industry are working with DOE to guide and focus emergency training, coordination with local officials, and other transportation activities to prepare for shipments to the repository.

Academy Finding

> Highway routes for shipment of spent nuclear fuel are dictated by DOT regulations (49 CFR Part 397). The regulations specify that shipments normally must travel by the

fastest route using highways designated by the states or the federal government. They do not require the carrier or shipper to evaluate risks of portions of routes that meet this criterion. These regulations are a satisfactory means of ensuring safe transportation, provided that the shipper actively and systematically consults with the states and tribes along potential routes and that states follow the route designation procedures prescribed by the DOT.

Academy Recommendation

DOT should ensure that states that designate routes for shipment of spent nuclear fuel rigorously comply with its regulatory requirement that such designations be supported by sound risk assessments. DOT and DOE should ensure that all potentially affected states are aware of and prepared to fulfill their responsibilities regarding highway route designations.

DOE is working collaboratively with states through State Regional Group committees (whose members are state officials responsible for transportation policy, law enforcement, emergency response, and oversight of hazardous materials shipments) and with American Indian tribal governments to assist them to prepare for the shipments.

As part of the routing discussions, DOE has provided training to officials of these stakeholders on its routing model (TRAGIS; DIRS 181276-Johnson and Michelhaugh 2003, all) and the risk model (RADTRAN 5; DIRS 150898-Neuhauser and Kanipe 2000, all). If states or tribes choose to designate alternative highway routes, technical assistance is available from the experts at the national laboratories who manage these two models. In addition, State Regional Group staff support their states with routing assistance as part of the cooperative efforts DOE supports.

L.10.4 FUTURE CONCERNS FOR TRANSPORTATION OF SPENT FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

L.10.4.1 Mode for Transporting Spent Fuel and High-Level Radioactive Waste to a Federal Repository

Academy Finding

Transport of spent fuel and high-level waste by rail has clear safety, operational, and policy advantages over highway transport for large-quantity shipping programs. The committee strongly endorses DOE’s selection of the “mostly rail” option for the Yucca Mountain transportation program for the following reasons:

- It reduces the total number of shipments to the federal repository by roughly a factor of five, which reduces the potential for routine radiological exposures, conventional traffic accidents, and severe accidents.
- Rail shipments have a greater physical separation from other vehicular traffic and reduced interactions with people along transportation routes, which also contributes to safety.
- Operational logistics are simpler and more efficient.
- There is a clear public preference for this option.

The committee does not endorse the development of an extended truck transportation program to ship spent fuel cross-country or within Nevada should DOE fail to complete construction of the Nevada rail spur or procure the necessary rail equipment by the time the federal repository is opened.

Academy Recommendation

DOE should fully implement its mostly rail decision by completing construction of the Nevada rail spur, obtaining the needed rail packages and conveyances, and working with commercial spent fuel owners to ensure that facilities are available at plants to support this option. These steps should be completed before DOE commences the large-quantity shipment of spent fuel and high-level waste to a federal repository to avoid the need to procure infrastructure and construct facilities to support an extended truck transportation program. DOE should also examine the feasibility of further reducing its needs for cross-country truck shipments of spent fuel through the expanded use of intermodal transportation (i.e., combining heavy-haul truck, legal-weight truck, and barge) to allow the shipment of rail packages from plants that do not have direct rail access.

In the Rail Alignment EIS, DOE analyzed the intermodal transfer of rail casks for generator sites that do not have direct rail access. The SEIS analysis identified nine such sites from which DOE would ship spent nuclear fuel or high-level radioactive waste using 2,650 truck shipments. In addition, DOE's transportation operational planning recognizes the value of barge and some heavy-haul truck shipments to maximize rail use to ship to the repository. DOE would address all modes of transportation in future transportation campaign plans.

L.10.4.2 Route Selection for Transportation to a Federal Repository

Academy Finding

DOE has not made public a specific plan for selecting rail and highway routes for transporting spent fuel and high-level waste to a federal repository. DOE also has not determined the role of its program management contractors in selecting routes or specific plans for collaborating with affected states, tribes, and other parties.

Academy Recommendation

DOE should identify and make public its suite of preferred highway and rail routes for transporting spent fuel and high-level waste to a federal repository as soon as practicable to support state, tribal, and local planning, especially for emergency responder preparedness. DOE should follow the practices of its foreign research reactor spent fuel transport program of involving states and tribes in these route selections to obtain access to their familiarity with accident rates, traffic and road conditions, and emergency responder preparedness within their jurisdictions. Involvement by states and tribes may improve the public acceptability of route selections and may reduce conflicts that can lead to program delays.

An initial step in the DOE planning process to ship spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain repository would be to identify a national suite of routes, both rail and highway, that DOE could use. Stakeholder groups are participating with DOE in this process by examining routing criteria the Department could use in the route identification process. State Regional Groups, American Indian tribes, transportation associations, industry, federal agencies, and local government organizations are some of the groups that work collaboratively with DOE in this process. The work would be conducted through a topic group of the Transportation External Coordination Working Group. Broader public input would also be sought to collect comments on routing criteria and the process for developing a set of routes. Industry practices, DOE requirements, and analyses of regional routes that were evaluated by state organizations would be included in the process to identify a preliminary set of routes. Public involvement is central to contributing to a safe, efficient, and flexible transportation system.

L.10.4.3 Use of Dedicated Trains for Transport to a Federal Repository

Academy Finding

Studies carried out to date on transporting spent fuel by dedicated versus general trains have failed to show a clear radiological risk based advantage for either option. However, the committee finds that there are clear operational, safety, security, communications, planning, programmatic, and public preference advantages that favor dedicated trains. The committee strongly endorses DOE's decision to transport spent fuel and high-level waste to a federal repository using dedicated trains.

Academy Recommendation

DOE should fully implement its dedicated train decision before commencing the large-quantity shipment of spent fuel and high-level waste to a federal repository to avoid the need for a stop gap shipping program using general trains.

DOE made a decision to use dedicated trains for its usual mode of shipment, which offers benefits that include efficient use of casks and rail cars, lower dwell time in rail yards and, in combination with other service features, direct service from origin to destination. DOE agrees with the Academy's recommendation.

L.10.4.4 Acceptance Order for Commercial Spent Fuel Transport to a Federal Repository

Academy Finding

The order for accepting commercial spent fuel that is mandated by the Nuclear Waste Policy Act (NWPA) was not designed with the transportation program in mind. In fact, the acceptance order prescribed by the NWPA could require DOE to initiate its transportation program with long cross-country movements of younger (i.e., radiologically and thermally hotter) spent fuel from multiple commercial sites. There are clear transportation operations and safety advantages to be gained from shipping older (i.e., radiologically and thermally cooler) spent fuel first and for initiating the transportation program with relatively short, logistically simple movements to gain experience and build operator and public confidence.

