U.S. Department of Energy
Idaho Operations Office

Draft Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site

August 2011

Idaho National Laboratory

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Draft
Environmental Assessment
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EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) proposes to provide replacement capability for disposal of remote-handled low-level radioactive waste (LLW) generated at the Idaho National Laboratory (INL) site beginning in October 2017. Historically, INL has disposed of this LLW onsite. However, the existing disposal area located within the INL Radioactive Waste Management Complex will undergo closure as part of ongoing cleanup of INL and will not be available after 2017. The proposed project to establish replacement capability is not a DOE Environmental Management Idaho Cleanup Project activity.

DOE is preparing this draft environmental assessment to evaluate potential environmental impacts related to replacement capability options for the disposal of remote-handled LLW generated on the INL site. DOE will continue to dispose of contact–handled LLW (waste having lower levels of radiation) off-site at acceptable disposal facilities.

DOE developed the following selection criteria to determine a range of reasonable alternatives that would meet DOE's need for replacement disposal capability:

- Provide dependable and predictable disposal capacity in support of continued INL site operations beginning in October 2017 and continuing for at least 20 years, with the potential for expansion to accommodate an additional 30 years

- Minimize impacts to the DOE Office of Nuclear Energy and the Naval Nuclear Propulsion Program missions and operations at facilities that generate remote-handled LLW

- Minimize disturbance of natural and cultural resources and other environmental impacts that may be associated with development of replacement disposal capability

- Minimize radiation exposure to the public from routine shipments and from accidents, in addition to nonradiological impacts of transporting remote-handled LLW.

Alternative 1, Develop Onsite Replacement Disposal Capability, would involve construction and operation of a new disposal facility on the INL site. It would be planned to meet the INL site's disposal needs for the required duration of up to 50 years. All waste transport would take place within the INL site without use of public roads. This alternative is preferred because it provides dependable and predictable disposal in support of DOE's mission and minimizes exposure to the public from routine shipments and accidents.

To develop Alternative 1, onsite disposal, INL completed a *Siting Study for the Remote-Handled Low-Level Waste Disposal Facility* to identify, evaluate, and recommend onsite locations for remote-handled LLW disposal. This Siting Study identified two locations (Candidate Site 1 and Candidate Site 2) that best meet the evaluation criteria; they are included in this environmental assessment. While both candidate sites are protective of the aquifer, Candidate Site 1 is preferred because of its slightly higher elevation, greater distance from the Big Lost River, and thicker sediment that provides greater protection of the aquifer as compared to Candidate Site 2. In addition, although neither candidate site presents a potential significant impact to groundwater, the potential for cumulative effects to groundwater from other sources of groundwater contaminants is less at Candidate Site 1 than at Candidate Site 2.

Alternative 2, Transport Waste to the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site), would involve use of existing disposal capability at another DOE disposal facility located at NNSS. NNSS may be able to accept the INL site's remote-handled LLW under its disposal authorization. Alternative 2 may provide continuity of operations because it is currently an operating facility and may be available for the duration needed of up to 50 years. Alternative 2 would involve infrastructure modifications and construction at the INL site to accommodate shipments offsite and modifications and construction at NNSS for receipt of remote-handled LLW shipments. Although the environmental risk may be comparable with Alternative 1, other risks such as transportation and operational risk may present more influence on the preferred option. Over 100 shipments to NNSS would be conducted each year. Alternative 2 involves the transportation risk of shipping waste for disposal and the operational risk of utilizing disposal capability at a location remote from the generator site and not under the generator's control.

This environmental assessment also includes analysis of the No Action Alternative. This alternative provides a baseline to help understand the impacts associated with the alternatives under consideration. Under the No Action Alternative, no activities would be conducted by DOE to ensure uninterrupted disposal capabilities for remote-handled LLW generated at the INL site. Remote-handled LLW would continue to be disposed of in the current location until it is full or must be closed in preparation for final Comprehensive Environmental Response, Compensation, and Liability Act closure. At that time, operational activities that generate the subject waste would cease or be significantly curtailed because of a lack of disposal capability, which would impact mission-critical activities.

The scope of the environmental assessment focuses on the resources that could potentially be affected by the proposed action as identified by resource specialists. The following were analyzed for potential impacts from Alternative 1:

- Cultural resources
- Water resources
- Air resources
- Ecological resources – vegetation and wildlife
- Energy use
- Transportation
- Accidents and intentional destructive acts.

Under Alternative 1, vegetation would be cleared for facility construction and weeds could increase with soil disturbance. No sensitive plant species would be impacted and no wetlands would be disturbed. This alternative would not affect critical habitat or threatened or endangered animals and would not negatively impact sagebrush-obligate species. There would be no impacts to surface water; the site would be located outside of the 100, 500, 1,000, and 10,000-year flood plain. Modeling of groundwater impacts several thousand years in the future from migrating contaminants after the disposal vaults have lost their integrity show that radionuclide concentrations would be less than maximum contaminant levels. Workers may be exposed to radiation through routine shipments or if an accident occurs. There would be no exposure to the public from routine onsite shipments, but members of the public located near the site boundary could be exposed if an accident occurs during onsite shipment or disposal operations.

The offsite (NNSS) disposal alternative, Alternative 2, would take place at an existing facility designed, approved, and operated to accept DOE remote-handled LLW. Therefore, impacts at NNSS were not evaluated for this alternative. Transportation, accidents, and intentional destructive acts and energy use were analyzed. This alternative could result in radiation exposure to the public and workers from routine shipments and from accidents, in addition to the potential for non-radiological transportation impacts from vehicle emissions and collisions.

This draft Environmental Assessment (EA) evaluates the risk of each alternative. Based on this EA, none of the alternatives present significant impacts to the human environment. DOE has identified development of an onsite replacement facility as the preferred alternative that best supports DOE’s mission after considering economic, environmental, and technical factors. This draft EA will be available for public review and comment. A decision on providing the remote-handled LLW capability will occur after public input is received and considered. The decision will be documented with either the issuance of a Finding Of No Significant Impact or a determination that more evaluation under National Environmental Policy Act (NEPA) is needed.

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TABLES

ACRONYMS

ATR	Advanced Test Reactor
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
DOE-NE	U.S. Department of Energy Office of Nuclear Energy
EDE	effective dose equivalent
EIS	environmental impact statement
EPA	Environmental Protection Agency
ESRPA	Eastern Snake River Plain Aquifer
GTCC	greater-than-Class C
ICDF	Idaho CERCLA Disposal Facility
IDAPA	Idaho Administrative Procedures Act
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
LCF	latent cancer fatality
LLW	low-level radioactive waste
MCL	maximum contaminant level
MEI	maximally exposed individual
MFC	Materials and Fuels Complex
NEPA	National Environmental Policy Act
NNSS	Nevada National Security Site
NRF	Naval Reactors Facility
RWMC	Radioactive Waste Management Complex

GLOSSARY

Alluvial	Loose, unconsolidated soil or sediment, eroded, deposited, and reshaped by water in some form in a non-marine setting.
Aquifer	A geological formation or structure that stores or transmits water (i.e., to wells and springs).
Basalt	Common extrusive volcanic rock, usually gray to black and fine-grained due to rapid cooling of lava at the surface of a planet.
Bq (Becquerel)	One Becquerel corresponds to the transformation (disintegration) of one atomic nucleus per second. Radon concentration in air is measured by the number of transformations per second in a cubic meter of air (Bq/cubic meters).
Candidate species (candidate)	A plant or animal species for which Fish and Wildlife Service or National Oceanic and Atmospheric Administration fisheries has, on file, sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened, but issuance of the proposed rule is precluded by other higher priority listing activities.
Critical habitat	Specific geographic areas, whether occupied by a listed species or not, that are essential for its conservation and that have been formally designated by rule published in the Federal Register.
Ecosystem	A dynamic and interrelating complex of plant and animal communities and their associated nonliving (i.e., physical and chemical) environment.
Effective dose equivalent	The summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health-effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The effective dose equivalent includes the committed dose from internal deposition of radionuclides and the dose due to penetrating radiation from sources external to the body. The effective dose equivalent is expressed in units of rem.
Endangered species	An animal or plant species in danger of extinction throughout all or a significant portion of its range.
Floodplain	A strip of relatively flat and normally dry land alongside a stream, river, or lake that is covered by water during a flood.
Forb	A broad-leaved herb other than a grass, especially one growing in a field, prairie, or meadow.
Habitat	The place or environment where a plant or animal naturally lives and grows (a group of particular environmental conditions).

Hazardous material	Any item or agent (i.e., biological, chemical, or physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.
Infiltration	The process by which water on the ground surface enters the soil.
Latent cancer fatality	Death from cancer, resulting from and occurring sometime after exposure to ionizing radiation or other carcinogens.
Leks	Breeding grounds that are used by male sage grouse each spring. They are usually open areas such as meadows, low sagebrush, or even roads surrounded by sagebrush.
Listed species	A species, subspecies, or distinct population segment that has been added to the federal list of endangered and threatened wildlife and plants.
Loess	An aeolian (wind-blown) sediment formed by the accumulation of wind-blown silt and lesser and variable amounts of sand and clay.
Low-level radioactive waste	Nuclear waste that does not fit into the categorical definitions for high-level waste, spent nuclear fuel, transuranic waste, or certain byproduct materials known as 11e.(2) waste, such as uranium mill tailings.
mrem (millirem)	One thousandth of a rem (a traditional historical unit of radiation dose equivalent) often used for the dosages commonly encountered; 1 rem = 0.01 Sv (sievert); the average annual radiation exposure from natural sources to an individual in the United States is approximately 300 millirem (3 millisieverts).
mSv (millisievert)	One thousandth of a sievert; the International System of Units derived unit of dose equivalent. It reflects the biological effects of radiation as opposed to the physical aspect, which is measured in terms of the energy absorbed in the body tissue and expressed in grays. One gray is one joule deposited per kilogram of mass.
pCi (picocuries)	Common measure of radioactivity. One pCi is equal to the decay of about two radioactive atoms per minute.
Playa	A nearly level area at the bottom of an undrained desert basin, sometimes temporarily covered with water.
Proposed species	A species of animal or plant that is proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act.
Radiation (ionizing)	Emission of particles (i.e., alpha, beta, or gamma) or rays (i.e., alpha, beta, gamma, or x-rays) by the nucleus of an atom.
Radiological	Of or relating to nuclear radiation.
Radon	A colorless, radioactive, inert gaseous element formed by the radioactive decay of radium.

Radioactive material	Material designated in national law or by a regulatory body as being subject to regulatory control because of its radioactivity, often taking account of both activity and activity concentration.
Radionuclide	Radioactive elements. These may be subdivided into natural radionuclides (i.e., radium or uranium) that are normally present in the earth and man-made radionuclides, which are not normally present (or normally present in very small amounts) and are produced by nuclear fission.
Recharge (groundwater recharge)	A hydrologic process where water moves downward from surface water to groundwater.
Remote-handled	Having a surface dose rate of 200 millrem/hour or greater.
Risk	The probability of a detrimental effect from exposure to a hazard.
Sagebrush steppe	A large, dry, level habitat having few or no trees and characterized by sagebrush and other shrubs and short grasses.
Sink	A depression in the land surface, especially one having a central playa or saline lake with no outlet.
Vadose	The zone between the land surface and the regional water table. It includes the capillary fringe and may also include localized perched groundwater.
Water table	The top of the water surface in the saturated part of an aquifer.
Wetland	Those areas that are 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. Wetlands generally include swamps, marshes, bogs, and similar areas.

Draft
Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site

1. PURPOSE AND NEED

The Idaho National Laboratory (INL) site, a U.S. Department of Energy (DOE) installation, provides capabilities to support the DOE Office of Nuclear Energy (DOE-NE) mission to advance nuclear power as a resource capable of making major contributions to meeting the nation's energy supply, environmental, and energy security needs (DOE-NE 2010). INL's role is to assist DOE-NE by conducting research, development, and demonstration to resolve barriers to accomplishing this mission. INL hosts the Naval Reactors Facility (NRF), which supports the Naval Nuclear Propulsion Program with examination and storage of spent fuel from Navy defueling operations. INL also provides infrastructure and research, development, and testing for other federal tenants (i.e., DOE Office of Environmental Management and U.S. Department of Defense [DOD]) and sponsors (e.g., the Department of Homeland Security or the Nuclear Regulatory Commission.

Operations conducted in support of these missions generate low-level radioactive waste (LLW). Some of this LLW is classified as remote-handled LLW because its potential radiation dose is high enough to require additional protection of workers using distance and shielding. Remote-handled LLW includes debris, used materials (i.e., gloves, tools, hardware, and other activated metal components), and ion-exchange resins and filters from filtration of water in pools and canals. DOE will continue to dispose of contact-handled LLW (waste having lower levels of radiation) off-site at acceptable disposal facilities.

Historically, INL has disposed of its remote-handled LLW onsite. However, the existing disposal area located within INL's Radioactive Waste Management Complex (RWMC) will undergo closure as part of ongoing cleanup of the INL site and is not planned to be available after the year 2017. The purpose of this action is to provide replacement capability for disposal of remote-handled LLW generated at the INL site after 2017. This provision is not part of the DOE Environmental Management Idaho Cleanup Project.

DOE needs to make decisions regarding disposal of remote-handled LLW in time to support development of new facilities and infrastructure for disposal of this waste before closure of the existing disposal vaults in 2017. Delays in action could impact the ongoing national security mission of the Naval Nuclear Propulsion Program supported by NRF. It also could affect DOE's ability to carry out critical research activities at INL that generate remote-handled LLW.

2. PROPOSED ACTION AND ALTERNATIVES

2.1 Background

Under the Atomic Energy Act of 1954 (42 USC § 2011 et seq.), as amended, DOE is responsible for managing radioactive materials, including radioactive waste, generated from its facilities and operations. DOE regulations and directives govern management of radioactive waste. INL is responsible for managing several types of waste, including LLW, which is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the Atomic Energy Act of 1954, as amended), or naturally occurring radioactive material.

LLW generated at DOE facilities is regulated by DOE pursuant to DOE orders, policy, and directives. LLW is not considered to be hazardous waste if it contains no constituents that are regulated as hazardous waste under state or federal laws. The LLW that is the subject of this proposed action is considered to be remote-handled LLW. Remote-handled LLW refers to LLW that has a surface dose rate of 200 mrem/hour or more.

The DOE manual for implementing DOE Order 435.1, "Radioactive Waste Management," defines LLW and provides the DOE requirement for disposing of radioactive waste (including LLW), as follows:

> *DOE radioactive waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste is generated, if practical; or at another DOE facility. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of non-DOE facilities for the storage, treatment, or disposal of DOE radioactive waste.*

Before DOE authorizes disposal of LLW under DOE Order 435.1, it must be demonstrated that the disposal facility will do the following:

- Be sited, designed, operated, maintained, and closed such that the total all-pathways exposure to the public is less than 25 mrem/year effective dose equivalent (EDE) from the facility and to less than 30 mrem/yr EDE for all potential sources of radionuclides.

- Limit the radionuclide concentrations for near surface disposal so that the potential exposure received by an inadvertent intruder (more than 100 years post-closure) would be limited to 100 mrem/year for acute exposure and 500 mrem total EDE for chronic exposure

- Include a combination of design and natural features to provide long-term stability and protection of water and air resources.

