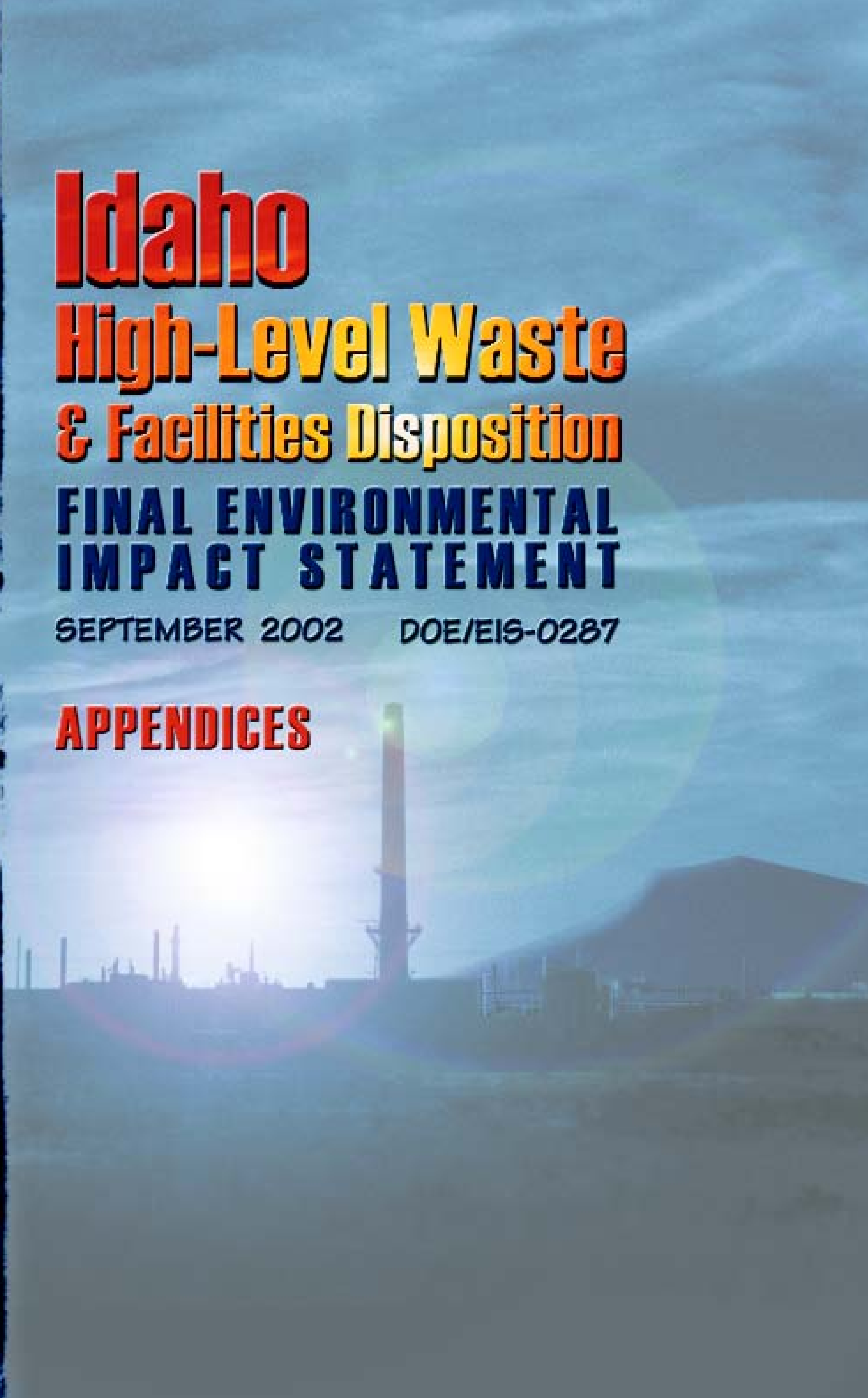

Idaho High-Level Waste & Facilities Disposition

FINAL ENVIRONMENTAL IMPACT STATEMENT

SEPTEMBER 2002 DOE/EIS-0287

APPENDICES

Appendix A

Site Evaluation Process

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Appendix A

Site Evaluation Process

A.1 Introduction

The U.S. Department of Energy (DOE) is preparing the Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (Idaho HLW & FD EIS), in accordance with the National Environmental Policy Act (NEPA), to evaluate alternatives for managing the high-level waste (HLW), ***mixed transuranic waste/sodium bearing waste (SBW)***, and associated radioactive wastes at the Idaho National Engineering and Environmental Laboratory (INEEL). ***Appendix B*** describes the process DOE used to identify potential alternatives to be analyzed in the EIS. Each of the alternatives and options ***other than No Action*** would involve constructing ***some*** new facilities.

Because HLW ***and mixed transuranic waste/SBW*** treatment and interim storage facilities and low-activity waste disposal facilities are options being evaluated in the Idaho HLW & FD EIS, DOE performed a preliminary site evaluation to assess the feasibility of locating such facilities on INEEL. This appendix describes the selection process that DOE used to identify locations for the potential siting of waste processing facilities (Section A.3) and disposal sites (Section A.4) in support of HLW operations. DOE has not made the final site selection decision. The preliminary site evaluation described in this appendix was used to identify potential sites to allow for impact analysis within the EIS. A complete description of the process used and the factors considered in identifying off-INEEL locations and sites for HLW treatment operations are included in DOE (1999).

A.2 Methodology

DOE used a qualitative approach based on existing data for the preliminary site evaluations. Only those criteria specific to the preliminary evaluation of locations were considered. Other concerns such as radiological consequences, risk assessment, site-specific seismic studies, site characterization, consequences to air quality, proximity to known Resource Conservation and Recovery Act (RCRA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, safety analysis, and other requirements for final site selection were deferred pending the analysis in the Idaho HLW & FD EIS. If it is determined through this EIS process that new facilities will be located on INEEL, the preliminary site evaluations can be used to define additional data needed to support final site selections.

The scope for the preliminary site evaluation included:

- Identify critical ("must") and desirable ("want") site criteria.
- Identify candidate locations on INEEL for both HLW treatment and interim storage facilities and the Low-Activity Waste Disposal Facility.
- Limit candidate sites for the HLW treatment and interim storage facilities to existing operational facilities or areas not located over the Snake River Plain Aquifer.
- Consider any location, including an area not over the Snake River Plain Aquifer, for the Low-Activity Waste Disposal Facility.
- Screen candidate sites against the critical and desirable criteria using existing information.
- Rank the candidate sites based on their relative suitability.

General assumptions applied to the preliminary site evaluations included:

- The new facilities will be dedicated primarily to the Idaho Nuclear Technology and Engineering Center (INTEC) wastes.
- Only sites on INEEL will be considered.
- If new facilities are constructed, appropriate site surveys, characterization, and risk assessment will be conducted before final site selection.
- DOE land-use plans will be observed.
- The draft U.S. Geological Survey approximate boundaries for the 100-year floodplain of the Big Lost River (Berenbrock and Kjelstrom 1998) are conservative and appropriate for preliminary site evaluation.

The first step in the evaluation process was to identify pertinent regulations for siting waste treatment, storage, and disposal facilities. Appendix A of Holdren et al. (1997) presents the results of this review of regulations. This information was used to develop two categories of site evaluation criteria: regulations with specific siting requirements designated as "must" criteria and regulations with recommendations for locating facilities designated as "want" criteria. In addition to the criteria that address regulatory requirements and recommendations, other "want" criteria were identified based on professional judgement. These other criteria address risk assessment, logistics, and other characteristics not clearly defined in regulations.

Once the criteria were determined, DOE identified candidate sites and performed initial screening against the criteria in preparation for decision analysis sessions. Candidate sites were identified based on professional judgement with the screening criteria in mind. ***Therefore,*** many areas of INEEL were not considered because of their inability to satisfy the screening criteria.

After the preliminary identification of criteria and screening of candidate sites was completed, decision analysis sessions were conducted to validate the results. Two decision analysis sessions were conducted, one for the HLW treatment and interim storage facilities and one for the Low-Activity Waste Disposal Facility. Participants from various areas of expertise (i.e., facility planning, transportation, safety, engineering, waste management, environmental affairs, risk assessment, hydrology, archeology, ecology, and seismology) formed an interdisciplinary team to ensure that all relevant screening criteria and viable candidate sites were identified and to evaluate the candidate sites against the screening criteria.

The decision analysis sessions began with refinement of the screening criteria. Through a consensus process, the team developed lists of criteria. The "want" criteria were assigned a weight, based on relative importance, on a scale of 1 to 10. A "want" criterion considered extremely important was assigned a weight of 10 with smaller weights assigned to criteria judged to be less critical. Criteria of equally perceived importance could be assigned equal weights.

The preliminary list of candidate sites was reviewed. With one exception, candidate locations for the HLW treatment and interim storage facilities were limited to current operational areas with at least some level of infrastructure. The preliminary list of candidate sites for the HLW treatment and interim storage facilities was accepted without change. Although the preliminary list contained candidate low-activity waste disposal sites representative of the most desirable physical characteristics of INEEL, three additional sites were added based on the potential to reuse previously disturbed areas.

The team then evaluated the candidate sites against the screening criteria. Sites were first evaluated against the "must" criteria. Any site failing to satisfy all of "must" criteria was eliminated from further consideration. If all of the "must" criteria were satisfied, the site was evaluated against the "want" criteria. For each "want" criterion, the candidate sites were assigned a value from 1 to 10 to describe how well, in the judgement of the team, the site satisfied the criterion. The site or sites that best satisfied the criterion were rated a 10, with lesser values assigned to the remaining sites.

The final component of the decision analysis was to compile overall rankings for the candidate sites based on the "want" criteria. The overall ranking was determined by calculating the product of the weight assigned to each criterion and the relative site ranking, and then summing the results.

DOE applied input from the decision analysis sessions during a secondary data gathering and screening phase to produce the final results. Data were gathered to support additional requirements defined during the decision analysis sessions. The relative comparisons of the candidate sites were then completed. A draft report was prepared and submitted to a peer-review committee comprised of members representing the areas of expertise pertinent to the preliminary site evaluation. In general, the comments generated by the peer review resulted in refinement or clarification of the information. No additional candidate locations or screening criteria were identified during the peer review.

A.3 High-Level Waste Treatment and Interim Storage Site Selection

The Idaho HLW & FD EIS analyzes facilities for treatment and interim storage of HLW and mixed transuranic waste/SBW that lie within the current INTEC boundaries. The INTEC candidate site for the proposed HLW processing facilities had the least impact to human health and the environment and the most advantageous logistical characteristics. DOE selected the site using a formal evaluation process that considered various INEEL locations and evaluated each against a set of evaluation criteria (Holdren et al. 1997). This section summarizes the HLW treatment and interim storage facilities site evaluation process.

A.3.1 IDENTIFICATION OF "MUST" CRITERIA

The first step in the evaluation process was to identify pertinent regulations for siting HLW treatment and interim storage facilities. For this evaluation, DOE assumed the HLW treatment and interim storage facilities would be subject to RCRA siting requirements and U.S. Nuclear Regulatory Commission (NRC) regulations. This step resulted in the development of a set of three specific siting requirements designated as "must" criteria:

1. Avoid the 100-year floodplain unless mitigations acceptable under RCRA are demonstrated

2. Avoid wetlands

3. Avoid critical habitats of endangered species

A.3.2 IDENTIFICATION OF "WANT" CRITERIA

In addition to those criteria formulated to address regulatory requirements and recommendations, DOE identified other "want" criteria based on professional judgment. These criteria address risk assessment, logistics, and other characteristics not clearly defined in regulations. Table A-1 provides the 17 "want" criteria and their relative weights.

A.3.3 IDENTIFICATION OF CANDIDATE SITES

With one exception, candidate sites were limited to existing operational areas because of the prohibitive costs that would be associated with establishing the new infrastructure (i.e., roads, utilities, emergency services, and technical and administrative support). For programmatic reasons, the analysis included one site ***that may*** not be over the Snake River Plain Aquifer and remote from existing facilities. There were twelve candidate sites evaluated for the HLW treatment and interim storage facilities:

1. INTEC

2. Central Facilities Area

3. Test Reactor Area

4. Power Burst Facility

5. Auxiliary Reactor Area

6. Argonne National Laboratory-West

7. Naval Reactors Facility

Table A-1. "Want" criteria and relative weights for the HLW treatment and interim storage facility candidate sites.

Criterion number	Relative weight	Criterion
1	8	Minimize potential impacts from earthquakes
2	4	Minimize proximity to the 500-year floodplain
3	3	Reduce risk of a release to a stream
4	3	Minimize local flooding and ponding
5	2	Minimize impact to riparian areas
6	5	Minimize impact to ecologically sensitive areas
7	9	Locate in areas controlled by the DOE Idaho Operations Office
8	3	Minimize impacts to cultural resources
9	8	Locate in an area with optimal surficial sediment and topography for construction
10	2	Avoid areas over perched water
11	2	Locate in an area with characteristics that would impede downward migration of contaminants
12	9	Locate near existing infrastructure
13	9	Minimize transportation costs
14	5	Avoid vegetation transects
15	5	Locate in accordance with projected land-use plans
16	10	Minimize transportation safety issues
17	8	Minimize environmental impacts from transportation

8. Radioactive Waste Management Complex

9. Test Area North

10. Experimental Breeder Reactor-I

11. Security Training Facility

12. Area north of the Big Lost River Sinks

Candidate sites 1 through 11 are located near or within existing INEEL operational areas. Site 12 was included to meet the programmatic need to consider a location ***that may*** not ***be*** over the Snake River Plain Aquifer. The locations of the candidate sites evaluated for the HLW treatment and interim storage facilities are shown in Figure A-1.

A.3.4 EVALUATION PROCESS

Because detailed specifications for the HLW treatment and interim storage facilities were not available, several assumptions were made for purposes of the preliminary site evaluation. These assumptions include:

- The facilities will include treatment, processing, and a co-located interim storage facility for HLW.
- Waste acceptance criteria for a federal repository will be finalized and the HLW from INTEC will eventually be transferred to a federal repository.
- The design description in Raytheon (1994) provides an adequate approximation of the required area for the HLW treatment and interim storage facilities (approximately 36,000 square meters), roughly equivalent to 9.2 acres.
- Up to five times the area of the facilities (180,000 square meters), equivalent to approximately 46 acres, may be required for construction, support facilities and future expansion.

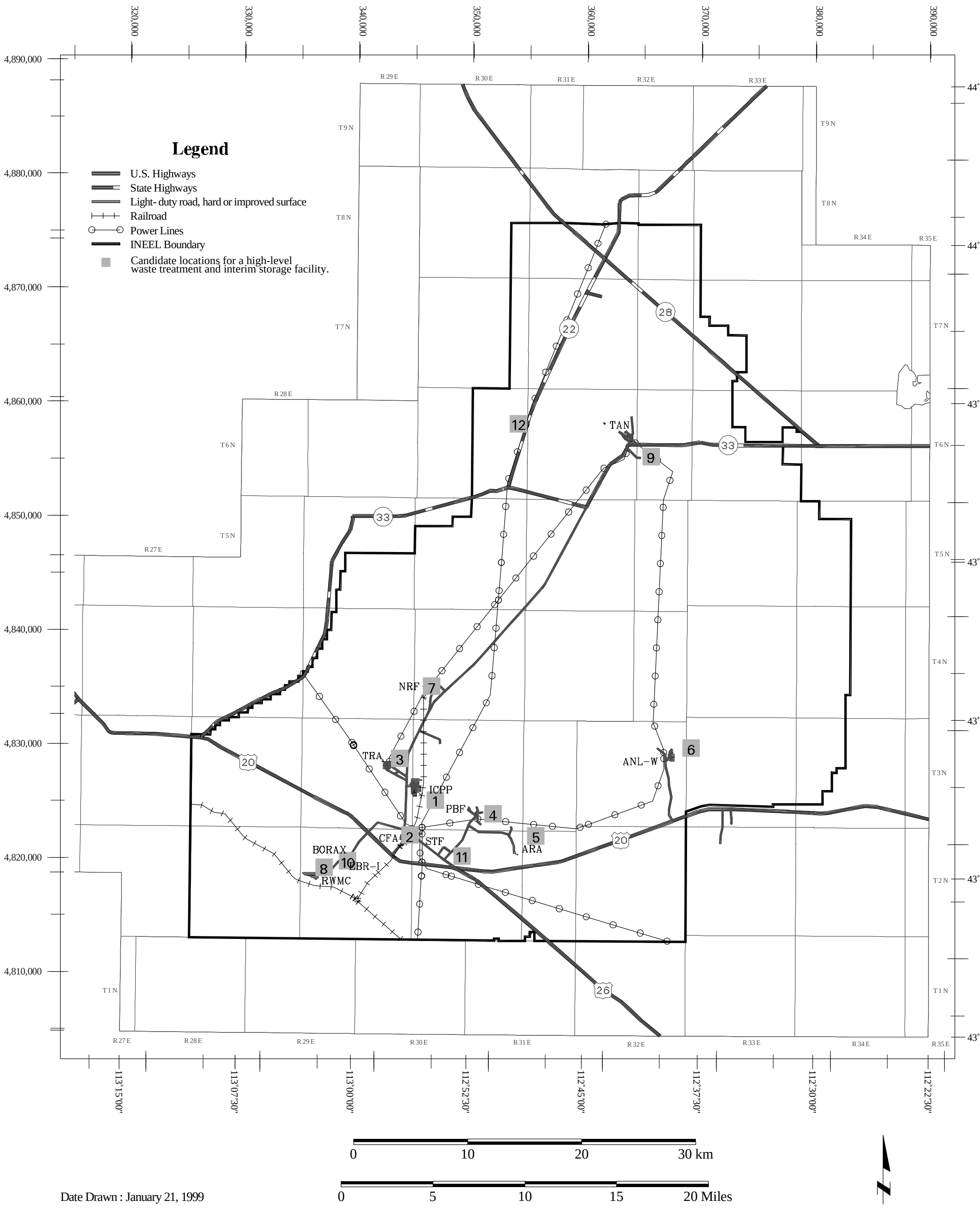

FIGURE A-1.
Candidate locations on the INEEL for HLW treatment and interim storage facilities.

- The facilities will process primarily INTEC waste.

- NRC licensing may eventually be negotiated for the HLW treatment and interim storage facilities.

- High activity liquid waste will be transported by pipeline. Transport by truck, rail, or other means is not currently feasible.

- The facilities will be housed in new construction. Existing buildings may be used for support activities ***and*** existing facilities may be reused for HLW treatment or interim storage facilities. ***However, existing facilities are already sited, therefore, they were not included in the siting evaluation.***

- Construction on sediment is significantly less costly than construction on basalt for comparable seismic designs.

- The HLW treatment and interim storage facilities will be classified as moderate hazard for purposes of seismic evaluation.

A.3.5 RESULTS OF EVALUATION PROCESS

Each of the candidate HLW treatment and interim storage facility sites satisfied the "must" criterion, although engineering controls or local restrictions may be required. If a candidate site had failed, it would have been eliminated from further consideration.

Each candidate site was then evaluated against the "want" criteria. Failure to satisfy one or more of these criteria is not a basis for eliminating a site from consideration. Depending on the relative importance of the criterion, engineering controls or other mitigative measures may be used to address the concern reflected by the criterion. In such cases, an estimate of the resources that may be required to implement the necessary engineering controls or mitigative measures is reflected in the relative site rankings. The relative ranking for the HLW treatment and interim storage facility candidate sites against the "want" criteria are provided in Table A-2.

For HLW treatment and interim storage facilities, the location at INTEC ranks far above the candidate sites in other operational areas on INEEL. The INTEC location meets the "want" criteria better than any other location because of the emphasis on transportation issues and infrastructure to support the new waste processing facilities. All other candidate sites require potentially hazardous and costly transportation of the waste from INTEC. With the exception of the area north of the Big Lost River Sinks (site 12), the range of scores for the remaining candidate sites is fairly small.

DOE is integrating its NEPA evaluation with other planning documents early in the decision-making process. In accordance with 40 CFR 1501.2(b), DOE must "identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses…." The site evaluation process used for the EIS provides comparative analysis and considers DOE needs (such as mission) beyond only environmental concerns. Environmental factors must be considered but do not necessarily require equal weighting with other factors.

A.4 Low-Activity Waste Disposal Site Selection

The processes being analyzed in the Idaho HLW & FD EIS alternatives produce a variety of waste types and forms. These include HLW, transuranic waste, low-level waste, mixed low-level waste, and industrial waste. Selection of the sites for disposal of these wastes is outside the scope of this EIS. These sites are or have been the subject of separate NEPA analyses. The Idaho HLW & FD EIS analyzes disposal of the low-activity waste fraction produced under ***various*** alternatives as either Class A or Class C-***type*** grout. A preliminary site evaluation was performed to identify a low-activity waste disposal site at INEEL for purposes of analysis in the EIS.

Table A-2. Total scores and overall rankings for HLW treatment and interim storage facility candidate sites.[a]

Number	Candidate site	Total weighted score	Percent of maximum score[b]	Overall rank
1	INTEC	872	92	1
2	Central Facilities Area	660	70	2
3	Test Reactor Area	634	67	3
4	Power Burst Facility	590	62	4
5	Auxiliary Reactor Area	524	55	7
6	Argonne National Laboratory-West	502	53	10
7	Naval Reactors Facility	503	53	9
8	Radioactive Waste Management Complex	529	56	6
9	Test Area North	506	53	8
10	Experimental Breeder Reactor I	471	50	11
11	Security Training Facility	557	59	5
12	Area north of Big Lost River Sinks	321	34	12

a. Details of the evaluation of candidate sites against each of the criteria can be found in Holdren et al. (1997).

b. The maximum possible score was 950.

The overall scores for the low-activity waste disposal candidate sites indicate that several locations on INEEL would be suitable for such a disposal facility. The two highest scoring locations were a site near INTEC and a location in the central part of INEEL (near U.S. Geological Survey Site 14) removed from current operational facilities. The advantages of the INTEC location include reuse of a previously disturbed area, reduced transportation hazards, and existing seismic hazard evaluation. The other location is in a pristine area far away from existing INEEL infrastructure, but has characteristics that offer better natural reduction of contaminant migration in the vadose zone.

In this EIS, DOE analyzed one onsite location. Although there are geohydrological differences across the INEEL, the single location analyzed would be representative of many potential locations that DOE could select within the INEEL boundaries. A site co-located with the INTEC was selected for analysis. The general location of this site identified by Holdren et al. (1997) was narrowed to a specific location for analysis in the EIS (Kiser et al. 1998).

A.4.1 IDENTIFICATION OF "MUST" CRITERIA

The first step in the evaluation process was to identify pertinent regulations for siting waste disposal facilities. For this preliminary evaluation, DOE assumed the Low-Activity Waste Disposal Facility would be subject to NRC regulations. RCRA regulations would not apply because DOE has assumed that the low-activity waste would be delisted prior to disposal (see Chapter 6). The result of this step was the development of a set of four specific siting requirements designated as "must" criteria:

1. Avoid the 100-year floodplain

2. Avoid wetlands

3. Avoid critical habitats of endangered species

4. Avoid areas in which tectonic processes such as faulting, folding, seismic activity, or vulcanism (1) may occur with such frequency and extent to significantly affect

the ability of the disposal site to meet performance objectives or (2) may preclude defensible modeling and prediction of long-term impacts.

A.4.2 IDENTIFICATION OF "WANT" CRITERIA

In addition to those criteria formulated to address regulatory requirements, "want" criteria were developed based on regulatory recommendations and professional judgement. Table A-3 provides the 19 "want" criteria and their relative weights. Most of the "want" criteria for the Low-Activity Waste Disposal Facility are duplicates of those identified for the HLW treatment and interim storage facilities. However, the relative weights assigned to the Low-Activity Waste Disposal Facility emphasize environmental issues because this facility would be a disposal facility whereas the HLW treatment and interim storage facilities would have limited operational lifetimes.

A.4.3 IDENTIFICATION OF CANDIDATE SITES

The only limitation applied to selecting the candidate sites for the Low-Activity Waste Disposal Facility was that they be located within the boundaries of INEEL. The evaluation included a site ***that may*** not ***be*** over the Snake River Plain Aquifer. DOE based selection of candidate sites on professional judgment, as well as familiarity with the physical characteristics of INEEL and the potential influence of those characteristics on risk to human health and the environment. Many areas of INEEL were not considered because of their inability to satisfy screening criteria. The 16 candidate low-activity waste disposal sites evaluated were:

1. Area north of Big Lost River Sinks
2. Area south of INTEC
3. Near Auxiliary Reactor Area
4. Near Power Burst Facility
5. Near Test Reactor Area
6. Near Test Area North
7. Near the Radioactive Waste Management Complex
8. Near the New Production Reactor site
9. Near U.S. Geological Survey (USGS) Site 14
10. Near Corehole 2-2A and USGS-18
11. Playa area southeast of USGS Site 14
12. Crater in Section 23
13. Area near the Second Owsley Canal
14. Near Argonne National Laboratory - West
15. Within the Naval Ordnance Disposal Area
16. Near the Security Training Facility

The locations of the candidate sites evaluated for the Low-Activity Waste Disposal Facility are shown in Figure A-2.

A.4.4 EVALUATION PROCESS

The screening process used for the Low-Activity Waste Disposal Facility resembled the process described for the HLW treatment and interim storage facilities site. For the most part, the same methodology was used to evaluate Low-Activity Waste Disposal Facility candidate sites. The major difference was that the environmental criteria received more weight.

Because detailed specifications for the Low-Activity Waste Disposal Facility were not available, several assumptions were made for purposes of the preliminary site evaluation. These assumptions include:

- The waste will be grouted solid waste that will be delisted and meet the applicable RCRA Land Disposal Restrictions standards (i.e., the waste will not be regulated as hazardous waste under RCRA).

Table A-3. "Want" criteria and relative weights for the Low-Activity Waste Disposal Facility candidate sites.

Criterion number	Relative weight	Criterion
1	6	Minimize potential impacts from earthquakes
2	2	Minimize proximity to the 500-year floodplain
3	5	Reduce risk of release to a stream
4	8	Minimize local flooding and ponding
5	3	Minimize impact to riparian areas
6	7	Minimize impact to ecologically sensitive areas
7	9	Locate in areas controlled by the DOE Idaho Operations Office
8	7	Minimize impact to cultural resources
9	6	Locate in an area with thick surficial sediment
10	8	Avoid areas over perched water
11	10	Locate in an area with characteristics that impede the downward migration of contaminants
12	4	Locate in an area conducive to future expansion
13	2	Locate in accordance with projected land use plans
14	6	Locate near existing infrastructure
15	8	Minimize transportation issues
16	8	Locate in an area where discriminatory monitoring can be achieved
17	9	Avoid vegetation transects
18	8	Use previously disturbed areas
19	1	Avoid unexploded ordnance areas

- The waste will meet requirements for classification as low-level waste.

- The Low-Activity Waste Disposal Facility will be an engineered structure designed to achieve long-term stability (i.e., for at least 500 years) and potential release from the disposal facility after 500 years will be sufficiently slow to maintain risk below acceptable levels. Locations were evaluated on the basis of natural and logistical considerations such as stable terrain and proximity to existing roads. Long-term stability during operation and ultimate closure of the facility will be dependent on engineering controls.

- In the absence of U.S. Environmental Protection Agency (EPA) siting regulations relative to earthquake ground motion and unstable terrain, it was assumed that compliance with RCRA, DOE, and NRC regulations would suffice to address any EPA concerns.

- The waste volume to be disposed of will be no greater than 25,000 cubic meters based on approximations for either Class A or Class C grout developed by Lockheed Martin Idaho Technologies Company.

- A minimum depth of 3 meters of surficial sediment is mandated by landfill design criteria.

A.4.5 RESULTS OF EVALUATION PROCESS

The overall scores for the candidate sites indicate that there are several locations on INEEL suitable for a Low-Activity Waste Disposal Facility. The total scores and relative ranking for the candidate sites against the "want" criteria are provided in Table A-4.

The scores for the top four candidate sites vary by less than 10 percent. Therefore, these sites could be worthy of further consideration in a final site selection study.

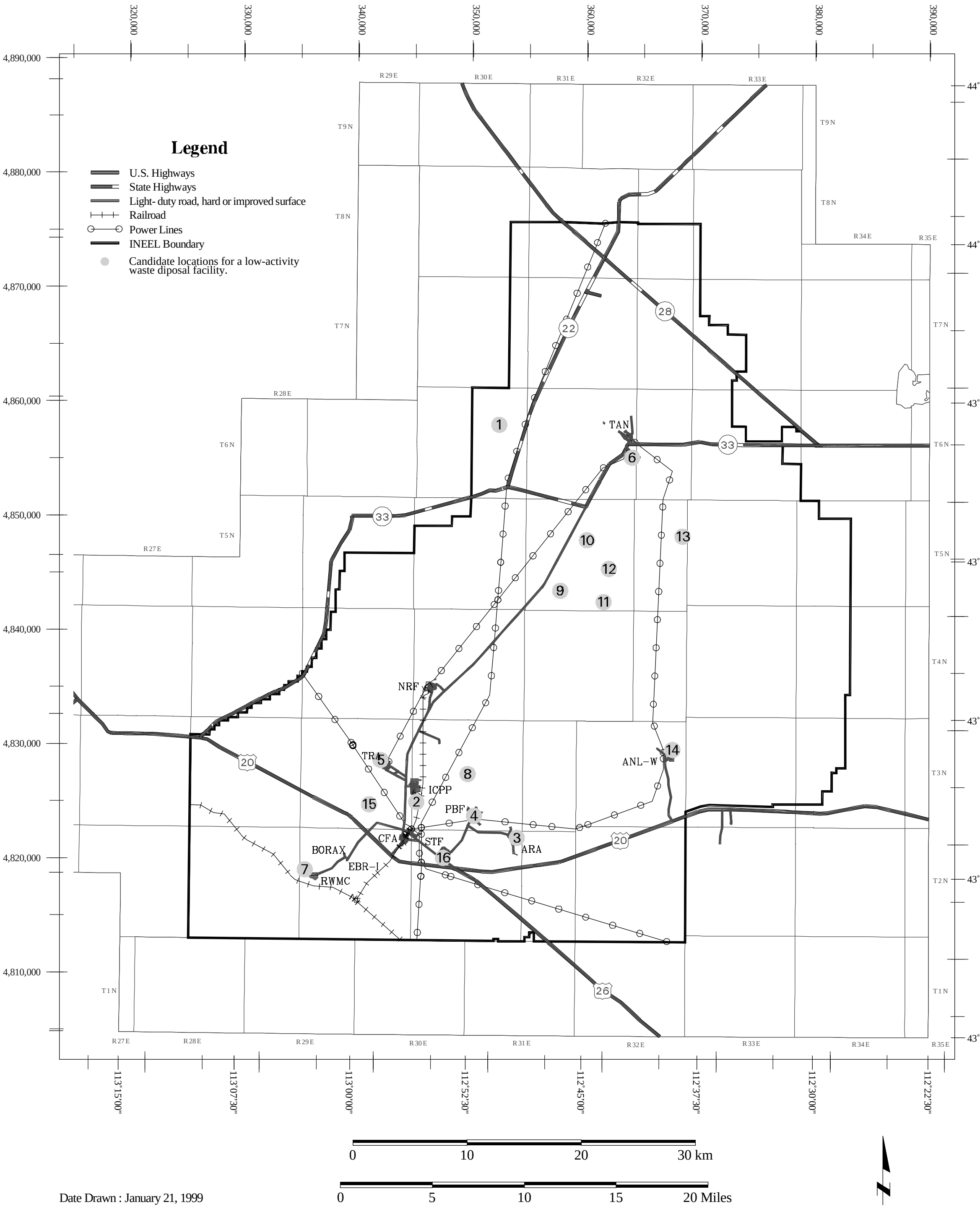

FIGURE A-2.
Candidate locations on the INEEL for a Low-Activity Waste Disposal Facility.

Table A-4. Total scores and overall rankings for Low-Activity Waste Disposal Facility candidate sites.