Academy Recommendation

DOE should negotiate with commercial spent fuel owners to ship older fuel first to a federal repository or federal interim storage, except in cases (if any) where spent fuel storage risks at specific plants dictate the need for more immediate shipments of younger fuel. Should these negotiations prove to be ineffective, Congress should consider legislative remedies. Within the context of its current contracts with commercial spent fuel owners, DOE should initiate transport through a pilot program involving relatively short, logistically simple movements of older fuel from closed reactors to demonstrate the ability to carry out its responsibilities in a safe and operationally effective manner. DOE should use the lessons learned from this pilot activity to initiate its full-scale transportation program from operating reactors.

The terms of the "Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste" (10 CFR Part 961) require DOE to assign priority to those generator sites whose fuel was discharged earliest. This is usually called the "Oldest Fuel First" priority. DOE must pick up fuel from sites that were designated by those generators as those with the oldest fuel regardless of the location. At sites that were designated by the generators who own the oldest spent nuclear fuel, DOE must pick up fuel the generators have selected and that has cooled for at least 5 years.

Regardless of which fuel DOE would ship first, it would conduct the shipments safely in NRC-certified casks for that type of fuel.

L.10.4.5 Emergency Response Planning and Training

Academy Finding

Emergency responder preparedness is an essential element of safe and effective programs for transporting spent fuel and high-level waste. Emergency responder preparedness has so far received limited attention from DOE, states, and tribes for the planned transportation program to the federal repository. DOE has the opportunity to be innovative in carrying out its responsibilities for emergency responder preparedness. Emergency responders are among the most trusted members of their communities. Well-trained responders can become important emissaries for DOE's transportation program in local communities and can enhance community preparedness to respond to other kinds of emergencies.

Academy Recommendation

DOE should begin immediately to execute its emergency responder preparedness responsibilities defined in Section 180(c) of the Nuclear Waste Policy Act. In carrying out these responsibilities, DOE should proceed to (1) establish a cadre of professionals from the emergency responder community who have training and comprehension of emergency response to spent fuel and high-level waste transportation accidents and incidents; (2) work with the Department of Homeland Security to provide consolidated "all-hazards" training materials and programs for first responders that build on the existing national emergency response platform; (3) include trained emergency responders on the escort teams that accompany spent fuel and high-level waste shipments; and (4) use emergency responder preparedness programs as an outreach mechanism to communicate broadly about plans and programs for transporting spent fuel and high-level waste to a federal repository with communities along planned shipping routes.

The NWPA requires DOE to provide technical assistance and funds to states and American Indian tribes for training public safety officials of appropriate units of local governments through whose jurisdictions the Department plans to transport spent nuclear fuel or high-level radioactive waste. Section 180(c) further provides that training cover procedures required for safe routing transportation of these materials, as well as procedures for dealing with emergency response situations. Section 180(c) indicates that funding for work under this subsection would come from the Nuclear Waste Fund. Once implemented, this program would provide the increment of funding and technical assistance necessary to train fire fighters, law enforcement officers, and other public safety officials in preparation for repository shipments through their jurisdictions.

To implement this requirement in the 1990s, DOE published four *Federal Register* notices soliciting public comments on its approach to implementing Section 180(c). Comments received in response to these notices were addressed in each subsequent Federal Register notice with the last notice issued in April 1998. In 2004, the changes in homeland security and DOE's transportation practices made it timely for DOE to renew efforts to develop Section 180(c) policy and implementation procedures. Changes in emergency preparedness and funding for responders since 1998 were reviewed and evaluated as well as emergency preparedness grant programs initiated after September 11, 2001. Programs developed by Department of Homeland Security and the Federal Emergency Management Agency were considered. Relevant DOE funding and emergency response training efforts such as the Waste Isolation Pilot Plant and Foreign Research Reactor transportation programs were also evaluated.

DOE's revisiting of Section 180(c) implementation began with the formation of the Transportation External Coordination Working Group 180(c) Topic Group in April 2005. DOE also worked with the state regional groups and the Tribal Issues Topic Group of the Transportation External Coordination Working Group to solicit stakeholder input on the policy. Topic Group members wrote issue papers on specific Section 180(c) topics such as allowable activities, funding allocation method, timing and eligibility, and definitions. From these materials, DOE developed a draft policy which it issued in a Federal Register Notice on July 23, requesting additional comments from stakeholders and the public. DOE plans to conduct a pilot to test the program, and then issue the final Section 180(c) Policy.

Under the proposed policy, two grants would be made available to eligible state and tribal governments. An initial assessment and planning grant would be available about four years prior to shipments commencing through a jurisdiction. Once the state or tribe completes the assessment and planning grant activities, they would be eligible for the training grant every year that shipments travel through their jurisdiction.

L.10.4.6 Information Sharing and Openness

Academy Finding

> There is a conflict between the open sharing of information on spent fuel and high-level waste shipments and the security of transportation programs. This conflict is impeding effective risk communication and may reduce public acceptance and confidence. Post-September 11, 2001, efforts by transportation planners, managers, and regulators to further restrict information about spent fuel shipments make it difficult for the public to assess the safety and security of transportation operations.

Academy Recommendation

> The Department of Energy, Department of Homeland Security, Department of Transportation, and Nuclear Regulatory Commission should promptly complete the job of developing, applying, and disclosing consistent, reasonable, and understandable criteria for protecting sensitive information about spent fuel and high-level waste transportation. They should also commit to the open sharing of information that does not require such protection and should facilitate timely access to such information: for example, by posting it on readily accessible Web sites.

Interactions with state and tribal governments would be guided by the Office of Civilian Radioactive Waste Management Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level

Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions (DIRS 172433-DOE 2003, all). During planning and actual transportation operations, states, tribes, industry, and other key stakeholders would be involved in route identification, funding approaches for emergency response planning and training, understanding safeguards and security requirements, operational practices, and communications and information access.

In addition to key stakeholder organizations and groups, the public has access to transportation information through the DOE web page and through the Transportation External Coordination Working Group web page. These two mechanisms allow program information that should be shared reach a broad audience.

L.10.4.7 Organizational Structure of the Federal Transportation Program

Academy Finding

Successful execution of DOE's program to transport spent fuel and high-level waste to a federal repository will be difficult given the organizational structure in which it is embedded, despite the high quality of many current program staff. As currently structured, the program has limited flexibility over commercial spent fuel acceptance order (Section 5.2.4); it also has limited control over its budget and is subject to the annual federal appropriations process, both of which affect the program's ability to plan for, procure, and construct the needed transportation infrastructure. Moreover, the current program may have difficulty supporting what appears to be an expanding future mission to transport commercial spent nuclear fuel for interim storage or reprocessing. In the committee's judgment, changing the organizational structure of this program will improve its chances for success.

Academy Recommendation

The Secretary of Energy and the U.S. Congress should examine options for changing the organizational structure of the Department of Energy's program for transporting spent fuel and high-level waste to a federal repository. The following three alternative organizational structures, which are representative of progressively greater organizational change, should be specifically examined: (1) a quasi-independent DOE office reporting directly to upper-level DOE management; (2) a quasi-government corporation; or (3) a fully private organization operated by the commercial nuclear industry. The latter two options would require changes to the Nuclear Waste Policy Act. The primary objectives in modifying the structure should be to give the transportation program greater planning authority; greater budgetary flexibility to make the multiyear commitments necessary to plan for, procure, and construct the necessary transportation infrastructure; and greater flexibility to support an expanding future mission to transport spent fuel and high-level waste for interim storage or reprocessing. Whatever structure is selected, the organization should place a strong emphasis on operational safety and reliability and should be responsive to social concerns.