INL and DOE-NE strategic planning documents (DOE-NE 2009, DOE-NE 2010, DOE-ID 2010) call for investments in state-of-the-art research capabilities, infrastructure, and management systems to support the mission of DOE-NE. These capabilities include the Advanced Test Reactor (ATR) and the Materials and Fuels Complex (MFC), the focal points for INL's nuclear energy research and development activities. Figure 2-1 depicts the INL site and the associated facilities of interest.

At the ATR Complex, change-out of reactor core components generates remote-handled activated-metal approximately every 8 years. These components are stored in water-filled canals to allow radioactivity to decay. In addition, filtration of the primary coolant and the canal water as part of ongoing maintenance generates spent ion-exchange resins that also are remote-handled LLW.

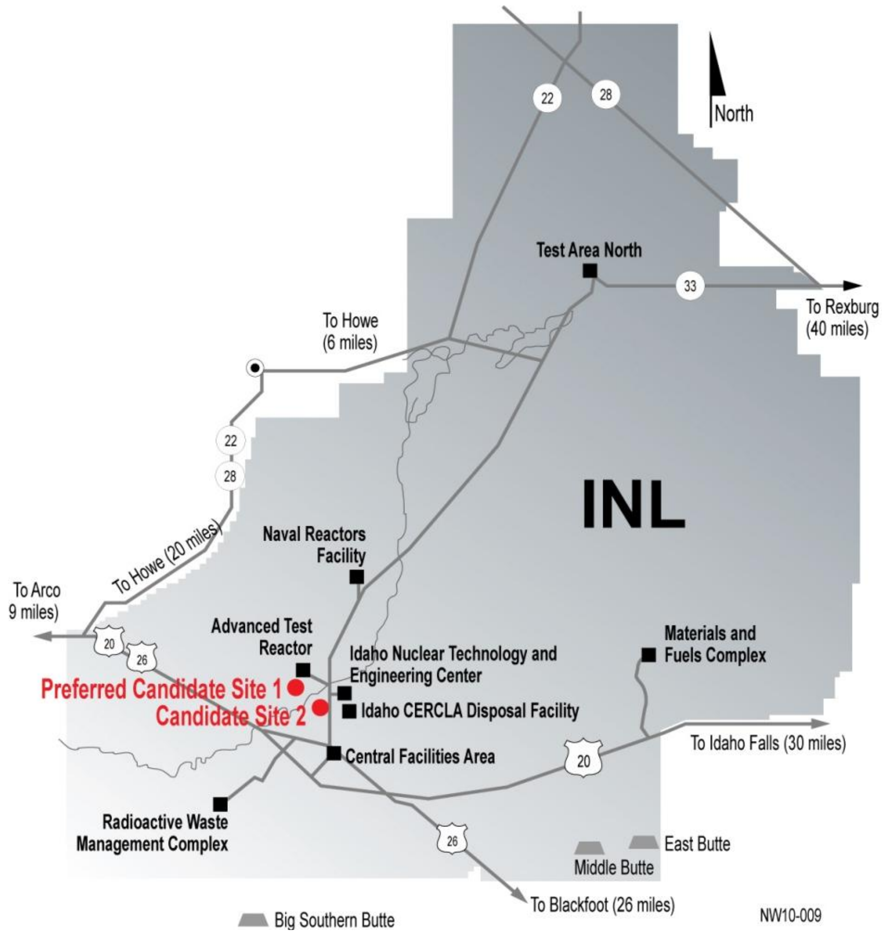

Figure 2-1. Idaho National Laboratory and associated facilities of interest.

At MFC, continuing and potential new DOE-NE missions could result in generation of remote-handled debris and process waste such as gloves, tools, steel hardware, and process components (e.g., pumps and drain tanks). In addition, DOE is continuing to remove and process for disposition remote-handled waste that was placed in storage at the Radioactive Waste and Scrap Facility at MFC between 1965 and 2007.

The Naval Nuclear Propulsion Program is a joint Navy and DOE organization responsible for all matters pertaining to U.S. nuclear-powered submarines and aircraft carriers. At the INL site, NRF supports the Naval Nuclear Propulsion Program by receiving, examining, and processing spent fuel assemblies as part of preparations for final disposition. Naval spent nuclear fuel is shipped by rail in shielded shipping containers from naval shipyards to NRF, where it is removed from the shipping containers and placed in water pools for examination. The assemblies are then prepared for dry storage prior to shipment for final disposition. The process for preparing spent fuel assemblies involves removing non-fuel structural components (activated metals), which are remote-handled LLW that require disposal. Filtration of water in the NRF pools as part of ongoing maintenance also generates spent ion-exchange resins that are remote-handled LLW.

INL also provides infrastructure and research, development, and testing for other federal tenants and sponsors. Remote-handled LLW could be generated over the next 50 years from other INL support facilities and operations as part of ongoing activities (such as spent nuclear fuel management) or from potential new missions.

2.2 Related National Environmental Policy Act Documents

The decision for developing replacement disposal capability for INL's remote-handled LLW is being made within the context of related National Environmental Policy Act (NEPA) documents involving DOE's plans for LLW disposal. Disposal of LLW was evaluated in the *DOE Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (EIS) (DOE 1995) and the *Final Waste Management Programmatic EIS* (DOE 1997).

Onsite disposal of LLW was selected in the *1995 Record of Decision for the Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final EIS* (60 FR 28680), although the decision on siting and construction of a new disposal facility, if needed, was deferred until development of a project definition and appropriate NEPA review.

Continued onsite disposal of INL's LLW and offsite disposal at DOE's Hanford Site and the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) were identified as alternatives in a Record of Decision for the *Waste Management Programmatic EIS* (65 FR 10061). Under this Record of Decision, waste from offsite could not be received for disposal at INL. In addition, this Record of Decision did not preclude consideration of commercial disposal facilities, consistent with DOE orders and policy.

Recent NEPA documents for waste management at the Hanford Site have the potential to restrict its availability for disposal of LLW from offsite until 2023. On October 30, 2009, the U.S. Environmental Protection Agency (EPA) issued a notice of availability of the *Draft Tank Closure and Waste Management EIS for the Hanford Site, Richland, Washington* (74 FR 56194). The DOE preferred alternative limits offsite waste importation until a proposed Hanford Consent Decree and Tri-Party Agreement milestone of December 31, 2022, is achieved for initial operations of the Waste Treatment Plant for tank waste.

DOE is currently conducting further NEPA review of its sitewide operations at NNSS. On July 29, 2011, DOE issued a notice of availability of a draft sitewide EIS for continued operation of the DOE NNSS and offsite locations in the State of Nevada (76 FR45548). The draft EIS considers a No Action Alternative and two action alternatives of expanded operations and reduced operations. LLW disposal operations at NNSS would continue under each of the alternatives, including the No Action Alternative. The No Action Alternative reflects the use of existing facilities and ongoing projects to maintain the levels of operations consistent with those experienced in recent years at the NNSS. As part of its EM mission, the NNSS would continue accepting and disposing wastes, such as low-level radioactive waste and mixed low-level radioactive waste. Under the expanded operations alternative, NNSA would accelerate the pace and amount of low-level radioactive waste that would be disposed on the NNSS. Under the reduced operations alternative, the pace of most waste generation and disposal rates would remain unchanged from those of the No Action Alternative. No preferred alternative is identified in the draft EIS.

2.3 Proposed Action and Alternative Selection Criteria

The proposed action would provide disposal capability, beginning in October 2017, to replace the existing RWMC disposal capability and accommodate disposal of remote-handled LLW generated at the INL site. Waste to be disposed of would be limited to remote-handled LLW generated from INL operations. An estimated average volume of 150 m^3 of remote-handled LLW is expected to be generated each year at the INL site. This waste would be packaged, transported, and disposed of in compliance with applicable regulations and standards. The proposed action includes purchase of transport casks as needed to accomplish shipments of waste from the INL site generating facilities to the disposal facility.

DOE developed the following selection criteria to determine potential alternatives that would meet the purpose and need identified in Section 1:

- Provide dependable and predictable disposal capacity in support of continued INL site operations beginning in October 2017 and continuing for at least 20 years, with the potential for expansion to accommodate an additional 30 years

- Minimize impacts to DOE-NE and the Naval Nuclear Propulsion Program missions and operations at facilities that generate remote-handled LLW

- Minimize disturbance of natural and cultural resources and other environmental impacts that may be associated with development of replacement disposal capability

- Minimize radiation exposure to the public from routine shipments and from accidents, in addition to nonradiological impacts of transporting remote-handled LLW.

The listed criteria provided the basis for determining the range of reasonable alternatives considered and analyzed, which are development of an onsite replacement facility and disposal offsite at NNSS. DOE has identified development of an onsite replacement facility as the preferred alternative. The onsite alternative involves evaluation of two candidate site locations.

2.4 Range of Reasonable Alternatives

2.4.1 Alternatives Considered but Eliminated From Further Consideration

DOE considered six other alternatives for accomplishing the purpose and need for action but eliminated them from further evaluation for the reasons listed below.

The alternative of continued disposal at RWMC involved continued use of the current disposal facility at RWMC. The active LLW disposal facility is planned for closure under DOE Manual 435.1-1, “Radioactive Waste Management,” in 2017. This alternative is not available for disposal for the needed 20 to 50-year duration.

The alternative of disposal at the Idaho Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF) would use an existing INL facility, which is currently limited to receiving only CERCLA waste and has a 2018 assumed closure date. ICDF is not designed to accept remote-handled LLW. Further, this alternative is not available for disposal for the needed 20 to 50-year duration.

The alternative of interim storage involved storage of remote-handled LLW at either the generator facilities or another acceptable, safe location until disposal capability is available. The generator facilities have very limited storage capacity available and there are no plans to expand interim storage capability. No other facilities exist or are planned onsite that could accommodate the remote-handled LLW for interim storage. Even if storage were available, implementation of an alternative for storage instead of disposal does not provide for permanent disposal of remote-handled LLW generated at the INL site beyond 2017.

The alternative of storage for decay considered storage of remote-handled LLW for sufficient time to enable its radioactive source term to decay to levels that would make it acceptable for disposal as contact-handled LLW. Storage for over 80 years would be required to provide time for the remote-handled LLW isotopes to decay to contact-handled LLW. Storage facilities do not exist to support this alternative. Even if storage were available, disposal capability for 80 to 130 years in the future is uncertain. In addition, an alternative for storage instead of disposal does not provide for permanent disposal of remote-handled LLW generated at the INL site beyond 2017.

The alternative of offsite remote-handled LLW disposal involved eight potential offsite facilities that were evaluated against the screening criteria of viability, cost, schedule, and risk. Four facilities were eliminated because they cannot currently receive any of the remote-handled LLW generated at INL. The remaining four facilities were evaluated based on their waste acceptance criteria and their availability for disposal of INL remote-handled LLW in the timeframe needed. None of these remaining four facilities, except NNSS, could accept the entire planned inventory of INL remote-handled LLW. DOE eliminated the offsite facilities, except NNSS, from further consideration because they did not provide replacement disposal capability for the remote-handled LLW anticipated to be generated from the INL site.

The alternative of privatization of remote-handled LLW disposal examined the possibility of contracting with a new commercial facility for disposal of the remote-handled LLW. However, no known commercial facilities will begin operations within the time of the project mission need. The programmatic risks of speculating when, where, and whether such a facility would open in time to support the need for uninterrupted disposal of INL and tenant-generated remote-handled LLW were regarded as too great to retain this alternative for further consideration. This alternative is not available for disposal of all of INL's anticipated remote-handled LLW for the needed 20 to 50-year duration.

2.4.2 Alternative 1 – Develop Onsite Replacement Disposal Capability (Preferred Alternative)

The preferred alternative of onsite disposal involves construction of a new facility specifically designed and operated for the INL site's remote-handled LLW. The conceptual facility layout is presented in Figure 2-2.

Remote-handled LLW coming into the facility would be contained in robust steel liners and transported in a shipping cask. At the facility, the liners would be placed in reinforced concrete disposal vaults constructed as precast concrete cylinders (i.e., pipe sections) stacked on end and placed in a close-packed array (Figure 2-3).

All vaults would be supported by reinforced concrete base sections placed atop a gravel layer and covered with removable precast concrete plugs. The plugs would serve as a radiation shield for emplaced waste and also help prevent water from entering the vaults. At the end of the operational life of the disposal facility, an engineered cover would be placed over the disposal vaults (Figure 2-4). The functional attributes of the facility are summarized in Table 2-1.

Project activities to establish an onsite replacement disposal facility would include (1) preparing the site and acquiring equipment; (2) constructing the site; (3) operating the site; and (4) closing the site (see Table 2-2 for specifics). Equipment and infrastructure used in current operations (i.e., the crane, cask-to-vault adapting structure, and NRF 55-ton or similar shipping cask) would be utilized to the extent possible. Table 2-3 lists operational controls that would be included as part of the onsite alternative to avoid or limit impacts to natural, ecological, or cultural resources, and to avoid contaminating the environment or exposing the public or employees to radioactive materials.

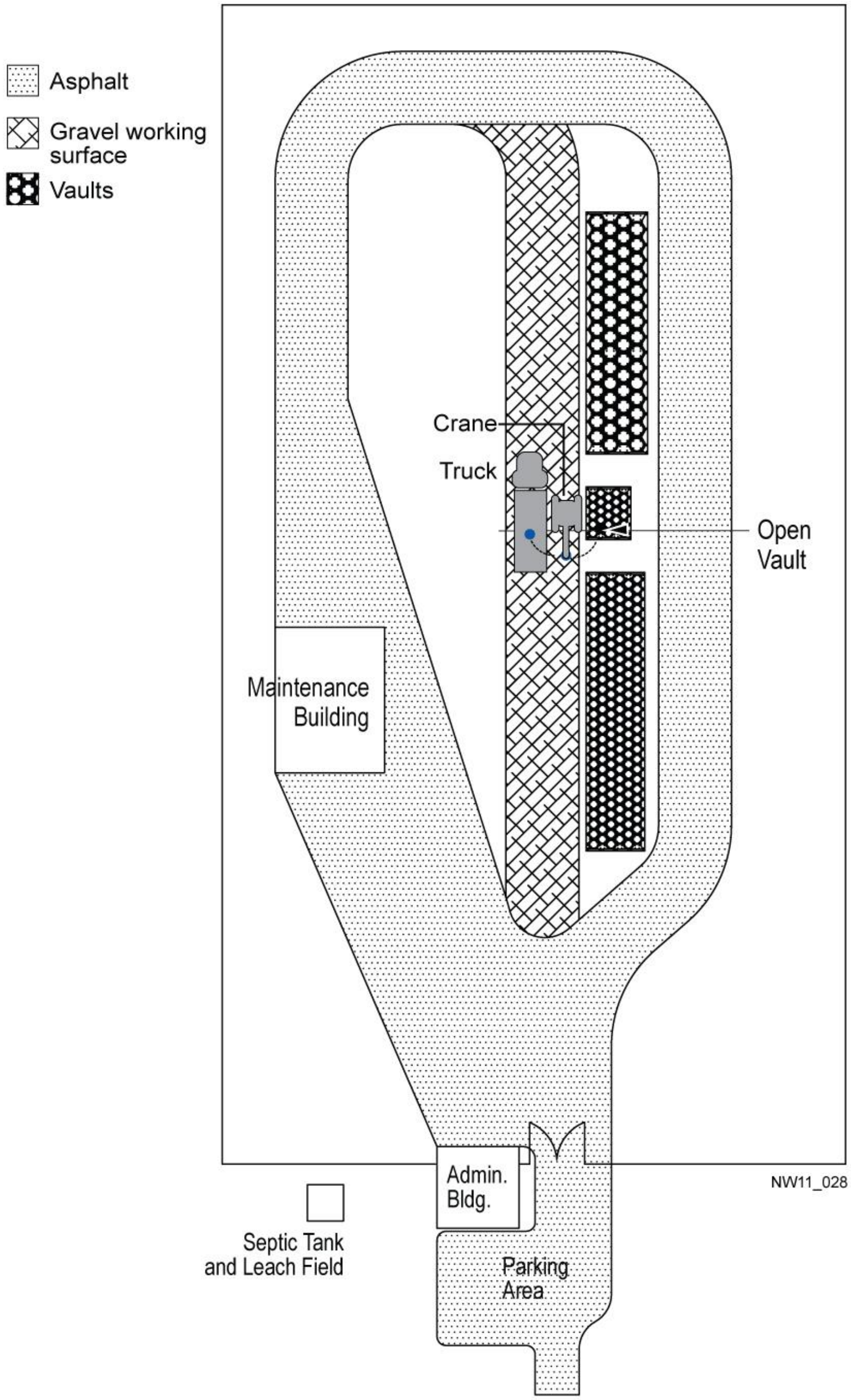

Figure 2-2. Conceptual remote-handled low-level waste facility layout.