Number	Candidate site	Total weighted score	Percent of maximum score[a]	Overall rank
1	Area north of Big Lost River Sinks	NA[b]	NA	NA
2	Area south of INTEC	976	83	1
3	Near Auxiliary Reactor Area	823	70	5
4	Near Power Burst Facility	821	70	6
5	Near Test Reactor Area	897	77	3
6	Near Test Area North	774	66	11
7	Near the Radioactive Waste Management Complex	690	59	15
8	Near the New Production Reactor site	778	67	10
9	Near USGS Site 14	924	79	2
10	Near Corehole 2-2A and USGS-18	806	69	7
11	Playa area southeast of USGS Site 14	749	64	13
12	Crater in Section 23	709	61	14
13	Area near the Second Owsley Canal	758	65	12
14	Near Argonne National Laboratory - West	793	68	8
15	Within the Naval Ordnance Disposal Area	867	74	4
16	Near the Security Training Facility	787	67	9

a. The maximum possible score was 1,170.

b. NA means not applicable. The area north of the Big Lost River Sinks (site 1) failed the screening against the "must" criteria and was not evaluated further against the "want" criteria.

The preliminary evaluation used existing data for the candidate sites. Total scores for some candidate sites (9, 10, 11, 12, and 13) could be higher because the average data for the cumulative sediment and surficial sediment thicknesses at these location may not be representative of the maximum possible score. Knowledge of these areas supports the conclusion that the sediment thicknesses are probably greater than indicated by the currently available data used in the preliminary site evaluation. These sites may be worthy of further consideration in a final site selection study.

A.4.6 FINAL SELECTION OF A LOW-ACTIVITY WASTE DISPOSAL FACILITY SITE FOR ANALYSIS

After further considering the preliminary evaluation, DOE selected a specific location adjacent to INTEC as the site to be analyzed in the EIS (Kiser et al. 1998). The final selection of the analysis site resulted from a determination that the site was the most cost-effective for inclusion in the feasibility design process. This site is generally located outside the southeast corner of and as near as possible to the INTEC security perimeter fence. (Subsequently, DOE also selected the Envirocare facility 80 miles west of Salt Lake City to be analyzed to provide an off-INEEL evaluation for disposal of the Class A grout produced under the Full Separations and Planning Basis options ***and the Chem - Nuclear Systems facility in Barnwell, South Carolina to be analyzed for disposal of Class C grout produced under the Transuranic Separations Option***.)

A.5 Conclusions and Summary

Evaluation of many site characteristics provides useful insight for decision-making and points out some of the tradeoffs that must be made. Each candidate location offers some advantages over the others for both waste processing and disposal. For example, if aquifer protection were the most important consideration for a Low-Activity Waste Disposal Facility, a site within the thick lake sediments in the central portion of INEEL would be desirable. This area is also conducive to construction. However, this generally low elevation and low-relief area is sometimes subject to local flooding events. If protection from flooding were a major criterion, the basalt highlands offer good choices but may involve some sacrifice of aquifer protection or ease of construction. These highland areas are also far from existing infrastructure and would require waste transport over several miles.

Unlike the preliminary evaluation of candidate sites for HLW treatment and interim storage facilities that indicated clear advantages for siting the facilities at INTEC, the range of total weighted scores for the Low-Activity Waste Disposal Facility was very small. Emphasis on environmental issues (e.g., Criterion 11 - Locate in an area with characteristics that impede downward migration of contaminants) tended to balance against other highly weighted criteria. The overall scores for the Low-Activity Waste Disposal Facility candidate sites indicate that there are several suitable locations on INEEL. If it is determined that a Low-Activity Waste Disposal Facility will be constructed at INEEL, the final site decision analysis must determine whether locations, such as the INTEC site that reuse previously disturbed areas ***and*** reduce transportation hazards, have been favorably evaluated for seismic hazards and possess physical characteristics that impede contaminant migration are preferred over pristine locations such as U.S. Geological Survey Site 14 that offer better natural reduction of contaminant migration but are not in the preferred seismic zones and are far away from existing INEEL infrastructure.

Appendix A References

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Appendix B

Alternative Selection Process

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Alternative Selection Process

This appendix is a summary of the process used to identify the alternatives found in this EIS. Of particular importance is Section B.9. Sections B.9.1 and B.9.2 describe the process used to identify the Decision Management Team's recommended preferred alternative. Section B.9.3 describes the Decision Management Team's recommended alternative, DOE's preferred alternative, and the State of Idaho's preferred alternative.

B.1 Introduction

The U.S. Department of Energy (DOE) is preparing the Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (Idaho HLW & FD EIS), in accordance with the National Environmental Policy Act (NEPA), to support the HLW decision-making process at the Idaho National Engineering and Environmental Laboratory (INEEL) formerly called the Idaho National Engineering Laboratory or INEL. Under NEPA in 40 CFR 1502.14(a), an EIS must "rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."

The Notice of Intent for the Idaho HLW & FD EIS (62 FR 49209; September 19, 1997) identified three initial alternatives for managing the HLW at INEEL: the Proposed Action or Separations Alternative, No Action Alternative, and Non-Separations Alternative. ***Since the issuance of the Notice of Intent and in the course of public scoping and review of public comments that include Tribal issues, private sector industry, State of Idaho, and agency comments on the Draft Idaho HLW & FD EIS, DOE has added a number of alternatives or options.***

B.2 Purpose

The purpose of this appendix is to describe the selection process that DOE employed to identify a range of reasonable waste processing alternatives for the Idaho HLW & FD EIS, including the identification and application of the criteria for assessing the validity of candidate alternatives.

The Council on Environmental Quality regulations direct all Federal agencies to use the NEPA process to identify and assess the reasonable alternatives to proposed actions that would avoid or minimize adverse effects of these actions upon the quality of the human environment [40 CFR 1500.2(e)]. These regulations further state that "reasonable alternatives include those that are practical or feasible from a common sense, technical, or economic standpoint. The number of reasonable alternatives considered in detail should represent the full spectrum of alternatives meeting the agency's purpose and need; but an EIS need not discuss every unique alternative, when an unmanageable number is involved."

The primary steps of the alternative selection process are:

- Review previous HLW management studies, DOE EISs, technical literature, industry recommendations, and stakeholder comments
- Identify an initial list of candidate alternatives
- Review engineering studies and public input
- Revise initial set of candidate alternatives based on recent studies and ***public*** input following the Notice of Intent and scoping meetings
- Identify screening criteria to evaluate the candidate alternatives
- Describe criteria that were used to assess each alternative
- Apply the screening criteria to each candidate alternative
- Select the recommended set of candidate alternatives

B.3 Identification of Candidate Alternatives

B.3.1 ANALYSIS OF PREVIOUS INEEL AND OTHER HLW DOE STUDIES

"Historical Fuel Reprocessing and HLW Management in Idaho" (Knecht et al. 1997)

A summary of historical fuel reprocessing and waste management at the Idaho Nuclear Technology and Engineering Center (INTEC) (formerly called the Idaho Chemical Processing Plant or ICPP) appeared in Radwaste Magazine (Knecht et al. 1997). The article outlines some of the early technology development work at INTEC and includes 40 references related to waste forms produced from calcine, such as metal spray coating, grout matrix, metal matrix, glass, and ceramic. Early studies were also carried out in calcine retrieval, calcine dissolution, calcine stabilization, and transuranic element separation. In many cases, results of early technology development work were used to develop pre-conceptual design and costs. The design information supported the INEEL portion of a number of complex-wide defense waste management studies under the Atomic Energy Commission and the Energy Research and Development ***Administration***, predecessors to DOE.

Alternatives for Long-Term Management of Defense High-Level Waste, Idaho Chemical Processing Plant, ERDA 77-43 (ERDA 1977)

This INTEC report evaluated and provided cost and risk estimates for three alternatives: (1) retain the waste at INTEC in retrievable storage facilities; (2) ship the waste to a geologic repository; and (3) remove (separate) the actinides, ship the actinides to a geologic repository, and store the remaining waste at INTEC. Waste form options under these alternatives included calcine pelletization, metal matrix, and sintered glass ceramic to span the range of calcine, concrete, metal, glass and ceramic waste forms.

Environmental Evaluation of Alternatives for Long-Term Management of Defense High-Level Radioactive Waste at the ICPP, IDO-10105 (DOE 1982a)

The subject evaluation considered four alternatives: (1) calcine all waste and leave calcine in place (no action); (2) retrieve, modify the calcine, and dispose of modified calcine at INEEL; (3) retrieve, separate the actinides, dispose of the actinides offsite, and dispose of the remaining waste at INEEL; (4) delay retrieval, modify the calcine, and dispose of the calcine offsite. In this study the waste form options included calcine, glass or pelletized calcine, glass or stabilized calcine, glass for actinides, and calcine for onsite disposal.

Long-Term Management of Defense High-Level Radioactive Wastes [Research and Development Program for Immobilization], Savannah River Plant, DOE/EIS-0023 (DOE 1979)

From 1970 to 1983 events outside of INEEL, such as waste-form research at DOE's Savannah River Site (SRS) influenced the INEEL HLW research and development program. As a result, DOE HLW management became focused on treating wastes first at SRS, then Hanford Site, and finally Idaho. In 1977, DOE issued ***the long-term management*** EIS for HLW immobilization research and development. That EIS evaluated a number of potential HLW forms, and a follow-on environmental assessment selected borosilicate glass as the preferred form (DOE 1982b).

The Defense Waste Management Plan, DOE/DP-0015 (DOE 1983)

This plan established a schedule for waste treatment and assumed that the Savannah River Site and Hanford Site would vitrify their HLW. INEEL was assumed to construct a new facility to immobilize newly generated liquid waste as well as calcined HLW with annual production of approximately 500 HLW canisters. This plan provided estimates of HLW volumes to be generated through 2015. Subsequently, the DOE-Idaho Operations Office completed the study (DOE 1983) in 1983 to evaluate reducing waste volumes by more efficient fuel processing methods.

ICPP Tank Farm System Analysis (WINCO-1192) (WINCO 1994)

This Tank Farm study proposed 14 variations of HLW separations alternatives. These alternatives differ with respect to the start of separations and immobilization operations, the number of calcining campaigns required, and various calcine pretreatment and treatment technologies. The conclusion was that the separations variations produced significant differences in calcine processing rates, bin set storage requirements, and final waste forms. This study underscored the advantages of a separations alternative and brought out the possibility of HLW calcine vitrification as a viable non-separations option.

SBW Treatment Study, WBP-8-95/ALO-3-95 (LITCO 1995a)

This study evaluated options for meeting the Notice of Noncompliance Consent Order to cease use of the INTEC pillar and panel tanks and the remaining tanks in the Tank Farm. The study addressed 15 separations and non-separations alternatives. The separations alternatives used an evaporation precipitation technique to reduce the sodium content of the SBW prior to calcining; the separations options also included cesium, strontium, and transuranic extraction methods for separating the high-activity fraction from the low-activity fraction. The non-separations alternatives focused on improving the calcine process by high-temperature operation or using additives such as aluminum nitrate, silica, and sugar to reduce the SBW volume. The study also included an alternative to ship all the concentrated SBW to Hanford for interim storage and processing.

ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Technical Report and Recommendation, INEL-94/0019 (LITCO 1995b)

The purpose of this evaluation was to support DOE in developing a strategic plan to manage INTEC radioactive liquid and calcined waste by presenting performance data for candidate alternatives. The study addressed 27 alternatives for waste treatment including both separations and non-separations techniques. These alternatives varied with respect to facilities, SBW treatment, calciner operations, and calcine treatment. Screening against six criteria led to radionuclide partitioning as one of the top options to be considered. The report recommended a two-phased implementation of a high-activity waste immobilization plant to spread the funding requirements over a longer time period.

HLW Alternatives Evaluation, WBP-29-96 (LMITCO 1996)

This study reviewed calcination and separations to determine the best path forward for INTEC HLW management. Both approaches ***would*** meet the Settlement Agreement/Consent Order and are technically feasible; the primary discriminator is cost. These approaches were developed into three basic options: (1) calcination of HLW until June 1998 and SBW until 2012; (2) calciner shutdown in 2001, radionuclide separation/grouting beginning in 2010, and calcine retrieval, dissolution, and separation commencing in 2015; and (3) separations and shipping of the high-activity waste offsite for immobilization and storage.

Regulatory Analysis and Proposed Path Forward for the Idaho National Engineering Laboratory High-Level Waste Program, DOE/ID-10544 (DOE 1996)

This report *is* a HLW regulatory analysis of the radionuclide constituents, identification of Resource Conservation and Recovery Act (RCRA) hazardous constituents, and plans for closure of the INTEC Tank Farm and bin sets. The report offered four major alternatives for consideration: no action, planning basis (DOE 1998), full treatment (separations), and limited vitrification.

B.3.2 CONSIDERATION OF PUBLIC COMMENTS

DOE conducted public scoping workshops on the Idaho HLW & FD EIS on October 16, 1997 in Idaho Falls, Idaho and on October 23, 1997 in Boise, Idaho. These public workshops and written scoping comments provided DOE public input about issues and potential alternatives that should be addressed in the Idaho HLW & FD EIS.

DOE also received scoping comments from the State of Idaho INEEL Oversight Program (Trever 1997), the State of Nevada Nuclear Waste Project Office (Loux 1997), and the INEEL Citizens Advisory Board (Rice 1997). All public comments were considered in developing the candidate alternatives for the Idaho HLW & FD EIS. A summary of the major ***public*** concerns appears in the next section; a list of new or modified alternatives obtained from the public inputs is shown later in ***this appendix***.

B.3.2.1 Overall *Public* Concerns

Treatment Criteria - At this time, there is considerable uncertainty regarding the proposed repository at Yucca Mountain and the final technical standards for wastes to be disposed of there. Given those uncertainties, determine what criteria DOE should use to establish that the waste form(s) produced are suitable for disposal in a geologic repository outside the State of Idaho (i.e., that a "road-ready" waste form has been achieved).

Disposal - If a geologic repository is not available, determine what other disposal options exist for HLW outside the State of Idaho.

Storage/Disposal in Idaho - Clearly examine and explain any proposal to store or dispose of treated waste over the Snake River Plain Aquifer, including performance-based or landfill closure of the Tank Farm as opposed to clean closure.

Hazardous Constituents - Develop a strategy for dealing with RCRA-regulated hazardous constituents.

Technical Viability/Privatization - Demonstrate in advance that the alternative selected will work.

Cost-risk Benefits - The alternative selected should reduce health and safety risks enough to justify the cost of treatment and any additional risk to workers posed by the treatment activities.

Funding - Cleanup of the INEEL site is important, and the Federal government should seek adequate funding to honor its commitments to do so.

Compliance Concerns - Numerous, and in some cases conflicting, compliance requirements exist for INEEL HLW management and facilities disposition activities. These conflicts should be clarified, and the compliance factors prioritized.

B.3.2.2 Public Comments Applied to Alternative Development

The following comments relate to new or modified alternatives resulting from ***public*** input. DOE considered these comments when preparing the list of Idaho HLW & FD EIS candidate alternatives.

- Include a true no action alternative-i.e. lock up and walk away.

- Postpone any action until waste decays to non-harmful levels, better technologies are developed, or disposal sites are identified.

- Calcine now, store ***the calcine*** onsite, and treat ***the calcine*** later when DOE disposal sites are available.

- Fully review options for disposing ***of*** INEEL HLW onsite in Idaho.

- Dispose of high-activity and low-activity waste offsite, such as in a new repository.

- ***Provide long-term storage of*** both high-activity and low-activity waste onsite.

- ***Remove*** the transuranics ***from the*** HLW**,** dispose of ***TRU*** at the Waste Isolation Pilot Plant, and dispose of the ***high-activity fraction*** at INEEL.

- Identify alternatives for bin set and Tank Farm closure including clean closure of HLW tanks.

- Consider a wide range of separations technologies.

- Vitrify all HLW before or after calcination.

- Consider technologies from other sites and countries.

- Ship HLW ***elsewhere*** for treatment and long-term storage such as the Nevada Test Site in Nevada.

- Explore volume reduction, filtration, and encapsulation technologies.

- Modify the No Action Alternative to include placement of calcine in closed INTEC tanks.

- Analyze treatment and disposal alternatives separately.

- Develop alternatives for facility disposition.

- Analyze all waste in all bin sets and tanks ***to determine*** all hazardous constituents.

- Use the same process the Hanford Site is using for waste immobilization.

- Don't let Yucca Mountain waste volume restrictions drive technology development; the Yucca Mountain repository may never open.

B.3.3 CANDIDATE ALTERNATIVES

DOE's first step in conducting the candidate alternative selection process was to review previous DOE and INTEC HLW studies as described earlier in this appendix. The ***review*** included five major INTEC waste treatment studies conducted between January 1994 and September 1997 and helped to ensure that DOE ***considered*** all reasonable and viable alternatives. Potential alternatives were then identified through a systematic, iterative process that used several sources including: (1) previous INTEC HLW studies, (2) value engineering sessions, and (3) ***public*** comments received during the Idaho HLW & FD EIS scoping process.

B.3.3.1 Alternatives Considered for Initial Analysis

This process resulted in an initial set of potential candidate alternatives for consideration in the Idaho HLW & FD EIS. The candidate alternatives include waste processing, interim storage, transportation, and final disposal options. It is important to note that each candidate alternative is composed of individual process stages (e.g., HLW treatment, interim storage, and/or disposal of low-activity grout) that are independent. Therefore, each candidate alternative is a combination of possible process stages that may be modified. This modular approach will allow DOE greater programmatic flexibility in implementing the HLW alternatives and coordinating programs and technologies from other DOE sites. DOE identified the following waste processing alternatives and options for initial EIS screening, analysis, and evaluation.

1. No Action Alternative (as described in the Notice of Intent)
2. Separations Alternatives
    A. Full Separations
    B. 2006 Plan

   - C. Transuranic Separations/Class A Grout
   - D. Transuranic Separations/Class C Grout

3. Non-Separations Alternatives
   - A. Vitrified Waste
   - B. Hot Isostatic Pressed Waste
   - C. Cement-Ceramic Waste
   - D. Direct Cement Waste

Additional information concerning these candidate alternatives considered for initial analysis is provided in DOE (1999a).

B.3.3.2 Alternatives Not Considered for Initial Analysis

Several candidate alternatives were eliminated from initial EIS analysis. These alternatives were not considered for one or more of the following reasons: (1) did not meet the purpose and need of the EIS, (2) required significantly more development work to achieve technical maturity, (3) was very similar to or was bounded by other alternatives, or (4) was judged to be impractical or too costly for consideration.

Alternatives Rejected for Technological Reasons

- In situ vitrification
- Upgrading tanks for long-term storage
- Use of Hanford crystalline silicotitanate technology
- Storage of wastes in long-lasting concrete containers
- Homogenization and mixing of various wastes (i.e., slurry)
- Use of small solid units to fill tanks versus poured liquids

Alternatives Rejected That Do Not Support the EIS Purpose and Need

- Treatment of Argonne National Laboratory-West spent nuclear fuel at INTEC
- Burning of HLW in a reactor such as the Integral Fast Reactor
- Importing other sites' HLW to INEEL for treatment and interim storage
- Use of old INTEC facilities as a second HLW repository

B.4 Evaluation of Candidate Alternatives

The primary purpose of this preliminary EIS alternative evaluation was to evaluate the candidate alternatives identified in Section B.3 and identify a reasonable set of alternatives for the Idaho HLW & FD EIS. The secondary purpose of this alternative evaluation ***was*** to provide a sound, traceable, and defensible process to support the final selection of Idaho HLW & FD EIS alternatives. These alternatives provided for the treatment, storage, and disposition of HLW and SBW currently managed at the INTEC.

B.4.1 EVALUATION METHODOLOGY

The methodology for the identification of the candidate alternatives was based upon a comprehensive evaluation of all potential alternatives with respect to six essential Idaho HLW & FD EIS criteria (see next section). A DOE team of experienced personnel, who qualitatively assessed each alternative against the criteria, performed the evaluation. The DOE Team was asked to recommend reasonable candidate alternatives with high potential to meet the criteria.

Prior to the evaluation of the candidate alternatives, DOE reviewed ***the studies listed in Section B.3.1***. The team focused on identifying important program considerations, ***public*** sensitivities, and related waste management data that would help evaluate potential alternatives with respect to each criterion.

The DOE Team then systematically applied the criteria to all candidate alternatives to assess how well each alternative met the program goals and ***public*** concerns. The assessment of each alternative with respect to each criterion was done on a qualitative basis. Each alternative was given one of three ratings for each criterion as shown in Table ***B-1***.

After reviewing the reference materials and conducting a structured ***assessment***, the DOE Team rated all candidate alternatives with respect to each of the six evaluation criteria. Then the team ***determined*** an overall rating for the alternatives with respect to each criterion. The team addressed each criterion in turn to ensure that all essential elements of each criterion were assessed and that the final qualitative ratings represented a team consensus.

The DOE Team completed ***the*** final analyses to determine which alternatives were considered reasonable and retained as an EIS candidate alternative. The team made a diligent effort to include a ***range of*** reasonable alternatives with potential to satisfy DOE program requirements and public concerns.

The DOE Team also ***identified*** potential new alternatives that were not included in the initial set of candidate alternatives. The team accomplished this by reviewing the processes involved in selecting the initial set of candidate alternatives, then applying their knowledge of HLW management technologies. This process resulted in the identification of the following additional alternatives for evaluation: (1) a No Action Orderly Shutdown Alternative, and (2) an Early Vitrification Option under the Non-Separations Alternative. The team then evaluated these two additional alternatives against the evaluation criteria described below.

Table B-*1*. Candidate alternatives.

Candidate alternative	Rating					
	Mission	Cost	Technical Feasibility	ES&H	Public ***Concerns***	Program Flexibility
1. No Action						
1A Notice of Intent	–	0	+	0	–	+
1B Orderly Shutdown	–	+	+	–	–	–
2. Separations						
2A Full Separations	+	0	+	0	0	0
2B 2006 Plan	+	–	+	–	0	0
2C Transuranic Separations/ Class A Grout	+	0	+	0	0	0
2D Transuranic Separations/ Class C Grout	+	0	+	0	+	0
3. Non-Separations						
3A Vitrified Waste	+	–	+	0	+	–
3B Hot Isostatic Pressed Waste	0	0	+	–	0	–
3C Cement-Ceramic	0	0	–	–	0	–
3D Direct Cement	0	0	+	0	0	–
3E Early Vitrification	+	–	0	0	+	–

Plus (+) = Expected to satisfy the criteria with minor deficiencies or concerns
Zero (0) = Expected to satisfy the criteria with some deficiencies or concerns
Minus (–) = Expected to satisfy the criteria with major deficiencies or concerns

B.4.2 EVALUATION CRITERIA

A major step of the evaluation methodology was to develop selection criteria. DOE developed the screening criteria to be used for selecting the set of alternatives. First, DOE determined the criteria should have the following attributes:

- Defensible, and clear to all parties
- Appropriate for waste processing alternative evaluation
- Limited to major program considerations and ***public*** concerns
- Easily evaluated by qualitative methods and analysis
- Inclusive of all major areas of concern and program viability

DOE then reviewed the selection criteria used in previous HLW studies and two recent DOE Environmental Impact Statements: the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (SNF & INEL EIS) (DOE 1995) and the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a). ***As a result, DOE developed the following criteria:***

- ***Program Mission***
- ***Cost Factors***
- ***Technical Feasibility***
- ***Environment, Safety, and Health***
- ***Public Concerns***
- ***Program Flexibility***

B.4.3 APPLICATION OF CRITERIA TO CANDIDATE ALTERNATIVES

B.4.3.1 Program Mission

The Program Mission criterion is essential to assessing capability of the alternatives to meet DOE complex-wide and INEEL HLW program objectives, major regulatory milestones, and legal obligations. Table B-***1*** presents the ratings of the candidate alternatives against this criterion.

For the Program Mission criterion, both options under the No Action Alternative were assessed minus (-) ratings. These alternatives do not meet the Settlement Agreement/Consent Order requirement to have all HLW road ready by 2035, and they do not address the long-term issue of removing all HLW from the State of Idaho, nor does the Orderly Shutdown Option meet the requirement to complete calcination of liquid SBW by 2012.

All four separations alternatives were assessed a plus (+) rating with minor deficiencies or concerns. Since the separations concept was driven by program mission requirements to reduce HLW disposal volume, the high ratings were expected. The separations options may lower the HLW volume for repository disposal to minimize transportation risk and cost, and they are consistent with DOE planning documents such as the Environmental Management Contractor Report (EMI 1997), *Accelerating Cleanup: Paths to Closure* (DOE 1998), and NEPA Records of Decision (RODs), with minor exceptions.

Under the Non-Separations Alternative, the Vitrified Waste and Early Vitrification Options were assessed a plus (+) rating because both would meet the essential requirements of the Settlement Agreement/Consent Order and produce a final waste form (borosilicate glass) that has a high probability of acceptance at a geologic repository. The other three options under the Non-Separations Alternative were assessed a zero (0) rating with some deficiencies or concerns. All three options would require a determination of equivalency by the U.S. Environmental Protection Agency (EPA).

B.4.3.2 Cost Factors

Inclusion of the Cost Factors criterion was considered essential because this EIS proposes a DOE Federal project that would be supported by ***Congressional appropriations***. This cost criterion includes consideration of life-cycle costs, ten-year costs, peak funding requirements, and the results of an independent risk-based cost study. The cost estimates of the risk-based study are contained in Section 5.0 of DOE (1999a). Table B-***1*** presents the ratings of the candidate alternatives against this criterion.

All the candidate options, except Orderly Shutdown, 2006 Plan, Vitrified Waste, and Early Vitrification, were deemed equivalent with respect to cost and received the zero (0) rating with some deficiencies or concerns. No cost estimates were available for the Orderly Shutdown Option, but it was given a plus (+) rating because of the obvious minimal costs for an orderly shutdown of INTEC facilities. The 2006 Plan Option under the Separations Alternative was considered more expensive than the other separations options ***and assigned a minus (-) rating to reflect the potential cost*** due to the calcination of both HLW and SBW and the subsequent calcine dissolving, separating, and processing the waste fractions into final waste forms.

With respect to the Non-Separations Alternatives, the Vitrified Waste Option was judged to have a higher life-cycle cost due to the high cost of a vitrification facility, the greater volume of material to be vitrified, and the greater amount of vitrified HLW to be transported to a geologic repository. No cost estimates were available for the Early Vitrification Option since it was a late entry to the candidate list. However, the Early Vitrification Option was assessed as more costly and assigned a minus (-) rating to reflect the potential cost of a vitrification facility and greater volumes of HLW compared to the Separations Alternative.

B.4.3.3 Technical Feasibility

Technical Feasibility or technical risk is a primary criterion to assess the capability of an alternative to meet the planned HLW program goals and milestones. Some alternatives may be more easily implemented due to use of proven technologies or the availability of well-developed processes. For alternatives that require new, unproven technologies, the team assessed the state of development (i.e., research and development, advanced development, or full-scale testing) and whether or not the proposed process ***would*** require a technical breakthrough or further testing and modification. Table B-***1*** presents the ratings of the candidate alternatives against this criterion.

The DOE Team concluded that both options under the No Action Alternative should receive a plus (+) rating because they rely solely on facilities and processes that are currently operational and require no major high-risk modifications. Therefore, the technical risk associated with these alternatives should be very low.

The team also noted that all four options under the Separations Alternative use the same proven dissolution, separations, vitrification, and grouting technologies. All these separations treatment technologies are well developed ***and*** have been successfully demonstrated throughout the DOE complex and industry. The current DOE HLW treatment at the Savannah River Site Defense Waste Processing Facility and at the West Valley Demonstration Project evidences the technical maturity of the vitrification process. ***Because*** the Separations Alternative ***includes vitrification as an option, which is technically mature, it*** received a plus (+) rating.

Under the Non-Separations Alternative, the Vitrified Waste, Hot Isostatic Pressed Waste, and Direct Cement Waste Options all received a plus (+) rating due to incorporation of well developed, demonstrated technologies at INEEL. The Early Vitrification Option was assessed a zero (0) rating because of the unknowns associated with the vitrification of SBW.

The Cement-Ceramic Option received a minus (-) rating due to the high-risk treatment process, (i.e., calcination of SBW/calcine slurry in the New Waste Calcining Facility). The New Waste Calcining Facility, designed to process a liquid feed, would have to undergo major modifications to process the slurry mixture. No research and development work has been done to demonstrate the feasibility of calcining this slurry feed in the New Waste Calcining Facility.

B.4.3.4 Environment, Safety, and Health

The Environment, Safety, and Health criterion focuses on the risk of radioactive and hazardous materials emissions, potential migration into the Snake River Plain Aquifer, waste volume produced, potential worker exposure during operations, and complex process hazards. Table B-*1* presents the ratings of the candidate alternatives against this criterion.

Based on preliminary worker risk data (DOE 1997b), the Orderly Shutdown, 2006 Plan, Hot Isostatic Pressed Waste, and Cement-Ceramic Options were considered least acceptable due to increased worker risk as compared to the other alternatives and received a minus rating. The increased worker risk for the 2006 Plan, Hot Isostatic Pressed Waste, and Cement-Ceramic Alternatives was attributed to longer periods of hazardous activity and more complex and higher risk processes. In the case of the Orderly Shutdown Alternative, the liquid SBW in the Tank Farm and the HLW calcine in the bin sets, to be left indefinitely at the INTEC, increased worker and environmental risk. For these reasons these options were all assessed a minus (-) rating.

Based on the limited amount of definitive information (only worker risk data) available to the team, the remaining alternatives received a zero (0) rating because of minimal worker risk and insufficient information to rank the alternatives in the other sub-elements of Environment, Safety, and Health.

B.4.3.5 *Public Concerns*

Considerations for the ***Public Concerns*** criterion were obtained from comments ***received by DOE*** during the EIS scoping period. The sub-elements of the ***Public Concerns*** criterion include final HLW form, disposal sites, aquifer impacts, waste acceptance criteria at the proposed geologic repository, definition of SBW, equity with respect to other DOE sites, HLW transportation, and tribal cultural and historic resources. Table B-*1* presents the ratings of the candidate alternatives against this criterion.

The DOE Team assigned a minus (-) rating to both options under the No Action Alternative because neither alternative addresses the widespread opposition to long-term storage or disposal of HLW above the Snake River Plain Aquifer. Also, the alternatives do not meet the Settlement Agreement/Consent Order requirement to have all INEEL HLW road ready by 2035.

Under the Separations Alternative, the team assigned the Full Separations, 2006 Plan, and Transuranic Separations/Class A Grout Options a zero (0) rating because of several concerns. These concerns include the long time estimated for the treatment processes, possible transportation for offsite treatment, health and safety of workers, and potential lack of a disposal facility that would accept INEEL HLW.

The Transuranic Separations/Class C Grout Option was given a plus (+) rating due to the possibility of eliminating the need for disposal of the HLW at the geologic repository. This is due to the planned classification of the high-activity fraction as transuranic waste, which would be eligible for disposal at the Waste Isolation Pilot Plant. Also, this option addresses the ***public*** concern of meeting the Settlement Agreement/Consent Order milestones. Both Transuranic Separations options would require an "incidental waste" determination.

Under the Non-Separations Alternative, the team gave the Vitrified Waste and Early Vitrification Options a plus (+) rating. These options respond to concerns of reducing worker risk (no separations activities) and expediting vitrification, which produces the acceptable waste form for disposal in a geologic repository.

The team gave zero (0) ratings to the Hot Isostatic Pressed Waste, Cement-Ceramic, and Direct Cement Waste Options to reflect the concerns for technical complexity of the treatment processes and their capability to meet the waste acceptance criteria at the disposal site. Moreover, these options would require additional research and development before the EPA could determine waste form equivalency to borosilicate glass.

B.4.3.6 Program Flexibility

Program Flexibility is an attribute of program management that allows critical funding decisions to be made in a logical, phased approach. Thus, critical decisions to implement costly programs could be done in a serial, time-phased manner to assess results of the initial phases or to allow time for technical maturity. The key to program flexibility is to minimize the number of irrevocable funding commitments at the early stages of a program. Table B-***1*** presents the results of the team's ratings of the candidate alternatives against this criterion.

The No Action Alternative ***published in the Notice of Intent*** was assessed a plus (+) rating with minor deficiencies because it is a short term, business-as-usual alternative with no significant changes in operations and requires no new facilities. Therefore, this option has high program flexibility with respect to cost and schedule because no processes or facilities that require early funding commitments would be needed.