The NWPA defines the Federal Government's responsibilities for disposal of spent nuclear fuel and high-level radioactive waste. The NWPA created the Office of Civilian Radioactive Waste Management within DOE to carry out these responsibilities, which include the development of a transportation system. The Act requires the Office to maximize use of the private sector to implement its transportation responsibilities. That collaborative development effort is underway, and would continue until the law changed.

L.11 References

166338	AAR 2003	AAR (Association of American Railroads) 2003. *Performance Specification for Trains Used to Carry High-Level Radioactive Material*. AAR S-2043. Washington, D.C.: Association of American Railroads. TIC: 257585.
175727	AAR 2005	AAR (Association of American Railroads) 2005. *Field Manual of the Interchange Rules*. Change No. 05-1. Washington, D.C.: Association of American Railroads. TIC: 257725; 257789.
166338	AAR 2003	AAR (Association of American Railroads) 2003. *Performance Specification for Trains Used to Carry High-Level Radioactive Material*. S-2043. Washington, D.C.: Association of American Railroads. TIC: 257585.
155658	AAR 2000	AAR (Association of American Railroads) 2000. *Recommended Railroad Operating Practices for Transportation of Hazardous Materials*. Circular No. OT-55-C. Washington, D.C.: Association of American Railroads. TIC: 250387.
181841	Adkins et al. 2007	Adkins, H.E., Jr.; Koeppel, B.J.; Cuta, J.M.; Guzman, A.D.; and Bajwa, C.S. 2007. *Spent Fuel Transportation Package Response to the Caldecott Tunnel Fire Scenario*. NUREG/CR-6894, Rev. 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20070724.0370.
182014	Adkins et al. 2006	Adkins, H.E., Jr.; Cuta, J.M.; Koeppel, B.J.; Guzman, A.D.; and Bajwa, C.S. 2006. *Spent Fuel Transportation Package Response to the Baltimore Tunnel Fire Scenario*. NUREG/CR-6886, Rev. 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20070724.0369.
175725	CVSA 2005	CVSA (Commercial Vehicle Safety Alliance) 2005. *North American Standard Out-of-Service Criteria*. Handbook and Out-of-Service Pictorial Edition. Washington, D.C.: Commercial Vehicle Safety Alliance. TIC: 257711.
182271	DHS 2003	DHS (U.S. Department of Homeland Security) 2003. "Management of Domestic Incidents." Homeland Security Presidential Directive/HSPD-5. Washington, D.C.: U.S. Department of Homeland Security. Accessed August 2, 2007. ACC: MOL.20070809.0003. URL: http://www.dhs.gov/xnews/releases/press_release_0105.shtm
175729	DHS 2004	DHS (U.S. Department of Homeland Security) 2004. *National Response Plan*. Washington, D.C.: U.S. Department of Homeland Security. ACC: MOL.20051020.0132.
155789	DOE 1999	DOE (U.S. Department of Energy) 1999. *Report to Congress on the Price-Anderson Act*. Washington, D.C.: U.S. Department of Energy. ACC: MOL.20011009.0012.

155970	DOE 2002	DOE (U.S. Department of Energy) 2002. *Final Environmental Impact Statement for a Geological Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*. DOE/EIS- 0250. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314; MOL.20020524.0315; MOL.20020524.0316; MOL.20020524.0317; MOL.20020524.0318; MOL.20020524.0319; MOL.20020524.0320.
171934	DOE 2002	DOE (U.S. Department of Energy) 2002. *Radioactive Material Transportation Practices.* DOE M 460-2.1. Washington, D.C.: U.S. Department of Energy. ACC: MOL.20050517.0204.
172433	DOE 2003	DOE (U.S. Department of Energy) 2003. *Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions*. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20041206.0113.
175728	DOT 2004	DOT (U.S. Department of Transportation) 2004. *2004 Emergency Response Guidebook.* Washington, D.C.: U.S. Department of Transportation. ACC: MOL.20051020.0131.
156703	FRA 1998	FRA (Federal Railroad Administration) 1998. *Safety Compliance Oversight Plan for Rail Transportation of High-Level Radioactive Waste and Spent Nuclear Fuel*. Washington, D.C.: U.S. Department of Transportation. ACC: MOL.20011212.0115.
182833	Golan 2005	Golan, P. 2005. "Letter Informing Stakeholders of Policy Adopted by the Department to Use Dedicated Trains for its Shipment of Spent Nuclear Fuel and High-Level Radioactive Waste to the Yucca Mountain Repository." Letter from P. Golan to Stakeholder, July 18, 2005, with attachment. ACC: HQO.20051003.0001.
181276	Johnson and Michelhaugh 2003	Johnson, P.E. and Michelhaugh, R.D. 2003. *Transportation Routing Analysis Geographic Information System (TRAGIS) User's Manual.* ORNL/NTRC-006. Oak Ridge, Tennessee: Oak Ridge National Laboratory.
182032	National Research Council 2006	National Research Council. 2006. *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*. Washington, D.C.: National Academies Press. TIC: 259563.
150898	Neuhauser and Kanipe 2000	Neuhauser, K.S. and Kanipe, F.L. 2000. *RADTRAN 5, User Guide.* SAND2000-1257. Albuquerque, New Mexico: Sandia National Laboratories. TIC: 249356.
182897	Reyes 2005	Reyes, L.A. 2005. "Details and Projected Cost of a Demonstration Test of a Full-Scale Spent Nuclear Fuel Rail Transportation Cask Under the Package Performance Study." Policy Issue Notation from L.A. Reyes to the Commissioners. Marcy 28, 2005.

152476	Sprung et al. 2000	Sprung, J.L.; Ammerman, D.J.; Breivik, N.L.; Dukart, R.J.; Kanipe, F.L.; Koski, J.A.; Mills, G.S.; Neuhauser, K.S.; Radloff, H.D.; Weiner, R.F.; and Yoshimura, H.R. 2000. *Reexamination of Spent Fuel Shipment Risk Estimates*. NUREG/CR-6672. Two volumes. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20001010.0217.
182896	Vietti-Cook 2005	Vietti-Cook, A.L. 2005. "Details and Projected Cost of a Demonstration Test of a Full-Scale Spent Nuclear Fuel Rail Transportation Cask Under the Package Performance Study." Commission Voting Record from A. L. Vietti-Cook to Distribution, June 9, 2005, with enclosures.