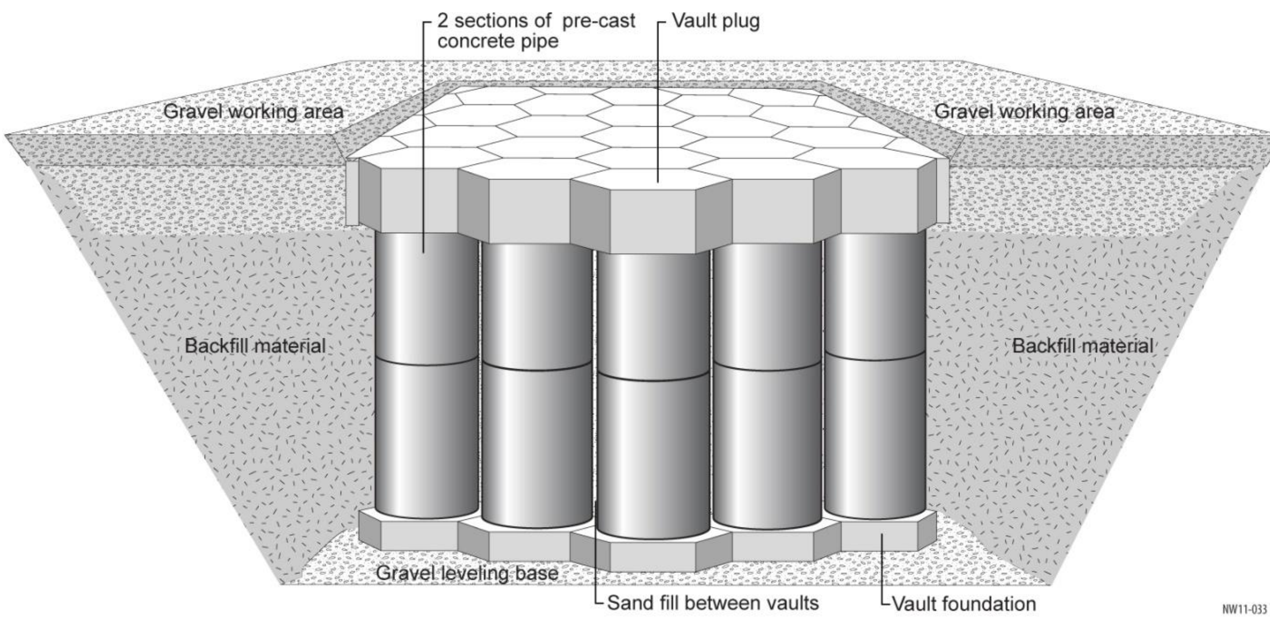

Figure 2-3. Conceptual concrete disposal vault layout.

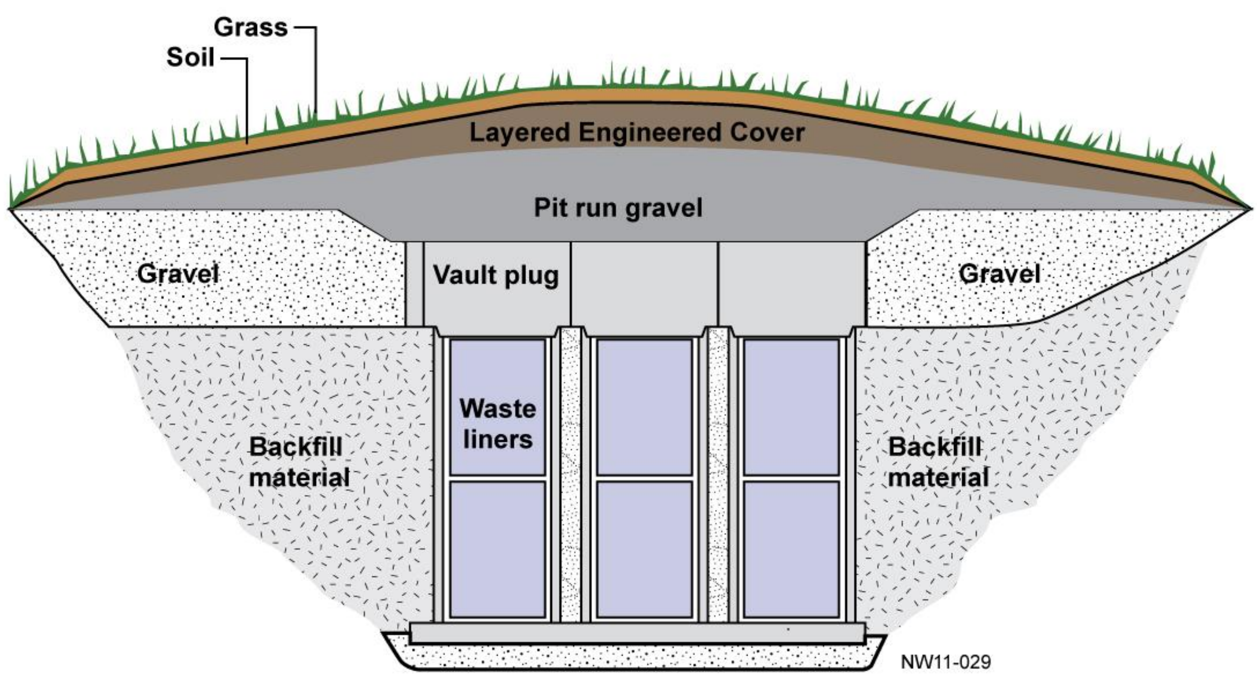

Figure 2-4. Conceptual disposal vault engineered cover.

Table 2-1. Functional attributes of the conceptual disposal facility.

1. Vault Characteristics

- Precast reinforced concrete vault base and riser sections. Reinforced concrete would be used to provide structural support. Concrete vaults are expected to maintain structural integrity for thousands of years.
- Reinforced concrete shielding plugs. Thick shielding plugs would be used to provide shielding for onsite workers. These plugs also would limit water infiltration into the vaults.
- Steel waste liners. Waste would be emplaced in the facility in the steel waste liners. These liners would limit water contact with the waste and subsequent release of contaminants. Liners would either be carbon steel or stainless steel, depending on the waste form, and of sufficient thickness to mitigate contaminant release to the environment.
- Sand infill between the vault sections and sand/gravel beneath the facility. This material would prevent water accumulation next to the vaults or steel waste liners by allowing free water drainage between and beneath the vaults.

2. Engineered Cover

- An approximate 2-ft thick interim cover would be placed over the facility as the vaults are filled. The interim cover would increase vault stability and would provide additional protection against water infiltration and water contact with the steel waste liners.
- A final engineered cover would be placed over the facility at the end of operations. The primary purposes of the engineered cover would be to (1) reduce infiltration into the disposal facility after facility closure, thus reducing contaminant transport, and (2) provide a physical barrier against intrusion. The cover would be configured to divert surface water away from the vaults and extend beyond the boundary of the facility. The cover dimensions, layer thicknesses, and other specifications would be determined prior to facility closure and would be based on the final size and configuration of the facility.

3. Additional Features

- Groundwater monitoring wells would be installed to allow early detection of releases from the facility as required by DOE Order 435.1. The State of Idaho INL Oversight Program and the Shoshone-Bannock Tribes may participate in well sampling to provide independently derived results for verification purposes.
- Monitoring would be conducted to detect potential releases into the air as required by DOE Order 435.1.
- Berms around the facility would control onsite precipitation and prevent surface water run-on.
- Security enhancements would be used to protect against intentional or inadvertent facility access.

Table 2-2. Site preparation and equipment acquisition, construction, operation, and closure activities.

1. Activities for Site Preparation and Equipment Acquisition

- Construct a facility access road to allow receipt of shipments of remote-handled LLW via truck.
- Prepare land in the vault, staging, and support building locations.
- Fence the facility for security control.
- Establish power, water, and septic systems.
- Procure casks and liners for onsite shipments of remote-handled LLW generated at the INL site (the waste is placed in the liners and the liners are placed in the cask for shipment).
- Procure equipment to transfer liners from the cask to the vaults.

2. Construction Activities

- Construct support buildings for administrative and equipment storage/maintenance activities.
- Conduct excavation for vault installation.
- Construct interior access roads and staging/storage pads for operations.
- Install vaults that have been fabricated using pre-cast concrete components. Vaults would be designed and configured similar to the current facility at RWMC.
- Fabricate concrete vault plugs to provide radioactive shielding for disposed waste.

3. Operational Activities

- Receive truck with transport cask at the facility.
- Position truck near a vault array and use the crane to unload the cask.
- Position the cask-to-vault transfer system over the vault.
- Place the cask within the cask-to-vault transfer system.
- Transfer the liner from inside the cask to the vault.
- Place concrete plugs onto each vault upon completion of transfer.
- Provide interim cover over vault plugs.
- Conduct groundwater monitoring.
- Conduct air monitoring.

4. Closure Activities

- Place a long-term protective engineered cover over the entire area of the disposal vaults that provides protection from water infiltration, configured to divert surface water away from facility, and protection from animal and biological intrusion.
- Maintain and monitor the cover during a 100-year, post-closure period.
- Continue air and groundwater monitoring during a 100-year, post-closure period.

Table 2-3. Construction and operational controls to avoid or lessen impacts to natural, ecological, cultural resources, and to the worker and the public.

Activity	Control
Construction Controls	Conduct nesting bird surveys before vegetation removal or disturbance between May 1 and September 1.
	Limit size of area disturbed through controls on the extent of excavation.
	Revegetate project-related disturbed area with native species.
	Implement noxious weed management plan.
	Complete cultural resource monitoring in sensitive areas with authority to redirect work to avoid any sensitive materials discovered.
	Implement a stop work procedure to guide the assessment and protection of any unanticipated discoveries of cultural materials.
	Complete cultural resource sensitivity training for construction personnel to discourage unauthorized artifact collection, off-road vehicle use, and other activities that may impact cultural resources. Encourage a sense of stewardship for cultural resources, including tribally sensitive plants and animals.
	Implement dust control practices during construction to prevent fugitive dust emissions.
	Implement controls for onsite precipitation and surface water run-on.
Operational Controls	Prevent exposure to ionizing radiation through shielded equipment or methods that ensure radiation protection during cask-to-vault transfers.
	Complete cultural resource sensitivity training for construction operations personnel to discourage unauthorized artifact collection, off-road vehicle use, and other activities that may impact cultural resources. Encourage a sense of stewardship for cultural resources, including tribally sensitive plants and animals.
	Implement dust control practices during operation to prevent fugitive dust emissions.
	Maintain controls for onsite precipitation and surface run-on.
	Control access by a perimeter security fence around the facility.

To develop the onsite disposal alternative, INL completed a siting study for the remote-handled LLW disposal facility (INL 2010a) to identify and recommend a limited number of onsite locations for remote-handled LLW disposal. The study used a five-step process to identify, screen, evaluate, score, and rank 34 separate sites located across INL, based on critical requirements from the following key areas: (1) regulations, (2) key assumptions, (3) conceptual design, (4) facility performance; and (5) previous INL siting study criteria. Each site was evaluated as a 45-acre parcel, with a smaller parcel (5 to 10 acres) where the disposal facility could be located.

This siting study identified two potential locations (Figure 2-5) that best meet the evaluation criteria:

1. Candidate Site 1 (the preferred location): located approximately 0.5-miles southwest of the ATR Complex. Surficial sediment thickness determined from wells in the vicinity of Candidate Site 1 ranges from 43 to 73 ft with a mean thickness of 55 ft. Candidate Site 1 is located at an approximate elevation of 4,943 ft and approximately 0.7 mi northeast of the Big Lost River channel.

2. Candidate Site 2: An alternative area located southwest of the Idaho Nuclear Technology and Engineering Center (INTEC) and across Lincoln Boulevard to the west of ICDF. Surficial sediment thickness determined in wells in the vicinity of Candidate Site 2 ranges from 20 to 49 ft with a mean thickness of 31 ft. Candidate Site 2 is located at an approximate elevation of 4,927 ft and approximately 0.4 miles southeast of the Big Lost River channel.

The initial evaluation of both sites indicates they are well suited for LLW disposal. Each site has adequate soil depth to support a remote-handled LLW disposal facility. However, in addition to thicker surficial sediment, Candidate Site 1 is at a slightly higher elevation and is located further from the Big Lost River than Candidate Site 2. These factors lower the potential for migration of contaminants from the facility. The potential for cumulative effects to groundwater from the disposal facility and other sources of groundwater contaminants is less at Candidate Site 1 than at Candidate Site 2. Therefore, Candidate Site 1 is the preferred onsite location.

2.4.3 Alternative 2 – Transport Waste to the Nevada National Security Site for Disposal

Alternative 2 would involve use of existing disposal capability at the NNSS Area 5 Radioactive Waste Management Complex. NNSS is located in Nye County, Nevada (Figure 2-3), approximately 65 miles northwest of Las Vegas, which is the largest population center in the state with nearly 2 million people. NNSS is owned by the federal government and administered, managed, and controlled by DOE. The waste disposed of at NNSS is accepted only from approved DOE and Department of Defense sites. NNSS has a planned LLW disposal capacity of 45,000 m^3 per year (DOE 1997). No closure date has been planned for the LLW disposal capability at NNSS; it is assumed NNSS could accept remote-handled LLW from INL to meet INL's mission need of 20 to 50 years subject to the conclusions resulting from the Draft EIS (76 FR45548).

The NNSS Area 5 Radioactive Waste Management Complex is a 732-acre site, with 160 of those acres being used for waste management and disposal. Waste would be approved for compliance with the NNSS waste acceptance criteria prior to shipment to NNSS. It is possible that a disposal facility similar to that being considered in Alternative 1 would be required to be built at NNSS to accept the RH-LLW. At closure, a final cap would be placed over the complex.