All four options under the Separations Alternative were assigned a zero (0) rating with some deficiencies or concerns. These separations options require early funding commitments for the new separations facility, which reduces program flexibility in the near-term. However, the options under the Separations Alternative have high program flexibility in the long-term because the HLW is separated into high-activity and low-activity waste fractions that allow several immobilization and disposal options to be considered at later stages of the program.

The five options under the Non-Separations Alternative were considered to be relatively inflexible compared to the No Action and Separations Alternatives. These five options were assessed a minus (-) rating with major deficiencies or concerns. These concerns relate to the early program commitments to SBW calcination, SBW and calcine retrieval, HLW immobilization, HLW interim storage, and the potential need to construct a new vitrification facility at INEEL.

B.5 Evaluation Summary and Results

Based on the preliminary criteria ratings, the DOE Team completed the final analyses to determine which options ***were*** considered reasonable and worthy of being retained on the ***Draft Idaho HLW & FD EIS*** Candidate Alternative List. Options with all pluses (+) would be top candidates. Options with pluses and zeroes were also considered candidates. However, options with more zeroes than pluses triggered additional analysis to ensure the zero ratings were not indications of inherent weaknesses. Options rated with one or more minuses were re-evaluated to determine if the minus ratings were significant enough to eliminate them. If the minus ratings indicated large areas of uncertainty, the evaluators reduced the uncertainty by obtaining and reviewing additional data.

The team made a diligent effort to include a ***range of*** reasonable options with the potential to satisfy DOE program requirements and concerns of ***the*** public.

Table B-***2*** shows the total criteria ratings achieved by all the candidate alternatives during the alternative evaluation discussed in the previous section. As shown in the table, the Transuranic Separations/Class C Grout Option under the Separations Alternative was assessed the highest total rating of +3 and the Cement-Ceramic Option under the Non-Separations Alternative was assessed the lowest total rating of -3. Since the total rating spread (lowest to highest total rating) was only 6 points and the lowest alternative was only a -3 rating, the Evaluation Team recommended that none of the initial candidate alternatives be rejected at this time. Moreover, the team analysis confirmed that none of the minus ratings indicated areas of serious or inherent weakness.

Table B-2. Total rating of candidate alternatives.

Alternative	Program mission	Cost	Technical feasibility	ES&H	***Public Concerns***	Program flexibility	Total rating
1. No Action							
1A Notice of Intent	–	0	+	0[a]	–	+	0[a]
1B Orderly Shutdown	–	+	+	–	–	–	–2
2. Separations							
2A Full Separations	+	0	+	0	0	0	+2
2B 2006 Plan	+	–	+	–	0	0	0
2C Transuranic Separations/ Class A Grout	+	0	+	0	0	0	+2
2D Transuranic Separations/ Class C Grout.	+	0	+	0	+	0	+3
3. Non-Separations							
3A Vitrified Waste	+	–	+	0	+	–	+1
3B Hot Isostatic Pressed Waste	0	0	+	–[a]	0	–	–1[a]
3C Cement-Ceramic	0	0	–	–[a]	0	–	–3[a]
3D Direct Cement	0	0	+	0	0	–	0
3E Early Vitrification	+	–	0	0	+	–	0

a. After the initial DOE Team evaluation and recommendation, these ratings were re-evaluated based on additional information received by the team. The re-evaluation did not change the team's recommended final ratings.

B.6 Refinement of Draft EIS Alternatives

Following the evaluation of candidate alternatives described in the previous section, several events occurred that affected the selection of alternatives for the Idaho HLW & FD EIS. These events include consideration of shipping stabilized HLW (or calcine or separated high-activity waste) to the Hanford Site for processing, use of the proposed INEEL Advanced Mixed Waste Treatment Project for processing certain HLW-related waste streams, and use of a cesium ion exchange process for treatment of liquid SBW and newly generated liquid waste. These events led DOE to further refine the Idaho HLW & FD EIS alternative selection process. ***Additional information for*** this refinement process are contained in DOE (1999a) and are summarized below.

B.6.1 DRAFT EIS ALTERNATIVES REFINEMENT (PHASE I)

DOE convened an Alternative Refinement Meeting on May 21, 1998 to evaluate the list of EIS alternatives considering the events described above. The following comparison factors (elimination criteria) were used by DOE personnel during the meeting:

- *Two or more alternatives share common process characteristics, but one presents:*
  - A bounding case for environment, safety, and health impacts
  - Substantially reduced cost
  - Substantially reduced waste handling risks

  - Similar impacts, but with an increased chance for public and/or regulator acceptance

- *An implementation alternative presents a process that would likely result in:*

  - Lack of expected regulator/DOE approval

  - Lack of ability to construct or operate facilities in the required time period

  - Significantly higher volume of waste for disposal

  - Significantly higher worker risk

  - Unreasonably higher cost to treat a small volume of waste

  - Unreasonably higher worker risk to process a small volume of waste

  - Creation of an intermediate waste form that cannot be transformed into an acceptable final waste form for disposal

DOE identified the following alternatives in Table B-*3* as "alternatives considered but not analyzed" and "alternatives identified for further DEIS analysis with use of the comparison factors," as discussed previously. The rationale for these conclusions is described below.

No Action Alternative - Orderly Shutdown Option - This option would not meet any of the Settlement Agreement/Consent Order and other requirements and does not tier off the SNF & INEL EIS decision to continue to operate the New Waste Calcining Facility (DOE 1999a). Under this option, the decision to shut down the New Waste Calcining Facility would be made in Fiscal Year 2000, and none of the INTEC HLW management facilities, including the Tank Farm, would be closed. The process vessels would be emptied of waste solutions, and some decontamination rinses would be performed. The Orderly Shutdown Option would stop the operation of the Process Equipment Waste Evaporator system and the Liquid Effluent Treatment and Disposal Facility, and would not empty or close the Tank Farm. The shutdown facilities would be left in a safe condition but would not be monitored. ***DOE concluded that the No Action Orderly Shutdown Option was not an environmentally responsible alternative and would not be an effective basis of comparison of the action alternatives.*** Thus, this option ***was*** eliminated from further consideration.

Separations Alternative - 2006 Plan Option - The 2006 Plan Option is identical to the Full Separations Option except that the SBW would not be processed (separated) directly but would

Table B-*3*. Summary of the Phase I Alternative Refinement Meeting.

Alternatives considered but not analyzed	Alternatives identified for further analysis
No Action Alternative	No Action Notice of Intent (per Notice of Intent)
No Action Orderly Shutdown Option	Separation Alternative
Separations Alternative	Full Separations Option
2006 Plan Option	Transuranic Separations/Class C Grout Option
Transuranic Separations/Class A Grout Option	Non-Separations Alternative
Offsite Disposal of Class C Grout Option under the Transuranic Separations Option	Hot Isostatic Pressed Waste Option
Non-Separations Alternative	Direct Cement Waste Option
Vitrified Waste Option	Early Vitrification Option
Minimum INEEL Processing Alternative	Minimum INEEL Processing Alternative
Advanced Mixed Waste Treatment Facility Option	Full Transport Option
	Full Transport with Alternate SBW Treatment Option

be calcined in the New Waste Calcining Facility by 2012 before dissolution and separation.

Thus, the 2006 Plan Option would require three major processing facilities (i.e., New Waste Calcining Facility with high-temperature and Maximum Achievable Control Technology upgrades, Calcine Dissolution and Separations Facility, and a HLW Vitrification Facility). The proposed 2006 Plan Option waste form would require redissolution of calcine with potential higher life cycle costs and worker risks than other separation options. For these reasons and for the additional processing and storage facilities required, it is apparent that this option offers no advantages over the Full Separations Option. It was also predicted to cost considerably more than the Full Separations Option. ***Therefore, it was*** determined that it be eliminated from the alternative list.

Non-Separations Alternative - Vitrified Waste Option - The calcining of SBW and newly generated liquid waste is the only action that differentiates the Vitrified Waste Option from the Early Vitrification Option. This option not only creates an additional waste form (SBW calcine) to be vitrified with the HLW calcine but also would not maintain the beneficial segregation of the SBW calcine from the HLW calcine. Because of this potential co-mingling, this option could result in a larger quantity of HLW being shipped to a geologic repository for disposal with the attendant higher disposal costs and would require greater facility costs for vitrification and storage. Therefore, there are no advantages for this option over the Early Vitrification Option that otherwise contains the same treatment concepts. For these reasons, ***it was*** concluded that the Vitrified Waste Option should be eliminated from further EIS consideration.

Offsite Low-Activity Waste Disposal - The group determined that offsite disposal of Class A grout should be retained. Initially, Hanford was selected to be a representative offsite location for Class A grout disposal. However, disposal at Hanford has been eliminated from consideration because previous evaluations of low-activity grout disposal at Hanford have indicated that the long-term (beyond 1,000 years) impacts of low-activity grout disposal could exceed regulatory standards for groundwater protection. Also, ***at the time,*** Hanford's HLW management strategy ***called*** for vitrifying the low-activity waste prior to onsite disposal ***and it was*** unlikely that Hanford would accept grouted INEEL low-activity waste for disposal. The group then recommended that the Envirocare facility in Utah be considered as a representative offsite disposal facility because it is a commercial facility that is limited only by its waste acceptance criteria.

Notice of Intent version of the* No Action Alternative - *This Option was re-aligned by the group to include the following requirements to meet the Notice of Noncompliance Consent Order:

- Run the New Waste Calcining Facility until June 2000.

- Place the New Waste Calcining Facility in standby and perform the high temperature and Maximum Achievable Control Technology upgrades.

- Run the High-Level Liquid Waste Evaporator until 2003 while the New Waste Calcining Facility is being upgraded.

- Complete the New Waste Calcining Facility permitting and upgrades by 2010.

- Run the New Waste Calcining Facility at an accelerated schedule to calcine the SBW by 2014.

Separations Alternative - Full Separations with Hanford Vitrification - This option is identical to the Full Separations Option except for the suboption to perform high-activity waste vitrification at the Hanford Site instead of at INEEL. In this option, the high-activity waste fraction would be solidified, packaged, and shipped to the Hanford Site for vitrification. The resulting HLW canisters would be returned to INEEL for interim storage awaiting shipment to a geologic repository. ***DOE*** concluded that the Idaho HLW & FD EIS will include "Hanford Vitrification" as an independent transportation analysis that will be covered in this EIS. The at-Hanford impacts would be discussed in a separate section of the EIS. This would allow the public to isolate the "at-INEEL" and "at-Hanford" impacts.

Separations Alternative - Transuranic Separations/Class A Grout Option - This option is similar to the Full Separations Option, except the separation process under this option would result in three waste products:

- Transuranic waste
- Fission products (primarily strontium/cesium)
- Class A grout

In the Transuranic Separations/Class A Grout Option, the liquid SBW would be sent directly to the Separations Facility for processing into high-activity and low-activity waste streams. After the SBW is processed, the HLW calcine would be retrieved from the bin sets, dissolved, and processed in the Separations Facility. Ion exchange columns would be used to remove the cesium from the waste stream. The resulting effluent would undergo the transuranic extraction process to remove the transuranic elements for eventual shipment to the Waste Isolation Pilot Plant. Then strontium would be removed from the transuranic extraction effluent stream via the strontium extraction process. The cesium and strontium would be combined to produce a high-activity waste stream that would be vitrified into borosilicate glass. This glass would be stored in an interim storage facility before shipment to a geologic repository. The Transuranic Separations waste would be dried and denitrated to produce a granular solid waste, and the low-activity waste would be denitrated and grouted to form Class A grout.

The Transuranic Separations/Class C Grout Option process would create only two waste streams: (1) solidified transuranic waste for disposal at the Waste Isolation Pilot Plant and (2) a low-activity waste stream to form Class C grout for onsite disposal. The Transuranic Separations/Class A Grout Option would involve more separations steps than the Transuranic Separations/Class C Grout Option and would require a larger Waste Separations Facility. Also, ***this*** option would require a separate High-Activity Waste Treatment (Vitrification) Facility and a High-Level Waste Interim Storage Facility that have an estimated cost substantially greater than the Transuranic Separations (Class C Grout) Option.

The estimated total discounted cost for the Transuranic Separations/Class A Grout Option is $3.29 billion, which would be 80 percent greater than the estimated total discounted cost of $1.82 billion for the Transuranic Separations (Class C Grout) Option. Thus, the Transuranic Separations/Class C Grout Option is similar, has less complex separations processing, and is more cost-effective than the Transuranic Separations/Class A Option. Moreover, the impacts of this option are expected to be bounded by the remaining two options under the Separations Alternative. For these reasons, the Transuranic Separations/Class A Option was eliminated from further consideration.

Non-Separations Alternative - Cement-Ceramic Waste Option - The Cement-Ceramic Waste Option under the Non-Separations Alternative is similar to the Direct Cement Waste Option except the liquid SBW would not be calcined directly but would be mixed with the existing calcine to form a slurry. In this option, all calcine would be retrieved and combined with the liquid SBW. The combined slurry would be recalcined in the New Waste Calcining Facility with the resulting calcine mixed into a concrete-like material. The concrete waste product would then be poured into drums, autoclaved (curing in a pressurized oven), and stored in an interim storage facility before shipment to a geologic repository. An estimated 16,000 concrete canisters would be produced. This option would require a calcine retrieval system, a major modification to the New Waste Calcining Facility to allow slurry calcination and the upgrade for compliance with the Maximum Achievable Control Technology rule, and a Grout Facility with autoclave. The final product would require an equivalency determination by EPA.

The rationale for initially considering the Cement-Ceramic Waste Option in the EIS was the potential for significant cost savings in using a greater confinement facility (such as at the Nevada Test Site) as the final repository for the resulting product. A basis for this assumption was that the cementitious waste form and the alluvial soil at the greater confinement facility were chemically compatible, and the cement waste form would be the least likely to migrate in the surrounding soil. However, the greater confinement facility for HLW disposal has not been constructed, nor has DOE approved the project for construction at this date. Moreover, DOE experiences at the Waste Isolation Pilot Plant and Yucca Mountain suggest that the development of a repository is a lengthy, costly, and high-risk undertaking. In addition, if INEEL were the only site disposing HLW at a greater confinement facility, INEEL would bear all costs associated with the development of the repository (e.g., site characterization and performance assessments associated with U.S. Nuclear Regulatory Commission licensing and EPA certification of compliance). Therefore, it is unlikely that significant cost savings at a greater confinement facility could be realized over a geologic repository where INEEL would pay a prorated share of the development and operational costs based on its share of the waste disposed of.

The Cement-Ceramic Waste Option is based on calcination of SBW/calcine slurry in the New Waste Calcining Facility, which is currently configured to process a liquid feed. To reconfigure the New Waste Calcining Facility to process an SBW/calcine slurry would be costly. Even if the New Waste Calcining Facility were modified to accept the slurry feed, no prior research and development work has been conducted to verify the feasibility of calcining the slurry. ***Even if the Cement-Ceramic Waste Option had a high potential to reduce life cycle costs, the fact that DOE has included the Direct Cement Waste Option, which has lower technical risk than the Cement-Ceramic Waste Option, negates the need to include the Cement-Ceramic Waste Option in the EIS analysis.***

Minimum INEEL Processing Alternative - The group concluded that an additional alternative, entitled the "Minimum INEEL Processing Alternative," should be analyzed in the Idaho HLW & FD EIS. This alternative would have two options: (1) the Full Transport Option and (2) the Full Transport with Alternate SBW Treatment Option. Under either option in this alternative, DOE would perform only the minimum activities necessary to prepare the calcine for shipment to the Hanford Site for treatment. In the Full Transport Option, DOE would also solidify and package the SBW for transport to Hanford. In the Full Transport with Alternate SBW Processing Option, DOE would not ship the SBW to Hanford but would instead process the SBW through an ion-exchange column to remove the cesium and grout to create a contact-handled transuranic waste that DOE would ship to the Waste Isolation Pilot Plant.

B.6.2 EIS ADVISORY GROUP (EAG) REVIEW

Subsequent to the Alternatives Refinement Meeting, DOE convened the Idaho HLW & FD EIS Advisory Group Meeting on June 30 and July 1, 1998. The purpose of the EIS Advisory Group ***was*** to provide a forum to assess the resolution of issues related to preparation and review of this EIS. The EIS Advisory Group concluded that the alternatives resulting from the Phase I Alternatives Refinement Meeting ***were*** acceptable except that the No Action Alternative should be revised so it does not include ***calcination*** or construction of new storage tanks. DOE subsequently decided that the alternative previously entitled the No Action Alternative would be retained but would be retitled the "Continued Current Operations" Alternative.

B.6.3 ALTERNATIVE REFINEMENT (PHASE II)

A second alternative refinement meeting was held on September 16, 1998. The intent of this second meeting was to discuss the potential Hanford alternatives for treatment of INEEL HLW and SBW. The DOE Evaluation Team concentrated on evaluating the physical characteristics of the Hanford alternatives and the timing for potential shipments of waste to Hanford for treatment. Timing of shipments is critical since it affects the treatment processes at INTEC, which would supply the waste for Hanford treatment.

The DOE Evaluation Team evaluated several options for treatment of INTEC wastes at Hanford, including (1) direct vitrification of calcine, (2) direct vitrification of separated high-activity waste, (3) calcine separations, and (4) shipping SBW/newly generated liquid waste to the Hanford Site for treatment. The DOE Evaluation Team concluded that only Option 3, "calcine separations," should be evaluated in the EIS. DOE's rationale for eliminating the other options is explained in DOE (1999a) and Section 3.3 of this EIS.

Therefore, the Minimum INEEL Processing Alternative would entail shipping calcine from INEEL to Hanford, separation of this calcine at Hanford into high-activity and low-activity streams, and vitrification of both waste streams at Hanford. The vitrified high-activity waste would be shipped back to INEEL for interim storage pending shipment to a geologic repository, while the vitrified low-activity waste would be shipped back to INEEL for disposal. The existing liquid SBW and newly generated liquid wastes would be retrieved and transported to an ion exchange facility, where it would be filtered and processed through an ion exchange column. The filtered solids would be dried and disposed of at the Waste Isolation Pilot Plant as remote-handled transuranic waste. The loaded ion exchange resin would be temporarily stored at INEEL, dried and containerized, and transported to Hanford for vitrification. After ion exchange, the liquid waste would be grouted to produce a contact-handled transuranic waste for disposal at the Waste Isolation Pilot Plant.

B.6.4 STATE OF IDAHO REVIEW

As described in Section ***2.3***, the State of Idaho ***served*** as a "Cooperating Agency" in the preparation of this EIS. In fulfilling this responsibility, the State reviewed the list of waste processing alternatives. The State's review concluded that the 2006 Plan Option comes the closest to fulfilling the Settlement Agreement/Consent Order and should be analyzed in the EIS. DOE incorporated the State's recommendation and evaluated this option in the EIS but retitled it the "Planning Basis Option."

B.7 Final List of Draft EIS Alternatives

Therefore, as a result of all the activities discussed in this Appendix, the Draft Idaho HLW & FD EIS analyzed the following waste processing alternatives and options:

1. No Action Alternative
2. Continued Current Operations Alternative
3. Separations Alternative
    A. Full Separations Option
    B. Planning Basis Option
    C. Transuranic Separations Option
4. Non-Separations Alternative
    A. Hot Isostatic Pressed Waste Option
    B. Direct Cement Waste Option
    C. Early Vitrification Option
5. Minimum INEEL Processing Alternative

B.8 Additional Alternatives/Options and Technologies Identified during the Public Comment Process

B.8.1 INTRODUCTION AND PURPOSE

The Notice of Availability of the Draft EIS was issued in 65 FR 3432 on January 21, 2000. Additional alternatives for the treatment and disposal of mixed transuranic waste/SBW and mixed HLW calcine were proposed by the public during the public comment period. Public comments, along with other relevant factors, such as information received after the Draft EIS was approved, had a bearing on the development of the Preferred Alternatives. This section identifies and describes the new alternatives and treatment technologies and their disposition. The new alternatives (Steam Reforming and Grout-in-Place) were identified from public comment on the Draft EIS. The additional treatment technologies described here include those identified by:

- The National Academy of Sciences (NAS 1999)
- The public comment process, and
- HLW treatment experts during the Preferred Alternative identification process

The evaluation criteria for the alternatives and technologies included environment, safety, and health impacts; treatment process effectiveness for both mixed transuranic waste/SBW and mixed HLW calcine; technical maturity of treatment technologies and risk of failure; public comment; ability to meet legal commitments for treating and preparing mixed transuranic waste/SBW and mixed HLW calcine to meet the Settlement Agreement/Consent Order and Notice of Noncompliance Consent Order requirements; agency concerns; adherence to DOE's mission and policies; uncertainties; schedule risk; project and operational costs; final waste form shipping and disposal costs; and maximizing the potential for early disposal of the final waste form.

B.8.2 ALTERNATIVES/OPTIONS EVALUATED AFTER THE DRAFT EIS WAS ISSUED

Waste processing methods were identified and evaluated during the review of public comments on the Draft EIS, from other reports, and during DOE internal review. Most of these methods, including Steam Reforming, were variations on the waste processing alternatives presented in the Draft EIS. However, application of Steam Reforming and Grout-In-Place as proposed waste treatment alternatives was identified during public comment and considered in the Final EIS alternative identification process. These proposed alternatives are described in the following subsections.

B.8.2.1 Steam Reforming

The steam reforming process proposed for processing mixed transuranic waste/SBW involves reaction of the waste in a fluidized bed with steam and certain reductants and additives, to produce a small volume of inorganic residue essentially free of nitrates and organic materials. The mixed transuranic waste/SBW, after mixing with sucrose, would be fed to the reactor. Solid carbon would be fed separately as a reactant in the steam-reforming process. Additional additives may also be used to alter the physical and chemical properties of the final product. Water in the waste would be vaporized to superheated steam. Additional energy would be supplied to the bed by injecting oxygen to react with the carbon sources. Organic compounds in the waste would be broken down through thermal processes (pyrolysis) and through reaction with hot nitrates, steam, and oxygen.

The fine solid-waste products, including small amounts of fixed carbon and alumina fines from the bed, would be separated from the larger semi-permanent fluid-bed particles in a cyclone within the reactor. The resultant vapor stream would be passed through ceramic candle filters where the solids would be separated from the vapors. The filter candles periodically would be backpulsed with nitrogen to recover the solids, which would then be packaged for disposal. These solids would be combined with larger particles that occasionally would be discharged from the bottom of the fluid bed reactor. Together these solids would make up the primary steam-reformed product.

The vapor stream exiting the ceramic candle filters would be processed through a quencher where acid gases would be neutralized. The vapor from the dryer would be combined with the building air exhaust before high-efficiency particulate air filtration. The water vapor from the scrubber would be condensed and cooled. The gases exiting the condenser would pass through a demister and bag house before being treated with air in a thermal converter. The vapors exiting the thermal converter would be passed through a high-efficiency particulate air filter and a cooler before being discharged to the atmosphere through a monitored vent stack.

A DOE-sponsored Tanks Focus Area sub-team evaluated the steam reforming technology for processing mixed transuranic waste/SBW (TFA 2001). The sub-team concluded that there was no strong technical incentive to pursue steam reforming but the technology may be useful as a vitrification pretreatment or offgas treatment method. The sub-team also concluded that DOE should not pursue the steam reforming technology as a means to treat the mixed transuranic waste/SBW. The recommendation was based primarily on process technical concerns and concerns about long-term storage of the resulting product (hydration and radiolysis). The steam reforming process is similar to the Continued Current Operations Alternative analyzed in this EIS, except the resultant waste produced would be shipped offsite rather than stored indefinitely in the bin sets. This is similar to NAS Option 6. Subsequently, DOE management requested an assessment of the steam reforming technology to treat the mixed transuranic waste/SBW. The assessment resulted in a Steam Reforming Option being added to the EIS in response to public and agency comments. The option includes containerizing the mixed HLW calcine and shipping it to the geologic repository. In addition, transportation of both waste streams to the respective disposal sites has been added.

B.8.2.2 Grout-In-Place

As part of the public comment process on the Draft EIS, the INEEL Citizens Advisory Board proposed a new alternative for evaluation (CAB 2000). This new alternative, Grout-in Place or Entombment, would leave the mixed transuranic waste/SBW in the tanks and the calcine in the bin sets and add grout to immobilize the waste in place. For the mixed transuranic waste/SBW, the grout/SBW mixture would be entombed directly in the tanks. The calcine would either be mixed with grout and entombed in the bin sets, or the vaults surrounding the bin sets could be filled with clean grout. This alternative was evaluated, but was eliminated from detailed analysis for the following reasons:

- Transformation of the mixed transuranic waste/SBW into a stable solid form may require removal of the waste from the tanks and addition of neutralizing and stabilizing materials that would result in a substantial volume increase. Although adding a grout mixture to the waste in the tanks may not exceed the capacity of the existing tanks (assuming a 30 percent waste loading and all 11 tanks filled to capacity), there are technical uncertainties related to the solidification in a tank to entomb the liquid mixed transuranic waste/SBW. For the calcine, there is insufficient capacity in the bin sets to grout the calcine in place. If the calcine were encased in clean grout around the bin sets, the potential long-term impacts would be similar to the Continued Current Operations and No Action Alternatives. For long-term impact analysis (Section 5.3.5.2 of this EIS), DOE assumed that any structure was vulnerable to degradation failure after 500 years in accordance with the U.S. Nuclear Regulatory Commission (NRC) position for long-term storage facilities (NRC 1994).

- Under NEPA, agencies may consider alternatives that are not consistent with applicable laws, regulations, and enforceable agreements. However, DOE does not regard disposal of the mixed transuranic waste/SBW in the tanks or calcine in the bin sets to be reasonable. This alternative would violate the Notice of Noncompliance Consent Order and Settlement Agreement/Consent Order, and would not meet RCRA regulatory requirements for a disposal facility for mixed waste.

B.8.3 TREATMENT TECHNOLOGIES EVALUATED AFTER THE DRAFT EIS WAS ISSUED

Following publication of the Draft EIS, new waste processing technologies and variations of previously studied treatment options were suggested by the public, the NAS, and subject matter experts. These options were evaluated and eventually eliminated from detailed analysis. This section includes a summary of the waste processing options considered and evaluated as part of the alternative review process and provides an abbreviated discussion as to why they were eliminated from detailed evaluation. The treatment technologies are grouped here by commentor, waste type, and by treatment type.

B.8.3.1 Treatment Technologies Suggested by the National Academy of Sciences

The following technologies for treating mixed transuranic waste/SBW were suggested by the NAS in *Alternative High-Level Waste Treatments at the Idaho National Engineering and Environmental Laboratory* (NAS 1999). In addition to the NAS report, the NAS team provided an extensive briefing on their findings and conclusions.

- **NAS Option 1, Two-Stage Low-Temperature Evaporation and Ship to the Waste Isolation Pilot Plant -** This option would use a first stage evaporator to heat the liquid mixed transuranic waste/SBW and produce a concentrated liquid, that would be sent to a second stage evaporator for further drying. This second stage could be a wiped film evaporator, a pot evaporator, or a rotary drier. Following the second stage evaporation, the concentrated liquid would be sent to a container filling operation where the liquid would be allowed to solidify upon cooling. The solidified product, a relatively large volume (1,300 cubic meters), would be sent to the Waste Isolation Pilot Plant as remote-handled transuranic waste. This option was eliminated from detailed evaluation because, in general, the process scored relatively low against the criteria listed in Section B.8.1. There were significant issues on technical maturity and technology for this option, and issues regarding remote maintenance requirements and containerization of product.

- **NAS Option 2, Hydroxide Precipitation without Separation -** In this process, excess acid in the mixed transuranic waste/SBW would be destroyed in an evaporator step. The concentrate would be neutralized with sodium hydroxide to a pH of 8 to 10, precipitating most of the metals. The slurry would be evaporated and solidified for disposition as in NAS Option 1. This process would produce additional remote-handled transuranic waste because acid neutralization adds waste volume. Precipitation of the concentrated mixed transuranic waste/SBW by caustic would introduce processing difficulties due to the gel-like substances produced. This option was eliminated from further evaluation because it would generate about 30 percent more remote-handled transuranic waste than NAS Option 1 above, and it is technically enveloped by that option.

- **NAS Option 3, Hydroxide Precipitation w/Separation -** This treatment option is similar to NAS Option 2, but requires additional processing steps. Excess acid would be destroyed and the waste would be evaporated and neutralized producing gelatinous slurry. Sulfide would be added to the slurry to treat for metals. A solid/liquid separator would then be used to separate the gelatinous material. This technology is considered to be very difficult and require significant technical development with no advantage compared to NAS Option 2.

- **NAS Option 4, Modified Hydroxide Precipitation -** This treatment process is similar to NAS Option 3 except two additional solid/liquid separation steps add technical complexity. The process is based on the Hanford Enhanced Sludge Leaching Process which operates on basic waste, not acidic waste, and would require the addition of caustic materials to increase the pH. This option would reduce the amount of remote-handled transuranic waste produced but would produce over 3,000 cubic meters of remote-handled low-level waste. No advantage was discerned over NAS Option 3.

- **NAS Option 5, Lanthanum Fluoride Precipitation -** In this option, multiple lanthanum fluoride scavengers would precipitate a transuranic waste fraction as an insoluble fluoride. This technology was eliminated from detailed evaluation because it has previously been investigated for application to the INTEC mixed transuranic waste/SBW and was shown to be an unsuccessful technology (Olsen et al. 1993).

- **NAS Option 6, Calcination with Maximum Achievable Control Technology (MACT) Upgrade and Ship Process Waste to the Waste Isolation Pilot Plant -** This option would calcine the mixed transuranic waste/SBW in the New Waste Calcining Facility following a MACT upgrade. The mixed transuranic waste/SBW calcine would be placed in RCRA compliant containers and sent to the Waste Isolation Pilot Plant. This option is similar to the Continued Current Operations Alternative analyzed in this EIS, except that the resultant waste produced would be shipped offsite rather than stored indefinitely in the bin sets.

B.8.3.2 Treatment Technologies Identified from Public Comment

This section briefly discusses options or treatment technologies suggested by the public during the public comment period on the Draft EIS.

- **Savannah River and/or West Valley treatment of Idaho waste -** This option would involve shipping mixed transuranic waste/SBW and mixed HLW calcine to Savannah River or West Valley for treatment. This option was evaluated for the Draft EIS, and considered again during preparation of the Final EIS. There was no additional information that would change the outcome of the initial evaluation. For the reasons identified in Section 3.3.5 of this EIS, this option was eliminated from detailed analysis.

- **"Formed Under Elevated Temperature and Pressure (FUETAP)" technology developed at Oak Ridge -** This technology was developed at Oak Ridge and was considered during the preparation of the Draft EIS. The technology is similar to the Hot Isostatic Pressed Waste and Direct Cement Waste treatment options. Its primary disadvantages are lack of technical maturity with an increase in technical risk. It would have an application to both mixed transuranic waste/SBW and mixed HLW calcine. The FUETAP option was not evaluated further for mixed HLW calcine treatment because it would produce about the same amount of HLW (13,000 cubic meters) as the less technically demanding Direct Cement Waste Option, would at present produce an unqualified waste form for the potential geologic repository, and would require considerable technology development.

- **Liquid waste treatment technologies used at other DOE sites -** Treatment technologies developed or being considered at other sites were examined as part of the alternative selection process.

- **Steam reforming process -** This technology has been added to the Final EIS. See Section B.8.2.1 for description.

- **Silicon ingots -** This process is considered equivalent to vitrification, where waste and frit are added to the melter to form glass. Since it is enveloped by the Early Vitrification Option, it was not further evaluated as a stand-alone alternative.

- **Dry-pack process for mixed HLW -** This process is similar to the two-stage evaporator process evaluated (see Section B.8.3.1, NAS Option 1) and was eliminated from detailed evaluation for the same reasons.

- **Cold crucible vitrification process for treating calcine** - This process was identified during the Draft EIS public comment period by a company called COGEMA. This process is under evaluation by the HLW program and could be chosen for mixed transuranic waste/SBW and mixed HLW calcine vitrification. This technology is similar to that evaluated under the Early Vitrification Option and the Vitrification with or without Calcine Separations, therefore further evaluation of the process was not performed.