APPENDIX M

CULTURAL RESOURCES PROGRAMMATIC AGREEMENT

QA:N/A

MOL.20060531.0087

PROGRAMMATIC AGREEMENT
AMONG
THE U.S. DEPARTMENT OF INTERIOR BUREAU OF LAND MANAGEMENT, NEVADA (BLM);
THE U.S. DEPARTMENT OF ENERGY (DOE);
SURFACE TRANSPORTATION BOARD (STB);
AND
THE NEVADA STATE HISTORIC PRESERVATION OFFICE (SHPO)
REGARDING THE NEVADA RAIL PROJECT (NRP)

WHEREAS, Congress directed the United States Department of Energy (DOE) to characterize and evaluate the suitability of Yucca Mountain as a potential site for a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste, and if appropriate, construct and operate the facility; and

WHEREAS, on July 23, 2002, the President signed into law (PL107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste; and

WHEREAS, in the event the Nuclear Regulatory Commission authorizes construction of the repository and receipt and possession of spent nuclear fuel and high-level radioactive waste at Yucca Mountain, DOE would be responsible for transporting these materials to the Yucca Mountain Repository as part of its obligations under the Nuclear Waste Policy Act; and

WHEREAS, on April 8, 2004, DOE selected the mostly rail transportation scenario analyzed in the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada," as the transportation mode both on a national basis and in the State of Nevada; and

WHEREAS, on April 8, 2004, DOE selected the Caliente rail corridor in which to examine potential alignments for construction of a rail line; and

WHEREAS, the BLM and DOE have determined that the proposed NRP in Southern Nevada may have an effect upon properties eligible for inclusion in the National Register of Historic Places (NRHP), and have consulted with the Nevada SHPO pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA); and

WHEREAS, BLM may issue a rail line right-of-way for the NRP across BLM managed lands; and

WHEREAS, this Programmatic Agreement (PA) covers all aspects of the planning, construction, and operation of the NRP, including but not limited to the rail alignment, sidings, staging area, borrow, ballast, or quarry pits, access roads, the construction zone, extra work areas, and all ancillary facilities;

WHEREAS, the Advisory Council on Historic Preservation was offered the opportunity to participate as a consulting party to this Agreement and declined; and

NOW THEREFORE, the consulting parties agree that construction of the NRP shall be administered in accordance with the following stipulations to ensure that historic properties will be treated to avoid or mitigate effects to the extent practicable, regardless of surface ownership, and to satisfy DOE and BLM Section 106 responsibilities for all aspects of the undertaking.

I. ROLES AND RESPONSIBILITIES

The consulting parties: BLM; SHPO; STB; and DOE, agree that DOE will be the Lead Federal Agency for implementing this PA. The consulting parties agree that the consultation and compliance portions of the current *BLM/SHPO Statewide Protocol* will be used to implement this PA (Appendix E, State Protocol Agreement as amended through January 2005). The relevant portions of that protocol are incorporated by reference.

DOE, in consultation with BLM, is responsible for administering this PA. This includes but is not limited to: ensuring that the consulting parties carry out their responsibilities; overseeing all cultural resource work; assembling all submissions to the SHPO, including reports, determinations of eligibility and effect, and treatment or data recovery plans; and for seeking SHPO concurrence with all agency compliance decisions. Stipulation E.9 delegates BLM lead responsibilities to the Ely Field Office (EFO) authorized officer.

DOE will be responsible for reviewing reports and making determinations of eligibility, developing treatment options, and determining effects of the NRP on private land. BLM will be responsible for reviewing reports and making determinations of eligibility, developing treatment options, and determining effects of the NRP on public land.

II. AREA OF POTENTIAL EFFECT

The Area of Potential Effect (APE) shall be defined to include all potential direct and indirect effects to cultural resources and properties of traditional religious and cultural importance from any activities associated with the undertaking, regardless of land ownership.

The proposed rail alignment, and all access roads and work areas or other facilities for this project located outside the rail alignment, will be managed according to the provisions of this PA. The APE for the rail line will be 200 feet from the center line of the alignment or the actual ROW application submitted to BLM, whichever is greater. The APE for access roads outside of the alignment will be a minimum of 100 feet wide with at least 50 feet on either side of centerline. The minimum APE for any construction areas or other temporary use areas, outside of the alignment, will be the footprint of the area plus 100 feet outward in all directions from the perimeter of each area. The APE for assessing indirect effects on historic properties outside of the rail line alignment will extend at least one mile in all directions from the perimeter of the direct effects APE.

DOE, in coordination with BLM, may amend the APE as needed, or as requested by the SHPO, by amending this PA under the provisions of Section J. The initial study area is described and presented in Appendix A.

STIPULATIONS

DOE, in cooperation with the other consulting parties, shall ensure that the following stipulations are carried out:

A. Identification

1. DOE funds all appropriate cultural resource identification activities (Appendix D), including inventory, records research, informant interviews, archaeological, historic, or ethnographic report preparation, monitoring, and curation based on the APE for all activity areas, or portions thereof, in a manner consistent with the BLM/SHPO Statewide Protocol.

2. Each consulting party (DOE, BLM, and SHPO) will identify interested persons and tribes to DOE. Upon concurrence from the consulting parties, DOE will involve identified interested persons, tribes, or affected ethnic groups in all activities associated with the undertaking, as appropriate.

3. Required identification activities shall be completed regardless of the ownership (federal or private) of the lands involved, and DOE shall be responsible for gaining access to privately held lands by applying all reasonable means available including obtaining right of entry through courts.

4. Previously recorded sites will be updated using the Nevada IMACS site form. Sites recorded ten years previously will be re-evaluated for National Register significance.

5. In cooperation with the BLM, DOE, in accordance with the *American Indian and Alaska Native Tribal Government Policy* (DOE, 2000), shall make a good faith effort to consult with tribes and identified interested persons, or affected ethnic groups, to identify properties of traditional religious and cultural importance, and to inform the consulting parties of their eligibility and suggest appropriate treatment to avoid adverse effects to historic properties in accordance with the consultation procedures as specified in Appendix C.

6. Prior to initiating identification efforts, the consulting parties, including DOE and its cultural resource consultants, the BLM State Office, all appropriate BLM field Offices and the SHPO, will meet to finalize identification efforts, including the treatment of isolates, historic mining complexes, and linear resources. The results of those meetings which materially affect the nature of this Agreement are automatically appended to this Agreement.

B. Eligibility

1. DOE on private land, BLM on public land, and in consultation with SHPO, shall evaluate all cultural resources located within the APE for eligibility to the NRHP. Eligibility will be determined prior to the initiation of activities, within a construction segment, that may affect cultural resources. Eligibility will be determined in a manner compatible with the BLM/SHPO Statewide Protocol.

2. DOE, in consultation with BLM and SHPO, shall consult with appropriate tribes to evaluate the eligibility of properties of traditional religious and cultural importance. Consultation procedures are specified in Appendix C.

3. To the extent practicable, eligibility determinations shall be based on inventory information. If the information gathered in the inventory is inadequate to determine eligibility, DOE, through its cultural resource consultants, shall conduct limited subsurface testing or other evaluative techniques to determine eligibility.