Two potential transportation routes have been identified for transporting waste from the INL site to NNSS. These routes are shown in Figure 2-6. Route A is preferred because it involves shipment along the least populated routes; however, Route B may be used depending on road conditions and weather. Table 2-4 provides information on the distances, states traveled, and estimated population residing within a 2,600-ft buffer for each route.

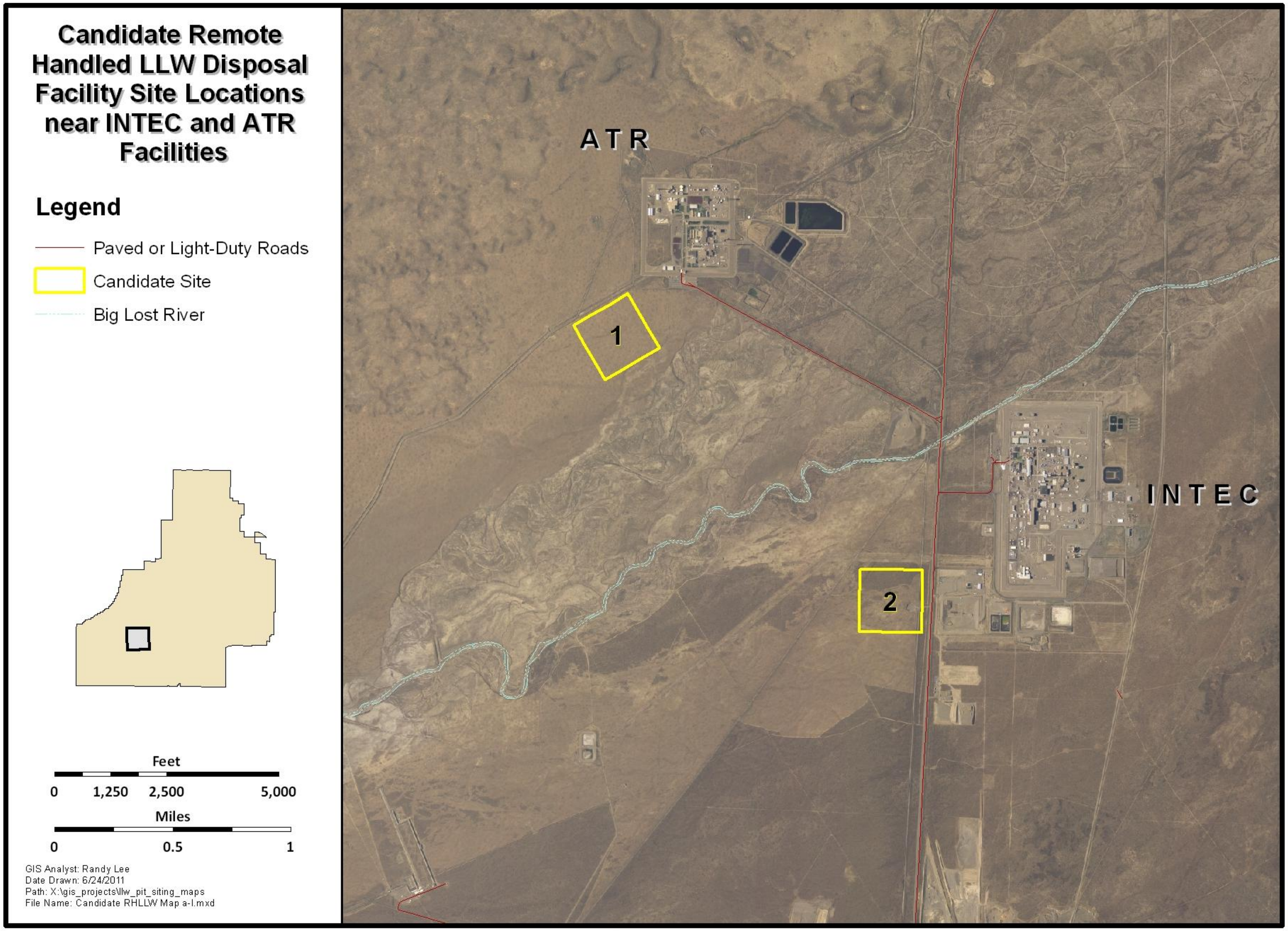

Figure 2-5. Candidate Remote-Handled Low-Level Waste Disposal Facility site locations near INTEC and ATR facilities.

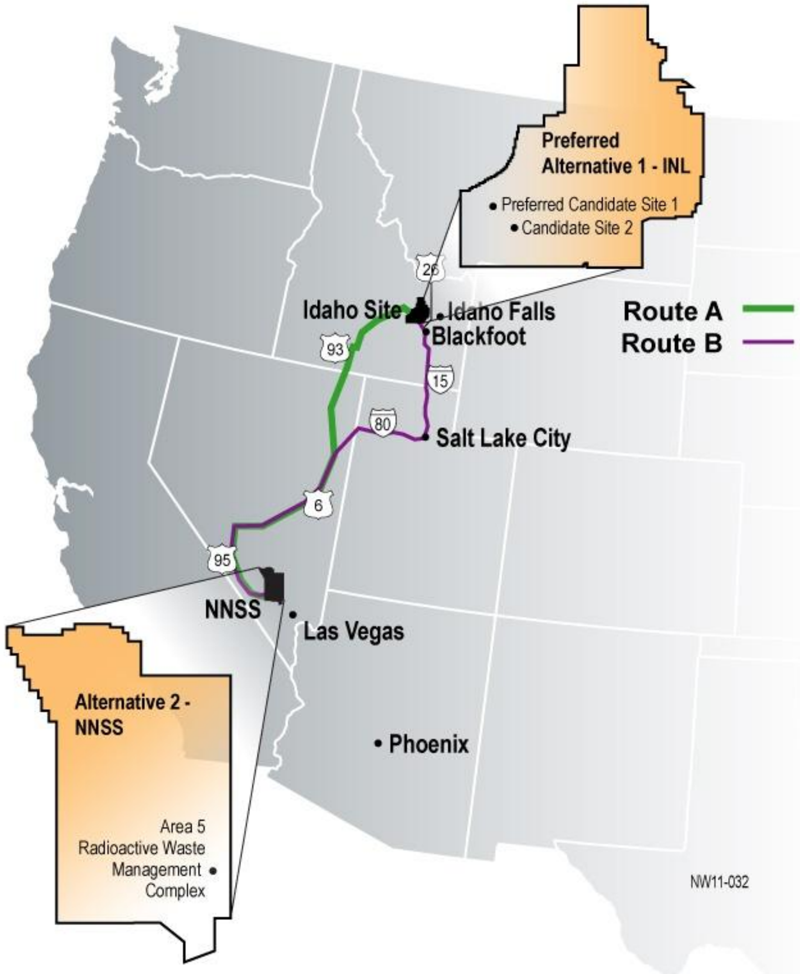

Figure 2-6. The alternatives of onsite disposal at Idaho National Laboratory and transportation to the Nevada National Security Site for disposal.

Table 2-4. Route-specific data for the two proposed transportation routes.

Route Designator	Distance by State (miles)			Total Distance	Population Along Route by State			Total Population
	ID	NV	UT		ID	NV	UT	
Route A	190	530	0	710	17,000	8,000	0	25,000
Route B	140	440	210	790	17,000	7,700	87,000	111,000

More than 100 shipments per year to NNSS would be required. This is a significantly larger number of total shipments that would be required for Alternative 1. In contrast to the shipments in Alternative 1 which would occur entirely within the INL boundary on nonpublic roads, these shipments would occur offsite, introducing potential impacts to the public. More shipments would be required because the current NRF cask used for onsite shipments can contain approximately 3 m^3 of activated metal LLW; this cask system is too heavy to be used for transport along public highways and is not certified for commercial transportation. Smaller 1 m^3 capacity shipping casks and trailers, along with transfer systems, would be required to ship 111 m^3 of metals and debris per year from NRF, ATR, and

MFC. With the capacity of each cask reduced by one third, three times as many shipments would be required than for Alternative 1. The use of smaller casks and the increased frequency of shipments would require modifications to infrastructure and operations at all INL site generating facilities, including reconfiguration and refurbishment of storage pools to accommodate increased use. Design of new casks would likely require an extensive certification process. The remaining 36 m^3 of remote-handled LLW consists of resins generated from pool operations at the ATR. This waste would be packaged into waste liners and shipping casks that can accommodate 6 m^3 per shipment. Therefore, it is estimated that a total of 117 shipments of remote-handled LLW would take place each year from INL to NNSS in Alternative 2. To accommodate the shipments, commercial truck-trailer combinations would be dedicated for exclusive transport of the hazardous materials. The numbers of shipments would require several transports to be in operation continuously.

Facility modifications at NNSS would likely be required to receive the INL remote-handled LLW. INL remote-handled LLW would have to meet the NNSS waste acceptance criteria, or would require waste-specific performance assessments. Because of the number of annual shipments, a dedicated operational crew, and facilities including a crane and excavator would be needed. It is likely that a decontamination station would be constructed and associated processes and procedures would need to be developed.

2.5 No Action Alternative

DOE must consider a No Action Alternative in all of its environmental assessments; the selection of the No Action Alternative means that the proposed activity, as described in Section 2.3, would not take place. Under the No Action Alternative, DOE would conduct no activities to ensure uninterrupted disposal capabilities for remote-handled LLW generated at the INL site. Because it can use an existing cask, remote-handled LLW from NRF would continue to be disposed of in the active Low-Level waste disposal facility at RWMC until it is full or must be closed in preparation for final CERCLA closure. No transport casks would be procured and individual generators could continue normal operations that result in generation of remote-handled LLW only until interim storage capacity was exhausted. INL missions supporting research, development, and demonstration activities and the activities of the Naval Nuclear Propulsion Program would be impacted by the lack of storage and disposal capacity for remote-handled LLW that would be generated.

3. AFFECTED ENVIRONMENT

3.1 Idaho National Laboratory

The INL site consists of eight major facilities, each less than 2 mi^2, situated on an 890-mi^2 expanse of otherwise undeveloped, cool, desert terrain. Most INL buildings and structures are located within these developed site areas, separated by miles of primarily undeveloped land. DOE controls all INL site land (Figure 3-1), which occupies portions of five Idaho counties: Butte, Bingham, Bonneville, Clark, and Jefferson.

Public highways US 20 and 26 and Idaho 22, 28, and 33 pass through the INL site, but off-highway travel within the INL site and access to INL site facilities are controlled. Onsite disposal would not involve transport on a public highway.

Population centers in the region include large cities such as Idaho Falls, Pocatello, Rexburg, and Blackfoot, located further than 30 miles to the east and south, and several smaller cities/communities located around the site (approximately 1 to 30 miles away), such as Arco, Howe, Terreton, Fort Hall Reservation, and Atomic City (Figure 3-1). Craters of the Moon National Monument is less than 20 miles to the west; Yellowstone and Grand Teton National Parks and the city of Jackson, Wyoming, are located more than 70 miles northeast. No permanent residents exist on the INL site.

Geographically, the INL site is included within a large territory once inhabited by, and still of importance to, the Shoshone-Bannock Tribes. To the Shoshone-Bannock people, cultural resources include not only archaeological sites affiliated with their history but many kinds of natural resources (i.e., traditionally used plants and animals). Finally, features of the natural landscape (i.e., buttes, rivers, and caves) often have particular significance to the Tribes.

The INL site has a rich and varied cultural resource record due to its continuous access restriction and geographic remoteness. This includes localities that provide an important paleontological context for the region and the many prehistoric archaeological sites. These campsites, cairns, and hunting blinds provide information about the activities of aboriginal hunting and gathering groups who inhabited the area for at least 13,500 years. The archaeological sites, pictographs, caves, and many other features are important to contemporary Native American groups for historic, religious, and traditional reasons. Many historic sites document the area’s use during the late 1800s and early 1900s, including the abandoned town of Pioneer/Powell, a northern spur of the Oregon Trail known as Goodale’s Cutoff, many small homesteads, irrigation canals, sheep and cattle camps, and stage and wagon trails. During World War II, the military used the central portion of INL to test fire ordnance used by the Pacific Fleet; evidence of this era remains.

National Wetland Inventory maps prepared by the U.S. Fish and Wildlife Service indicate that the primary wetland areas on INL are associated with the Big Lost River, the Big Lost River spreading areas, and the Big Lost River sinks, although smaller (i.e., less than approximately 1 acre) isolated wetlands also occur intermittently. The only areas of jurisdictional wetlands are the Big Lost River sinks (Figure 3-2). Wetlands associated with the Big Lost River are classified as riverine/intermittent, indicating a defined stream channel with flowing water during only part of the year. Wetland vegetation exists along the Big Lost River; however, this vegetation is in poor condition because of recent years of only intermittent flows. The Big Lost River spreading areas and Big Lost River sinks are seasonal wetlands and can provide more than 2,000 acres of wetland habitat during wet years. There are no mapped wetlands within either candidate site location.

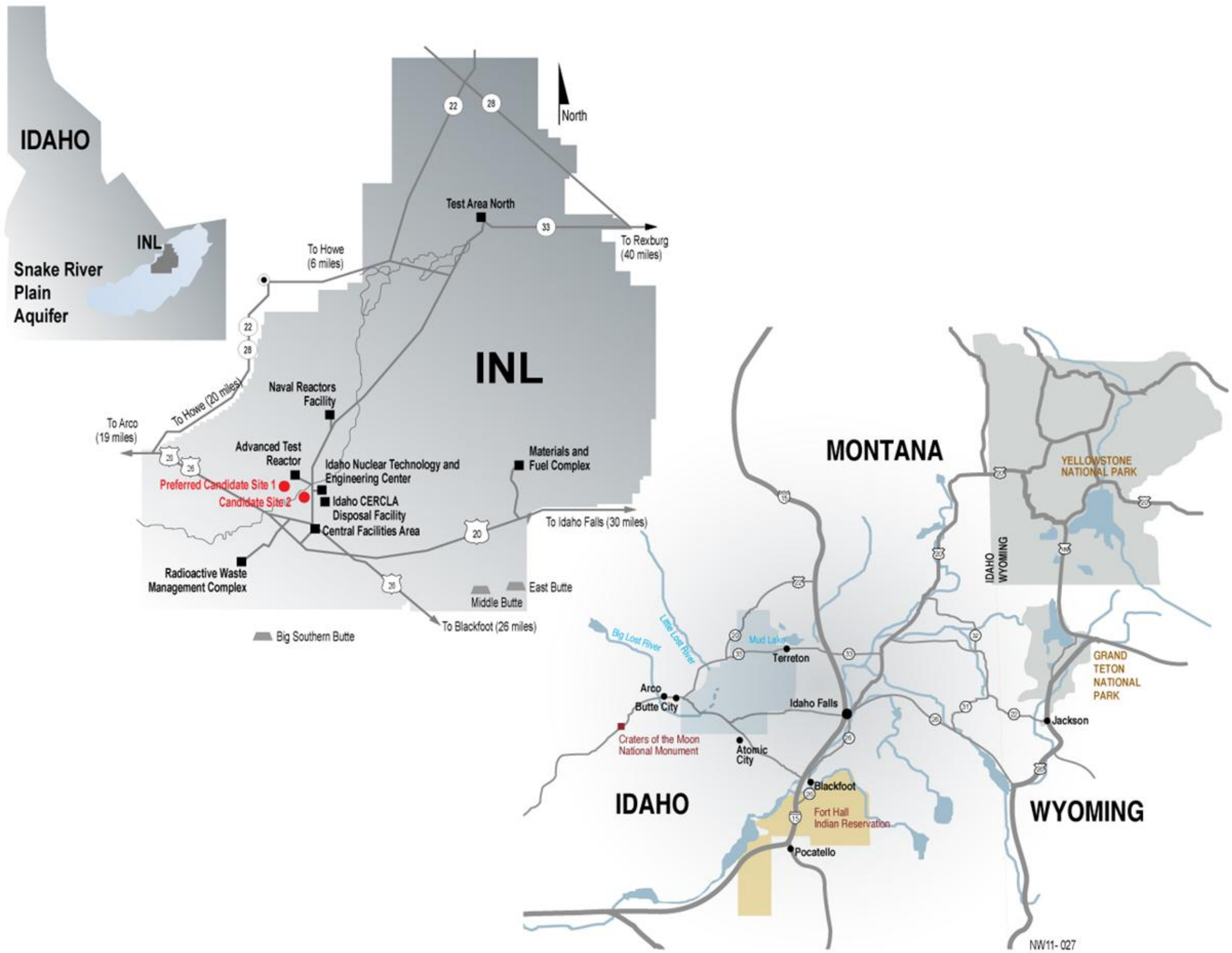

Figure 3-1. Map of Idaho National Laboratory and region showing major facility areas, highways, water bodies, and nearby towns.