- **Advanced Vitrification System (AVS) -** The Radioactive Isolation Consortium AVS technology involves vitrification of HLW in the same canister in which it would be disposed of. This technology currently has maturity and technology development issues that DOE is studying. Depending on the results of the studies, this technology may be considered for waste treatment at the INEEL. This technology is similar to that evaluated under the Early Vitrification Option and the Vitrification with or without Calcine Separations, therefore further evaluation of the process was not performed.

- **Mixed HLW calcine encapsulation in a metal matrix -** Early research at INTEC showed that surrogate calcined HLW could be melted directly into an aluminum matrix potentially making the handling and transport of the calcined waste safer and easier. The option was dropped from further consideration because of the lack of technical maturity and it offers no advantage for disposal in a national geologic repository. Additionally, the process has no application to the treatment of mixed transuranic waste/SBW unless the liquid waste was first calcined.

- **Mixed HLW calcine entombed in situ and mixed transuranic waste/SBW solidified and entombed in tanks -** This option is discussed in Section B.8.2.2.

- **Other waste disposal options -** During public comment, several comments suggested various methods of disposing of INTEC waste. These included such ideas as disposing of waste in the Great Salt Lake Desert, Sahara Desert, outer space, other countries, etc. These alternatives were dropped from further consideration based on costs, transportation risk, environmental justice, managerial risk (political acceptability), and technology issues.

B.8.3.3 Evaluation of Treatment Technologies and Options During the Preferred Alternative Identification Process

The following treatment technologies were identified during the Preferred Alternative identification process by subject matter experts, from reference materials and other sources.

Calcine Options for Mixed Transuranic Waste/SBW Treatment - Options involving calcination of the mixed transuranic waste/SBW were generally eliminated from detailed evaluation during the Preferred Alternative identification process because they 1) would not meet the Settlement Agreement/Consent Order requirements, 2) upgrades to the New Waste Calcining Facility would require restart after a prolonged shutdown of an old facility, 3) expected difficulty in obtaining approvals for partial upgrades from the State of Idaho and the U.S. Environmental Protection Agency, 4) calcination without offsite shipment would not close the waste disposal loop, 5) calcination involves a thermal treatment which received significant negative public comment after the Draft EIS was released, and 6) major modifications to the 20 year old New Waste Calcining Facility could be technologically difficult. For these reasons, options that required calcination of the mixed transuranic waste/SBW were evaluated and eliminated from further analysis as candidates for the preferred treatment alternative. These are listed below.

- Calcine with MACT Upgrade with calcine to Bin Sets
- Calcine without MACT Upgrade with Project XL (eXcellence and Leadership), and Shipment of the Product to the Waste Isolation Pilot Plant (similar to NAS Option 6) (See Section B.8.3.1.)
- Calcine with Partial MACT Compliance
- Risk-Based Calcination to Bin Set
- Calcine under Interim Status with RCRA Upgrades
- Calcine with Propane in place of Kerosene
- Calcination with Sugar at 500°C with MACT Upgrade and shipment to the Waste Isolation Pilot Plant
- Calcine with a Surrogate Raffinate

Calciner under Interim Status - The option of operating the calciner in its interim status configuration was not included in the detailed analysis of the Draft EIS because it was analyzed in the SNF & INEL EIS. For purposes of the Final EIS, DOE has determined that it is not a reasonable alternative based on programmatic considerations, including those discussed above.

Evaporation Methods for Treatment of Mixed Transuranic Waste/SBW - In addition to NAS Option 1, Two-Stage Low-Temperature Evaporation (see Section B.8.3.1), two additional evaporation methods were evaluated for the treatment of mixed transuranic waste/SBW: Direct Evaporation in the Shipping Cask, and High-Temperature Evaporation with a Rotary Kiln (with MACT) and shipment of process waste to the Waste Isolation Pilot Plant. Direct Evaporation in the Shipping Cask was eliminated from detailed evaluation because of container integrity concerns and significant materials development and investigation. Treatment of mixed transuranic waste/SBW using High-Temperature Evaporation with a Rotary Kiln was eliminated because 1) it is expected to cost significantly more than calcination, 2) it has no significant technical or schedule advantages, and 3) it is a thermal process, would produce considerable air emissions, and would require MACT.

Separations Options for Treatment of Mixed Transuranic Waste/SBW - Various options involving separation of the mixed transuranic waste/SBW were evaluated during the Preferred Alternative identification process. These options, and the reasons they were eliminated from detailed evaluation, are listed below.

- ***Cesium Ion Exchange with Transuranic Waste Grout Treatment -*** This technology uses a sorbent in an ion exchange column to extract cesium from the mixed transuranic waste/SBW. The remaining waste product would be grouted and shipped to the Waste Isolation Pilot Plant. At the time of this evaluation, the cesium-loaded resin would be grouted and sent directly to Hanford or the Nevada Test Site for disposal as remote-handled low-level waste. This process has some technology development questions concerning cesium ion-exchange column performance that would need to be resolved to use for mixed transuranic waste/SBW. In addition, this process has development questions that would require significant added functions and technology development in order to treat calcined waste, which would require dissolution prior to separations. This process was eliminated for further evaluation since it is not directly applicable to the treatment of mixed HLW calcine without significant further technology development. However, if calcine separations were considered it could be reconsidered.

- **Cesium Ion Exchange with Transuranic Extractions -** This option involves the use of cesium ion exchange, as described above, followed by transuranic extraction through the use of solvent technology and centrifugal contactors. The process is more complex than Cesium Ion Exchange with Transuranic Waste Grout, requiring several additional processes for the transuranic extraction cycle. The process has a low technical maturity, and would be more expensive than Cesium Ion Exchange or Transuranic Extractions alone.

- **Transuranic Extractions with Class C-Type Grout or Class A-Type Grout -** This option is similar to that described above and uses a solvent and centrifugal contactors to separate high activity and transuranic radionuclides from the mixed transuranic waste/SBW. Because cesium is not separated out of the waste stream at the front of the process, the process would produce transuranic wastes as well as remote-handled low activity waste for disposal at Hanford. The flow sheets for these options are more complex than either Universal Extractions (described below) or the Cesium Ion Exchange with Transuranic Waste Grout Treatment (described above), have low technical maturity and no perceived technical advantage over other mixed transuranic waste/SBW treatment options.

- **Universal Extractions and Modified Universal Extractions -** Universal Extractions technology uses solvents and centrifugal contactors to separate the high-activity and transuranic radionuclides from the mixed transuranic waste/SBW. The Modified Universal Extraction Option differs in that the low-activity transuranic waste would stay with the low-activity waste stream to create 5,000 cubic meters of contact-handled transuranic grout. Both extraction technologies would produce about 400 cubic meters of remote-handled transuranic waste. In general, Universal Extractions is not as mature a technology as Cesium Ion Exchange, and has a relatively complicated flow sheet, which would require significant technology development. Currently, solvent procurement questions exist with this technology since most technology development has been performed in foreign countries. Since these alternatives have no advantage over other separation processes, they were dropped from further evaluation.

Separations by Precipitation for Mixed Transuranic Waste/SBW - In addition to the four precipitation technologies proposed by the NAS (NAS Options 2-5, Section B.8.3.1), two additional precipitation methods were evaluated: Low-Temperature Precipitation and High-Temperature Evaporation and Precipitation.

- **Low-Temperature Precipitation -** Low-Temperature Precipitation removes the heat from mixed transuranic waste/SBW by refrigeration, causing at least one component of the waste to solidify as salt crystals, which can then be separated off. The concentrated liquid contains most of the fission and transuranic elements, and the precipitate would contain approximately 60 percent of the sodium. The precipitated salt cake would be grouted. This treatment technology is complex, in particular attempting to separate crystals out of the liquid mixed transuranic waste/SBW is viewed as difficult and perhaps impossible. A large amount of technology development would be required in order to determine if this process would work. There was no perceived advantage of this technology over more mature separations technologies and the technological risk was higher. Consequently, it was dropped from further evaluation.

- **High-Temperature Evaporation and Precipitation -** This option would evaporate mixed transuranic waste/SBW at less than 150°C to a specific gravity of 1.3, then collect the precipitate as the batch cools. The remaining liquid would be direct grouted, and the remote-handled grout would be shipped the Waste Isolation Pilot Plant. The precipitate would be low-level waste. There is no technical advantage of this technology over Low-Temperature Precipitation. It would produce more remote-handled transuranic waste and offgases compared to Low-Temperature Precipitation. There is significant technological uncertainty associated with this alternative, in particular there is a potential hazard of unplanned cool down with precipitate depositing and solidifying in process lines.

Direct Immobilization of Mixed Transuranic Waste/SBW - In addition to the waste immobilization options evaluated in the Draft EIS, three additional direct immobilization options were evaluated: Polymer Encapsulation, Direct Absorbent, and Silica Gel. Steam Reforming, also a direct immobilization alternative, was discussed in Section B.8.2.1.

- **Polymer Encapsulation -** This option would use a mix of 40 percent mixed transuranic waste/SBW and 60 percent polymer. The polymer is mixed with the mixed transuranic waste/SBW and forms a solid block directly in the can. This option was eliminated because waste volumes of remote-handled transuranic waste would be large (6,100 cubic meters), and the polymer is expensive. Although this technology has been demonstrated for low-level waste, the manufacturer does not recommend this treatment alternative for mixed transuranic waste/SBW. Consequently, it was dropped from further evaluation.

- **Direct Absorbent (similar to kitty litter) -** A clay material such as kitty litter or Ultra Sorb would be used to absorb mixed transuranic waste/SBW and eliminate the free liquids associated with the waste. This option was eliminated from detailed evaluation because of the large quantity of remote-handled transuranic waste that would be produced by this treatment alternative (12,500 cubic meters). This quantity of waste could exceed the Waste Isolation Pilot Plant capacity for remote-handled transuranics, and there are technical uncertainties regarding the dissociation of water in the containers.

- **Silica Gel -** In this option, a clay material would be added directly to the mixed transuranic waste/SBW and eliminate free liquid. The adsorbed waste would then be sent to Hanford for vitrification. The volume of remote-handled transuranic waste could exceed the capacity of the Waste Isolation Pilot Plant, significant development work could be required to initiate this alternative, and there is no perceived advantage over the Direct Cement Waste Option (evaluated in the Draft EIS) where the process is simpler.

HLW Calcine Technologies - For calcine treatment technologies, both separations and non-separations technologies were evaluated during the Preferred Alternative identification process. Calcine separations technologies were not eliminated from detailed evaluation, rather the final decision was postponed until at least 2007 after additional technology development. The technologies listed below are essentially the same as for mixed transuranic waste/SBW with some modifications to handle the calcine. In addition to the technologies listed below, separated high-activity waste could be sent to Hanford for vitrification.

- **Polymer Encapsulation -** In addition to the non-separations options evaluated in the Draft EIS, Polymer Encapsulation of mixed HLW calcine was also evaluated. The technology is described above for mixed transuranic waste/SBW. Polymer Encapsulation was eliminated from detailed evaluation because it would produce twice as much HLW as the Hot

Isostatic Pressed Waste Option evaluated in the Draft EIS. Additionally, the vendor has indicated it is probably not applicable for calcine treatment.

- **Cesium Ion Exchange with Transuranic Grout Treatment -** This process would be the same as for mixed transuranic waste/SBW, except for an added dissolution step for the mixed HLW calcine. For the calcine, cesium represents 99 percent of the gamma radiation associated with the dissolved calcine. This option removes the cesium in a downstream operation that allows the rest of the process to operate with less shielding. This separation technology for calcine has advantages of a simple flow sheet, small waste volumes of remote-handled low-level and transuranic wastes, and it is a non-thermal treatment. Disadvantages include leaving key nuclides in the low-activity stream, some technology development questions exist concerning the operation of the cesium ion exchange column, and it would require a waste incidental to reprocessing determination for disposal at the Waste Isolation Pilot Plant. If a decision were to be made in the future to separate mixed HLW calcine and process the waste, this option could be evaluated as a part of that process.

- **Cesium Ion Exchange with Transuranic Extractions -** This alternative is similar to the mixed transuranic waste/SBW treatment alternative except it would include the retrieval and dissolution of mixed HLW calcine prior to treatment. For calcine, cesium represents 99 percent of the gamma radiation associated with the dissolved calcine. This option removes the cesium in a downstream operation that allows the rest of the process to operate with less shielding. Most of the waste could go to Hanford as low-activity waste, it is a non-thermal process, and it maintains the flexibility to send high-activity waste to Hanford for vitrification. Disadvantages include low technical maturity, and it is more complicated than either Cesium Ion Exchange or Transuranic Extractions alone.

- **Transuranic Extractions with Class C-Type or Class A-Type Grout -** Both of these options have the advantage of non-thermal processes and were described for mixed transuranic waste/SBW processing. The same disadvantages discussed for mixed transuranic waste/SBW would apply to the processing of mixed HLW calcine and these options were dropped from further evaluation for the separations and treatment of calcine.

- **Universal Extractions and Modified Universal Extractions -** These processes are described above for mixed transuranic waste/SBW. These options are non-thermal and less complicated than Transuranic Extractions. Separations for calcine have not been eliminated, and this option could be evaluated as a backup to Cesium Ion Exchange with Transuranic Grout if needed.

B.9 Process Used to Identify the Preferred Alternatives

The purpose of this section is to provide a description of the activities undertaken by DOE and, as a cooperating agency, the State of Idaho (the State) to evaluate available data and reach consensus on recommended Preferred Alternatives for this EIS. This section summarizes the Preferred Alternatives identification process undertaken after the Draft EIS was issued in December 1999.

B.9.1 BACKGROUND

In 1995, DOE and the State entered into a Settlement Agreement/Consent Order which, in part, set enforceable milestones for the treatment of approximately 4,400 cubic meters of solid mixed HLW calcine and 1 million gallons of liquid mixed transuranic waste/SBW stored at the INTEC. In order to meet the milestones, various waste processing alternatives needed to be evaluated and programmatic decisions made relative to identifying the best path forward. Subsequently, DOE filed a Notice of Intent in 1997 to complete an EIS in accordance with NEPA to evaluate the environmental impacts of alternatives for treating calcine and mixed transuranic waste/SBW (as well as newly generated liquid waste), and the alternatives for the disposition of related HLW management facilities at INTEC. The State agreed to participate as a cooperating agency in the development of the EIS as a means to support the Settlement Agreement/Consent Order, provide State input into the decision process, and to facilitate the EIS review process.

During the alternative selection process for the Draft EIS, DOE identified and evaluated over 100 potential treatment technologies for calcine, mixed transuranic waste/SBW and newly generated liquid waste. The potential environmental impacts of the identified alternatives were analyzed in the Draft EIS. The extensive effort to identify the alternatives for the Draft EIS was documented in the report entitled *Process for Identifying Potential Alternatives for the Idaho High-Level Waste and Facilities Disposition Draft EIS* (DOE 1999a).

In January 2000, DOE issued the Draft EIS, but did not identify a Preferred Alternative to allow consideration of all public comment on the Draft EIS as a part of the Preferred Alternative identification process. After the Draft EIS was issued, data gathering and evaluation of potential waste processing technologies began, and continued until a Preferred Alternative was identified in October 2000.

B.9.2 APPROACH

This section provides an overview of the process for identifying the preferred waste processing alternatives for treating mixed transuranic waste/SBW, newly generated liquid waste, and calcine, and the Preferred Alternative for the disposition of HLW management facilities at INTEC.

B.9.2.1 Waste Processing Alternative Evaluation

The preferred waste processing alternative identification process commenced with the development of a Decision Management Plan that defined a structured approach. Key to this approach was the establishment of a Decision Management Team assigned the responsibility for overseeing the evaluation of relevant data, reaching consensus, and recommending a Preferred Alternative to senior DOE management. The plan also defined the roles and responsibilities of the three teams supporting the Decision Management Team, and included directions for incorporating public input and independent reviews. The process for identifying the preferred facility disposition alternative is discussed in Section B.9.2.2.

Figure B-1 shows the general organization of the teams supporting the identification of the Decision Management Team Preferred Alternative. The DOE Assistant Secretary for Environmental Management provided management guidance and direction to the Decision Management Team. Senior State of Idaho management were also involved through representatives on the team. The Decision Management Team consisted of a multidisciplinary group of experienced personnel from the State of Idaho's INEEL Oversight Program and Department of Environmental Quality and within the DOE complex (DOE Headquarters, DOE Idaho Operations, DOE Carlsbad Area Office, DOE Office of River Protection, and DOE Savannah River). The Public Involvement Team, the Performance Management Team, and the Decision Support Team provided input to the Decision Management Team for their consideration in identifying a Preferred Alternative.

In January 2000, the Decision Support Team began collecting and evaluating data to support the decision process. The Decision Support Team was comprised of four subteams. Team members were identified for specific expertise needed for each subteam and represented DOE, the State, and contractor staffs. The subteams and their areas of responsibility were:

- Technology and Cost Subteam - technology and costs

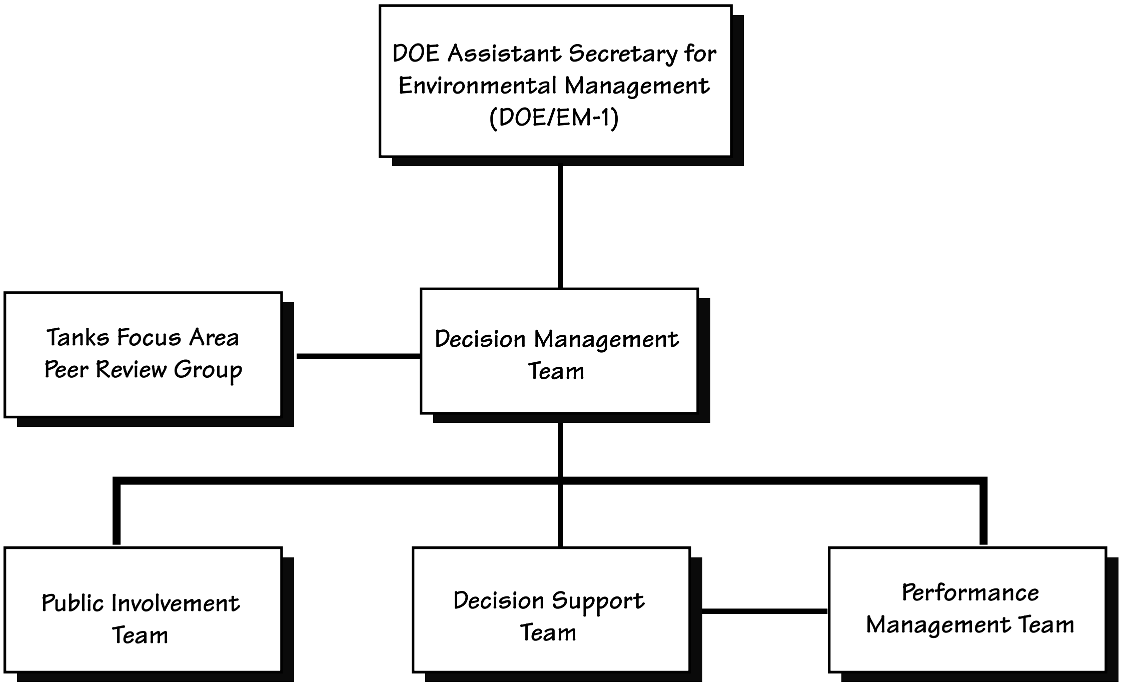


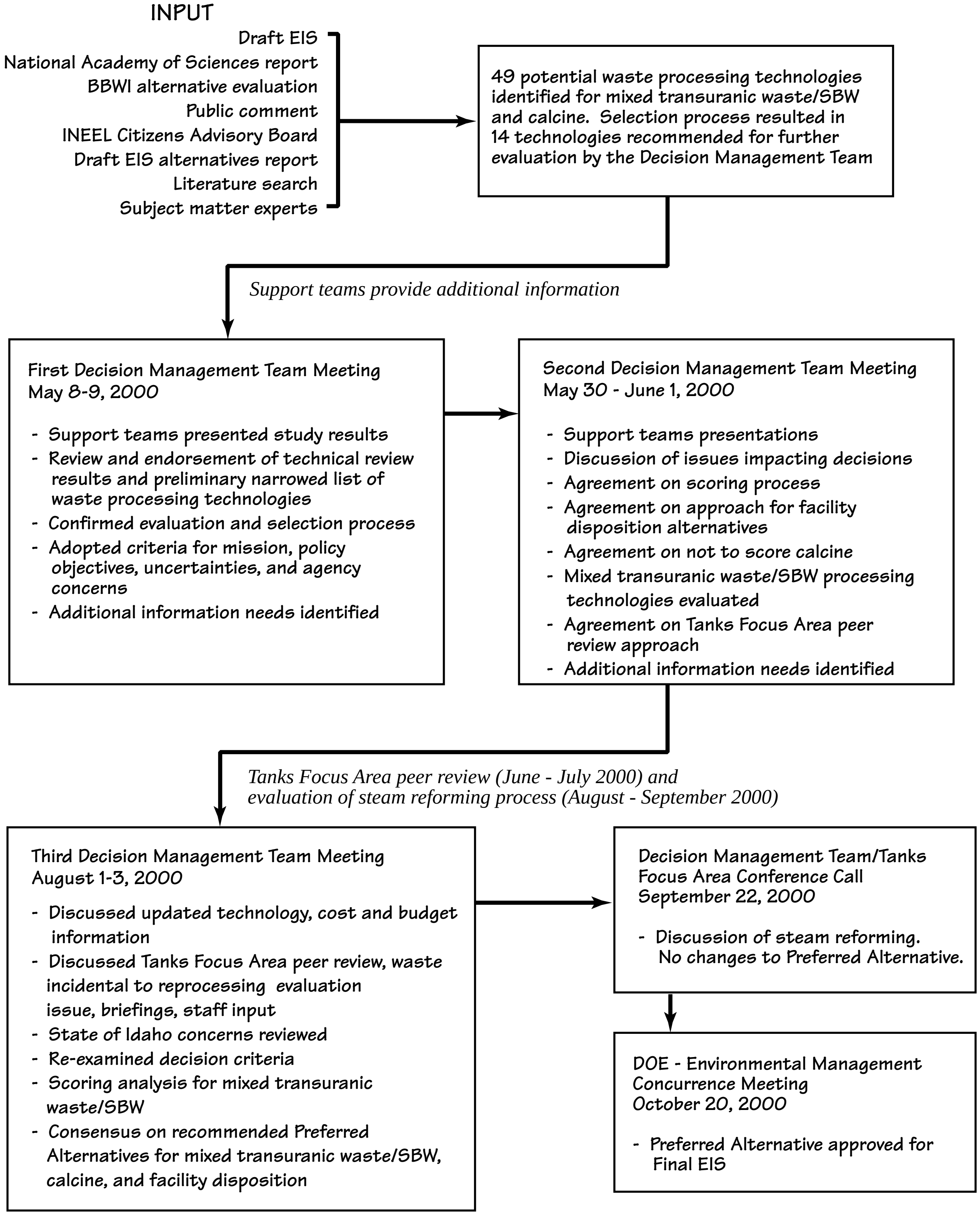
FIGURE B-1.
Organization of teams for identifying the Preferred Alternative.

- Environmental Subteam - estimated environmental impacts
- Facility Disposition Subteam - facility disposition impacts and approaches
- Combined Subteam - agency concerns, mission, policy, and uncertainties.

However, for simplicity, the individual subteams will be referred to here solely as the Decision Support Team.

Figure B-2 depicts the overall decision process. As shown in Figure B-2, the process began with a methodical search for reasonable waste processing technologies. Over sixty reference documents were evaluated, along with input from interviews, presentations, and agency and public comment. The technology identification process resource database included:

- The Draft EIS alternatives identification report (DOE 1999a) to identify technologies and alternatives warranting re-evaluation
- The NAS report, *Alternative High Level Waste Treatments at the Idaho National Engineering and Environmental Laboratory* (NAS 1999)
- A mixed transuranic waste/SBW processing analysis conducted by the management and operating contractor (Murphy et al. 2000) and detailed talks with authors
- Presentations by, and discussions with, waste processing subject matter experts
- Recommendations by the INEEL Citizens Advisory Board (CAB 2000)



INPUT
Draft EIS
National Academy of Sciences report
BBWI alternative evaluation
Public comment
INEEL Citizens Advisory Board
Draft EIS alternatives report
Literature search
Subject matter experts

49 potential waste processing technologies identified for mixed transuranic waste/SBW and calcine. Selection process resulted in 14 technologies recommended for further evaluation by the Decision Management Team

Support teams provide additional information

First Decision Management Team Meeting
May 8-9, 2000

- Support teams presented study results
- Review and endorsement of technical review results and preliminary narrowed list of waste processing technologies
- Confirmed evaluation and selection process
- Adopted criteria for mission, policy objectives, uncertainties, and agency concerns
- Additional information needs identified

Second Decision Management Team Meeting
May 30 - June 1, 2000

- Support teams presentations
- Discussion of issues impacting decisions
- Agreement on scoring process
- Agreement on approach for facility disposition alternatives
- Agreement on not to score calcine
- Mixed transuranic waste/SBW processing technologies evaluated
- Agreement on Tanks Focus Area peer review approach
- Additional information needs identified

Tanks Focus Area peer review (June - July 2000) and evaluation of steam reforming process (August - September 2000)

Third Decision Management Team Meeting
August 1-3, 2000

- Discussed updated technology, cost and budget information
- Discussed Tanks Focus Area peer review, waste incidental to reprocessing evaluation issue, briefings, staff input
- State of Idaho concerns reviewed
- Re-examined decision criteria
- Scoring analysis for mixed transuranic waste/SBW
- Consensus on recommended Preferred Alternatives for mixed transuranic waste/SBW, calcine, and facility disposition

Decision Management Team/Tanks Focus Area Conference Call
September 22, 2000

- Discussion of steam reforming. No changes to Preferred Alternative.

DOE - Environmental Management Concurrence Meeting
October 20, 2000

- Preferred Alternative approved for Final EIS

FIGURE B-2.
Overview of Decision Management Team.

- Input from the public from scoping activities, public involvement activities, and the Draft EIS public comment process
- Draft EIS alternative descriptions

Using this input and a structured alternatives identification process, the Decision Support Team identified 34 potential mixed transuranic waste/SBW treatment technologies and 15 potential calcine treatment technologies. The potential mixed transuranic waste/SBW treatment technologies were also applicable to newly generated liquid waste. The Decision Support Team then developed screening criteria. These criteria were eventually incorporated into one comprehensive list. Go/no-go criteria were also developed and used to screen out technologies. If a technology failed to meet this criteria, it was not scored. The go/no-go criteria were:

- Judged to be reasonable and satisfies "purpose and need" for this EIS
- Meets INTEC objectives of ultimate disposition of DOE radioactive liquid waste, calcine, and contaminated mixed debris according to regulatory requirements
- All the liquid in the 300,000 gallon underground tanks and all calcine in the bin sets is treated and made ready to leave Idaho by 2035

This process eliminated most of the technologies, leaving the most promising for further review.

The Decision Management Team was tasked with reviewing the technical data provided on various waste processing technologies, and determining if the data presented were suitable to support the identification process and if all reasonable technologies had been considered.

In addition, the Decision Management Team considered public and agency comments on the Draft EIS. The 15 key issues expressed from the comment period on the Draft EIS are listed below:

- Treatment alternatives
- Continued public involvement
- Meeting agreements/requirements versus making sound technical decisions
- Federal government obligations to States/Tribes versus funding constraints
- Scope of EIS (cost, technical viability)
- Continued calcine operations
- Treat liquids (mixed transuranic waste/SBW) first
- Protection of air and water
- Concern over the capability to fund alternatives
- DOE credibility
- Reclassification of waste
- Long-term stewardship of the land
- Issues affecting disposal
- Maintaining agreements with tribes
- Opposition to waste incineration

The Decision Management Team considered this information as it developed the goals and criteria used for evaluating, narrowing, and scoring the mixed transuranic waste/SBW technologies. For instance, the public preferences for no separations treatments and no incineration-type treatments were considered and discussed as the technologies were scored. These considerations and all other public issues identified were folded into appropriate criteria for scoring and were discussed as each technology was scored by the Decision Management Team. The Decision Management Team also periodically briefed and received guidance/direction from senior DOE/EM management on the nature of the public comments received, and the team's process for factoring the consideration of public comments into its deliberations.

The Decision Management Team also decided that an independent peer review team would be tasked with reviewing and evaluating the adequacy of the Preferred Alternative identification process and making independent recommendations. The requested independent review was conducted by the DOE Tanks Focus Area Peer Review Team. This team included experts in the field of HLW processing from Hanford, the Savannah River Site, Los Alamos National Laboratory, Oak Ridge National Laboratory, Syracuse University, and a consulting company. The Tanks Focus Area Peer Review Team issued a report in July 2000 (TFA 2000). The team concluded "DOE-ID and contractor staff have implemented a technology identification process and path forward planning approach that is very likely to succeed." (TFA 2000)

For mixed transuranic waste/SBW processing, the Tanks Focus Area Peer Review Team recommended adoption of direct vitrification as the baseline Preferred Alternative, with cesium ion exchange as a backup process. For treatment of calcine, the team recommended that DOE continue to develop direct vitrification and separations options and make final processing decisions consistent with plans to meet the 2035 "road-ready" compliance date specified by the Settlement Agreement/Consent Order. Additional recommendations include detailed technology road mapping with adequate resources made available to support evaluations and development of technologies.

The Tanks Focus Area Peer Review Team was also asked to participate in the evaluation of the steam reforming process, an alternative suggested as a result of public review of the Draft EIS. The team concluded that steam reforming of liquid mixed transuranic waste/SBW would not generate a waste form that can be directly disposed in a repository.

The Decision Management Team's goals and final screening criteria that were used to score the mixed transuranic waste/SBW processing technologies incorporated criteria from the areas of technology, costs, environmental impacts, public concerns, mission, agency concerns, uncertainties, and policy. Overall goals and individual criteria measuring the success of the goals were established by the Decision Management Team (Table B-4).

The Decision Management Team met three times and had one conference call over a period of five months to discuss and evaluate the proposed waste processing technologies. The results of the meetings are summarized in Figure B-2. The narrowed set of potential mixed transuranic waste/SBW processing technologies were scored by the Decision Management Team at the final meeting in August 2000.

The Decision Management Team also decided against scoring the calcine processing technologies because DOE lacked information regarding calcine retrievability and the potential impact of calcine characterization on the success of separations and immobilization technologies. The Decision Management Team determined that these knowledge gaps warranted further technology development as part of the overall decision process on a Preferred Alternative for calcine.

B.9.2.2 Facility Disposition Alternative Evaluation

As the list of waste processing technologies was narrowed, the Decision Support Team evaluated the various technologies and determined which facilities would need to be disposed that are currently part of the HLW program or that would be constructed to support the preferred waste processing alternative. The facility disposition alternatives evaluated were those identified in the Draft EIS, namely:

- Clean closure, with no hazardous or radiological contamination detectable above background
- Performance-based closure, with cleanup and closure conducted on a case-by-case basis based on risk to the workers and public
- Landfill closure, with cleanup conducted to meet standards for landfills

Consistent with the objectives and requirements of DOE Order 430.1A, Life Cycle Management, and DOE Manual 435.1-1, Radioactive Waste Management Manual, all newly constructed facilities implementing the preferred waste processing alternative would be designed and con-

Table B-4. Goals and associated criteria used by the Decision Management Team to score mixed transuranic waste/SBW processing technologies.

Goal and Definition	Criteria
Maximize Meeting Schedule Commitments - Meet the 2012 and 2035 Settlement Agreement/Consent Order and Notice of Noncompliance Consent Order milestones.	1. Schedule risk 2. Liquid mixed transuranic waste/SBW road-ready date
Minimize Cost - Minimize the near-term costs as well as the life-cycle costs. Disposal cost includes packaging and transportation.	3. Projects and operational costs 4. Disposal cost
Minimize Technical Risk - Minimize the potential for selection of a technically nonviable waste processing technology.	5. Technical maturity 6. Risk of technical failure
Minimize Environment, Safety, and Health Impacts -Minimize (a) impact to workers during the construction and operation of the facilities, (b) public risk from transportation doses and accidents, and (c) risk to the environment from releases to the air, soil, and water.	7. Safety and health (worker) 8. Public risk 9. Environmental risk
Maximize Utilization by Other Wastes - Get the most from the technology in terms of processing newly generated liquid waste, tank heel solids, and calcine.	10. Newly generated liquid waste mission 11. Calcine mission 12. Heel solids mission
Maximize Ability to Dispose - Make a waste that can be disposed of as quickly as possible.	13. Maximizes early disposal

structed consistent with the measures that facilitate clean closure methods.