   As needed, DOE, in consultation with the other consulting parties, will develop testing plans and submit them to the SHPO for concurrence. DOE shall provide identified tribes and interested parties with the same review opportunity as afforded the SHPO. Any proposed testing shall be limited to disturbing no more than 25 percent of the surface area of the resource being evaluated.

4. If any of the consulting parties, identified tribe or interested parties disagree regarding eligibility, DOE shall notify all consulting parties of the dispute and seek to resolve it among the parties. If the dispute cannot be resolved, DOE shall seek a formal determination of eligibility from the *Keeper of the National Register*. The Keeper will take 45 calendar days to make a determination or request additional information. The Keeper's determination will be considered final.

C. Treatment

1. In avoiding or mitigating effects, DOE on private land, BLM on public land and in consultation with SHPO, shall determine the precise nature of effects to historic properties identified in the APE. DOE, in consultation with BLM, shall develop a comprehensive treatment or data recovery plan and seek SHPO concurrence on the consolidated plan. At the same time, DOE shall provide identified tribes and interested parties with the same review timeframe as afforded the SHPO.

2. To the extent practicable, the consulting parties shall ensure that DOE avoids effects to historic properties through project design, or redesign, relocation of facilities, or by other means in a manner consistent with the BLM/SHPO Statewide Protocol. When avoidance is not practical, DOE, in consultation with the consulting parties, identified interested persons, and appropriate tribes, shall ensure that an appropriate Treatment or Data Recovery Plan designed to lessen or mitigate project-related effects to historic properties is developed and implemented.

3. For properties eligible under Criteria (a) through (c), mitigation other than data recovery may be considered in the Treatment Plan (e.g., Historic American Buildings Survey/Historic American Engineering recordation, oral history, historic markers, exhibits, interpretive brochures or publications, etc.). Where appropriate, Treatment Plans shall include provisions (content and number of copies) for a publication for the general public.

4. When data recovery is proposed, DOE, in consultation with BLM and SHPO, shall ensure that a Data Recovery Plan is developed and implemented that is consistent with the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716), and *Treatment of Historic Properties: A Handbook* (Advisory Council on Historic Preservation 1980).

5. DOE, through its cultural resource consultants, shall implement and complete the fieldwork portions of any final Treatment or Data Recovery Plan prior to initiating any activities in any construction segment (Stipulation G) that may affect historic properties located within the area covered by the plan.

6. DOE shall ensure that all records and materials resulting from identification and treatment efforts are curated in accordance with 36 CFR 79 in a BLM-approved facility in Nevada. Materials covered by Native American Graves Protection and Repatriation Act (NAGPRA) will be handled in accordance with 43 CFR 10. All materials collected will be maintained in accordance with 36 CFR 79 or 43 CFR 10 until the final treatment report is complete and collections are curated or returned to their owners. DOE will encourage private owners to donate collections from their lands to an appropriate curation facility.

7. DOE shall ensure that all final archaeological reports resulting from actions pursuant to this PA will be provided to the consulting parties, tribes and other interested persons. All such reports shall be consistent with contemporary professional standards and the Secretary of the Interior's Standards for *Final Reports of Data Recovery Programs* (48 FR 44716-44740).

8. The consulting parties agree that visual impacts to landscapes or other historic properties that are mitigated to BLM Class II Visual Resource Management standards (substantially unnoticeable) shall be considered to have no adverse affect.

9. Any dispute concerning treatment will be resolved according to Stipulation I.

D. Discovery Situations

1. Human Remains

    a. If anyone associated with the NRP encounters what appears to be human remains during construction or other project related activities, all activity will halt in the immediate vicinity of the discovery, and all project related activities will be kept at least 200 feet away from the discovery in all directions.

    b. The BLM, DOE, and SHPO will be notified of the find as soon as possible.

    c. The BLM shall notify its law enforcement staff, who will inform and work with local law enforcement and coroner, to determine if the human remains are associated with a crime.

d. Once it has been determined that the discovery is not the result of a crime scene, the BLM and DOE shall comply with the 43 CFR 10 on public land and Nevada Revised Statutes (NRS) 383 on private land.

2. Other Situations

a. Prior to initiating any activities within the APE, DOE will identify who will be responsible for notifying BLM of any discoveries. In addition to the stipulations here, the process detailed in Appendix B will be followed in all discovery situations, including human remains and other NAGPRA objects.

b. As soon as there is a discovery or unanticipated impact situation, all NRP related activities will halt in the immediate vicinity of the discovery. Once in a safe condition, activities would be directed away from an area at least 200 feet in all directions from the point of discovery. DOE will immediately notify BLM, the SHPO and other landowner as appropriate of the situation.

c. DOE shall notify the SHPO, BLM, tribes, and interested parties as appropriate within one working day of being notified of the discovery or unanticipated impact, and consider their initial comments on the situation. DOE will also initiate the procedures outlined in Appendix B. Within two working days after initial notification, the BLM for public lands, and DOE for private lands, shall notify all consulting parties, tribes, and interested parties, of the decision to either allow NRP activities to proceed or to require further evaluation or mitigation.

d. If, in consultation with the consulting parties, BLM determines that mitigation for discoveries or unanticipated impacts is required, DOE shall solicit comments from the consulting parties, tribes, and interested persons, as appropriate, to develop mitigating measures. The consulting parties, tribes, and interested persons, as appropriate, will be allowed two working days to provide DOE with comments to be considered when BLM or DOE, depending on land status, decides on the nature and extent of mitigative efforts. Within seven working days of initial notification, the BLM or DOE, depending on land status, will inform all consulting parties of the nature of the mitigation required, and ensure that such mitigative actions are implemented before allowing NRP activities to resume.

e. DOE, in consultation with BLM, may consider the following types of activities as categorical exclusions meaning SHPO consultations are not required:

1) Conducting non-archaeological data collection and monitoring activities, not associated with proposed undertakings, that involve new surface disturbance less than one square meter. Such activities include but are not limited to forage trend monitoring, stream gauges, weather gauges, research geophysical sensors, photoplots, traffic counters, animal traps, or other similar devices.
2) Installing facilities such as recreational, special designation, regulatory, or information signs, visitor registers, kiosks, cattle guards, gates, temporary corrals, or portable sanitation devices in previously disturbed areas outside of known historic properties.

3) Decisions and enforcement actions (that do not involve cultural resources) to ensure compliance with laws, regulations, orders, and all other requirements imposed as conditions of approval, when the original approval was subject to the NHPA Section 106 process.

3. DOE shall ensure that reports of mitigation efforts for discovery situations are completed in a timely manner and conform to the Secretary of Interior's *Format Standards for Final Reports of Data Recovery Programs* (42 FR 5377-79). Drafts of such reports shall be submitted to the SHPO for review and comment as set forth in Stipulation H.2 of this PA.

4. Any disputes or objections arising during a discovery situation that cannot be resolved by DOE, BLM and SHPO shall be handled in accordance with Stipulation I.

5. NRP related activities in the area of the discovery will be halted on public land until DOE is notified by the BLM Authorized Officer in writing that mitigation is complete and activities can resume.