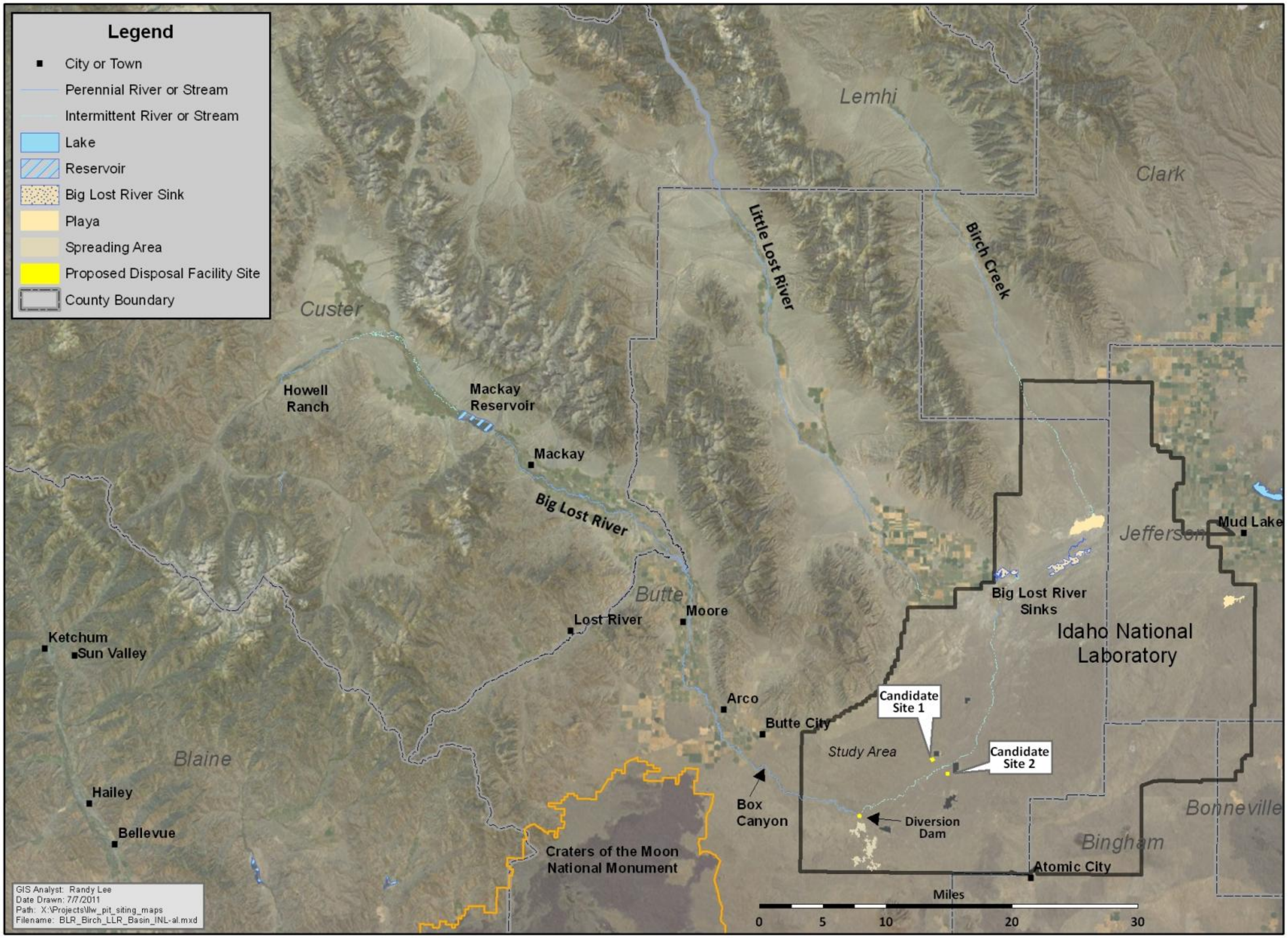

Figure 3-2. Mud Lake-Lost River Basin and candidate onsite locations.

Flow reaching the INL site in the Big Lost River is controlled by the Mackay dam, which releases water from Mackay reservoir. The impacts on the INL site from a potential Mackay dam failure have been evaluated (INL 2010b). While these flows would be higher than incurred during an extreme precipitation event, dam failure would not affect facility performance at either site. Excess flow that reaches the INL site through the Big Lost River can be diverted southward at the INL diversion dam into "spreading areas" at the southern end of the INL site, where the water will infiltrate and recharge the Eastern Snake River Plain Aquifer (ESRPA). Typically, when flows in the Big Lost River exceed 300 ft^3/second, a part of the flow is diverted into the spreading areas. The remainder of the flow continues through culverts at the INL diversion dam and flows northward through the Big Lost River channel. If sufficient flow exists, water will reach the Big Lost River Sinks and, potentially, the terminal ponding areas (Big Lost River playas) where it will either evaporate or infiltrate into the ESRPA (Figure 3-2).

In addition to the Big Lost River, surface waters on the INL site include the Little Lost River and Birch Creek and their tributaries (Figure 3-2). Flow in all three streams is intermittent and largely dependent on runoff from spring and early summer snowmelt from the mountainous upper drainage areas. Much of the flow in these other creeks and rivers is typically diverted for irrigation or is depleted by infiltration losses before reaching INL site boundaries. Both Candidate Sites 1 and 2 are outside the floodplain inundation areas depicted for the 100, 500, and 1,000-year floods (flood events that are predicted to occur once every 100, 500, and 1,000 years, respectively) (INL 2010b). The candidate sites are located within two 45-acre study areas, and small portions of each study area are within the 10,000-year floodplain. The approximate ten-acre footprint of the facility would be located outside of the 10,000-year floodplain within either of the two 45-acre study areas.

The only other surface water bodies at the INL site are the manmade percolation and evaporation ponds used for wastewater management (DOE-ID 2003).

The INL site overlies the north-central portion of the 10,800-mi^2 ESRPA. This highly productive aquifer is the major source of drinking water for southeastern Idaho and has been designated a Sole Source Aquifer by the EPA (56 FR 50634). The U.S. Geological Survey has estimated that the thickness of the active portion of the ESRPA at INL ranges between 250 to 820 ft (Mann 1986). Depth to the water table ranges from about 200 ft below land surface in the northern part of the site to more than 900 ft in the southern part. The depth to the top of the ESRPA is approximately 480 ft below the two candidate remote-handled LLW disposal facility sites (INL 2011a).

The five Idaho counties that are part of the INL site are all in attainment areas or are unclassified for National Ambient Air Quality Standards status under the Clean Air Act. The nearest nonattainment area is located approximately 50 miles south of INL in Power and Bannock counties. INL is classified under the Prevention of Significant Deterioration regulations as a Class II area – an area with reasonable or moderately good air quality.

The natural vegetation of the INL consists of a shrub overstory with a grass and forb understory. The most common shrub is Wyoming big sagebrush, although basin big sagebrush may dominate or co-dominate in areas with deep or sandy soils. Other common shrubs include green rabbitbrush, winterfat, spiney hopsage, gray horsebrush, gray rabbitbrush, and prickly phlox. The grass and forb understory consists of native grasses, thickspiked wheatgrass, Indian ricegrass, bottlebrush squirreltail, needle-and-thread grass, Nevada bluegrass, and bluebunch wheatgrass and native forbs (i.e., tapertip hawksbeard, Hood's phlox, hoary false yarrow, paintbrush, globe-mallow, buckwheat, lupine, milkvetches, and mustards). A portion of INL has been designated as the Sagebrush Steppe Ecosystem Reserve, which is managed to provide research opportunities and preserve sagebrush steppe habitat. In addition, the INL site is designated as a National Environmental Research Park.

A wide range of vertebrate species are located within the site. Several species are considered sagebrush-obligate species, meaning that they rely on sagebrush for survival. Among others, those species include sage sparrow, Brewer's sparrow, northern sagebrush lizard, greater sage-grouse, and pygmy rabbit.

There are currently no species on the INL site that are listed as endangered or threatened under the Endangered Species Act. The greater sage-grouse is a candidate species and is common on the INL site. Several species of concern, including long-eared myotis, small-footed myotis, Townsend's big-eared bat, pygmy rabbit, Merriam's shrew, long-billed curlew, ferruginous hawk, northern sagebrush lizard, and loggerhead shrike occur on the site.

INL also provides important breeding and nesting habitat for many species of raptors and songbirds. Most avian species occupying INL use both sagebrush and grassland habitats from a few days for feeding and resting during migration to several months for breeding and raising young. Many bird species use specific habitats for foraging and reproduction. Species that primarily use sagebrush include the greater sage-grouse, sage sparrow, Brewer's sparrow, sage thrasher, and loggerhead shrike. Species that occur mainly in grassland habitats include horned lark, western meadowlark, vesper sparrow, and grasshopper sparrow. Other common bird species at INL include the following: rock wren, common nighthawk, red-tailed hawk, rough-legged hawk, prairie falcon, ferruginous hawk, golden eagle, and common raven. Although most raptors use the site indiscriminately for foraging, nesting structures are a limiting factor in population abundance and species diversity.

DOE presently contracts with Idaho Power to supply electric power to INL. Site electrical energy availability is about 480,000 megawatt-hours per year. Current electrical energy consumption at INL is 230,000 megawatt-hours annually (based on 2010 data). Fuel consumed at INL includes natural gas (280,000 therms), and fuel oil (heating fuel), propane and liquid natural gas (2,200,000 gallons). Diesel fuel consumption in 2010 was approximately 750,000 gallons and gasoline consumption was approximately 580,000 gallons. Greenhouse gas emissions totaled 110,000 metric tons in 2010.

The INL facilities that currently transport remote-handled LLW are located within a few miles of the candidate onsite disposal locations, with the exception of MFC, which is approximately 18 miles east of the locations. Transport of remote-handled LLW from MFC would utilize a road being constructed that will connect MFC and INTEC (DOE 2010a); therefore, use of public highways for this purpose would not be required. The amount of diesel fuel used for onsite transport is estimated to be 230 gallons per year (Huai et al. 2006).

3.2 Nevada National Security Site

The NNSS is located in Nye County, Nevada (Figure 2-6), approximately 65 miles northwest of Las Vegas, the largest population center in the state, with nearly 2 million people. The NNSS is owned by the federal government and administered, managed, and controlled by DOE. The mission of NNSS is to fully utilize the inherent capabilities and remote location of the site to support the nation's nuclear, energy, and environmental security efforts. This mission includes acceptance of radioactive waste for disposal from DOE and DOD sites. NNSS is suited for radioactive waste disposal due to its arid environment, deep groundwater, and remote location.

Disposal at NNSS takes place at the Area 5 Radioactive Waste Management Complex. This area is in a closed basin with thick alluvial soil and a depth to groundwater of 781 ft (NNSS 2010). NNSS has a planned LLW disposal capacity of 45,000 m^3 per year (DOE 1997). No closure date has been planned for the LLW disposal capability at NNSS, and it is assumed NNSS could accept remote-handled LLW from the INL site to meet the INL's mission need of 20 to 50 years.

One package of remote-handled LLW would be transported at a time in a shipping container licensed for transporting radioactive waste on public highways. It is estimated that 117 shipments of remote-handled LLW would be transported each year.

Transport vehicles would be commercial truck-trailer combinations dedicated to exclusive use for hazardous materials transport. Total vehicle weight would not exceed 80,000 lb to comply with road limit restrictions. Annual estimated diesel fuel use for round-trip transport from INL to NNSS (117 shipments or approximately 190,000 miles) would be approximately 28,000 gallons (Huai et al. 2006).

4. ENVIRONMENTAL CONSEQUENCES

Section 4.1 and Section 4.2 describe the potential environmental consequences from Alternative 1 (preferred alternative) and Alternative 2, respectively. Section 4.3 addresses the environmental consequences from the No Action Alternative. Cumulative effects are addressed in Section 4.4, and Section 4.5 presents a comparison of the alternatives.

4.1 Onsite Disposal

4.1.1 Cultural Resources

Since 1984, archaeological surveys of INL lands have been conducted according to the standards outlined in the INL Cultural Resource Management Plan (DOE-ID 2009). Cultural resources investigations have been completed in the vicinity of the alternative onsite disposal facility sites for more than three decades, and none resulted in the recording of cultural resources within the 45-acre candidate site areas or in adjacent areas where utility and access connections might be placed (INL 2010c).

In May 2010, the INL Cultural Resource Management Office conducted archival searches, intensive archaeological field surveys, and initial coordination with the Shoshone-Bannock Tribes to identify cultural resources that may be present within either of the two candidate onsite locations (INL 2010c). Near preferred Candidate Site 1, surveys encompassed 130 acres and four archaeological resources were identified, including a historic homestead, historic canals, and two isolated prehistoric artifacts. The historic homestead and canals are potentially eligible for nomination to the National Register of Historic Places. Near Candidate Site 2, seventy acres were examined and two archaeological resources were identified, including a small historic activity area and a historic canal and ditch. The canal exhibits potential for National Register listing (INL 2010c).

Specific Native American cultural resources were not officially documented by the Shoshone-Bannock Tribes in the candidate onsite locations for construction of the remote-handled LLW disposal facility. However, a representative from the Tribe’s Heritage Tribal Office toured the project areas, and general concerns with regard to protection of the natural environment have been documented.

Ground disturbance associated with facility construction and associated infrastructure (e.g., utilities, access roads, and telecommunications) has the potential to impact any archaeological sites and natural resources of importance to the Shoshone-Bannock Tribes in the chosen footprint of the project. Location and construction of the remote-handled LLW disposal facility footprint within either of the two candidate sites would be undertaken to avoid disturbing the archaeological resources identified through the cultural resource surveys. Although no subsurface archaeological resources have been identified, cultural resource monitoring would occur during all ground disturbing activities to prevent inadvertent damage to subsurface archaeological resources.