The team reviewed the list of existing HLW Program facilities for accuracy and developed a list of new facilities anticipated for each waste processing technology. The team determined that there were three measurable parameters impacting facility disposition decisions: (a) size of the new facility, (b) complexity of facility operations, and (c) volume of the waste streams generated during facility disposition. Using the relative waste volumes, size of facility, and a judgment of process complexity, the team participated in an evaluation process that assigned a ranking score for each of the individual treatment technologies as it related to the requirements and activities associated with facility disposition.

The primary conclusion made by the Decision Management Team was that there were no facility disposition discriminators that would affect the team's decisions related to the preferred waste processing alternative. The team also concluded that the total environmental impact to meet facility disposition requirements for the EIS is considerably less significant when compared with the total environmental impacts associated with waste processing activities.

B.9.3 PREFERRED ALTERNATIVES

B.9.3.1 Decision Management Team's Recommended Preferred Alternative

This section summarizes the Decision Management Team's recommended Preferred Alternative.

B.9.3.1.1 Waste Processing

Mixed Transuranic Waste/SBW Treatment Preferred Alternative - Direct vitrification was recommended by the Decision Management Team because it has the advantage of being a mature technology with a lower risk of technical failure, and the final waste form (borosilicate glass) is the EPA's approved form for disposal in the HLW national geologic repository. Converting the mixed transuranic waste/SBW to glass would allow the waste to go to either the Waste Isolation Pilot Plant or the HLW geologic repository. Vitrification also has the advantage of being able to treat both mixed transuranic waste/SBW and calcine, although some modifications to the treatment process would be required for the treatment of calcined waste. Use of vitrification for both waste types enables the prorating of facility and processing costs, thereby reducing the overall cost for mixed transuranic waste/SBW processing.

The final disposal for vitrified SBW would depend on the outcome of the Waste Incidental to Reprocessing determination required by DOE Order 435.1 (DOE 1999b). The Waste Incidental to Reprocessing process is being used to determine whether the SBW at INTEC can be managed as mixed transuranic waste. The designation of the vitrified SBW as HLW would require disposal of the waste in a HLW national geologic repository (assumed to be Yucca Mountain). If the vitrified SBW were designated as transuranic waste, it would be disposed of at the Waste Isolation Pilot Plant. Disposing the vitrified SBW at the Waste Isolation Pilot Plant has the advantages of lower disposal costs, schedule compatibility with INEEL proposed processing times, a final waste form that would meet the Waste Isolation Pilot Plant waste acceptance criteria, and adequate disposal space to handle INEEL waste.

The HLW national geologic repository has not developed a final waste acceptance criteria, the schedule for opening the proposed Yucca Mountain facility (the only site currently being studied for a HLW geologic repository) is uncertain, and there are concerns on the adequacy of capacity available to accommodate DOE HLW. However, regardless of which location the final waste form is disposed of, it will be protective of human health and the environment.

Calcine Treatment Preferred Alternative - The Decision Management Team's recommended Preferred Alternative for calcine was to retrieve the calcine presently stored in the six bin sets at INTEC, vitrify it, and place it in a form to enable compliance with the current legal and regulatory requirement to have HLW road ready by a target date of December 31, 2035. Concurrent with the program to design, construct, and operate the vitrification facility for mixed transuranic waste/SBW, DOE would initiate a program to characterize the calcine, and develop methods to construct and install the necessary equipment to retrieve calcine from the bin sets. DOE would focus technology development on the preferred calcine treatment technology of vitrification, and the feasibility and merits of performing calcine separations as well as refine cost and engineering design. Conditioned on the outcome of future technology development and resulting treatment decisions, DOE could design and construct the appropriate calcine separations capability at INEEL. For treatment of separated mixed HLW fractions, DOE would also evaluate the use of Hanford vitrification capabilities as they are developed. A final treatment decision on the specific waste processing method would be anticipated after 2007 when technology development would be completed.

Newly Generated Liquid Waste Treatment Preferred Alternative - In 2005, DOE intends to redirect all newly generated liquid waste to tanks that meet state and federal Resource Conservation and Recovery Act regulations, or treat the waste directly. Under the Decision Management Team's Preferred Alternative, the newly generated liquid waste stream would be completely segregated from the mixed HLW calcine and mixed transuranic waste/SBW streams and would contain no fraction requiring management as HLW. Newly generated liquid waste could be grouted in containers and disposed of as low-level waste or transuranic waste, depending on its characteristics.

B.9.3.1.2 Facility Disposition

Consistent with the objectives and requirements of DOE Order 430.1A, Life Cycle Management, and DOE Manual 435.1-1, Radioactive Waste Management Manual, all newly constructed facilities implementing the preferred waste processing alternative would be designed and constructed consistent with the measures that facilitate clean closure methods. For existing HLW facilities, the Decision Management Team's Preferred Alternative was to apply, on a case-by-case basis, the most viable closure options, that would provide a systematic reduction of risks due to residual wastes and contaminants. These remaining residual wastes would be immobilized by methods such as grouting and disposed of in-place and monitored in accordance with the applicable requirements of RCRA and Idaho Hazardous Waste Management Act. Closure would be performed to levels economically, practically, and technically feasible such that satisfactory protection of the environment and the public is achieved in accordance with applicable regulations.

The Decision Management Team's Preferred Alternatives for mixed transuranic waste/SBW processing, newly generated liquid waste, calcine processing, and facility disposition were identified for recommendation to DOE/EM. Final approval of the alternatives recommended by the Decision Management Team was obtained from the DOE Assistant Secretary for Environmental Management on October 20, 2000.

After DOE and the State of Idaho identified the alternative of vitrification with or without calcine separations, it was decided to use the term "direct vitrification" in reference to the broader alternative with "vitrification without calcine separations" and "vitrification with calcine separations" to distinguish options. The new alternative referred to in this EIS as Direct Vitrification is described in Section 3.1.6.

B.9.3.2 DOE's Preferred Alternative

As discussed in the previous section, DOE and the State of Idaho identified vitrification of the mixed transuranic waste/SBW and calcine with or without separations as the Preferred Alternative in October 2000. In September 2001, DOE conducted an assessment of the alternatives and options using the following assumptions:

- Sodium bearing waste is mixed transuranic waste
- Treated SBW can be disposed of at WIPP
- Calcine is an acceptable final waste form for disposal at the geologic repository
- Steam reforming is an acceptable treatment technology for the SBW
- The liquid mixed transuranic waste/SBW can be grouted in place
- The calciner can be operated in its present interim status configuration.

With these assumptions as a basis, and also in consideration of public comment on the Draft EIS, DOE decided on a performance based rather than a technology based Preferred Alternative for waste processing. DOE's Preferred Alternative for facility disposition is the same as that identified by DOE and the State of Idaho in October 2000.

The revised Preferred Alternative for waste processing focuses on the removal and stabilization of the remaining liquids, without specifying a stabilization technology. There is a range of technologies, analyzed in the EIS that meet this performance objective.

With respect to the alternative of continued calcination of the remaining liquids, the current analysis regarding operation of the calciner with modifications to comply with environmental regulations would be maintained. Operating the calciner in its present interim status configuration was evaluated and eliminated from detailed analysis in the Final EIS based on programmatic considerations.

The alternative of disposing of the grouted liquid waste *in situ* was re-evaluated and eliminated from detailed analysis considering the complexity of the stabilization process and regulatory obstacles involved. Based on the re-evaluation it is included in the Final EIS as an alternative considered but eliminated from detailed analysis.

An additional option called Steam Reforming has been added to the Non-Separations Alternative. This option analyzes the use of a steam reforming technology to treat the mixed transuranic waste/SBW, and incorporates updated information received since the Tanks Focus Area report was issued that recommended steam reforming as an offgas treatment. In addition, this option includes the analysis for placing the HLW calcine in containers and sending it directly to a repository. This option is structured similar to the alternatives/options analyzed in the EIS for comparison purposes.

DOE has decided to identify a Preferred Alternative that meets performance objectives rather than a single technology. Thus, DOE's Preferred Alternative is to implement a slightly revised version of the Proposed Action presented in Chapter 1 of this EIS. The Preferred Alternative is a performance-based rather than technology-based approach to fulfilling the Department's statutory mission and responsibilities. The performance objectives could be accomplished through implementing technologies and actions representative of those analyzed in the EIS. The Proposed Action and the performance objectives of the Preferred Alternative are presented below:

- **Develop appropriate technologies and construct facilities necessary to prepare INTEC mixed transuranic waste/SBW for shipment to WIPP -** DOE would treat all mixed transuranic waste/SBW stored in the INTEC Tank Farm and ship the product waste to WIPP for disposal. A range of potential treatment technologies representative of those that could be used is analyzed in this EIS. The Department's objective is to treat the mixed transuranic waste/SBW such that this waste would be ready for shipment to WIPP by December 31, 2012.

- **Prepare the mixed HLW calcine so that it will be suitable for disposal in a repository -** DOE would place all mixed HLW calcine in a form suitable for disposal in a repository. This may include any of the treatment technologies analyzed in this EIS in addition to shipment to a repository without treatment as analyzed in this final EIS. The Department's objective is to place the mixed HLW calcine in a form such that this waste would be ready for shipment out of Idaho by December 2035.

- **Treat and dispose of associated radioactive wastes -** DOE would treat and dispose of all wastes associated with the treatment and management of HLW and mixed transuranic waste at INTEC. This includes the treatment and disposal of newly generated liquid waste. A range of the potential treatment technologies that could be used is analyzed in this EIS.

- **Provide safe storage of HLW destined for a repository -** DOE will continue to store mixed HLW calcine in the INTEC calcine bin sets until the calcine is retrieved for treatment or placed in containers for shipment to a repository.

- **Provide for the disposition of INTEC HLW management facilities when their missions are completed -** DOE will disposition existing INTEC HLW management facilities in accordance with performance based closure standards. All newly constructed facilities necessary to implement the Proposed Action/Preferred Alternative would be designed and constructed consistent with measures that facilitate clean closure.

  Selection and implementation of specific technologies would be based on a balance of optimum treatment and cost effectiveness with reduction of risk to human health and the environment. The range of potential environmental impacts and risk to human health, including cumulative impacts, under any of the currently available technologies is characterized by the analysis in this EIS. The alternatives are composed of modular options and projects that may be combined and configured as needed to implement the Proposed Action/Preferred Alternative.

B.9.3.3 State of Idaho's Preferred Alternative

The State of Idaho has elected to keep the Preferred Alternative recommended by the Decision Management Team as the State of Idaho's Preferred Alternative. The State is willing to reconsider its preference if further development of other technologies or analysis of repository and transportation requirements indicates another alternative meets the following criteria:

- The alternative meets transportation and repository waste acceptance requirements to enable DOE to ship all HLW and mixed transuranic waste/SBW and any fraction thereof out of Idaho;
- The alternative has environmental impacts comparable or less than those of the State's Preferred Alternative;
- The alternative can be completed in a comparable or shorter timeframe; and
- The alternative is of comparable or lower cost.

B.9.3.3.1 Waste Processing

The State of Idaho's Preferred Alternative for waste processing is the Direct Vitrification Alternative described in Section 3.1.6. This alternative includes vitrification of mixed transuranic waste/SBW and vitrification of the HLW calcine with or without separations.

Under the option to vitrify the mixed transuranic waste/SBW and calcine without separations, the mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets and vitrified. In both cases, the vitrified product would be stored at INTEC pending disposal in a geologic repository.

The option to vitrify the mixed transuranic waste/SBW and vitrify the HLW fraction after calcine separations would be selected if separations were shown to be technically and economically practical. Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets and chemically separated into a HLW fraction and transuranic or low-level waste fractions, depending on the characteristics of the waste fractions. The HLW fraction would be vitrified. In both cases, the vitrified product would be stored at INTEC pending disposal in a geologic repository. The transuranic or low-level waste fractions would be disposed of at an appropriate disposal facility outside of Idaho.

In addition, under the Direct Vitrification Alternative, newly generated liquid waste could be vitrified in the same facility as the mixed transuranic waste/SBW, or DOE could construct a separate treatment facility for newly generated liquid waste.

B.9.3.3.2 Facility Disposition

The State of Idaho's Preferred Alternative for facility disposition is the same as that recommended by the Decision Management Team. DOE would disposition existing INTEC HLW management facilities in accordance with performance based closure standards. All newly constructed facilities necessary to implement the Preferred Alternative would be designed and constructed consistent with measures that facilitate clean closure.

B.10 Final List of Final EIS Alternatives

Therefore, as a result of all the activities discussed in this Appendix, the Final Idaho HLW & FD EIS analyzed the following waste processing alternatives and options:

1. No Action Alternative
2. Continued Current Operations Alternative
3. Separations Alternative
    A. Full Separations Option

- B. Planning Basis Option
- C. Transuranic Separations Option

4. Non-Separations Alternative
   - A. Hot Isostatic Pressed Waste Option
   - B. Direct Cement Waste Option
   - C. Early Vitrification Option
   - D. Steam Reforming Option
5. Minimum INEEL Processing Alternative
6. Direct Vitrification Alternative
   - A. Vitrification without Calcine Separations Option
   - B. Vitrification with Calcine Separations Option

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Appendix C.1

Socioeconomics

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(continued)

Appendix C.1

Socioeconomics

The socioeconomic impact analysis conducted for this environmental impact statement (EIS) examines the potential effects of the proposed Idaho HLW & FD EIS waste processing and facility disposition alternatives on the region of influence's social and economic resources, including employment, regional income, and population. The methodology for this EIS is similar to that used in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (SNF & INEL EIS) (DOE 1995) but uses updated data and a revised version of the Regional Input-Output Modeling System (RIMS II) model.

The analysis presented in Sections 5.2.2 and 5.3.2 evaluates the potential effects of the waste processing and facility disposition alternatives relative to the baseline socioeconomic conditions described in Section 4.3, Socioeconomics. The existing and projected economic conditions in the region of influence provide the framework for assessing the socioeconomic impacts of the alternatives. The impact analysis, as described in the following methodology section, estimates the effects of the alternatives on regional employment and earnings. Employment and earnings effects could generate possible changes in regional population and in the demand for housing and community services.

In general, the analysis indicates that each alternative would have the potential to generate changes in Idaho National Engineering and Environmental Laboratory (INEEL)-related expenditures and workforce levels with possible pass-through or indirect effects on the regional economy. Since 1991, INEEL employment levels have declined about 35 percent to approximately 8,100 jobs. Long-range employment forecasts are not available for INEEL missions but indications based on budget forecasts suggest workforce levels have stabilized at current levels and will not fluctuate more than ± 5 percent (McCammon 1999). Currently, about 1,100 of these workers are associated with the Idaho Nuclear Technology and Engineering Center (Beck 1998). The U.S. Department of Energy (DOE) assumes that these workers are the basis for the high-level waste (HLW) workforce.

C.1.1 REGION OF INFLUENCE

The analysis of socioeconomic impacts is limited to a seven-county area surrounding the INEEL comprised of Bannock, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison counties and the Fort Hall Indian Reservation and Trust Lands (home of the Shoshone-Bannock Tribes). This region of influence is determined according to the following criteria previously used in the programmatic SNF & INEL EIS:

- Counties that contain the residences of at least 85 percent of the current INEEL operations and construction workforce

- Counties in which the resident INEEL workforce comprises 5 percent or greater of the county's civilian labor force

C.1.2 METHODOLOGY AND KEY ASSUMPTIONS

The analysis of socioeconomic impacts considers impacts on economic activity, as measured by changes in employment and earnings, and the community, as measured by changes in population and the demand for housing and community services. The socioeconomic impacts estimated in this analysis would be generated by expenditures and employment allocated to the waste management program at INEEL, which include DOE employment as well as site-related contractors and subcontractors.

The analysis addresses both direct and indirect socioeconomic impacts. Direct impacts are changes in INEEL employment and expenditures expected to take place under each alternative and include both construction and operations phases. Direct employment impacts represent actual increases or decreases in INEEL staffing for a given project regardless of whether or not the jobs are new or reassigned from other missions. Indirect impacts include (a) the impacts to businesses in the region of influence and employment resulting from changes in DOE purchases or nonpayroll expenditures and (b) the impacts to the region of influence businesses and employment that result from changes in spending by INEEL employees. The total economic impact to the region of influence is the sum of direct and indirect impacts.

To analyze socioeconomic effects, DOE used total employment and earnings multipliers, obtained from RIMS II developed specifically for the INEEL region of influence by the U.S. Bureau of Economic Analysis. RIMS II is widely used in both the private and public sector. In the private sector, analysts, consultants, and economic development practitioners use the model to estimate regional impacts of proposed projects. In the public sector, this model is used by state and Federal agencies, including the U.S. Department of Defense and DOE (BEA ***2000***). In addition, several recent DOE EISs and programmatic EISs for INEEL used the RIMS II model. The model's multipliers derive from the U.S. Bureau of Economic Analysis's national input-output table, adjusted using the U.S. Bureau of Economic Analysis's most recent region-specific information describing the relationship of the regional economy to the national economy (BEA 1997).

The indirect impacts are thus determined by applying the regional specific multiplier to direct job and INEEL expenditure estimates for each project to determine the comparable change in the regional economy. The multipliers vary by project phase. For example, the multiplier used to estimate indirect employment is approximately ***50*** percent higher for activities in the operational phase than it is for those in the construction or facility disposition phases. The multipliers used to estimate total earnings are less than 1% higher for the construction and facility disposition phases.

Since the publication of the Draft EIS, Census 2000 and related data have been incorporated into the socioeconomic analyses. Population figures, housing characteristics, labor information, and economic multipliers (such as employment and earnings multipliers) have been updated to reflect the most current socioeconomic environment in the region of influence.

C.1.3 ECONOMIC ACTIVITY

The following assumptions were used as a basis for conducting the analysis:

- Construction and operations employment are treated as if they were newly created jobs for all the alternatives; in reality, a substantial amount of retraining and reassignment of existing personnel would occur.
- Construction staffing is based on project data sheets (see Appendix C.6). Impacts are assessed for the peak year of construction.
- Operations staffing is based on project data sheets (see Appendix C.6). Impacts are assessed for the peak year of operations.
- For construction and operations workers, an average annual salary of $28,040 and $32,683 respectively is assumed (IDOL 1998).
- Based on DOE budget forecasts and historical trends, the analysis assumes a stabilized INEEL workforce of about 8,100 with a ± 5 percent fluctuation (McCammon 1999).

C.1.3.1 INEEL Employment and Expenditures

Potential jobs and total earnings associated with INEEL waste management activities would be greatest during the construction phase. The maximum peak year (2013) direct and indirect employment is estimated to be about ***1,700***. Compared to the estimated employment pool for the region of influence in that year of ***154,000*** (RIMS II), in the construction sector, forecasts indicate about 6,500 to 7,000 construction workers would be in the area.

Similarly, the maximum peak work force levels for the operational phase is estimated to be about ***1,560*** jobs (2015). Again, compared to the estimated employment pool in the peak year of

158,000 (RIMS II) any small net increase in new jobs required could be obtained regionally.

Because regional earnings or expenditures are fundamentally related to the workforce assigned to a project, the maximum related total earnings also would occur in 2013 and 2015 for construction and operations, respectively. The estimated total regional earnings for 2013 are about $***42*** million; an estimated $31 million would occur in the operational peak year (2015). Both of the earnings estimates take into account indirect job creation in the region of influence.

In the case of facility disposition activities, peak year estimates are not as meaningful. During disposition activities, the durations of discrete project elements are relatively short, and activities do not always occur sequentially. Consequently, annual employment rather than peak year estimates were utilized for each alternative to determine the potential impacts. ***Also, any HLW storage-related projects were eliminated from the peak year analysis because storage timing and durations are dependent on outside factors such as completion of the national geologic repository. It would be difficult to form estimates based on these unknowns.***

C.1.3.2 Population, Housing, and Community Services

Population changes associated with the project baseline conditions and the proposed alternatives are an important determinant of other social, economic, and environmental impacts. These population changes have three key components: (1) baseline growth, (2) relocation of workers and their dependents, and (3) natural increases in population over the longterm.

As mentioned in Chapter 5, indications are that the INEEL workforce has stabilized but could vary by about 5 percent. If the variation resulted in downsizing, about 400 jobs could be lost. Consequently, the reduction of employment could result in a reduced demand for housing and rental units. Assuming all 400 individuals own or rent housing units, the amount of available housing would increase by about one-half of 1 percent (or 0.005).

The situation involving potential impacts to community services and public finance is similar to that described for population and housing. As the demand for workers in a region vary, the pressure on community services and the tax base also varies. A potential downsizing of 400 jobs as discussed in the previous ***paragraph*** would not likely generate discernible impacts on community services and public finance within the region of influence. While the magnitude of the impacts may be small, they could result in reduced school enrollments and similar declines in demand for other community services.

C.1.4 DATA

Figures C.1-1 through C.1-***22*** summarize construction and operations-phase employment estimates for the various waste processing alternatives. Figures C.1-***23*** through C.1-***33*** show employment associated with disposition of new waste processing facilities required under the various alternatives. ***As stated previously, HLW storage-related projects were eliminated from the peak year analysis for facility disposition because storage timing and duration are dependent on outside factors such as the completion of the national geologic repository.***

The figures depict estimated direct employment on an annual basis. The multipliers and wage rate described in Section C.1.2 of this appendix were applied to these employment estimates to estimate the total employment and expenditure potential associated with each alternative.

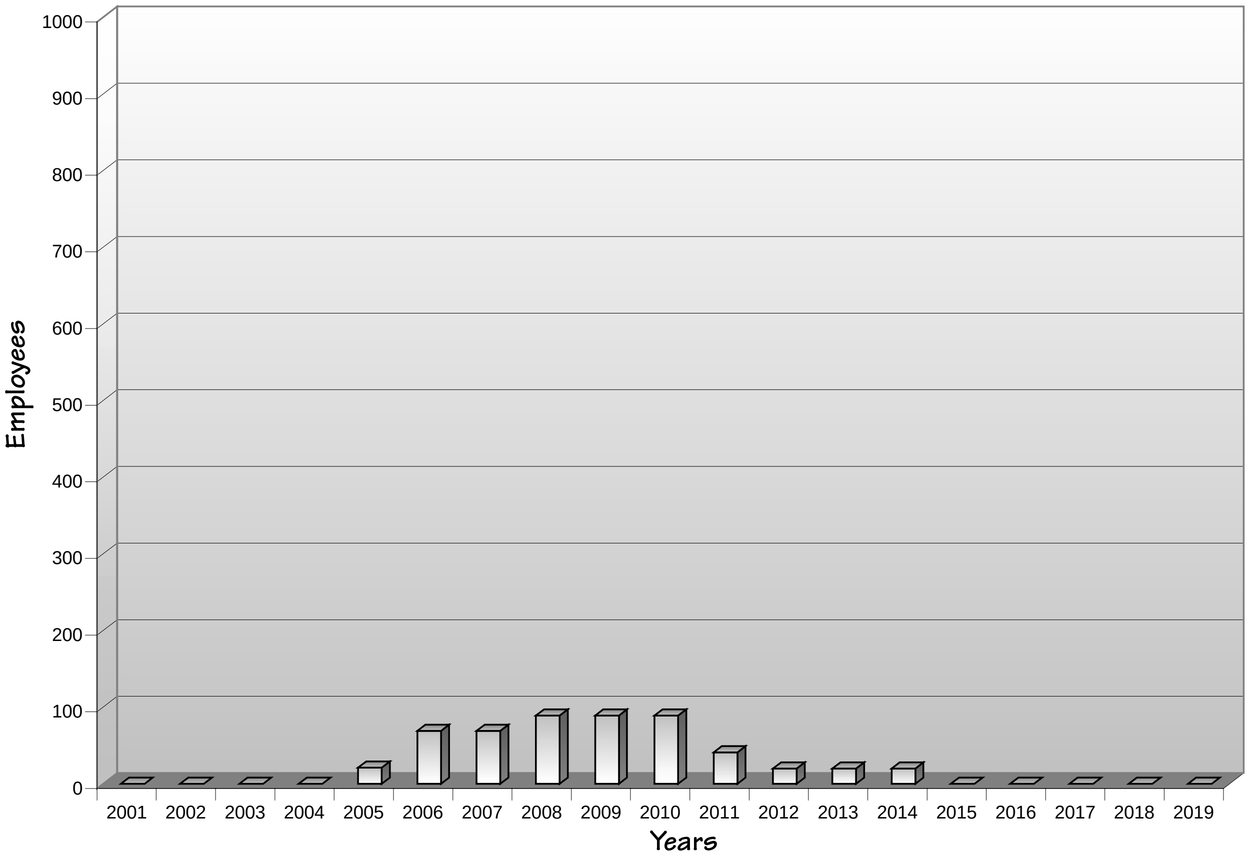

FIGURE C.1-1.
Continued Current Operations Alternative - Construction Employment.

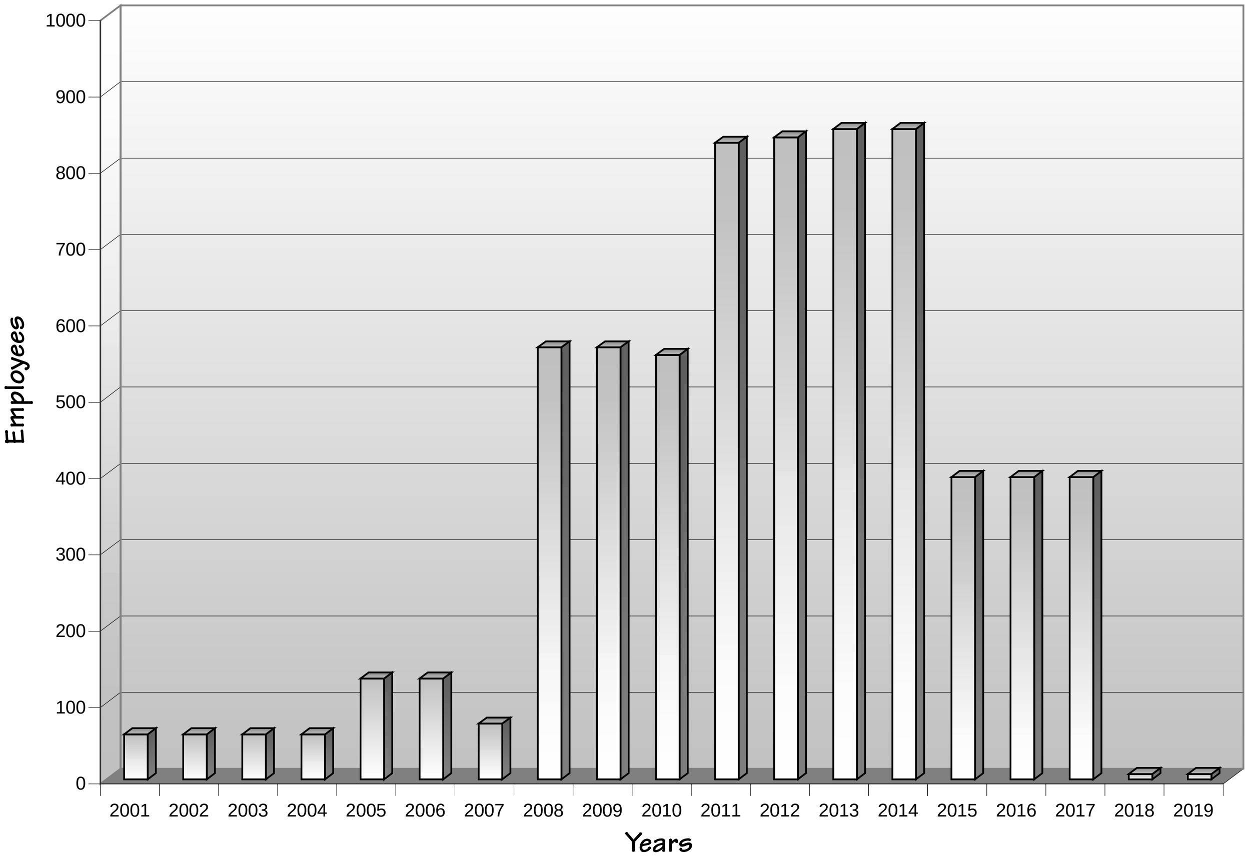

FIGURE C.1-2.
Separations Alternative - Full Separations Option - Construction Employment.

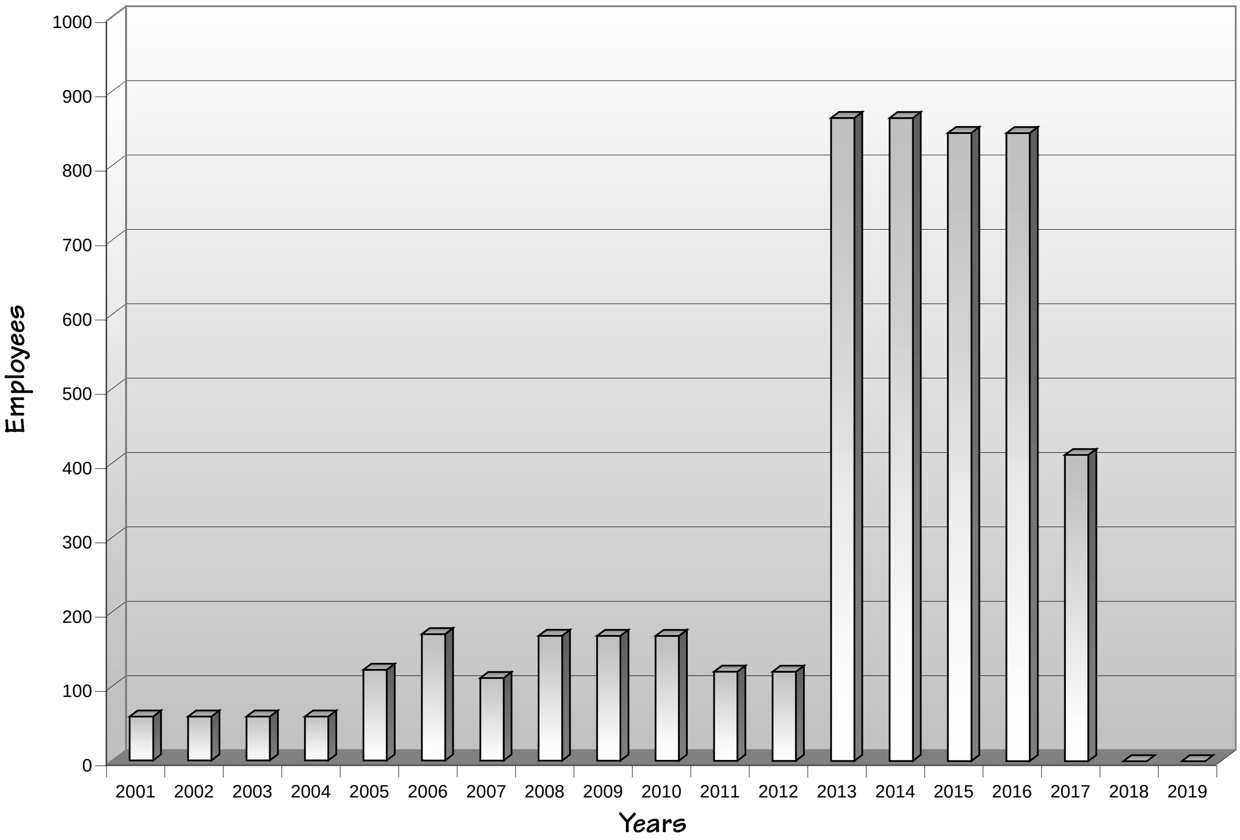

FIGURE C.1-3.
Separations Alternative - Planning Basis Option - Construction Employment.