E. Other Considerations, including but not limited to

1. DOE shall ensure that all stipulations of this PA are carried out by BLM, SHPO, and all contractors, subcontractors, cultural resource consultants, or other personnel involved with this undertaking.

2. DOE shall ensure that ethnographic, historic, architectural, and archaeological work conducted pursuant to this PA is carried out by or under the direct supervision of persons meeting qualifications set forth in the Secretary of the Interior's *Professional Qualification Standards* dated June 20, 1997 (62 FR 33707-33723), which are part of the larger Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716) and who have been permitted for such work by the consulting parties.

3. DOE, in cooperation with BLM and SHPO, shall ensure that all its personnel and all the personnel of its contractors, subcontractors, and cultural resource consultants are trained and directed not to engage in the illegal collection of historic and prehistoric materials. DOE shall cooperate with the BLM to ensure compliance with the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470) on Federal lands and with NRS 381 for private lands.

4. DOE shall bear the expense of identification, evaluation, monitoring and treatment of all cultural resources directly or indirectly affected by NRP-related activity. Such costs shall include, but not be limited to, pre-field planning, fieldwork, post-fieldwork analysis, research and report preparation, interim and summary report preparation, publications for the general public, and the cost of curating project documentation and artifact collections.

5. Identification, evaluation, and treatment efforts may extend beyond the geographic limits of the APE when the resources being considered extend beyond the APE.

6. Properties of traditional religious and cultural importance will be identified, evaluated,

and treated through consultation with appropriate tribes or interested persons. DOE may contract for data gathering to assist in identifying, evaluating, and treating these properties. However, formal consultation, as needed, will be done by DOE in consultation with the other consulting parties. Identification, evaluation, and treatment efforts for properties of traditional religious and cultural importance shall be consistent with the BLM/SHPO Statewide Protocol and Appendix C.

7. Information on the location and nature of all cultural resources and will be made available consistent with the provisions of the Archaeological Resources Protection Act, the NHPA, and their associated implementing regulations. All information considered proprietary by tribes, will be held confidential by the consulting parties to the extent provided by Federal law.

8. DOE shall ensure that any human remains, grave goods, items of cultural patrimony, and sacred objects encountered during the undertaking are treated with the respect due such materials. In coordination with this PA, human remains and associated grave goods found on Federal land will be handled according to the provisions of the NAGPRA and its implementing regulations (43 CFR 10). Human remains and associated grave goods on private land will be handled according to the provisions of Nevada Revised Statutes NRS 383.

9. The lead and point of contact for BLM will be the EFO authorized officer. All DOE/SHPO activities will be coordinated through the EFO and all other BLM Field Offices (Las Vegas and Tonopah) will coordinate their determinations, comments, issues, and other matters through the EFO to ensure consistency among Field Offices. The EFO will consolidate all BLM comments and other communications into a single BLM communication. DOE will not interact with the BLM offices without explicit approval of the EFO. Any issues that cannot be resolved by the EFO will be referred to the BLM State Office for resolution.

F. Monitoring

1. Consulting parties may monitor actions carried out pursuant to this PA. To the extent practicable, all monitoring activities will be done so as to minimize the number of monitors involved in the undertaking.

2. Areas that DOE, in consultation with the SHPO, BLM, tribes, or interested party, identifies as sensitive historic properties or religiously or culturally important in a monitoring plan will be monitored by an appropriate professional or tribal representative during construction or operational activities that may impact the area. Monitors shall be empowered to stop work in the specific area of concern to protect resources and work will not proceed in identified sensitive areas without a monitor present.

G. Notices to Proceed

After compliance with Stipulation A.3, the BLM, in consultation with the other consulting parties may issue Notices to Proceed to DOE for individual construction segments, as defined by the Treatment Plan, which includes the approach for effects mitigation, under any of the following conditions:

1. DOE, BLM and SHPO have determined that there are no cultural resources within the APE for the construction segment; or

2. DOE, BLM and SHPO have determined that there are no historic properties within the APE for the construction segment; or

3. DOE, after consultation with the BLM, SHPO, tribes, and interested persons has implemented an adequate Treatment Plan for the construction segment, and

    a. The fieldwork phase of the treatment option has been completed; and

    b. DOE and BLM have accepted a letter summary description of the fieldwork performed and a reporting schedule for that work.

H. Time Frames

1. Reports: BLM, shall review and comment on any report submitted by DOE within 30 calendar days of receipt. DOE will consolidate all comments and send them to SHPO as needed.

2. SHPO Consultation: After review by the other consulting parties, DOE shall submit the results of all identification, evaluation, and treatment efforts, including Treatment or Data Recovery Plans to the SHPO for a 30-calendar-day review and comment period.

3. Consultation with Tribes or Interested Parties: Concurrent with SHPO review, DOE shall submit the results of all identification and evaluation efforts, including discovery situations, and Treatment Plans to tribes and other identified interested persons for a 30-calendar-day review and comment period.

4. If any consulting party to this PA, tribe, or other interested person fails to respond to DOE within 30 calendar days of the receipt of a submission, DOE shall presume concurrence with the findings and recommendations as detailed in the submission and proceed accordingly.

5. Reports: A draft final report of all identification, evaluation, treatment or other mitigative activities will be due to the BLM from DOE within nine months after the completion of the fieldwork associated with the activity, unless otherwise negotiated. Negative inventories will be documented on BLM Negative Inventory Forms and sent to BLM and SHPO in a timely manner.

6. Curation: All reports, records, photographs, maps, field notes, artifacts, and other materials collected or developed for any identification, evaluation, or treatment activities will be curated in a facility in accordance with 36 CFR 79 approved by the consulting parties at the time the final report associated with that activity is accepted by DOE, unless materials and artifacts must be returned to the owner.

7. Discovery Situations: As specified in Stipulation D.

I. Dispute Resolution

1. Should any party to this PA object to any action carried out or proposed with respect to the implementation of this PA, DOE shall consult with the objecting party to resolve the objection. If after initiating such consultation DOE determines that the objection cannot be resolved through consultation, DOE shall forward all documentation relevant to the objection to the State Director of the Bureau of Land Management. Such documentation shall include DOE's proposed response to the objection, with the expectation that within 30 days after receipt of all pertinent documentation, the State Director shall:

    a. Advise DOE that the BLM concurs in DOE's proposed final decision, whereupon DOE will respond to the objection accordingly; or,

    b. Provide DOE with an alternative to resolve the objection.

    The BLM State Director's decision shall be considered final.

2. In consultation with DOE, any determination made by the BLM State Director will be understood to pertain only to the subject of the dispute. DOE's responsibility to carry out actions required by this PA that are not subject of the dispute shall remain unchanged.

J. Amendment

Any consulting party to this PA may request that this PA be amended, whereupon the consulting parties will consult to consider such amendment.

K. Termination

Any consulting party to this PA may terminate the PA by providing 30 calendar days' advance written notice with cause to the other consulting parties, provided that the consulting parties will consult during the period prior to termination to seek agreement on amendments or other actions that would avoid termination.

L. Execution

1. Execution and implementation of this PA evidences that the consulting parties have satisfied their Section 106 responsibilities for all actions associated with the construction and installation of the NRP.