4.1.2 Water Resources

The Big Lost River is the only surface water feature near the candidate disposal sites. The facility would be located outside the 100, 500, 1,000, and 10,000-year floodplain inundation areas. There are no mapped wetlands within either candidate site location. No impacts to surface water are expected from the proposed action.

Most of INL is underlain by the ESRPA. The depth to the top of the ESRPA is approximately 480 ft below the two candidate sites. The geology above the ESRPA, the vadose zone, is generally comprised of basalt (95%) with a layer of soil (loess) or sediment on top of the basalt with thin layers of sediment (1 to 20-ft intervals) between basalt flows. The ESRPA has similar geology as the overlying vadose zone and is generally 250 to 900-ft thick.

No releases from the proposed facility are anticipated from operations. A remote-handled LLW disposal facility would be operated, closed, and maintained post-closure to avoid the potential for migration of contaminants (i.e., radionuclides) from the facility. The potential exists for contaminants to be released from the remote-handled LLW disposal facility at either of the two candidate sites following the closure period (several thousand years in the future) and be transported downward through the vadose zone into the aquifer.

Potential groundwater impacts following facility closure were analyzed for the two candidate onsite locations (INL 2011a). The analysis evaluated radionuclide transport from the facility to a hypothetical human receptor via the groundwater pathway. The analysis assumed the failure of the steel waste liners, concrete vaults, and an engineered cover. It compared predicted groundwater concentrations to groundwater quality standards, and compared the predicted cumulative all-pathways EDE to the dose criteria for a member of the public set forth in DOE Order 435.1 (25 mrem per year). The receptor is assumed to be located 330 ft downgradient from the edge of the remote-handled LLW disposal facility for all times following facility closure.

The Idaho Ground Water Quality Rule (IDAPA 58.01.11) establishes minimum requirements for protection of groundwater quality through standards and an aquifer categorization process. Primary constituent standards are based on protection of human health, and secondary constituent standards are generally based on aesthetic qualities. The primary constituent standards for radionuclides incorporate standards set by EPA (40 CFR 141.66). These limits are typically specified as a maximum contaminant level (MCL). MCLs found in 40 CFR 141 include values for beta-gamma-emitting radionuclides and alpha-emitting radionuclides. The MCL for beta-gamma-emitting radionuclides is the concentration that, assuming an ingestion rate of about one-half gallon of water per day for 365 days per year, the dose equivalent to the whole body or critical organ does not exceed 4.0 mrem/year. Other specific limits include a maximum gross alpha activity of 15 pCi/L (excluding radon and uranium isotopes), a maximum combined Ra-226 and Ra-228 concentration of 5 pCi/L, a maximum uranium mass concentration of 30 μg/L, and maximum H-3 and Sr-90 concentrations of 20,000 pCi/L and 8 pCi/L, respectively.

Table 4-1 presents, for each candidate site, the peak predicted concentrations for the radionuclides that are the primary dose contributors, along with the predicted time of occurrence and corresponding MCL. The list includes parent radionuclides and the daughters of each parent (shown in parentheses). The primary radionuclides are Tc-99, C-14, I-129, and U-238. At each candidate site location, predicted concentrations were lower than the MCL and meet all of the state groundwater primary constituent standards. The predicted concentrations for the preferred Candidate Site 1 were lower than Candidate Site 2 concentrations.

The analysis also evaluated the total all-pathways dose from ingesting groundwater, locally grown crops, locally raised beef, and locally produced milk for each radionuclide. These estimated peak doses and corresponding time of occurrence are presented in Table 4-2. The predicted peak cumulative all-pathways dose from all radionuclides will never exceed the regulatory limit of 25 mrem/year (DOE Order 435.1). For Candidate Site 1, the total peak all-pathways dose is estimated to be 0.88 mrem/year in year 5500. For Candidate Site 2, the total peak all-pathways dose is estimated to be 1.6 mrem/year in year 4000. The average annual radiation exposure from natural sources to an individual in the United States is approximately 300 mrem/year.

The results shown in Tables 4-1 and 4-2 for both candidate sites are conservative because the evaluation of groundwater impacts does not take into account the natural and engineered features of the facility, which would reduce and slow migration of contaminants. These features include use of steel waste liners to reduce water contact with the waste, reinforced concrete vaults to provide structural integrity, placement of an engineered cover to reduce the potential for infiltration of water into the facility, and operational controls, including berms and an interim cover.

Table 4-1. Peak predicted groundwater concentrations and time of occurrence for Candidate Sites 1 and 2.

Radionuclide (Progeny)	Candidate Site 1		Candidate Site 2		MCL[a] (pCi/L)
	Peak Concentration (pCi/L)	Calendar Year Peak Occurs	Peak Concentration (pCi/L)	Calendar Year Peak Occurs	
C-14	150	5500	280	4000	2,000
Cl-36	0.12	3900	0.11	3500	700
H-3	0.000023	2200	0.0004	2200	20,000
I-129	0.19	11000	0.26	8600	1
Mo-93	0.044	22000	0.38	16000	469
Nb-94	0.016	410000	0.092	300000	853
Ni-59	5.8	270000	14	210000	300
Tc-99	110	3100	150	2800	900
Np-237	0.00072	57000	0.00095	42000	15
(U-233)[b]	0.0002	49000	0.0002	37000	289,000
(Th-229)	3.8E-06	59000	3.4E-06	46000	15
Pu-239	3.1E-13	260000	7.7E-11	220000	15
(U-235)[b]	3.2E-06	56000	3.5E-06	40000	65
(Pa-231)	3.4E-08	92000	3.3E-08	71000	15
(Ac-227)	5.4E-08	92000	5.4E-08	71000	15
Pu-240	5.3E-16	67000	7.0E-15	67000	15
(U-236)[b]	2.4E-05	42000	2.9E-05	33000	1,941
(Th-232)	9.5E-13	580000	9.10E-13	430000	15
(Ra-228)	8.1E-13	580000	7.8E-13	440000	5
(Th-228)	5.9E-13	580000	5.7E-13	440000	15
U-235[b]	0.0021	56000	0.0029	40000	65
(Pa-231)	0.000016	92000	0.000017	71000	15
(Ac-227)	0.000026	92000	0.000028	71000	15
U-238[b]	0.097	130000	0.093	92000	10
(U-234)[b]	0.54	92000	0.54	63000	187,000
(Th-230)	0.0097	370000	0.0096	360000	15
(Ra-226)	0.0097	380000	0.0096	360000	5
(Pb-210)	0.016	370000	0.016	360000	2.12

a. MCLs for beta-gamma emitting radionuclides are based on a whole body and critical organ dose equivalent limit of 4 mrem/year. The whole body and critical organ doses are calculated using the dose conversion factors in the National Bureau of Standards Handbook 69, "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air and Water for Occupational Exposure," (NBS 1963). The dose conversion factors in National Bureau of Standards Handbook 69 are based on International Commission on Radiation Protection Publication 2, which has been superseded by International Commission on Radiation Protection Publication 30, and more recently, International Commission on Radiation Protection Publication 72 (ICRP 72 1995).

b. MCL for uranium isotopes converted from 30 µg/L mass concentration to equivalent activity concentration.

Table 4-2. Peak predicted all-pathways doses and time of occurrence for Candidate Sites 1 and 2.

	Candidate Site 1		Candidate Site 2	
Radionuclide (progeny)	Peak All-Pathways Groundwater Dose (mrem/year)[a,b]	Calendar Year Peak Occurs	Peak All-Pathways Groundwater Dose (mrem/year)[a,b]	Calendar Year Peak Occurs
C-14	0.85	5500	1.6	4000
Cl-36	0.012	3900	0.012	3500
H-3	2.9E-09	2200	5.2E-08	2200
I-129	0.13	11000	0.16	8600
Mo-93	0.00056	22000	0.0049	16000
Nb-94	0.0011	410000	0.0068	300000
Ni-59	0.0014	270000	0.0034	210000
Tc-99	0.60	3100	0.81	2800
Np-237	0.00022	57000	0.00029	42000
(U-233)	3.1E-05	49000	3.0E-05	37000
(Th-229)	6.9E-06	59000	6.2E-06	46000
Np-237 Total[c]	0.00026	56000	0.000032	42000
Pu-239	2.2E-13	260000	5.4E-11	220000
(U-235)	4.5E-07	56000	4.9E-07	40000
(Pa-231)	4.6E-08	92000	4.5E-08	71000
(Ac-227)	6.8E-08	92000	6.7E-08	71000
Pu-239 Total[c]	5.2E-07	60000	5.6E-07	42000
Pu-240	3.8E-16	67000	5.0E-15	67000
(U-236)	3.4E-06	42000	4.1E-06	33000
(Th-232)	6.2E-13	580000	5.9E-13	430000
(Ra-228)	1.7E-12	580000	1.6E-12	440000
(Th-228)	2.4E-13	580000	2.3E-13	440000
Pu-240 Total[c]	3.4E-06	42000	4.1E-06	33000
U-235	4.5E-07	56000	5.0E-07	40000
(Pa-231)	4.6E-08	92000	4.5E-08	71000
(Ac-227)	6.8E-08	92000	6.7E-08	71000
U-235 Total[c]	5.2E-07	60000	5.6E-07	42000
U-238	0.014	130000	0.013	92000
(U-234)	0.08	92000	0.08	63000
(Th-230)	0.0059	370000	0.0058	360000
(Ra-226)	0.008	380000	0.008	360000
(Pb-210)	0.065	370000	0.064	360000
U-238 Total[c]	0.16	310000	0.16	280000

a. The dose limit is 25 mrem/year (DOE Order 435.1). The average annual radiation exposure from natural sources to an individual in the United States is approximately 300 mrem/year.

b. Doses calculated using dose coefficients from Federal Guidance Report 13: Cancer Risk Coefficients for Environmental Exposure to Radionuclides (EPA 1999) and corresponding supplement (EPA 2002).

c. Peak doses for parent and progeny are not additive because of differences in time of occurrence.

4.1.3 Ecological Resources

Both candidate sites are in an area burned by the Tin Cup Wildfire in 2000. Only a few patches of sagebrush remain in these areas. The current vegetation includes primarily native and non-native perennial grasses, green rabbit brush, native perennial forbs, and non-native annual grasses and forbs. A number of small mammals and reptiles permanently reside in the area around the candidate sites, while bird species and large mammals use this habitat in a seasonally transitory manner. Wildlife species of concern include greater sage-grouse, all migratory birds (including raptors), pygmy rabbits, Great Basin rattlesnakes, and all large mammal species (Blew et al. 2010).

Bird species observed at Candidate Site 1 were horned lark, ravens, and various species of sparrow. Two active nests were found at Candidate Site 1. Bird species observed at Candidate Site 2 were western meadowlark, sage thrasher, horned lark, and various sparrow species. Five active bird nests were located at Candidate Site 2.

Elk, mule deer, and pronghorn have been observed using the general vicinity of both candidate sites during semiannual surveys. During surveys conducted in June 2010, there was visual confirmation of pronghorn antelope, horned lark, ravens, ground squirrels, and other small mammals at Candidate Site 1. There also was evidence of badger present in the area. Wildlife or signs observed at Candidate Site 2 included ground squirrels and other small mammals, badger, sage thrasher, barn swallow, horned lark, meadowlark, pronghorn, and coyote.

The U.S. Fish and Wildlife Service recently released a finding indicating that sage-grouse warrant protection under the Endangered Species Act (16 USC §1531, et. seq.) but are precluded due to other listing priorities (DOI-FWS 2010). With the loss of big sagebrush in the Tin Cup Wildfire, no suitable nesting, brood rearing, or wintering habitat exists in the general vicinity of either candidate site. Surveys in June 2010 did not find sign of sage-grouse using these areas.

Pygmy rabbits are sagebrush obligate species that are under consideration for protection under the Endangered Species Act (16 USC § 1531, et. seq.). They depend on sagebrush for cover and forage. Surveys conducted in February 2010 indicated that no active burrows, and little, if any, suitable habitat were present at either of the onsite candidate sites.

No critical habitat for threatened or endangered species, as defined in the Endangered Species Act, exists on the INL site. Greater sage-grouse is considered to be a candidate species for listing under the Endangered Species Act. However, if a species such as the greater sage-grouse or pygmy rabbit are listed before or during construction of the facility, DOE would initiate formal consultation with the U.S. Fish and Wildlife Service. No habitat or sign for either sage-grouse or pygmy rabbit were found in either candidate site location (Blew et al. 2010).

After placing the engineered cover over the facility, native vegetation will be established on the cover and in the surrounding area to promote re-establishment of native habitat.

4.1.4 Routine Transportation

Transportation of remote-handled LLW would take place entirely within the INL site, and the public would not have access to the transport route or the disposal facility. The chance of radiological exposure during routine operation of the remote-handled LLW disposal facility is extremely low. The principal radiation hazard is direct radiation emitting from the remote-handled LLW. With adequate shielding, the radiation levels at the surface of the remote-handled LLW transport cask may be maintained at levels that are protective of workers and the public.

Approximately 2,500 vehicle miles would be travelled onsite each year to support remote-handled LLW disposal operations. No health impacts to the public are anticipated from emissions associated with these miles because the transportation would not occur on public highways (NorthWind 2011).

4.1.5 Accidents and Intentional Destructive Acts

The potential exists for an accident to occur during transport onsite. There also is the potential for unlawful entry onto the INL site, including the candidate remote-handled LLW disposal facility sites, to cause harm to facilities and personnel. Extensive security measures are in place to prevent this from occurring. Transport and disposal of radioactive material at the INL site routinely employs a variety of measures that mitigate the likelihood and consequences of intentional destructive acts at the candidate remote-handled LLW disposal facility sites. Access to the INL site facilities is controlled, with only those persons performing official business and presenting the proper credentials being allowed onsite. The INL site perimeter is monitored and patrolled to prevent unauthorized entry. The INL site maintains a highly trained and equipped protective force intended to prevent attacks against and entry into INL's facilities.

Potential impacts for transportation and handling accidents and intentional destructive acts were analyzed for the onsite disposal alternative (NorthWind 2011). In a transportation or handling accident, the principal material hazard originates from a breach of a payload and release of radioactive material. A truck collision involving fire and a partial release of the contents of the shipping cask was analyzed. The upper bound number of such accidents for onsite waste shipments over the life of the facility is estimated to be 0.00059 (substantially less than one occurrence). Dropping a shipping container, improper loading, and single or multiple vehicle crashes are considered bounded by the truck collision-fire scenario. An intentional destructive act involving transportation or handling of the remote-handled LLW is considered bounded by this truck collision-fire scenario. In this accident scenario, dose to the facility worker, collocated worker, and a maximally exposed individual (MEI) member of the public is estimated from intake of radiological material made airborne in the fire. Inhalation dose consequences were estimated for a crash resulting in a breach of a container and a vehicle fuel fire that engulfs the container and causes airborne dispersion of a portion of the contents.