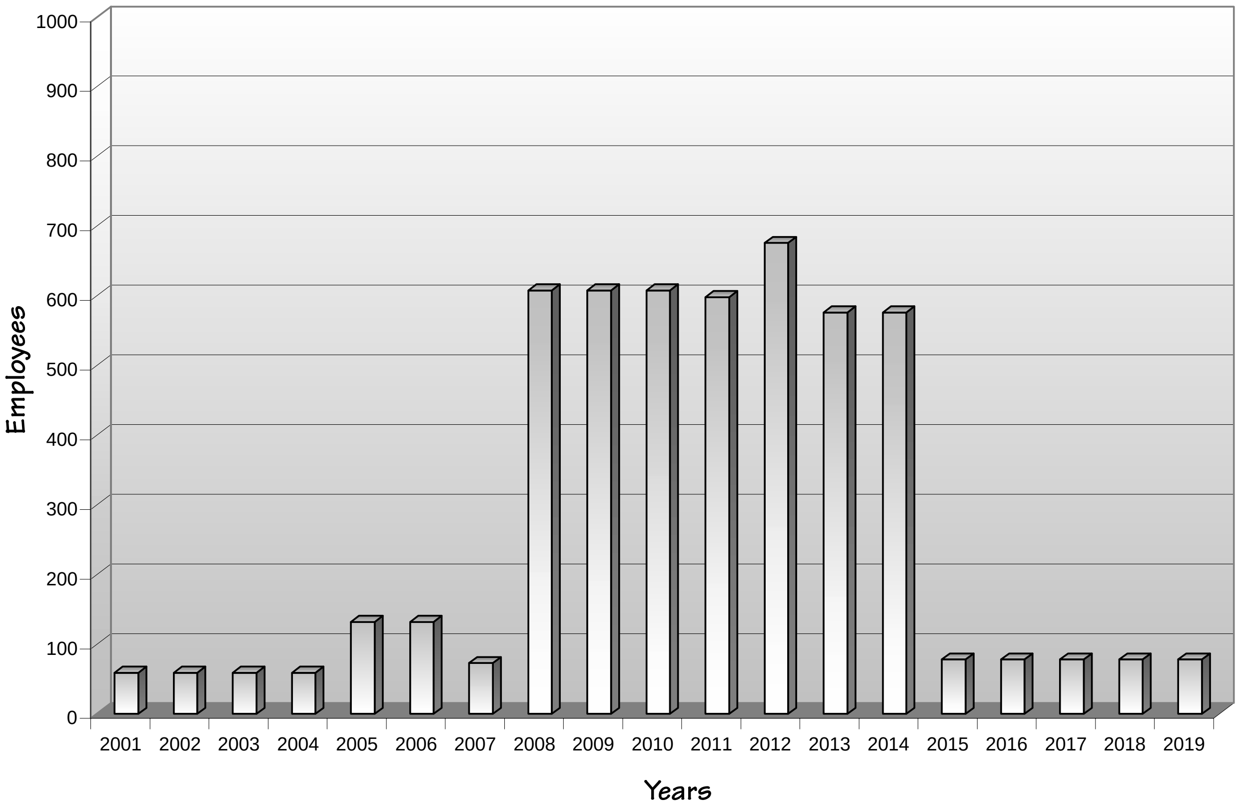

FIGURE C.1-4.
Separations Alternative - Transuranic Separations Option - Construction Employment.

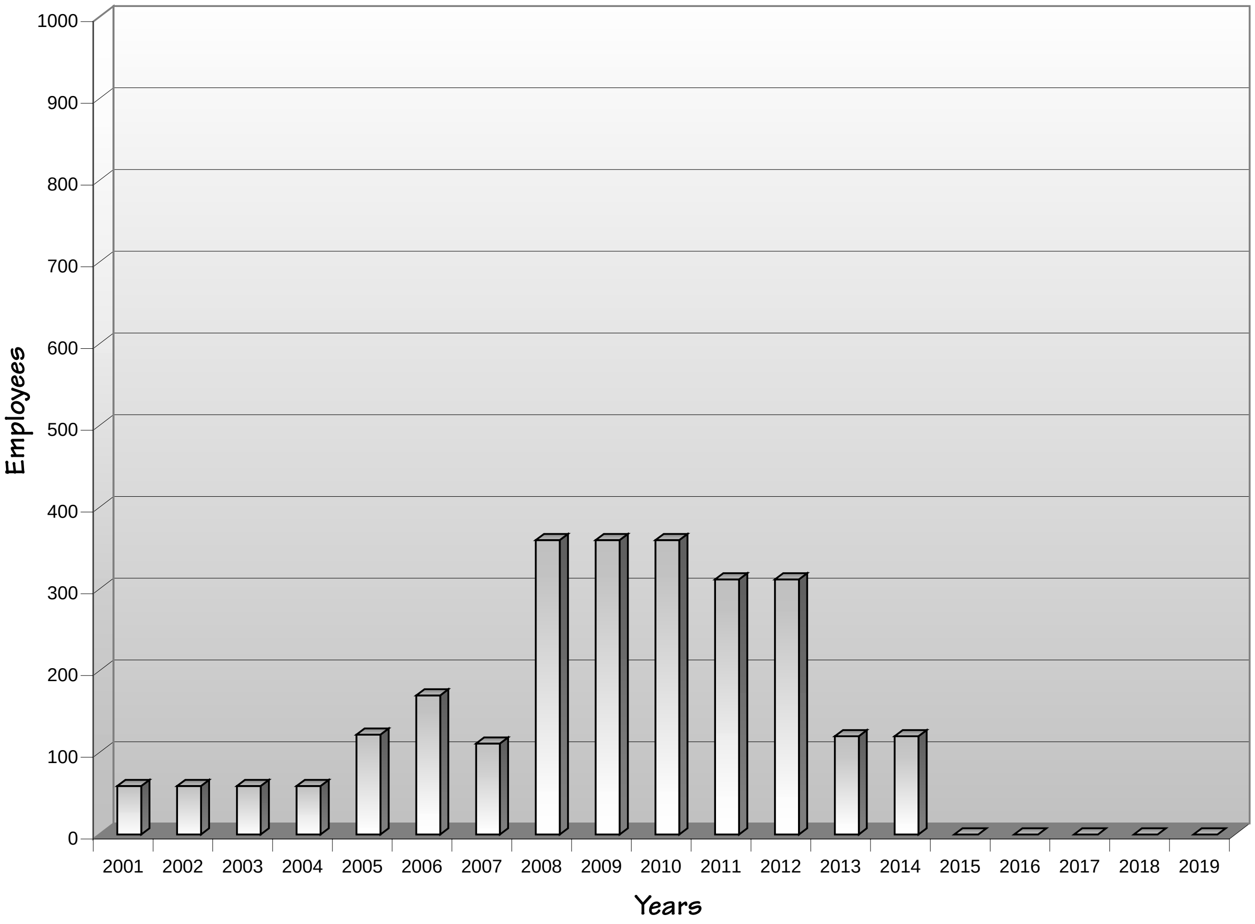

FIGURE C.1-5.
Non-Separations Alternative - Hot Isostatic Pressed Waste Option - Construction Employment.

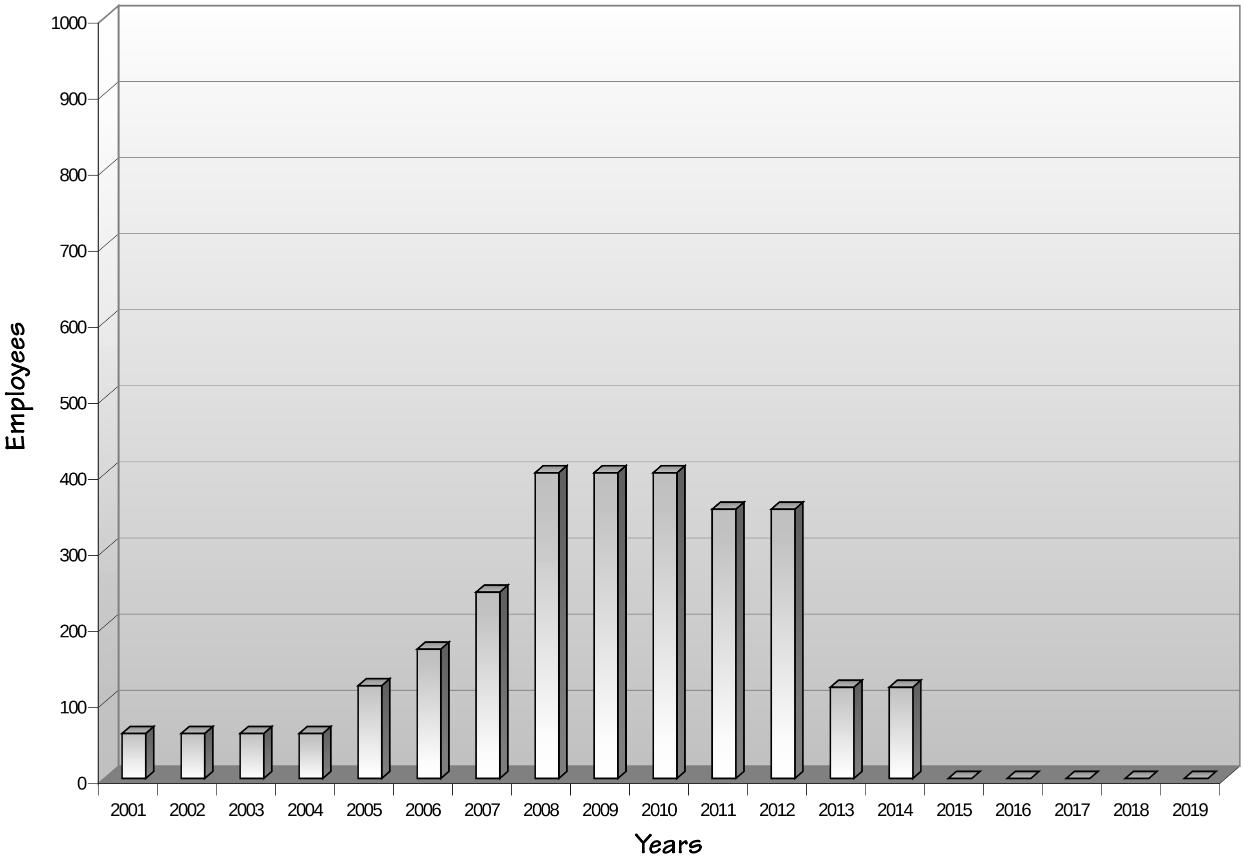

FIGURE C.1-6.
Non-Separations Alternative - Direct Cement Waste Option - Construction Employment.

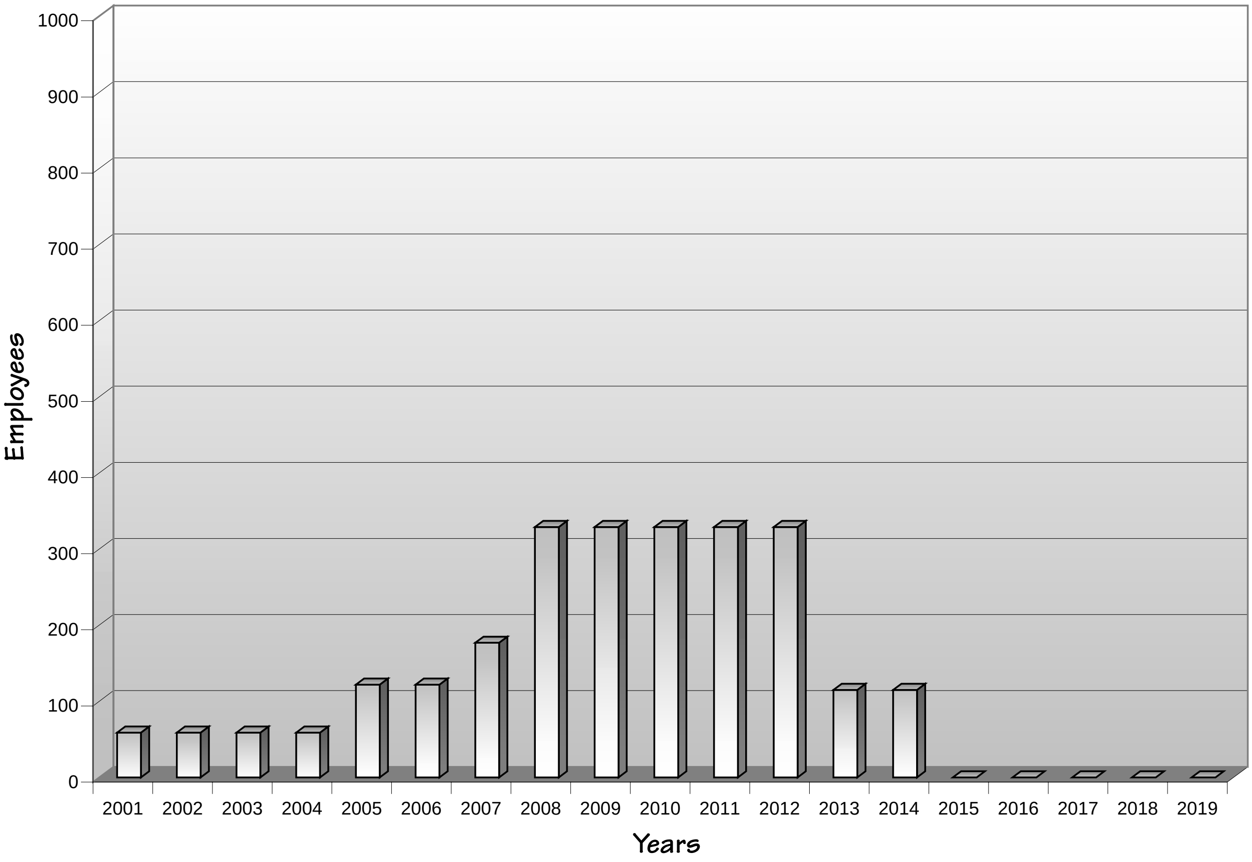

FIGURE C.1-7.
Non-Separations Alternative - Early Vitrification Option - Construction Employment.

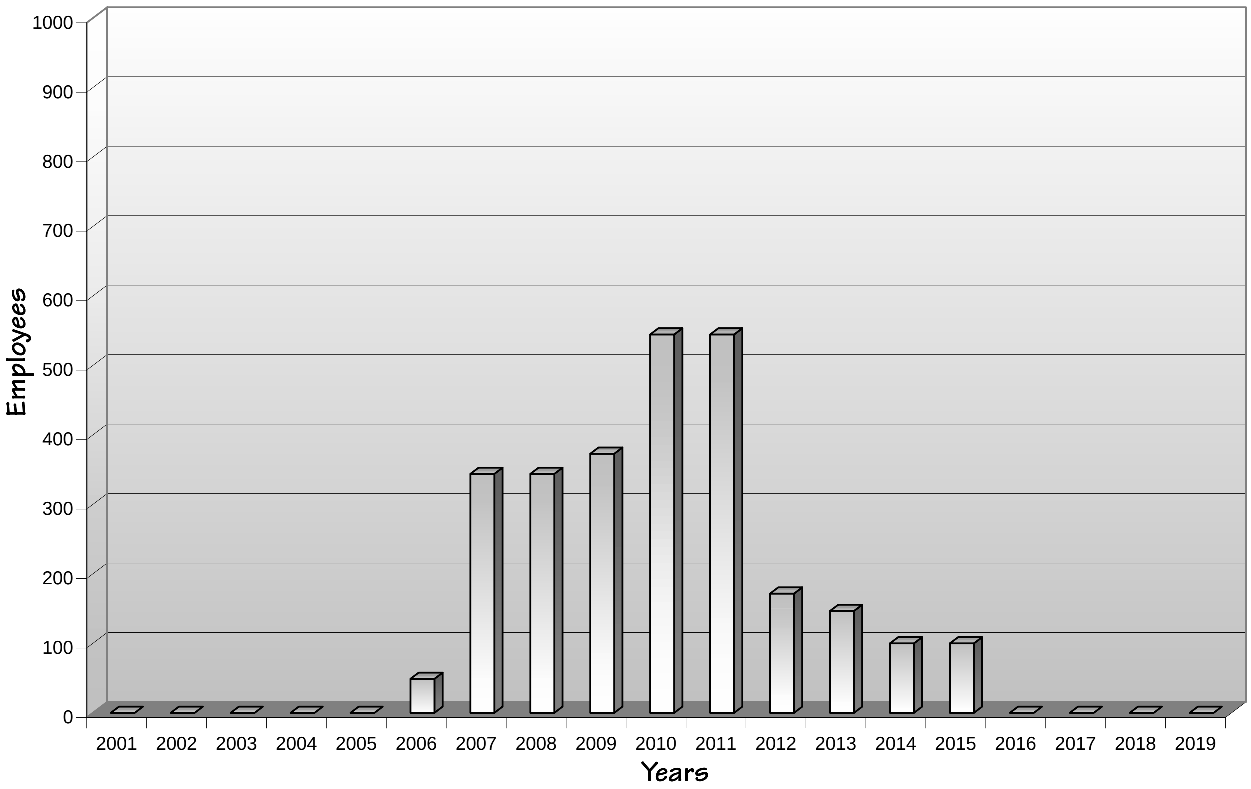

FIGURE C.1-8.
Non-Separations Alternative - Steam Reforming Option - Construction Employment.

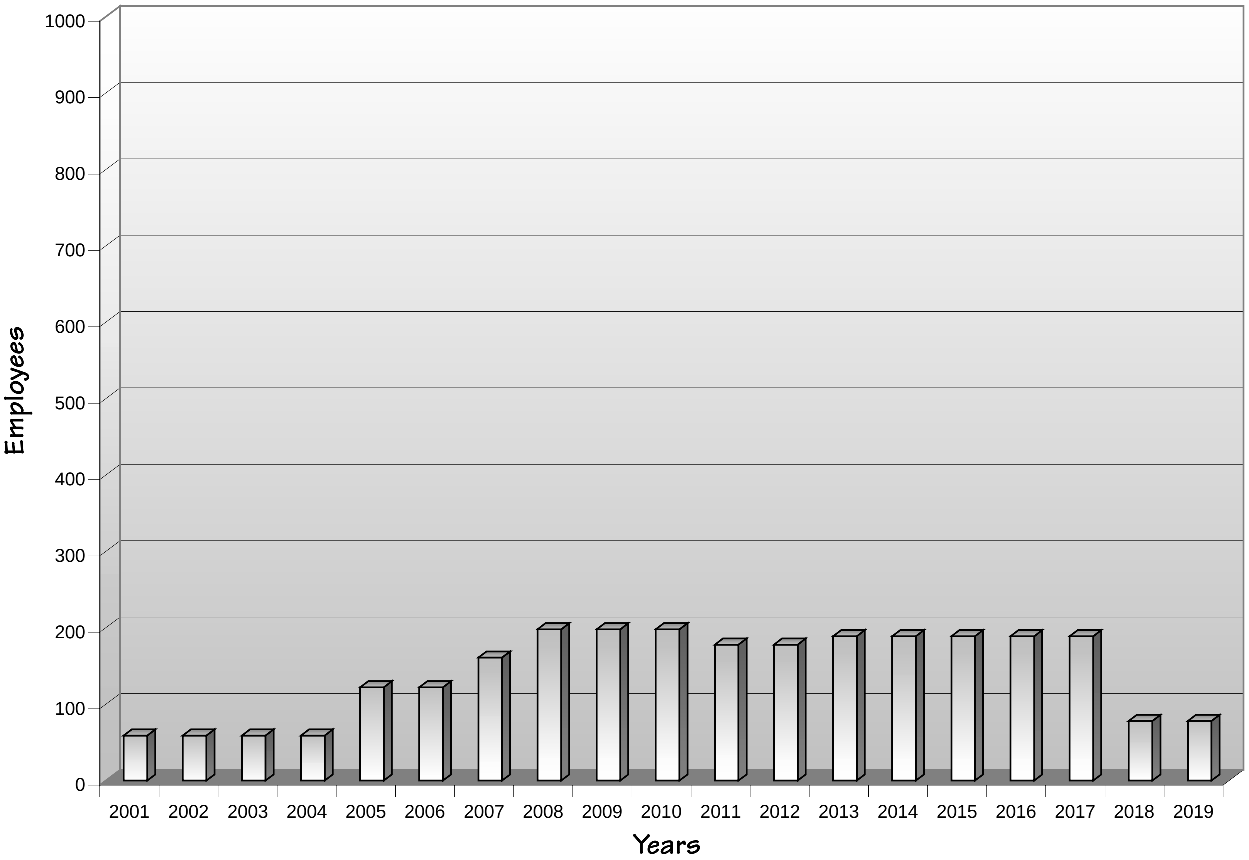

FIGURE C.1-9.
Minimum INEEL Processing Alternative - Construction Employment.

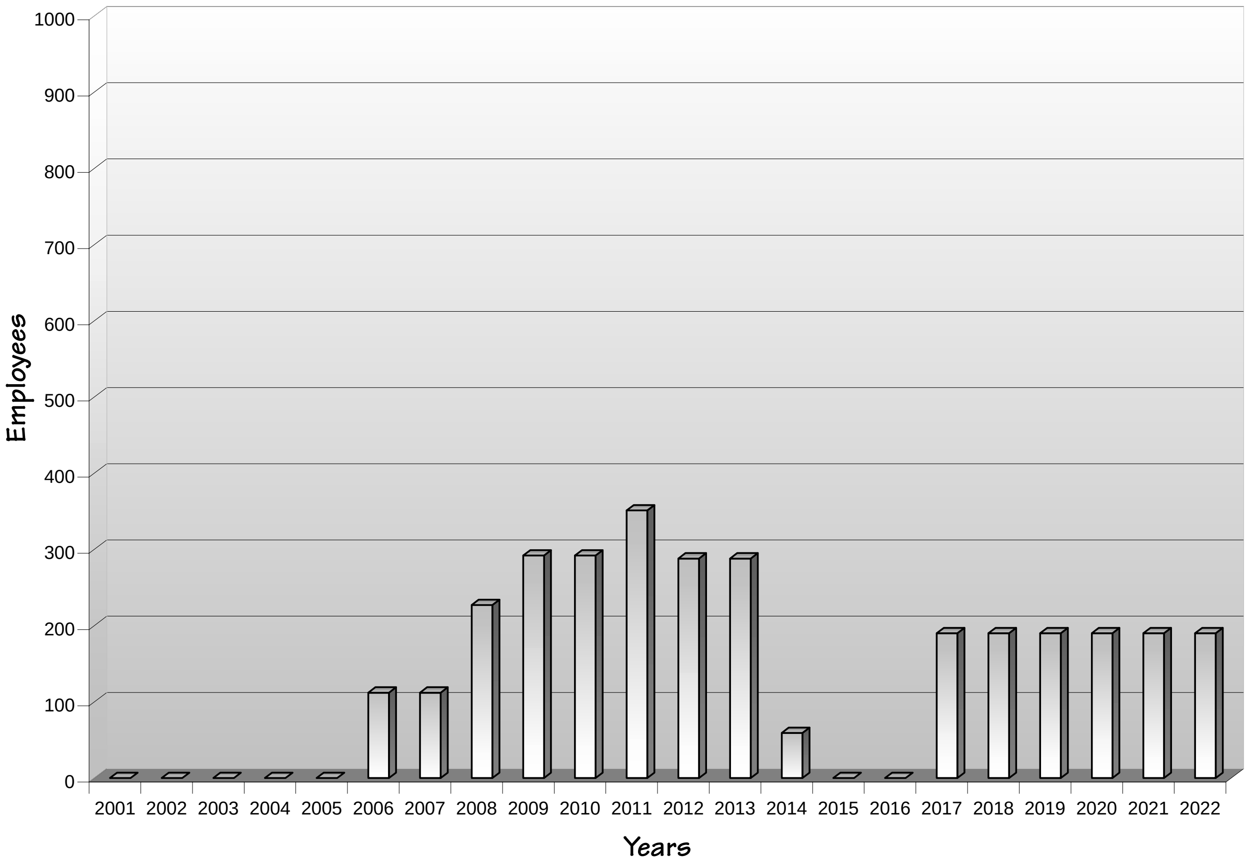

FIGURE C.1-10.
Direct Vitrification Alternative - Vitrification without Calcine Separations Option - Construction Employment.

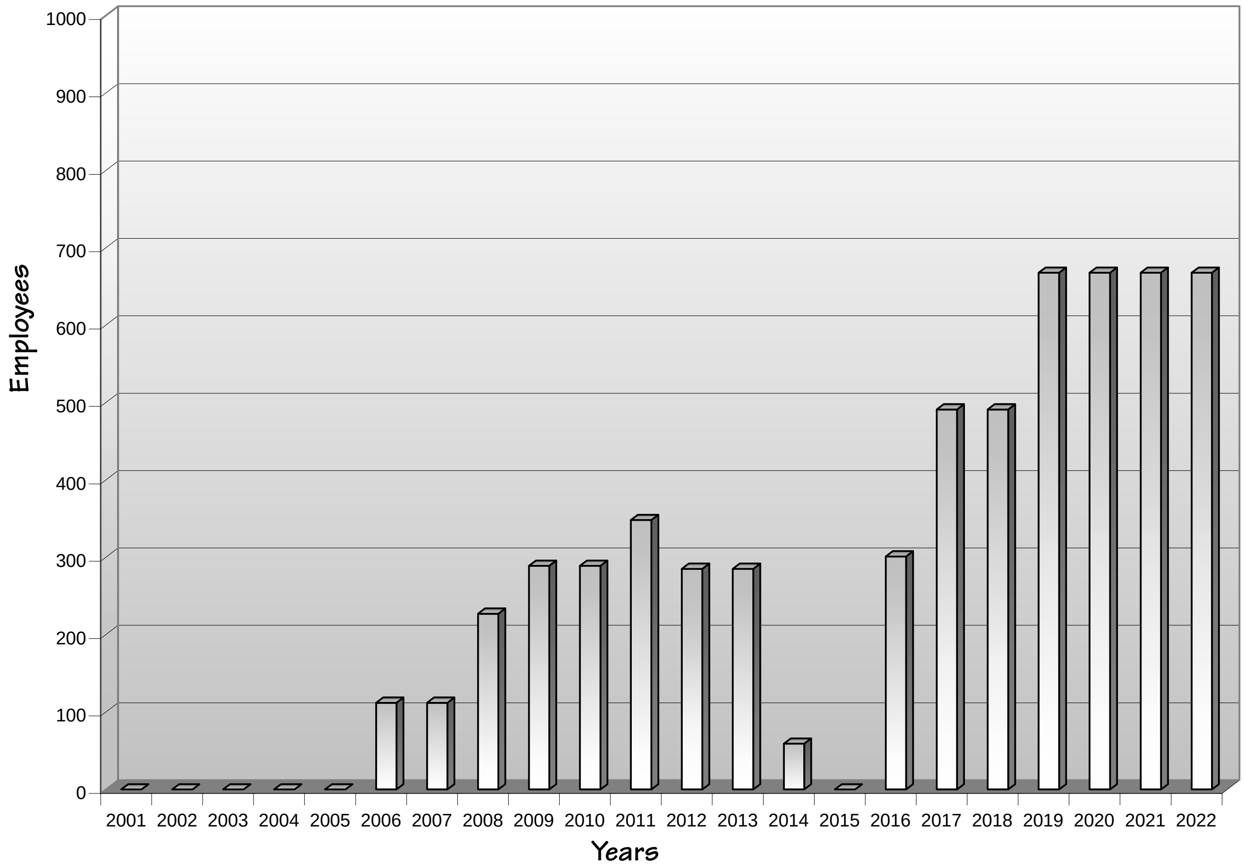

FIGURE C.1-11.
Direct Vitrification Alternative - Vitrification with Calcine Separations Option - Construction Employment.

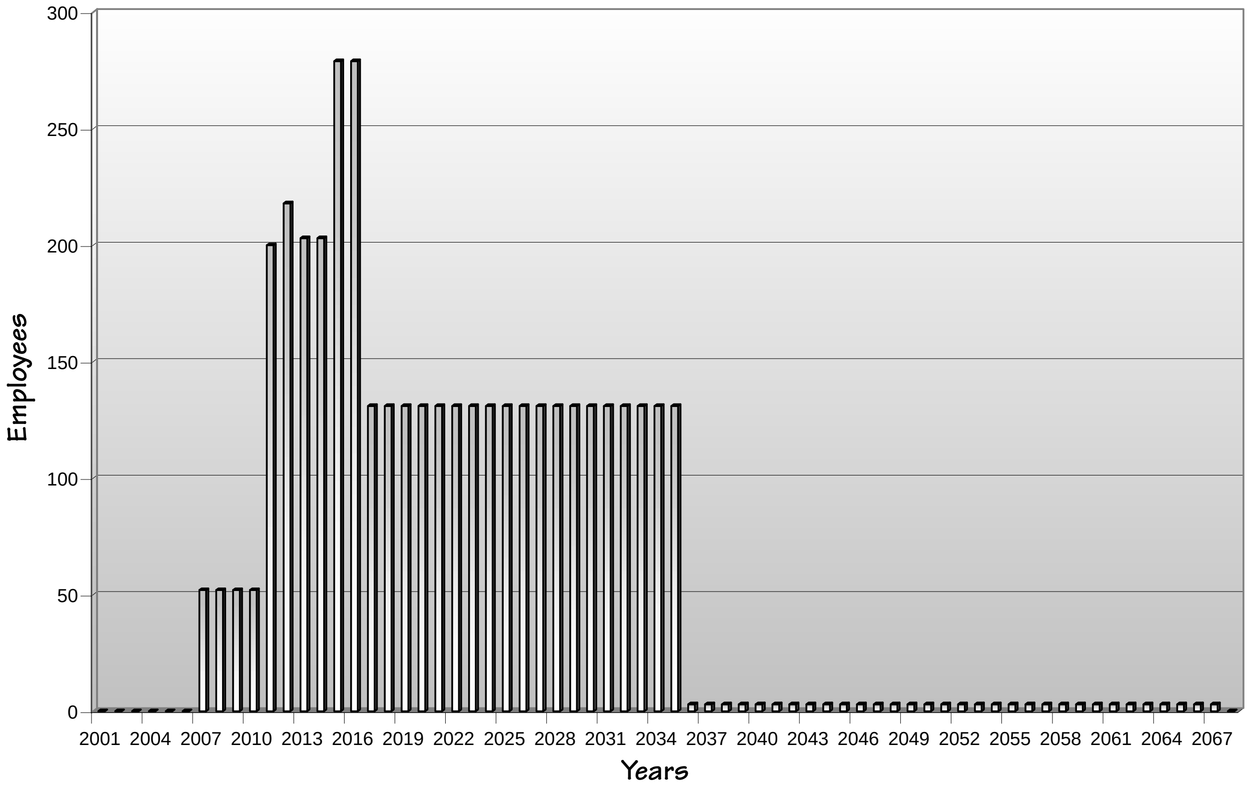

FIGURE C.1-12.
Continued Current Operations Alternative - Operations Employment.