2. In the event that this PA is terminated, DOE in cooperation with BLM, shall follow the requirements of 36 CFR800 for the management of historic properties.

3. This PA shall become effective on the date of the last signature below and shall remain in effect until terminated as provided in Stipulation K, or until undertaking is completed, or a maximum five (5) years from the effective date.

CONSULTING PARTIES:

BUREAU OF LAND MANAGEMENT

By: [signature] Date: 3/10/06

Title: BLM Nevada State Director

CONSULTING PARTIES:

DEPARTMENT OF ENERGY

By: [signature] Date: 9 FEB 2006

Title: Director, Office of National Transportation

CONSULTING PARTIES:

NEVADA STATE HISTORIC PRESERVATION OFFICE

By: Alice M. Baldrica Date: 4/17/06

Title: Deputy Nevada State Historic Preservation Officer

CONSULTING PARTIES:

SURFACE TRANSPORTATION BOARD

By: [signature] Date: Feb. 8, 2006

Title: Chief, Section of Environmental Analysis

APPENDIX N

DISTRIBUTION LIST

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APPENDIX N

DISTRIBUTION LIST

N.1 United States Congress

The U.S. Department of Energy (DOE) is providing copies of the Nevada Rail Corridor SEIS and Rail Alignment EIS to federal, state, and local elected and appointed officials and agencies of government; American Indian groups; national, state, and local environmental and public interest groups; and other organizations and individuals listed below. DOE will provide copies to other interested organizations or individuals on request.

N.1.1 UNITED STATES SENATORS FROM NEVADA

The Honorable John E. Ensign
U.S. Senator
United States Senate

The Honorable Harry Reid
Senate Majority Leader
United States Senate

N.1.2 UNITED STATES REPRESENTATIVES FROM NEVADA

The Honorable Shelley Berkley
1st District Representative
U.S. House of Representatives

The Honorable Jon C. Porter, Sr.
3rd District Representative
U.S. House of Representatives

The Honorable Dean A. Heller
2nd District Representative
U.S. House of Representatives

N.1.3 UNITED STATES SENATE COMMITTEES

The Honorable Jeff Bingaman
Chairman
Senate Committee on Energy & Natural Resources

The Honorable Thad Cochran
Ranking Member
Senate Committee on Appropriations

The Honorable James Inhofe
Ranking Member
Senate Committee on Environment & Public Works

The Honorable Carl Levin
Chairman
Senate Committee on Armed Services

The Honorable Robert C. Byrd
Chairman
Senate Committee on Appropriations

The Honorable Pete V. Domenici
Ranking Member
Senate Committee on Energy & Natural Resources

The Honorable Daniel K. Inouye
Chairman
Senate Committee on Commerce, Science & Transportation
Subcommittee on Surface Transportation & Merchant Marine

The Honorable John S. McCain
Vice Chairman
Senate Armed Services Committee

The Honorable Bernard Sanders
Senate Committee on Environment & Public Works

The Honorable John Warner
Senate Committee on Armed Services
Senate Committee on Environment & Public Works

The Honorable Trent Lott
Senate Committee on Commerce, Science & Transportation
Subcommittee on Surface Transportation & Merchant Marine Infrastructure, Safety & Security

The Honorable Ted Stevens
Vice Chairman
Senate Committee on Commerce, Science & Transportation

N.1.4 UNITED STATES HOUSE OF REPRESENTATIVES COMMITTEES

The Honorable Joe Barton
Ranking Minority Member
House Committee on Energy & Commerce

The Honorable John D. Dingell
Chairman
House Committee on Energy & Commerce

The Honorable David Hobson
Ranking Member
House Committee on Appropriations
Subcommittee on Energy & Water Development

The Honorable David Obey
Chairman
House Committee on Appropriations

The Honorable Peter J. Visclosky
House Committee on Appropriations
Subcommittee on Energy & Water Development

The Honorable Rick Boucher
House Committee on Energy & Commerce
Subcommittee on Energy & Air Quality

The Honorable Ralph M. Hall
House Committee on Energy & Commerce
Subcommittee on Energy & Air Quality

The Honorable Duncan Hunter
Ranking Member
House Committee on Armed Services

The Honorable Jerry Lewis
Ranking Member
House Committee on Appropriations

The Honorable Ike Skelton
Chairman
House Committee on Armed Services

N.2 Federal Agencies

Dr. Mark Abkowitz
U.S. Nuclear Waste Technical Review Board

Dr. William Howard Arnold
U.S. Nuclear Waste Technical Review Board

Dr. Daryle Busch
U.S. Nuclear Waste Technical Review Board

Dr. George Milton Hornberger
U.S. Nuclear Waste Technical Review Board

Dr. Andrew C. Kadak
U.S. Nuclear Waste Technical Review Board

Dr. Ronald Latanision
U.S. Nuclear Waste Technical Review Board

Dr. Thure Cerling
U.S. Nuclear Waste Technical Review Board

Dr. David Duquette
U.S. Nuclear Waste Technical Review Board

Dr. B. John Garrick
Chairman
U.S. Nuclear Waste Technical Review Board

Ms. Susan Absher
NEPA Compliance Division
U.S. Environmental Protection Agency

Ms. Dana Allen
U.S. Environmental Protection Agency
Region 8

Mr. William Arguto
U.S. Environmental Protection Agency
NEPA/Federal Facility
EPA Region 3

Ms. Nova Blazej
Acting Manager
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The Honorable Sherry Cordova
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The Honorable Darrin Daboda
Chairman
Moapa Band of Paiute Indians

Ms. Darlene Dewey
Tribal Representative
Yomba Shoshone Tribe

Ms. Barbara Durham
Tribal Representative
Timbisha Shoshone Tribe

Mr. Atef Elzeftawy
Tribal Representative

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The Honorable Darrell Flyingman
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The Honorable Harold Frank
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Forest County Potawatomi Community of Wisconsin

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Chemehuevi Tribe
Ms. Jacqueline Johnson
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National Congress of American Indians

The Honorable Joe Kennedy
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Mr. Bill R. Larson
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Mr. Bill Larson
Western Shoshone Defense Project

Las Vegas Paiute Tribe

Mr. Ron Escobar
Tribal Representative
Chemehuevi Tribe

The Honorable John Feliz, Jr.
Chairwoman
Coyote Valley Band of Pomo Indians of California

Mr. Maurice Frank-Churchill
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Duckwater Shoshone Tribe

The Honorable Elizabeth Hansen
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Mr. Bill Helmer
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The Honorable Mike Jackson, Sr.
President
Quechan Tribe of the Fort Yuma Indian Reservation, California & Arizona

Ms. Clara Belle Jim
Tribal Representative
Pahrump Paiute Tribe
Mr. Gerald Kane
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Bishop Paiute Indian Tribe

The Honorable Roland E. Johnson
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The Honorable Jason Johnson
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The Honorable George R. Lewis
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Morongo Band of Cahuilla Mission Indians of the Morongo Reservation, California

The Honorable Nora McDowell
Chairwoman
Fort Mojave Indian Tribe of Arizona, California & Nevada

The Honorable Dean Mike
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Twenty-Nine Palms Band of Mission Indians of California

The Honorable Richard M. Milanovich
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Agua Caliente Band of Cahuilla Indians

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Lone Pine Paiute-Shoshone Tribe

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Gila River Indian Community of the Gila River Indian Reservation, Arizona
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Ms. Lalovi Miller
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The Honorable Virgil Moose
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The Honorable Larry Nuckolls
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Citizens Against Contamination

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Citizens Against Nuclear Trash

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Mr. David Beckman
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Mr. Jim Riccio
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Environmental Poverty Law Project

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Center for Nuclear Waste Regulatory Analyses

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Nuclear Energy Institute

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Nuclear Control Institute

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Western Regional Air Partnership

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Association of American Railroads (AAR)

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American Public Power Assoc.