The estimate of the radiation dose is then converted to an estimate of health effects. Exposure of populations to low levels of ionizing radiation is associated with an estimated number of resulting latent cancer fatalities (LCFs) in the exposed population. If an accident involved radiation exposures, the potential LCFs would be a consequence. The number of radiation-induced LCFs is estimated by multiplying the dose in person-rem by health risk conversion factors. These factors relate the radiation dose to the potential number of expected LCFs based on comprehensive studies of people historically exposed to large doses of radiation (e.g., the Japanese atomic bomb survivors). The health risk conversion factor recommended for use by the Interagency Steering Committee on Radiation Standards is 0.0006 LCF per person-rem of exposure (ISCORS 2002). A calculated value of less than 1 indicates that there will be no LCFs in the population from a transportation or handling exposure.

The consequence of a dose to an individual is expressed as the probability that the individual would incur fatal cancer from the exposure. For example, based on a dose-to-risk conversion factor of 0.0006 LCFs per person-rem, a maximally exposed worker receiving a dose of 1 rem in an accident would have an estimated lifetime probability of fatal cancer induced by the radiation of 0.0006 or 1 chance in 1,700.

Using conservative estimates, the likelihood that a MEI (located 2.5 miles from the accident at the point of nearest public access to the candidate sites) would incur an LCF was estimated to be 5.0E-08 (0.000082 rem). The LCF likelihood for a crew member is estimated to be 1.0E-05 (0.018 rem). The LCF likelihood for a collocated worker (330 ft away) is estimated to be 7.0E-06 (0.011 rem) (NorthWind

2011). There are no populations residing near the INL site; therefore, collective dose and associated LCFs were not estimated for this onsite accident.

4.1.6 Energy Use

Energy resource impacts would include both fuel costs associated with construction and longer-term fuel and energy costs associated with transporting waste and operating the remote-handled LLW disposal facility. The amount of energy that would be consumed during the construction and operation phases of the project is likely to be similar at either candidate onsite location. Transportation costs are likely to be similar at both candidate sites as they are both relatively close to the remote-handled LLW generating facilities. Operation of a replacement remote-handled LLW disposal facility would not overburden energy capacities at the INL site. Impacts from energy use would be in the form of carbon dioxide emission from use of fuel for transport and disposal operation. Carbon dioxide emissions for the onsite alternative are estimated to be 3 tons per year (NorthWind 2011).

4.1.7 Other Resources

Air emissions from construction activities would be similar to those produced during typical facility and infrastructure construction activities. Light-duty and heavy-duty trucks would be used to deliver materials to specific construction areas and remove any debris within the project area. During construction, short-term adverse effects on air quality, including increased greenhouse gas emissions, may result from dust and exhaust emissions. Any emissions discharged during construction of the proposed facility are not expected to cause an increase in local air pollutant concentrations beyond state and federal standards at any time or to be a significant source of greenhouse gas emissions. Topography and meteorology of the area in which the project is located would not seriously restrict dispersion of any air pollutants. Only small, short-term impacts are expected from the construction phase of the proposed project.

Once the remote-handled LLW disposal facility is operational, air quality would return to pre-construction levels. There would be no significant greenhouse gas emissions resulting at any time from remote-handled LLW disposal. There would be negligible toxic and criteria air pollutant emissions. After closure, there would be no potential emissions from the facility except insignificant amounts of gaseous radionuclide emissions, including radon (INL 2011b).

4.2 Offsite Disposal at the Nevada National Security Site

4.2.1 Routine Transportation

Potential impacts for routine transportation of remote-handled LLW were analyzed for the offsite disposal alternative (NorthWind 2011). This analysis of transportation impacts assumes that shipments of remote-handled LLW from the INL site to NNSS would take place over 20 years with the potential for up to an additional 30 years, for a total timeframe of 50 years.

The radiological cargo-related risks from the transportation of radiological waste from the INL site to the NNSS (Figure 2-6) would be attributable to ionizing radiation exposure. The radiological risk associated with routine transportation results from the potential exposure of people to low levels of external radiation near a loaded shipment. The RADTRAN (Weiner et al. 2008) and RISKIND (Yuan et al. 2002) computer codes were used for routine and accident risk assessments to estimate the radiological impacts to collective populations and individuals. Using these codes and conservative assumptions to evaluate transportation risk, the collective population dose from routine radiological exposure can be estimated.

The dose rate from each shipping container is assumed to be 10 mrem/hour at 3.3 ft, which is typical for remote-handled radioactive waste shipping analysis (DOE 2002a). The exposures to members of the pubic within 2,600 ft of the transport link (off-link), sharing the transport link (on-link), and at stops are added to yield the collective dose to the public for each shipment. This per shipment dose can be multiplied by the number of shipments per year to estimate the total potential annual dose that could be received by members of the public. Consequences of the collective population dose are expressed in terms of increased LCFs per year using the health risk conversion factors recommended by the Interagency Steering Committee on Radiation Standards (ISCORS 2002). Table 4-3 presents the results of the analysis of impacts to the population along the three potential transport routes.

Table 4-3. Transportation impacts to the surrounding population from routine shipment of remote-handled low-level waste from the Idaho National Laboratory site to the Nevada National Security Site.

Transport Route	Off-link Collective Dose[a]	On-link Collective Dose	Total Stop Collective Dose[b]	Per Shipment Collective Dose	Collective Dose Per Year (117 Shipments)	LCFs/Year[c]
Route A	0.00014	0.0066	0.072	0.079	9.3	0.006
Route B	0.0002	0.0073	0.072	0.08	9.4	0.006

a. Dose is collective population dose and is presented in person-rem.

b. Total stop dose assumes three one-half-hour stops made during the course of each shipment.

c. Conversion factor of 0.0006 LCFs per person rem (ISCORS 2002).

Table 4-4 presents the results of the RADTRAN analysis for each of the two crew members. Consequences of the individual doses received are expressed in terms of increased likelihood of the individual incurring an LCF. It is assumed the crew would be DOE or contractor employees working under the DOE occupational exposure limit of 5 rem/year for radiological workers (10 CFR 835). This limit will be enforced by limiting the number of shipments per person-year.

Table 4-4. Transportation impacts to the crew from routine shipment of remote-handled low-level waste from the Idaho National Laboratory site to the Nevada National Security Site.

Transport Route	Crew Member Dose[a] – Transport	Crew Member Total Stop Dose[b]	Crew Member Dose Per Shipment[c]	Crew Member Dose Per Year (117 Shipments)	Increased LCF Likelihood/ Year[d]
Route A	0.039	0.04	0.079	9.2	0.006
Route B	0.043	0.04	0.083	9.7	0.006

a. Dose is individual dose and is presented in rem.

b. Total stop dose assumes three one-half-hour stops made during the course of each shipment.

c. Sum of Crew Member Dose (Transport) and Crew Member Total Stop Dose.

d. Conversion factor of 0.0006 LCFs per rem used (ISCORS 2002).

Vehicle-related risks (i.e., latent health effects from vehicle emissions) result simply from transporting any material from one location to another independent of the characteristics of the cargo. The presence or absence of cargo is not a factor in the assessment of these risks. The collective risk of pollution health effects to the surrounding population from truck emissions, which include greenhouse gas emissions (Biwer and Butler 1999), is estimated to be 0.00025.

4.2.2 Accidents and Intentional Destructive Acts

Potential impacts for transportation and handling accidents and intentional destructive acts were analyzed for the offsite disposal alternative (North Wind 2011). This analysis of transportation impacts assumes that shipments of remote-handled LLW from the INL site to NNSS would take place over 20 years with the potential for up to an additional 30 years, for a total timeframe of 50 years. Approximately 185,000 vehicle-miles would be traveled for all projected waste shipments from the INL site to NNSS in Nevada each year.

Based on state-specific accident and fatality rates (Saricks and Tompkins 1999), the upper bound number of traffic accidents for all projected waste shipments is estimated to be 0.048 (less than one occurrence) and no traffic-related fatalities are expected.

The radiological risk from transportation-related accidents and intentional destructive acts lies in the potential release and dispersal of radioactive materials into the environment during an accident and the subsequent exposure of people through multiple exposure pathways (i.e., exposure to contaminated soil, inhalation, or the ingestion of contaminated food). Collective population dose in an urban area from the accidental release of radioactive materials caused by a shipping accident involving a fuel fire and an impact severe enough to damage a shipping container is shown in Table 4-5. Dose and the associated LCFs are presented for the surrounding population, an MEI near the site of the accident, the crew member, and a collocated worker. There is no risk of an acute cancer fatality under any of the accident scenarios (NorthWind 2011).

Transport of remote-handled LLW would routinely employ a variety of measures that mitigate the likelihood and consequences of an intentional destructive act, including acts of terrorism. Crew members would be screened for behavioral and substance abuse issues and would receive safety and security training. Crew members would conduct a thorough inspection of their vehicle and load prior to transport. During transport, crew members would always have in their possession a working means of communication and would be trained to immediately report suspicious activity encountered in route.

Table 4-5. Estimated impacts to the collective population, a maximally exposed individual, the crew member, and a collocated worker from an offsite accident.

	Collective Population		MEI		Crew Member		Collocated Worker	
Accident	Dose	LCFs[a]	Dose	Increased LCF Likelihood	Dose	Increased LCF Likelihood	Dose	Increased LCF Likelihood
Vehicle collision and fuel fire	1.8 person-rem	0.001	0.0083 rem	<0.0001[a]	0.077 rem	<0.0001[a]	0.011 rem	<0.0001[a]

a. Conversion factor of 0.0006 per rem/person-rem used (ISCORS 2002).

4.2.3 Energy Use

Energy resources would include fuel costs associated with transport of the waste from the INL site to NNSS and the return trip to the INL site. It is expected that approximately 28,000 gallons of diesel fuel would be used for transport each year. Impacts from energy use would be in the form of carbon dioxide emissions from use of fuel for transport operations. Carbon dioxide emissions for the offsite alternative are estimated to be 310 tons per year (NorthWind 2011).

4.3 No Action Alternative

Under the No Action Alternative, no onsite or offsite actions would be taken to provide remote-handled LLW disposal capacity. Because NRF has an existing cask, it would continue shipments to RWMC until it is closed or filled. No new transport casks would be developed and remote-handled

LLW activated metals and ion-exchange resins would continue to be stored at the generating facilities until storage capacity is exceeded; at that time, activities that generate the subject waste would cease or be significantly curtailed because of a lack of disposal capability, which would impact mission-critical activities. INL site missions supporting research, development, and demonstration activities and the activities of the Naval Nuclear Propulsion Program could be impacted by the lack of storage and disposal capacity for remote-handled LLW that would be generated. Under this scenario, the No Action Alternative would not result in any additional impacts on the physical, biological, and socioeconomic environments because waste generation would cease.

Selection of the No Action Alternative would result in DOE not having sufficient disposal capacity for its remote-handled LLW. If waste streams continued to be generated after 2017 without additional storage or disposal capacity, the potential for exposures to workers, the public, and the environment from the waste would increase.

4.4 Cumulative Effects

This section describes cumulative effects of the project that are caused by the aggregate of past, present, and reasonably foreseeable future actions. The impact of this project on resources such as air, energy, and transportation is not significant and cumulative effects are anticipated to be minimal. The onsite disposal alternatives have the potential to affect cultural, ecological, and groundwater resources by their activities, which include land disturbance and waste disposal.

Two recently approved projects have the potential to contribute cumulative impacts to cultural resources. The Radiological Response Training Range will include two ranges, one at the north end of the INL site and one to the south, near RWMC (DOE 2010b). The ranges are for outdoor field exercises that would simulate conditions expected during a major radiological incident. The Stand-Off Experiment Range will be located at the north end of the INL site (DOE 2011a). This range is for testing of nonintrusive active-interrogation systems capable of detecting nuclear and explosive materials in a variety of field-deployable applications at greater standoff distances. Both projects have identified the potential for minor direct and indirect impacts to cultural and archaeological resources at the north end of the INL site. Operational controls would be implemented before and during project activities to minimize the potential for adverse direct and indirect impacts to cultural resources in the range areas. Considering the small potential impacts to cultural resources at the INL site from these ranges and that most of the site remains pristine, the cumulative impact of a remote-handled LLW disposal facility is likely small.

Construction and operation of the remote-handled LLW disposal facility would increase habitat loss and fragmentation; however, it is unlikely that this would have a substantial effect on wildlife because Candidate Sites 1 and 2 are adjacent to or near existing industrial infrastructure in areas that are presently not dominated by sagebrush. A small amount of native vegetation would be impacted as a result of the proposed project, because most of the area within each of the proposed construction sites has previously been disturbed. Implementation of revegetation and non-native invasive plant species control practices should result in minimal impacts to site ecology.

Other future projects at the INL site could involve cumulative effects to cultural and ecological resources as a result of ground disturbance. The DOE Naval Nuclear Propulsion Program has announced its intent to prepare an EIS for recapitalization of naval spent nuclear fuel handling and examination facilities at the INL site (75 FR 42082). The proposed action includes alternatives for development of new facilities for spent fuel handling and examination at NRF, and the ATR Complex. The cumulative impact from these projects would be small, because they would be located at existing INL site facilities where the vegetation and soil has previously been disturbed and cultural resources have been evaluated. Monitoring for cultural resources would be conducted to avoid any sensitive materials that might be discovered during excavation. The potential for increased remote-handled LLW generation and disposal as a result of the expanded capability for Naval spent nuclear fuel handling and examination is bounded by the groundwater analysis and accident scenarios used in this assessment. Airborne release for the cumulative effects of the NRF recapitalization is not expected to have impacts on the ground water.

Assessing the cumulative impacts to groundwater requires consideration of other sources of contaminants that either exist in the aquifer currently or will enter the aquifer in the future. Locations of the sources include upgradient contaminants that could migrate through the aquifer volume potentially impacted by the remote-handled LLW disposal facility, nearby sources that could overlap the impacted region, and those sources downgradient that might be affected by the remote-handled LLW disposal facility. The potential for cumulative impacts to groundwater were analyzed for each candidate onsite location (INL 2011a).

The preferred location, Candidate Site 1, is essentially located downgradient of the ATR Complex and NRF. There are no predicted or existing contaminants of concern in the aquifer upgradient of NRF with the potential to impact groundwater concentrations at Candidate Site 1. Historic releases at NRF have been addressed under CERCLA. There also have been historical releases within the ATR Complex identified and partially remediated through CERCLA activities. The potential groundwater concentrations from historical releases at the ATR Complex and NRF that could be expected to reach the groundwater beneath Candidate Site 1 were evaluated for the potential for cumulative impacts, and it is unlikely that contamination from either the ATR complex or NRF will increase the dose over and above what is predicted at Candidate Site 1 (INL 2011a).

Predicted peak all-pathways EDE at NRF and the ATR Complex are given in Table 4-6 (INL 2011a). The peak dose shown for C-14 at NRF will be much lower once it reaches Candidate Site 1 and will occur just after the facility begins to accept waste. The later contributions from NRF and the ATR Complex are predicted to occur more than 3,000 years after facility closure.

A similar analysis was conducted for Candidate Site 2 (INL 2011a). Candidate Site 2 is located southwest of INTEC. There are no predicted or existing contaminants with the potential of impacting the aquifer upgradient of INTEC. Residual radionuclides from historical releases at INTEC evaluated under CERCLA, radionuclides disposed of in ICDF located southwest of INTEC, and the residual inventory in the Tank Farm Facility at INTEC all have the potential to impact groundwater near Candidate Site 2 (INL 2011a).