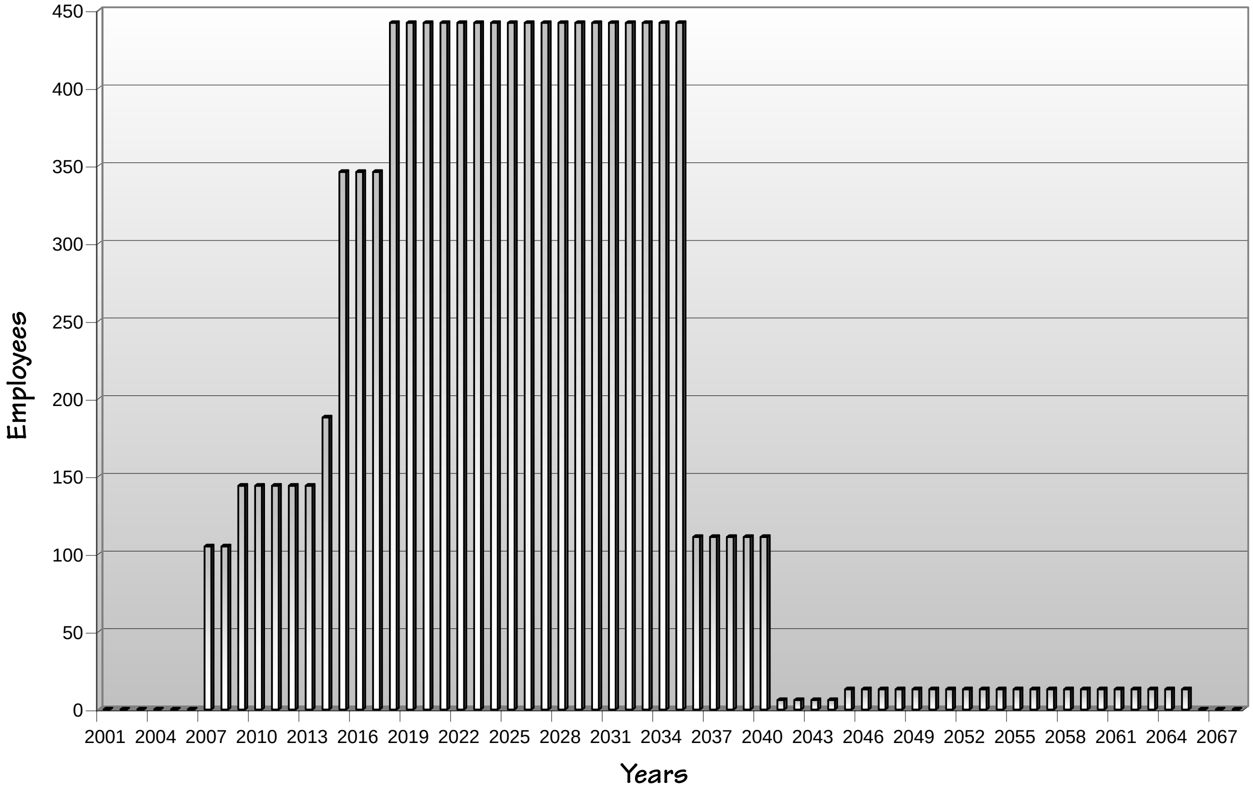

FIGURE C.1-*13*.
Separations Alternative - Full Separations Option - Operations Employment.

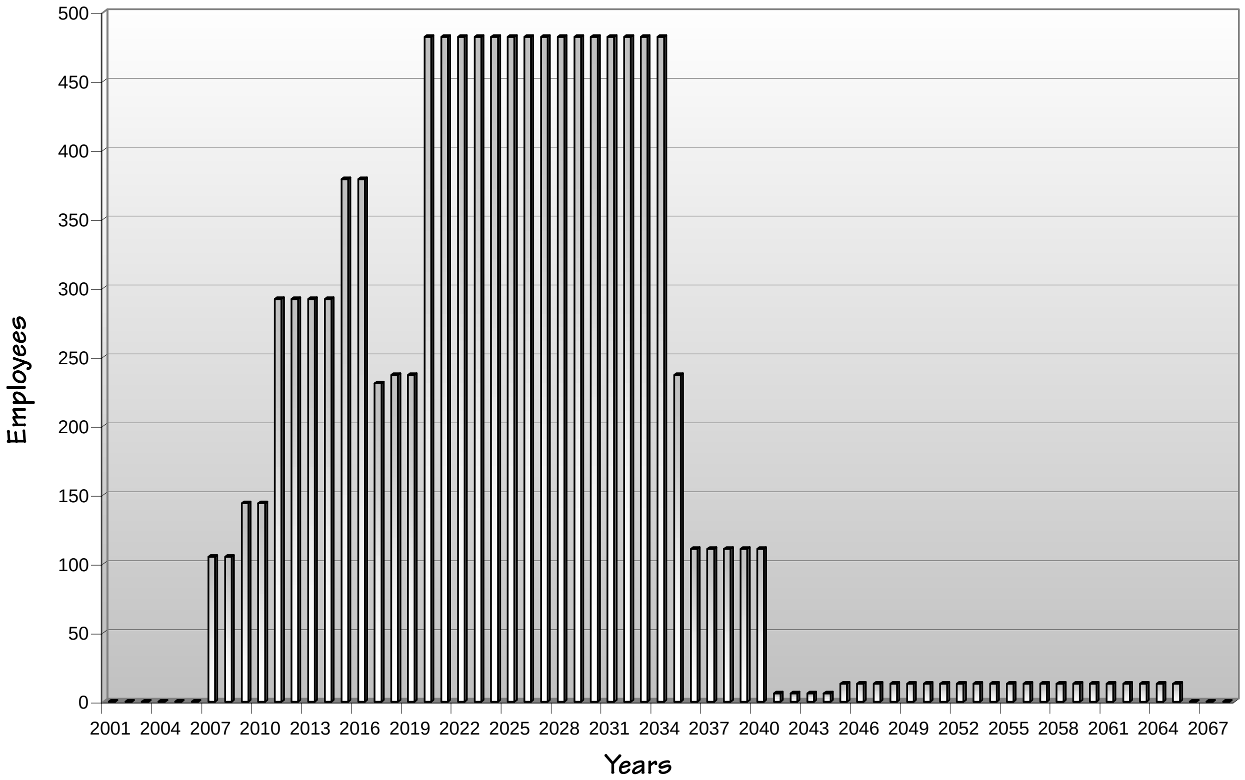

FIGURE C.1-*14*.
Separations Alternative - Planning Basis Option - Operations Employment.

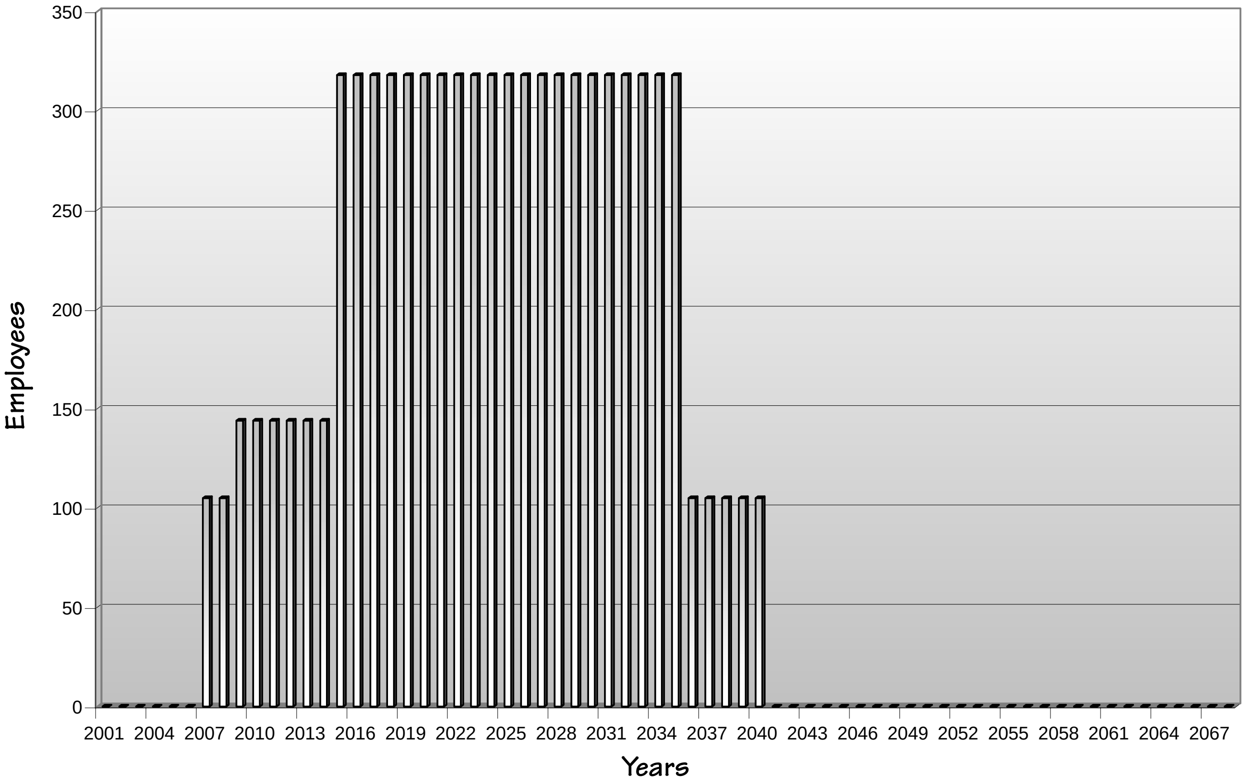

FIGURE C.1-15.
Separations Alternative - Transuranic Separations Option - Operations Employment.

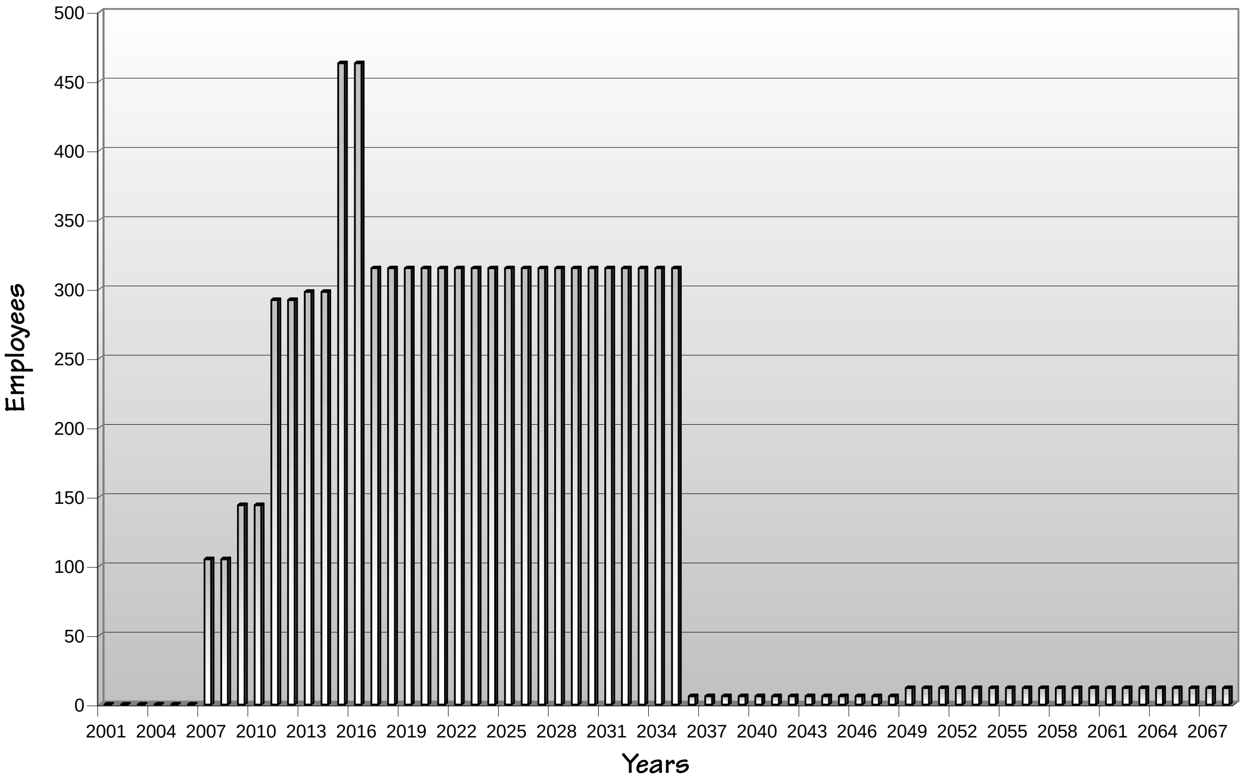

FIGURE C.1-*16.*
Non-Separations Alternative - Hot Isostatic Pressed Waste Option - Operations Employment.

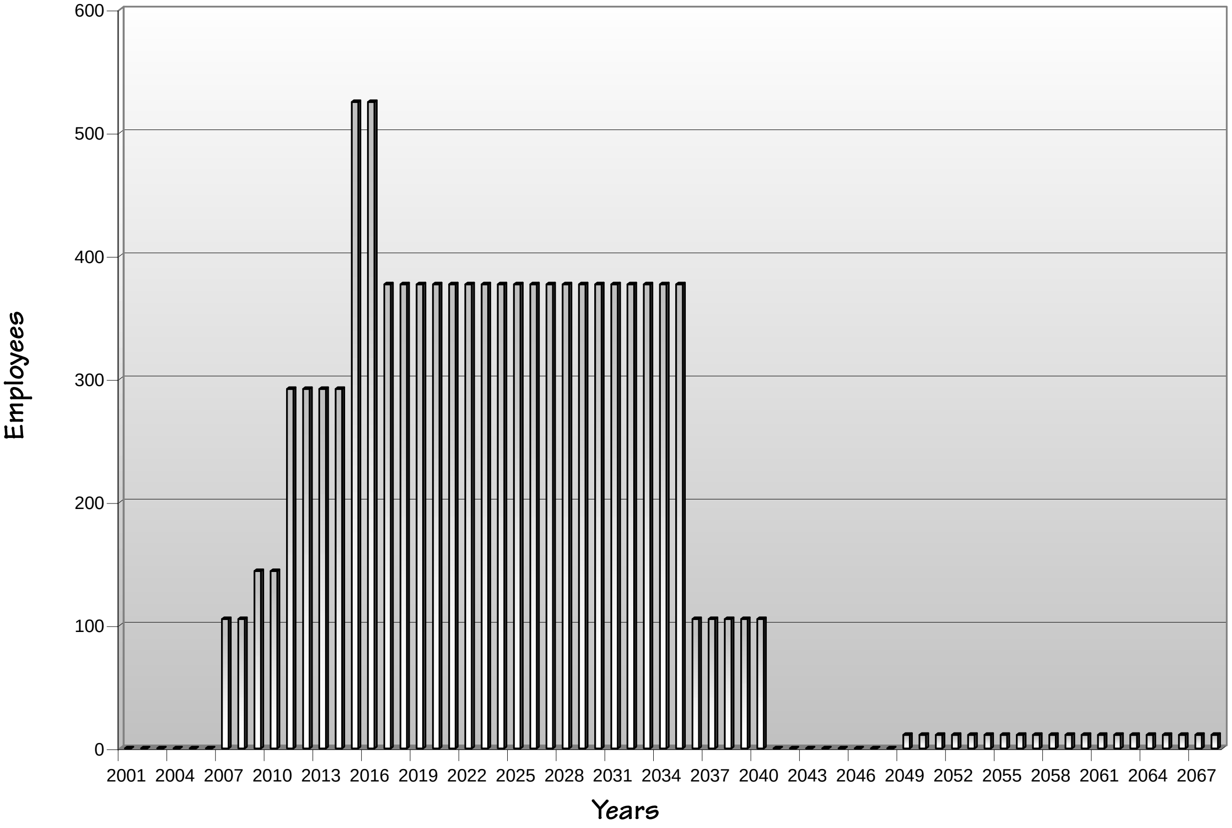

FIGURE C.1-17.
Non-Separations Alternative - Direct Cement Waste Option - Operations Employment.

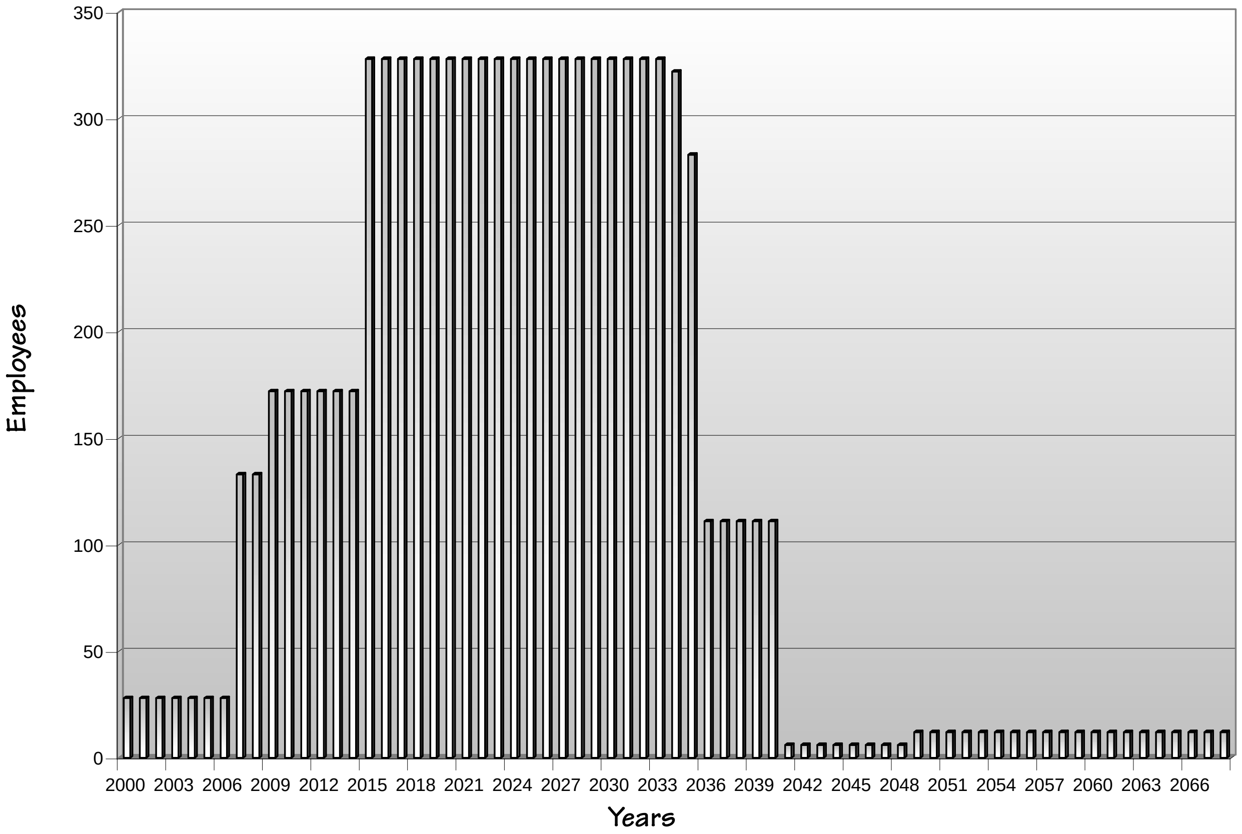

FIGURE C.1-*18*.
Non-Separations Alternative - Early Vitrification Option - Operations Employment.

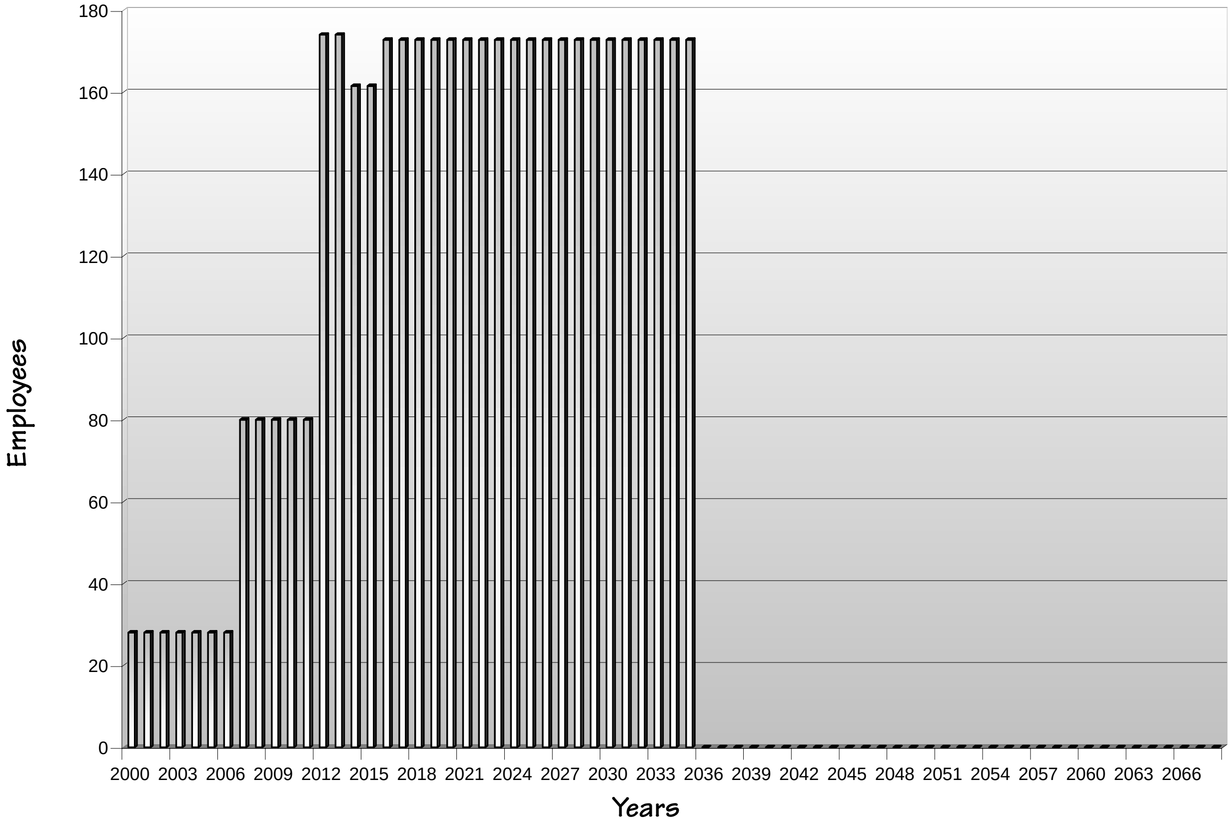

FIGURE C.1-19.
Non-Separations Alternative - Steam Reforming Option - Operations Employment.

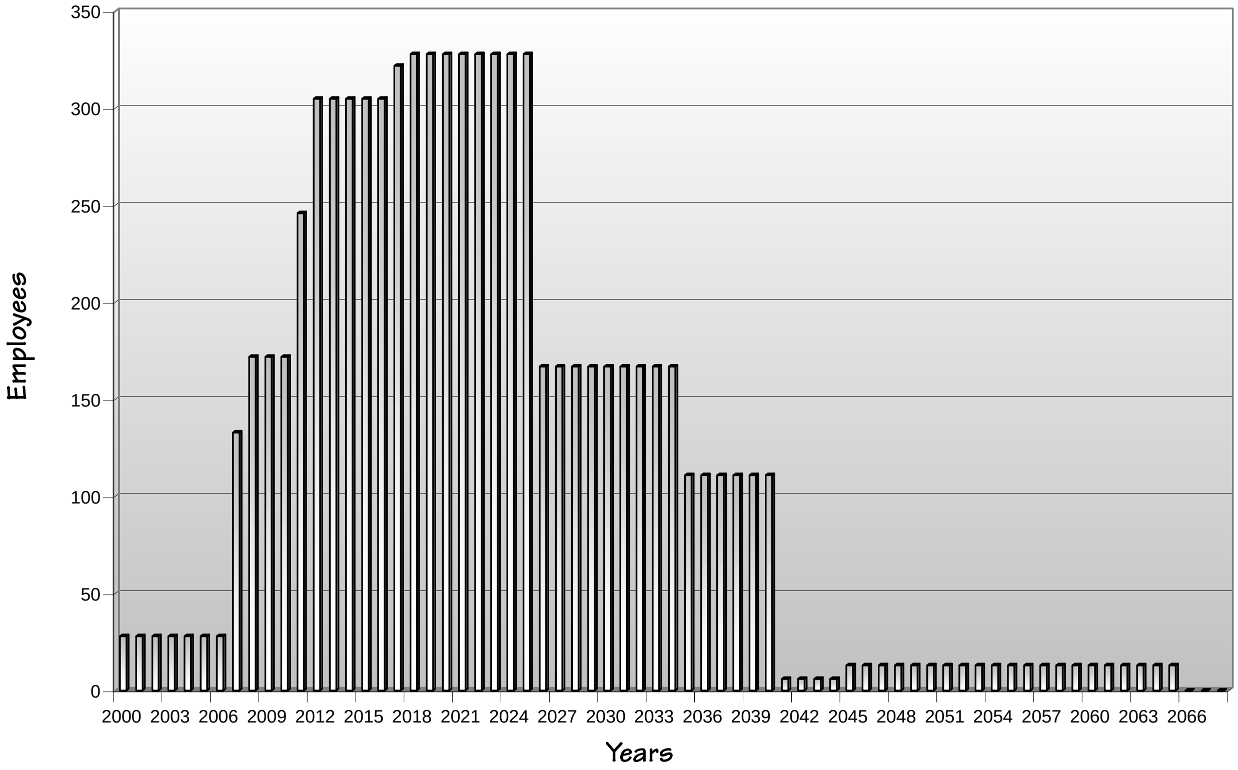

FIGURE C.1-20.
Minimum INEEL Processing Alternative - Operations Employment.

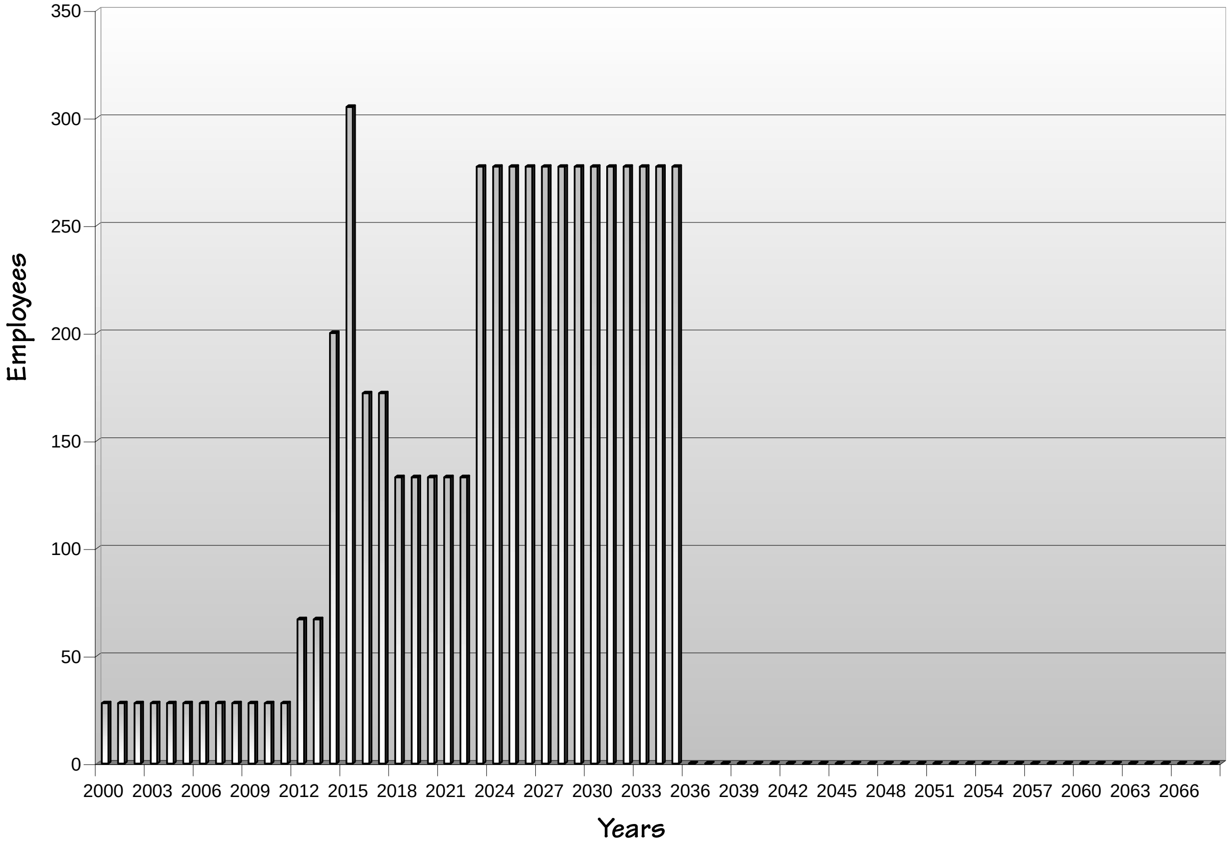

FIGURE C.1-21.
Direct Vitrification Alternative - Vitrification without Calcine Separations Option - Operations Employment.

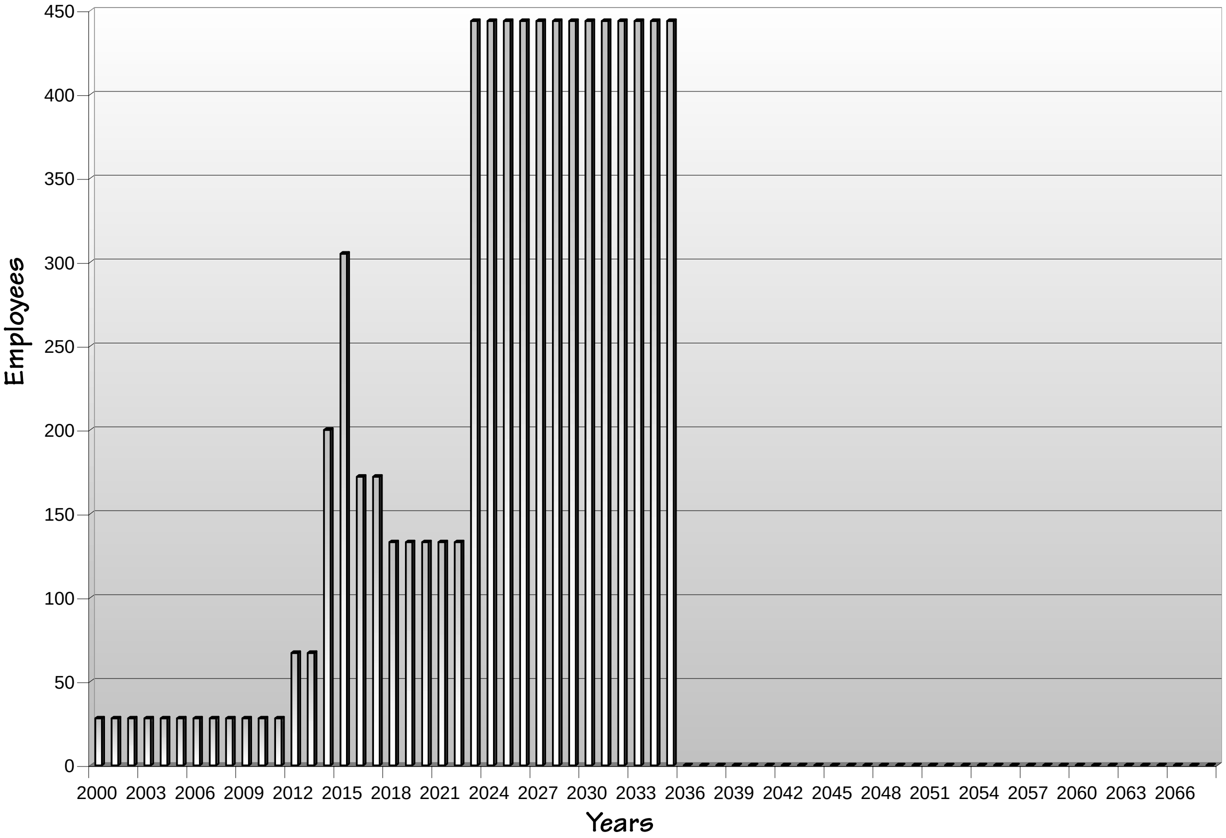

FIGURE C.1-22.
Direct Vitrification Alternative - Vitrification with Calcine Separations Option - Operations Employment.