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Region III President
International Association of Emergency Managers
c/o General Physics Corporation

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FRA/State Rail Safety Participation Program
c/o Transportation Division
Ohio Public Utilities Commission

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National Conference of State Legislatures

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National Conference of State Legislators (NCSL)

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Safety & Operations Dept.

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The Aspen Institute
Program on Energy, the Environment & the Economy

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Western Interstate Energy Board (WIEB)

Mr. William Mackie
Program Manager
Western Governors' Association

Mr. Brian J. O'Connell
Director, Nuclear Waste Program
National Assoc. of Regulatory Utility Commissioners (NARUC)

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American Legislative Exchange Council (ALEC)

Mr. Randy Rawson
President
American Boiler Manufacturers Association

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Energy Resources International, Inc.

Mr. James S. Tulenko
President
American Nuclear Society

Mr. George D. Turner
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Arden L. Bement, Ph.D.
Director
National Science Foundation
Mr. Anthony DeSouza
Director, Board on Earth Studies & Natural Sciences
National Academy of Sciences

Ms. Julie Ufner
Associate Legislative Director
National Association of Counties (NACo)

N.8 Reading Rooms and Libraries

Esmeralda County Yucca Mountain Oversight Office
Goldfield, NV

Nye County Department of Natural Resources and Federal Facilities
Pahrump, NV
U.S. Department of Energy Headquarters
Office Public Reading Room
Washington, D.C.

Ms. Susan Beard
Librarian
Northern Arizona University
Cline Library

Ms. Michelle Born
Librarian
Clark County Library
Main Branch
Reference Department

Mr. Bert Chapman
Purdue University
Hesse Library - Documents Department

Ms. Pauline Conner
Administrator
Savannah River Operations
University of South Carolina-Aiken, Gregg-Graniteville Library
Public Reading Room

Ms. Kathy Edwards
Nevada State Library & Archives

Lincoln County Nuclear Waste Project Office
Caliente, NV

Pahrump Yucca Mountain Information Center
Pahrump, NV

The University of Nevada Libraries
Business and Government Information Center
Reno, NV

Mr. Dan Barkley
University of New Mexico
Zimmerman Library

Ms. Jan Bennett
Public Affairs Representative
Entergy Nuclear Vermont Yankee

Ms. Carol Brown
Office of Intergovernmental Affairs
City of Chicago

Mr. Hui Hua Chua
Michigan State University

Ms. Kay Collins
University of California, Irvine
Langson Library

Ms. Sherry DeDecker
University of California, Santa Barbara
Davidson Library - Government Information Center

Ms. Amy Sue Goodin
Associate Director of Research
University of New Mexico
Institute for Public Policy

Ms. Heather Elliott
Clearinghouse Coordinator, Nevada State Clearinghouse
Department of Administration
State of Nevada

Ms. Sandra Groleau
Bates College Library

Ms. Paige Harper
University of Florida
Documents Department

Ms. Deanna Harvey
Strategic Petroleum Reserve Project
Management Office
SPRPMO/Reading Room

Mr. John Horst
National Renewable Energy Lab
Public Reading Room

Librarian, Government Documents
University of New Hampshire
Dimond Library

Librarian
San Jose State University
Martin Luther King, Jr. Library
Government Publications Department

Librarian
University of Colorado, Boulder
Library - Government Publications

Librarian
University Library, California State University
Government Documents

Librarian
Susanville District Library

Librarian
Sparks Branch Library

Librarian
Fishlake Branch Library

Librarian
Carson City Library
Reference Department
Librarian
Laughlin Branch Library

Librarian
Needles Library

Public Reading Room

Ms. Verna Graybill
Librarian
Northwestern Oklahoma State University
J.W. Martin Library Depository

Mr. Michele Hayslett
North Carolina State University Libraries
Government Information Services – RISD

Mr. Mark Holt
Library of Congress

Ms. Alisa Huckle
Mr. Brent Jacobson
Idaho Operations Office
INEEL Technical Library
U.S. DOE Public Reading Room

Mr. Walter Jones
University of Utah
Marriott Library, Special Collections

Librarian
University of Notre Dame
Hesburgh Library - Government Documents Center

Librarian
University of California, Riverside
Rivera Library - Government Publications Department

Librarian
U.S. Geological Survey
Serial Records Unit
National Center

Librarian
Spring Valley Library

Librarian
Billinghurst Middle School Library

Librarian
Inyo County Free Library

Librarian
New Mexico State University

Librarian
Round Mountain Public Library

Librarian
University of Wisconsin, Madison
Wendt Library - Technical Reports Center

Librarian
University of Texas, San Antonio
Library - Government Documents Department

Mrs. Pat Loper
Great Basin College Library

Mr. Joseph Milazzo
Southern Methodist University
Fondren Library East
Government Information

Ms. Janice Parthree
U.S. Department of Energy
Richland Operations Center
Public Reading Room
Mr. Tim D. Petrosky
Public Affairs Director
Consumer Energy
Big Rock Point

Mr. William H. Schalk
Communications Manager
American Electric Power Company
Cook Visitor Information Center

Ms. Susie Skarl
Head, Government Publications
University of Nevada, Las Vegas
Lied Library

Ms. Barbara Sullivan
Center for Health, Environment and Justice
CHEJ Library

Ms. T. Twyford
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Tecopa Library

Mr. John Walters
Branson Library - Documents

Librarian
North Las Vegas Public Library
Librarian
Brainerd Memorial Library

Librarian
University of Rhode Island
Library - Government Publications Office

Librarian
University of Maryland, Baltimore County
Albin O. Kuhn Library and Gallery -
Government Documents

Mr. David Mienke
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Duane Arnold Energy Center

Mr. Gary Morell
College Hill Library
Rocky Flats Field Office

Mr. Walter Perry
U.S. Department of Energy Information Center
Oak Ridge Operations Office

Ms. Angela Riley
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TXU Electric & Gas
Comanche Peak Visitors Center

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Richard J. Daley Library
Documents, Maps and Microforms Department
University of Illinois at Chicago

Mr. Bobby St. John
Media Coordinator
Washington TRU Solutions

Mr. Tim Sutherland
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