Based on the analysis conducted for Candidate Site 2, it is very unlikely that doses from the INTEC CERCLA sites will overlap in time to any great extent with the peak dose from the candidate remote-handled LLW facility. However, peak doses from ICDF and the Tank Farm Facility occur closer in time to the predicted facility peak dose and, therefore, could potentially overlap and contribute to an increase in the total dose. These potential doses are shown in Table 4-6 (INL 2011a). If the peak doses from ICDF and the Tank Farm Facility were added to the peak dose from Candidate Site 2, the total dose could be 3.54 mrem/year, although dilution could result in the combined impact being less than the sum of the peak doses.

An assessment of both sites shows that cumulative impacts for Site 2 are expected to be greater than for Site 1; however, the cumulative impacts at either site will not be significant. At either site, doses from all releases would not exceed the groundwater protection limit set by DOE of an annual all-pathways dose to the public of 30 mrem/year. The peak cumulative doses are significantly less than the average annual radiation exposure from natural sources to an individual in the United States of approximately 300 mrem/year.

DOE has issued the *Draft EIS for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste and Greater-Than-Class C -Like Waste* (DOE 2011b). That document provides an analysis of the environmental impacts of disposing of radioactive waste at several alternative locations in the United States, including the INL Site. While the document includes an analysis of the disposal of radioactive waste on the INL Site, the draft EIS did not identify a preferred alternative. In addition, as required under the Energy Policy Act of 2005, before DOE makes a final decision on a disposal method or location, DOE must submit a report to Congress that includes a description of the alternatives under consideration and await action by Congress. Because Congressional action in regard to this EIS is unknown at this time and will be dependent on a number of circumstances and considerations, DOE considers the potential for greater-than-Class C waste disposal at INL to be speculative and not a reasonably foreseeable action at this point.

Table 4-6. Predicted annual groundwater dose and peak time at facilities upgradient of the remote-handled low-level waste disposal facility candidate sites and at the candidate sites.

Site	Radionuclide	Peak Dose (mrem/year)	Calendar Year of Peak Dose
Candidate Site 1			
ATR	U-234	0.027	44000
NRF	U-234	0.02	43000
NRF	C-14	2.6	2000
Remote-Handled LLW Facility	Mostly C-14	0.88	5500
Expected Peak Dose and Year of Occurrence		About 0.88	5500
Candidate Site 2			
Operable Unit 3-14	U-234	0.22	About 44000
ICDF	Mostly C-14	0.58	8400
Tank Farm	All Pathways	1.4	About 2900
Remote-Handled LLW Facility	Mostly C-14	1.6	4000
Expected Combined Dose and Year of Occurrence		1.6 to 3.6	2900 to 8400

DOE is planning to develop capabilities to support nuclear research, development, and testing at the INL Site and at facilities located in Idaho Falls (DOE-ID 2011). At the INL site, the restart of the Transient Reactor Test Facility is being considered for testing fuel behavior over a brief interval of time. Potential new capabilities include an analytical laboratory for post-irradiation examination and facilities for conducting laboratory-and engineering-scale testing of aqueous separations and materials disposition. These projects are in the initial planning phases and insufficient data exists to support evaluation of whether they could have a cumulative effect on a remote-handled LLW disposal facility. As these projects progress, their potential for cumulative effects will be considered as part of project planning.

4.5 Comparison of Alternatives

This section compares the onsite and offsite alternatives and presents a summary of effects to the resources evaluated as they pertain to the alternatives (Table 4-7). Disposal at NNSS (Alternative 2) would take place at an existing facility designed, approved, and operated to accept DOE's LLW. Therefore, location impacts were not evaluated for this alternative.

Table 4-7. Comparison of effects on resources evaluated for onsite and offsite alternatives.

Resource	Preferred Location Near the ATR Complex (Candidate Site 1)	Location Near ICDF (Candidate Site 2)	Offsite Disposal at NNSS	No Action Alternative	Cumulative Effects
Cultural Resources	Disturbance of cultural resources would be avoided; impacts not significant.	Same as Candidate Site 1. ←	NA	No impact	New projects could contribute slight cumulative impacts to cultural resource.
Water Resources	Peak annual all-pathways EDE impacts to groundwater of 0.88 mrem/year in year 5500.	Peak annual all-pathways EDE impacts to groundwater of 1.6 mrem/year in year 4000.	NA	No impact	Combined peak annual dose and year for groundwater at Candidate Site 1 of about 0.88 mrem/year in year 5500. Combined peak annual dose and year for groundwater at Candidate Site 2 of 1.6 to 3.6 mrem/year between 2900 and 8400.
Ecological Resources	Vegetation removed for site development. Potential increase in weeds. No effects to sensitive plants. No effects to critical habitat or threatened or endangered animals. No adverse effects to sagebrush obligate species.	Same as Candidate Site 1. ←	NA	No impact	Minimal increased habitat loss and fragmentation because both candidate sites are in areas of low quality habitat. Negligible impacts to vegetation due to past disturbance.
Energy Resources	Short term increase in fuel use. Long-term fuel and energy use of 230 gallons/year.	Same as Candidate Site 1. ←	No short term increase in fuel use. Long-term fuel and energy use of 28,000 gallons/year.	No impact	No cumulative effects anticipated due to small amounts of energy resources consumed.

Table 4-7. (continued).

Resource	Preferred Location Near the ATR Complex (Candidate Site 1)	Location Near ICDF (Candidate Site 2)	Offsite Disposal at NNSS	No Action Alternative	Cumulative Effects
Air Resources, including Greenhouse Gas Emissions	Insignificant impacts to climate and air quality from construction and transportation. Greenhouse gas emissions of 3 tons/year.	Same as Candidate Site 1. ←	Insignificant impacts to climate and air quality from transportation. Greenhouse gas emissions of 310 tons/year.	No impact	No cumulative effects anticipated due to small amounts of air emissions.
Routine Transportation	2,500 vehicle miles/year No exposure to public from routine transportation.	Same as Candidate Site 1. ←	190,000 vehicle miles/year Potential annual LCFs to public and crew from routine incident free shipments: • For public: 0.006 • For crew: 0.006	No impact	No cumulative effects anticipated due to small number of shipments.
Accidents and Intentional Destructive Acts	LCF risk from an accident: No collective (surrounding) population For MEI: less than 0.0001 For crew member: 0.0001 For collocated worker: less than 0.0001 Risk to public of injury accident: 0.00059 (all shipments) Risk to public of fatality: 0.0 (all shipments)	Same as Candidate Site 1. ←	LCF risk from an accident: For collective population: 0.001 For MEI: less than 0.0001 For crew member: less than 0.0001 For collocated worker: less than 0.0001 Risk to public of injury accident: 0.048/year Annual risk to public of fatality accident: 0.0/year	No impact	No cumulative effects anticipated due to low probability that multiple acts would occur.

5. REGULATORY REQUIREMENTS

This section describes the regulatory requirements that apply to the proposed action.

5.1 Remote-Handled Low-Level Waste Management

The Atomic Energy Act authorizes DOE to manage its radioactive materials. DOE's radioactive waste management, including disposal of remote-handled LLW at the INL site, is governed by DOE Order 435.1. This requires that LLW disposal facilities be sited, designed, operated, maintained, and closed so that a reasonable expectation exists that the following objectives will be met:

- Dose to representative members of the public shall not exceed 25 mrem (0.25 mSv) in a year total EDE from all exposure pathways, excluding the dose from radon and its progeny in air.

- Dose to representative members of the public via the air pathway shall not exceed 10 mrem (0.10 mSv) in a year total EDE, excluding the dose from radon and its progeny.

- Release of radon shall be less than an average flux of 0.74 Bq/m^2/s (20 pCi/m^2/s) at the surface of the disposal facility. Alternatively, a limit of 0.0185 Bq/L (0.5 pCi/L) of air may be applied at the boundary of the facility.

Each disposal facility conducts a performance assessment that includes calculations of potential doses to representative future members of the public and potential releases from the facility for a 1,000-year period after closure. The performance assessment is an analysis of physical and chemical mechanisms that control the migration of radioactive materials through the environment to points of potential human exposure. The performance assessment includes activities that future members of the public may conduct (e.g., drinking water and recreational activities) that could potentially result in an exposure to the radioactive material. Real-time worker protection is not a future concern; therefore, worker radiological exposure is addressed by operational safety analysis and is not included in the performance assessment.

In addition to completing a performance assessment for the disposal facility, a site-specific radiological composite analysis that accounts for all sources of radioactive material that may be left at the DOE site and may interact with the LLW disposal facility must be completed. The performance assessment and composite analysis conducted on the disposal facility provide the reasonable expectation that the performance objectives will be met by establishing parameters, limits, and controls on the siting, design, operations, maintenance, and closure of the facility.

A Disposal Authorization Statement must be obtained from DOE before construction of a new disposal facility can begin. This statement is based on a review of the performance assessment, composite analysis, preliminary closure plan, and monitoring plan. It provides the specific limits for design, construction, operation, and closure.

5.2 Cultural Resources

A variety of laws, regulations, and statutes manage or protect cultural resources, including buildings, sites, structures, or objects, each of which may have historical, architectural, archaeological, cultural, and scientific importance. The requirements include the following:

- American Antiquities Act of 1906 (Public Law 59-209, 16 USC §§ 431-433)

- National Historic Preservation Act of 1966 (Public Law 89-665, 16 USC § 470 et seq.); Section 106 of this act and its implementing procedures require federal agencies to take into account the potential effects of proposed projects on historic properties listed on or potentially eligible for listing on the National Register of Historic Places

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

- Archaeological and Historic Preservation Act of 1974 (Public Law 93-291, 16 USC § 469-469c)

- Archaeological Resources Protection Act of 1979 (Public Law 96-95, 16 USC § 470aa-470ll)

- Native American Graves Protection and Repatriation Act of 1990 (25 USC § 3001 et seq.).

In 2004, DOE-ID entered into a programmatic agreement with the Idaho State Historic Preservation Office and the Advisory Council on Historic Preservation. The agreement legitimizes the INL Cultural Resource Management Plan (DOE-ID 2009), by which INL complies with Section 106 of the National Historic Preservation Act and its implementing regulations (36 CFR 800), as well as various other sections of the National Historic Preservation Act and cultural resource laws to meet the unique needs of the INL site. DOE-ID's "Agreement-in-Principle" (DOE 2002b) with the Shoshone-Bannock Tribes ensures an active tribal role in cultural resource impact assessment and protection. INL would continue to comply with the National Historic Preservation Act, Section 106, through the INL Cultural Resource Management Plan, and the plan would be used to develop a strategy to protect cultural resources from adverse impact. If the preferred alternative for onsite disposal at Candidate Site 1 is selected, a cultural resource protection plan would be developed for the project in consultation with the Idaho State Historic Preservation Office and Shoshone-Bannock Tribes.

5.3 Groundwater

The Idaho Ground Water Quality Rule (IDAPA 58.01.11) establishes minimum requirements for protection of groundwater quality through standards and an aquifer categorization process. The requirements of this rule serve as a basis for the administration of programs that address groundwater quality. Depending on the specific location of the facility and the availability of existing sanitary facilities, a new system for handling wastewater may be required. The State of Idaho has regulations and a technical guidance manual governing individual/subsurface sewage disposal (IDAPA 58.01.03).

The Idaho Rules for Public Drinking Water Systems (IDAPA 58.01.08) issues MCLs for public drinking water systems. The Idaho Department of Environmental Quality also sets forth monitoring and reporting requirements for inorganic and organic chemicals and radiochemicals. Water quality monitoring data at the INL site is compared to Idaho's groundwater primary constituent standards and secondary constituent standards (IDAPA 58.01.11). All water quality monitoring and reporting at the INL site is consistent with IDAPA requirements.

5.4 Climate and Air Quality

Parts of the proposed facility are considered a fugitive source of particulate matter by state (IDAPA 58.01.01.006.47) and federal rules as applied through the State Implementation Plan (DEQ 2010). Under state regulations, fugitive sources are exempt from pre-construction permit (IDAPA 58.01.01.220.01); therefore, the facility has no pre-construction permit requirements. However, activities at the INL site are subject to a Clean Air Act Title V Operating Permit, which specifies facility-wide requirements for activities that generate pollutants such as fugitive dust. Activities at the preferred onsite candidate site will operate in compliance with all requirements of the Title V Operating Permit.

The Council on Environmental Quality has issued draft NEPA guidance on consideration of the effects of climate change and greenhouse gas emissions (CEQ 2010). This guidance encourages the consideration of (1) the greenhouse gas emissions effects of a proposed action and alternative actions; and (2) the relationship of climate change effects to a proposed action or alternatives, including the relationship to proposal design, environmental impacts, mitigation, and adaptation measures in NEPA analyses. Specifically, if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2-equivalent greenhouse gas emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Greenhouse gas emissions would be below thresholds under any of the alternatives being considered in this Environmental Assessment.

5.5 Ecological Resources

Soil disturbing activities, including those associated with the use of unimproved roads, have the potential to increase noxious weeds and invasive plant species that would be managed according to 7 USC § 2814, "Management of Undesirable Plants on Federal Lands," and Executive Order 13112, "Invasive Species." The INL site would follow the applicable requirements to manage undesirable plants.

In analyzing the potential ecological impacts of the use of alternative routes for this project, DOE-ID has followed the requirements of the Endangered Species Act (16 USC §1531 et seq.) and has reviewed the most current lists for threatened and endangered plant and animal species. Other federal laws that could apply include the Fish and Wildlife Coordination Act (16 USC § 661 et seq.), Bald Eagle Protection Act (16 USC § 668), and the Migratory Bird Treaty Act (16 USC §§ 703-712).

5.6 Transportation

Transportation of hazardous and radioactive materials and substances is governed by the Hazardous Materials Transportation Act (49 USC §§ 5101-5127) and by the U.S. Department of Transportation, Nuclear Regulatory Commission, and DOE regulations. Onsite shipments would not travel along public highways and would be shipped per DOE Order 460.1B, "Packaging and Transportation Safety" requirements. These out-of-commerce shipments would be described in a transport plan that demonstrates equivalent safety to the applicable Department of Transportation and Nuclear Regulatory Commission regulations. Shipments under the alternative of disposal at NNSS would be conducted in accordance with Nuclear Regulatory Commission and Department of Transportation requirements for shipment of hazardous and radioactive materials on public highways.

5.7 Energy Use

Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance," strives to improve energy efficiency and environmental performance in federal agencies. This Executive Order strengthens requirements set forth by the Energy Independence and Security Act, the Energy Policy Act of 2005, and Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management." It contains a variety of initiatives for federal agencies to implement for energy efficiency and conservation, including consideration of the energy impacts of decisions. This Environmental Assessment considers the relative energy impacts of the alternatives being evaluated.

6. LIST OF AGENCIES AND PERSONS CONSULTED

No other federal or state agencies were formally consulted during preparation of this Environmental Assessment. DOE-ID conducted separate notifications and briefings to the Idaho Governor's and Congressional Delegation Offices, the Shoshone-Bannock Tribes, and the Idaho Department of Environmental Quality (INL Oversight Program).

The Shoshone-Bannock Tribes and Idaho State Historic Preservation Office have been contacted regarding cultural resources at the two candidate onsite locations. Communication and consultation, if necessary, would continue to identify and assess cultural resources and, if necessary, develop a cultural resource protection plan.

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