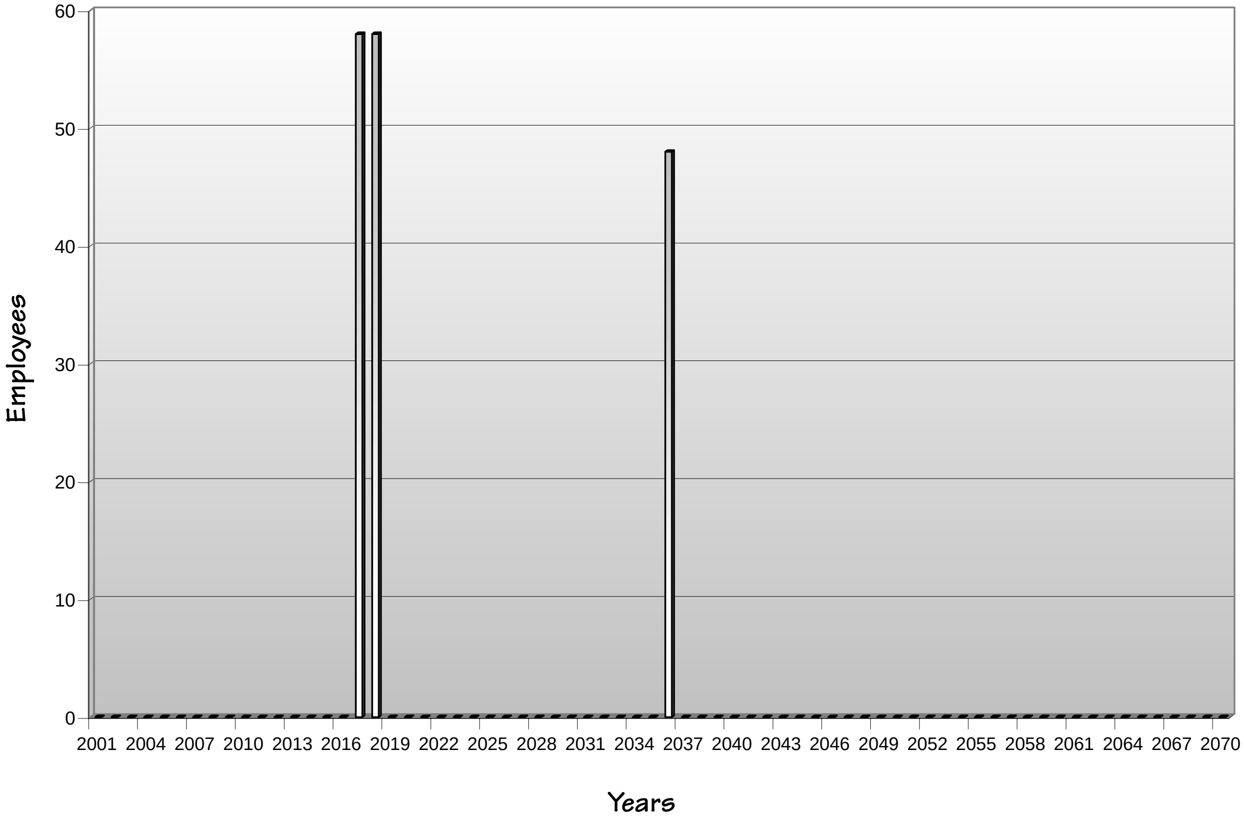

FIGURE C.1-23.
Continued Current Operations Alternative - Facility Disposition Employment.

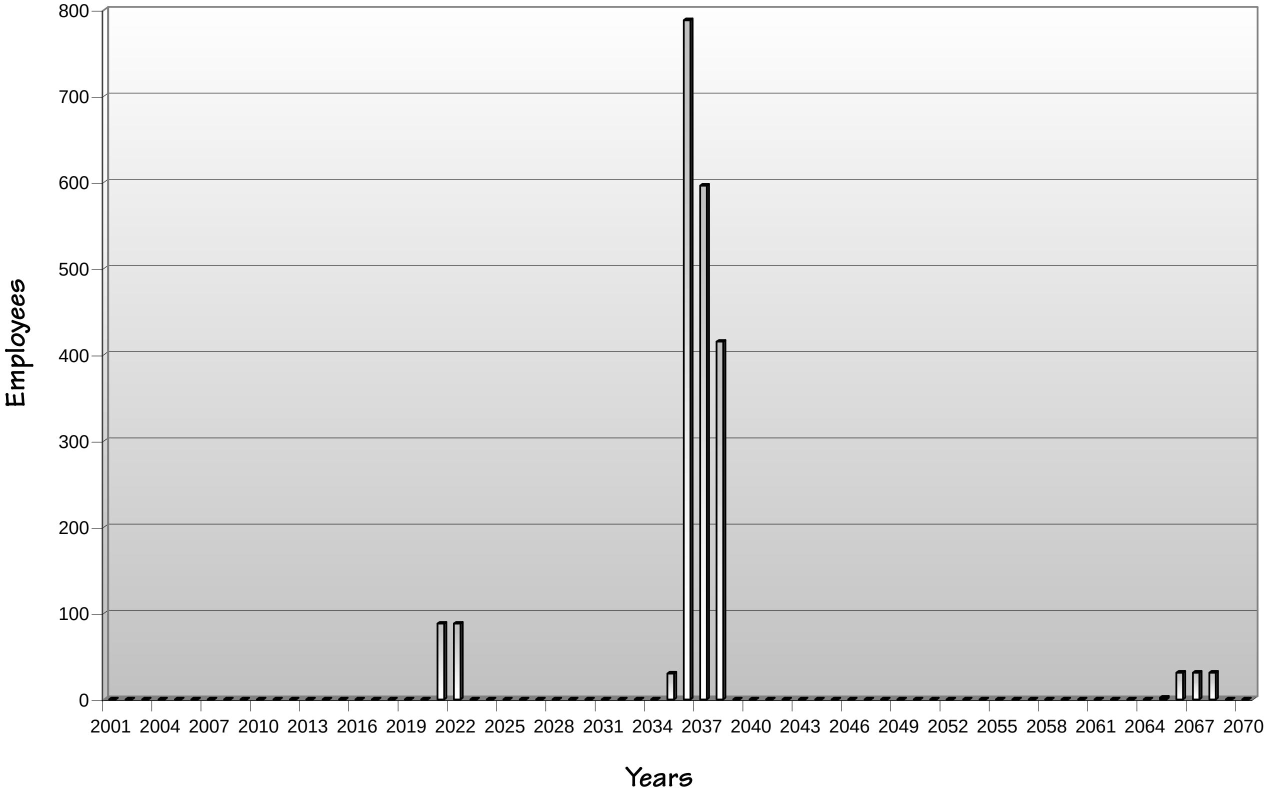

FIGURE C.1-24.
Separations Alternative - Full Separations Option - Facility Disposition Employment.

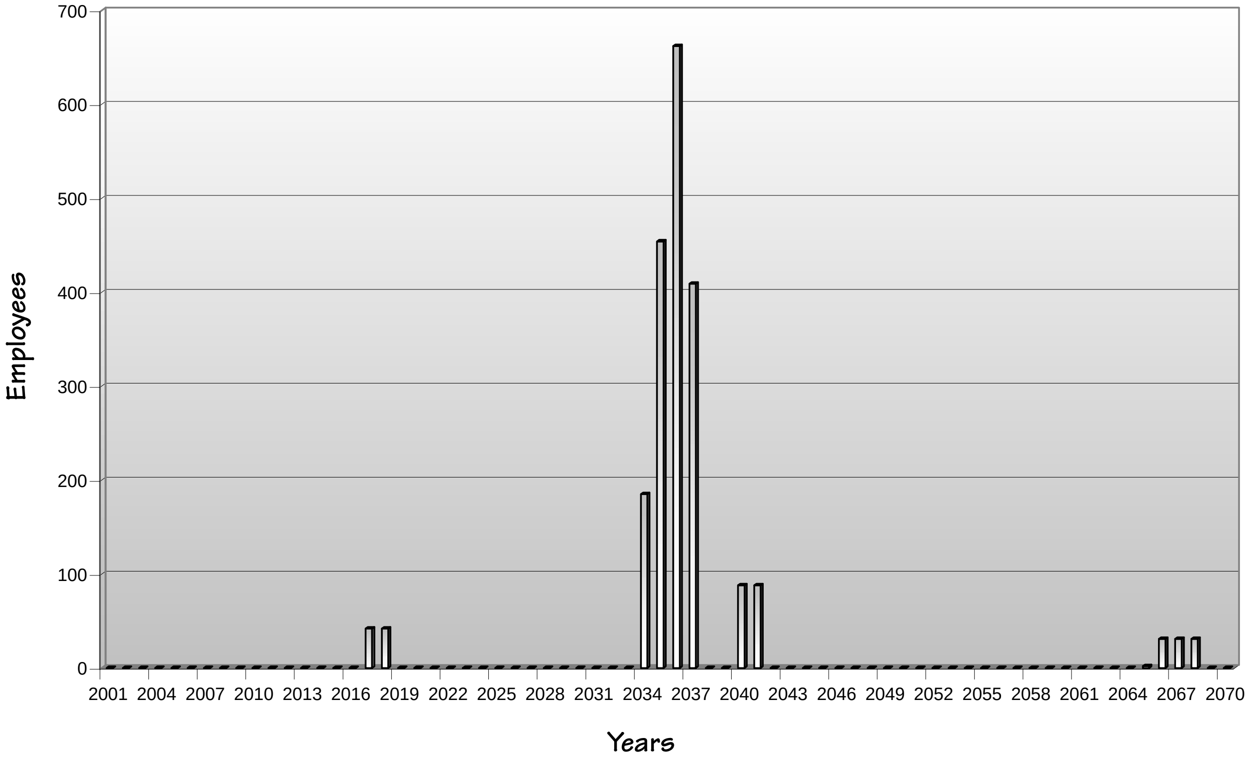

FIGURE C.1-25.
Separations Alternative - Planning Basis Option - Facility Disposition Employment.

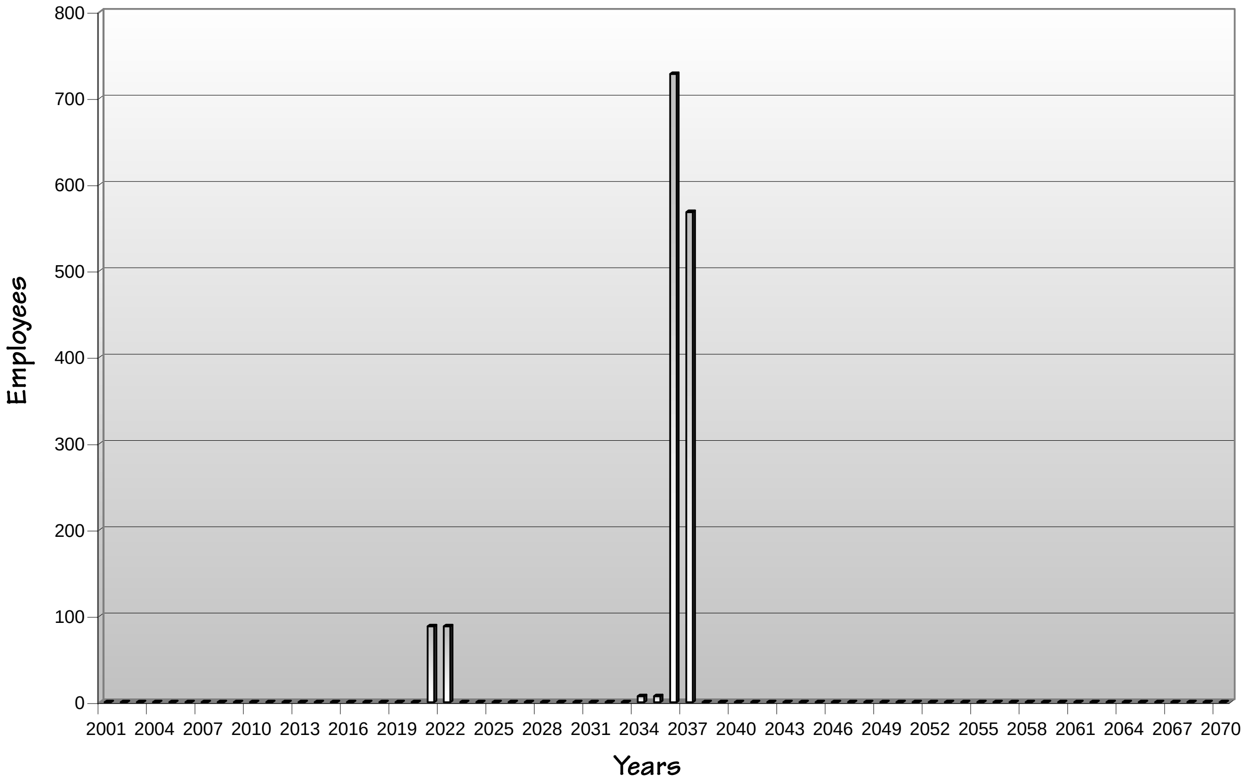

FIGURE C.1-26.
Separations Alternative - Transuranic Separations Option - Facility Disposition Employment.

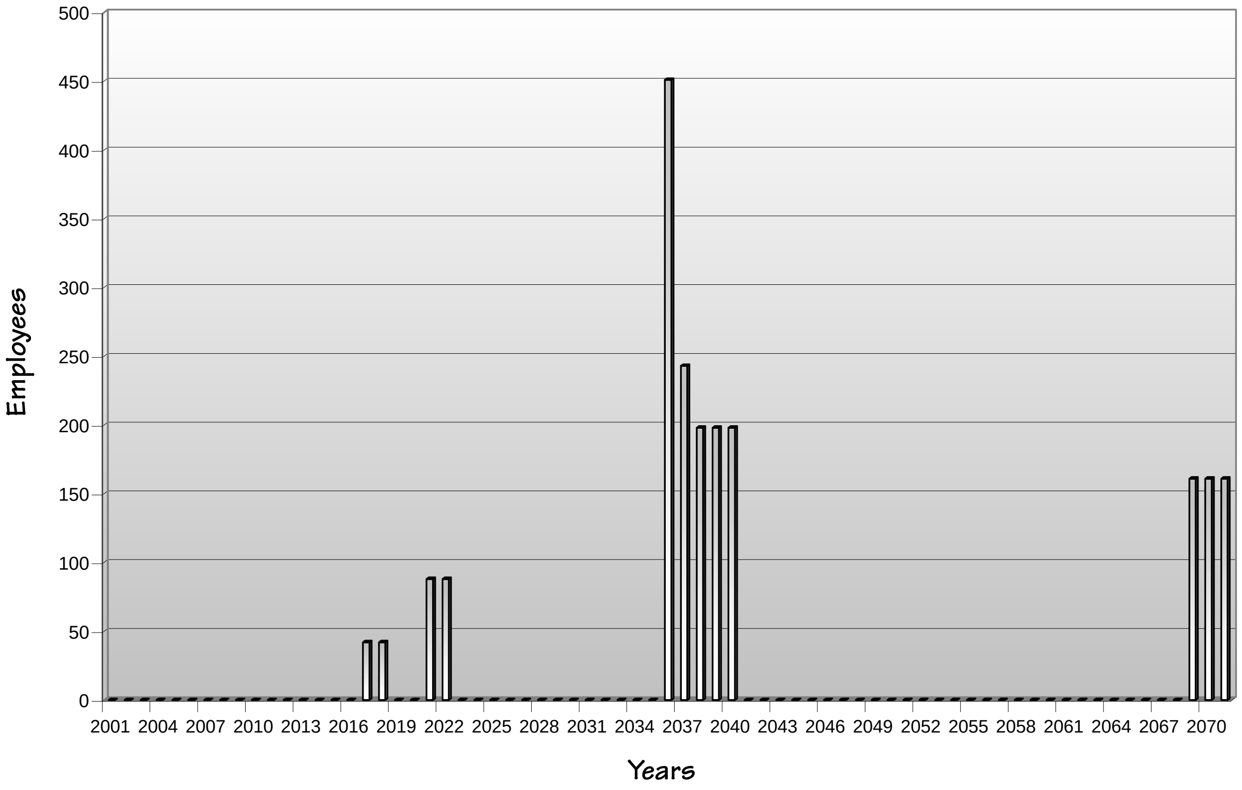

FIGURE C.1-27.
Non-Separations Alternative - Hot Isostatic Pressed Waste Option - Facility Disposition Employment.

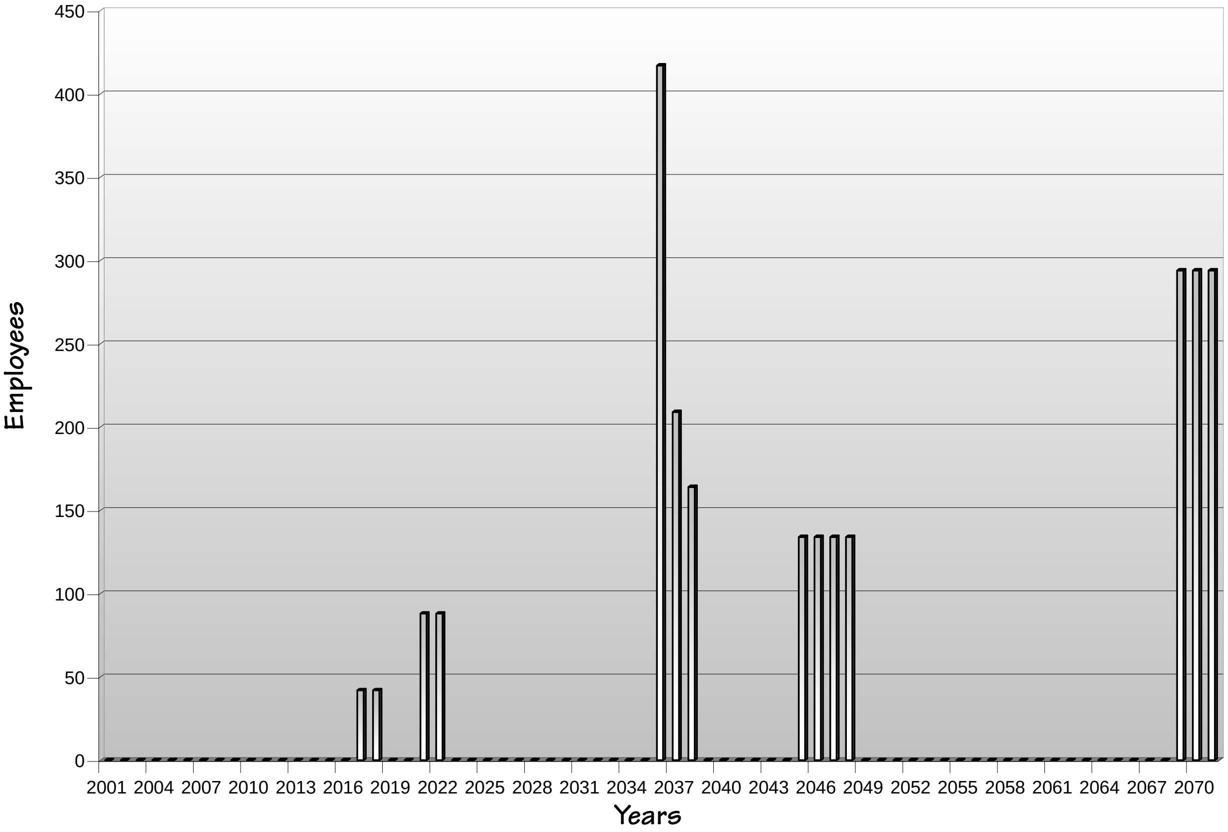

FIGURE C.1-28.
Non-Separations Alternative - Direct Cement Waste Option - Facility Disposition Employment.

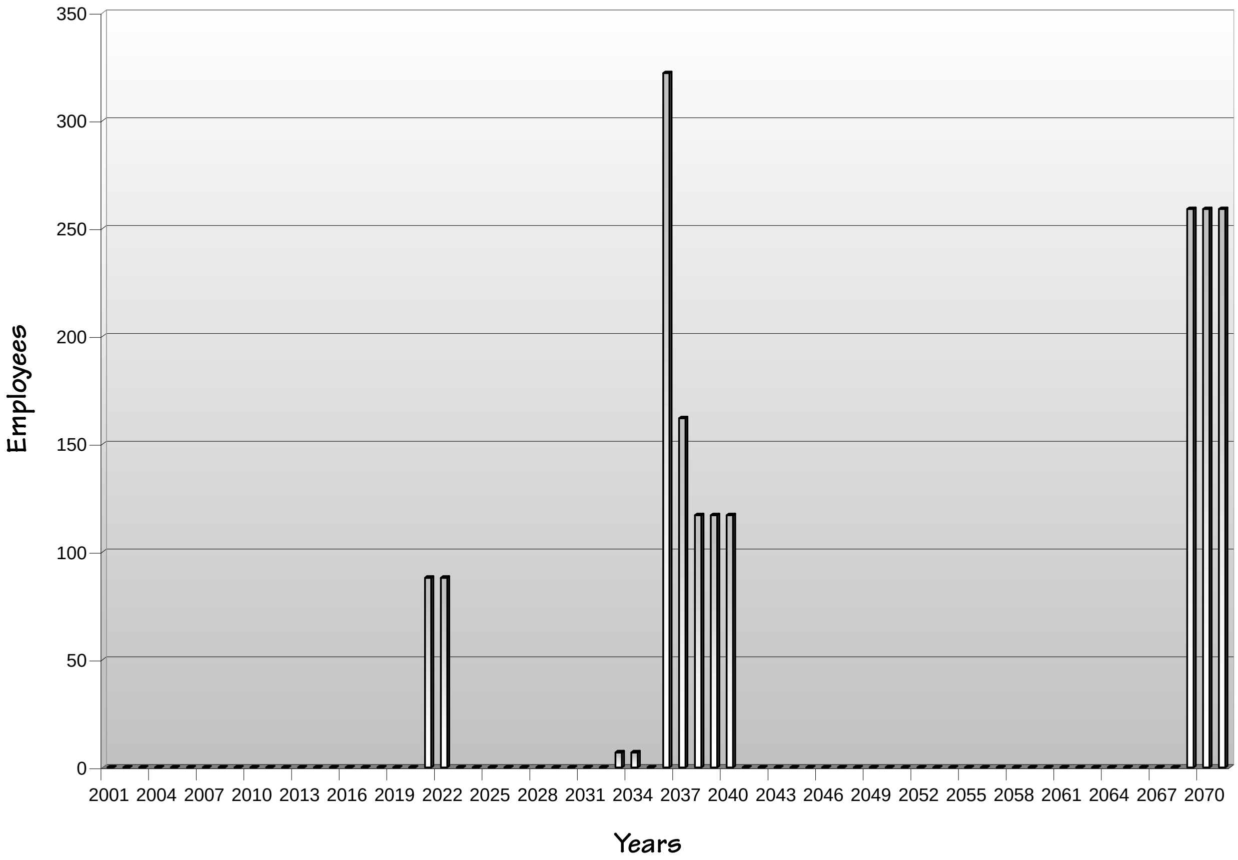

FIGURE C.1-*29*.
Non-Separations Alternative - Early Vitrification Option - Facility Disposition Employment.

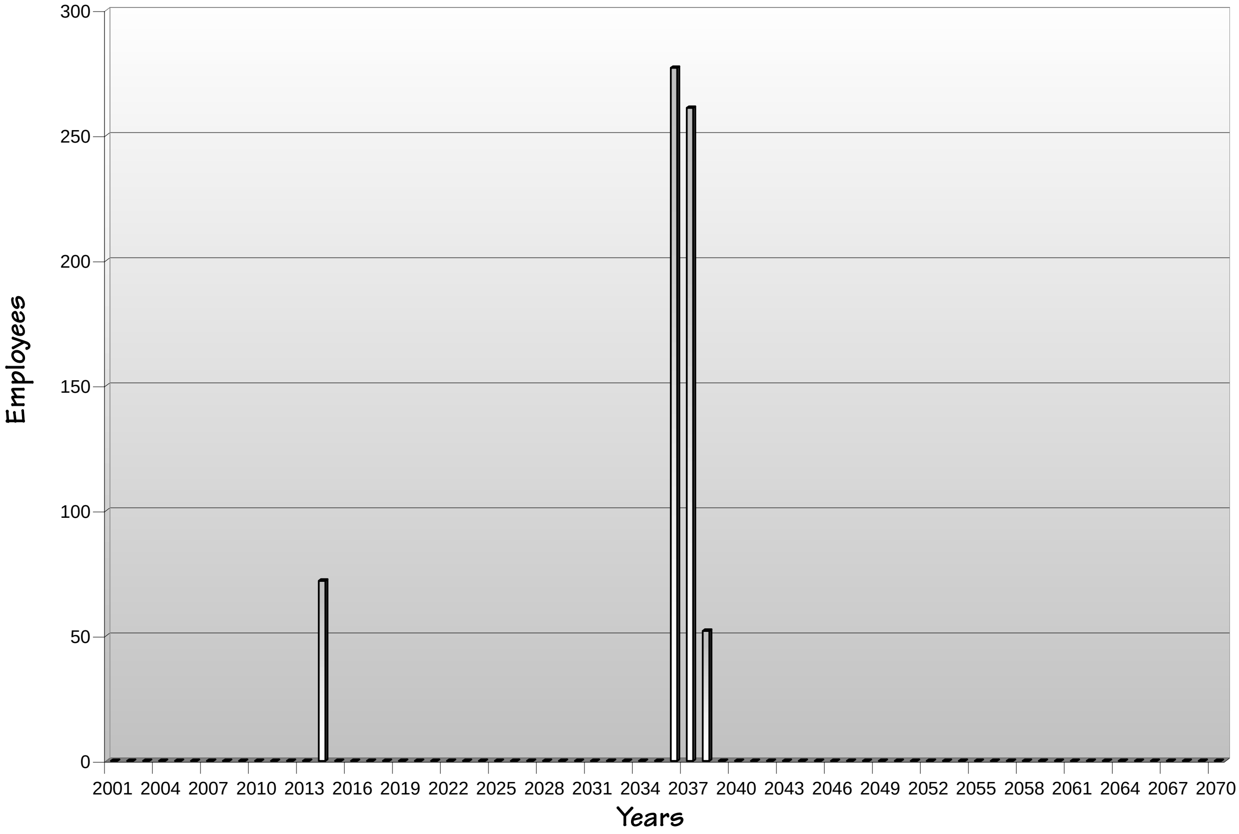

FIGURE C.1-30.
Non-Separations Alternative - Steam Reforming Option -
Facility Disposition Employment.

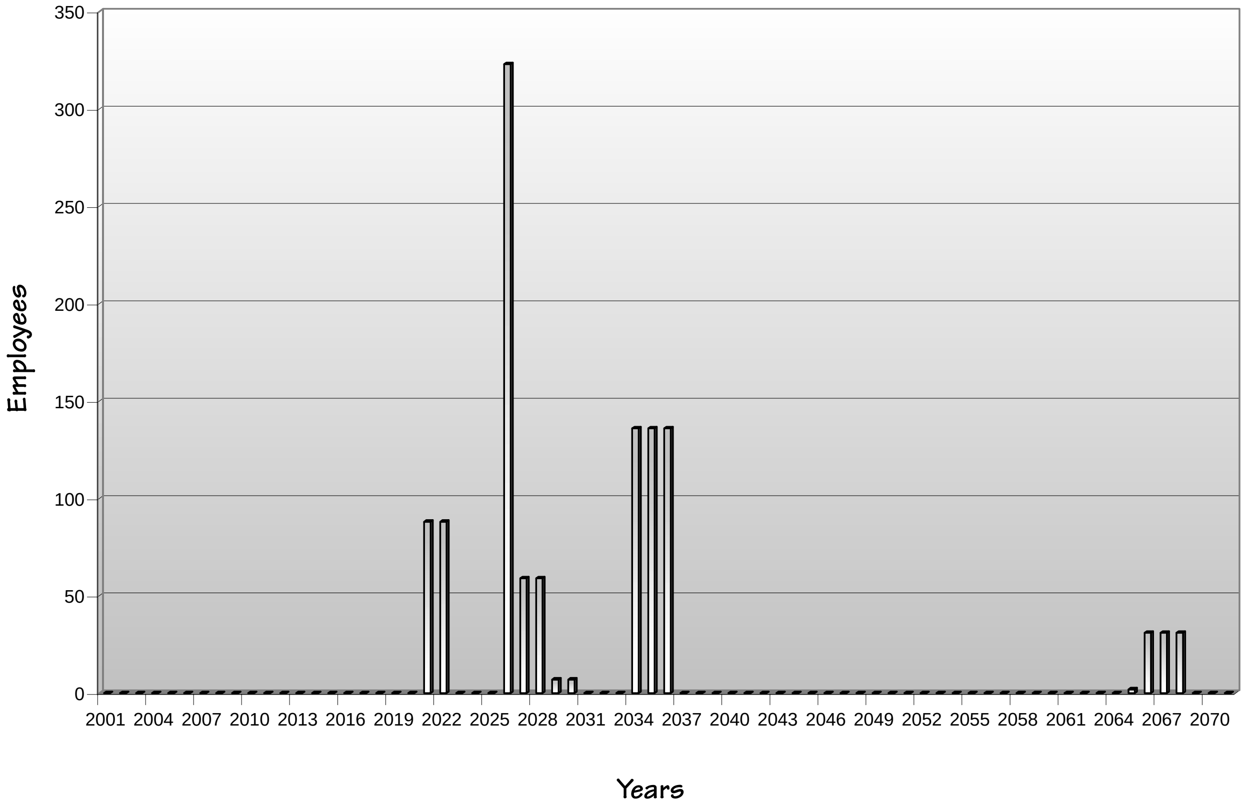

FIGURE C.1-*31*.
Minimum INEEL Processing Alternative - Facility Disposition Employment.

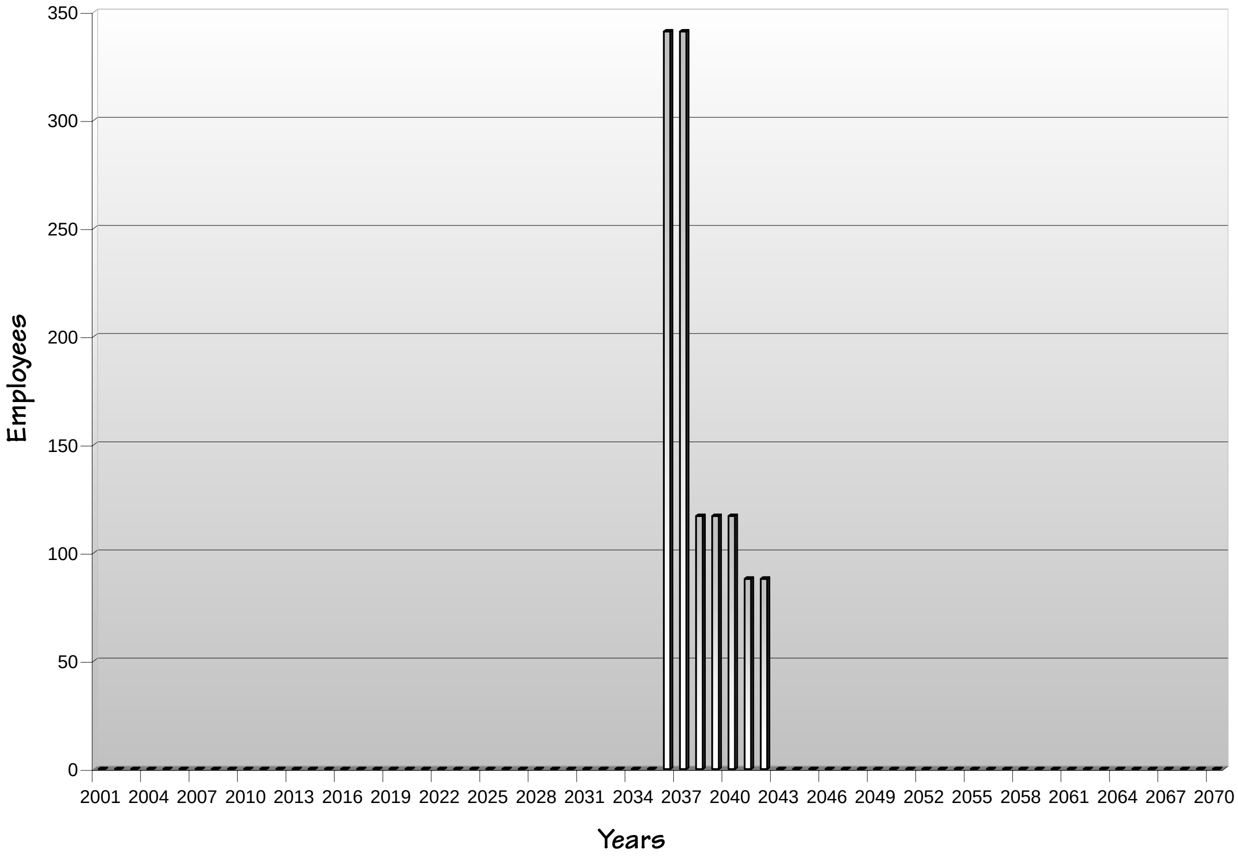

FIGURE C.1-32.
Direct Vitrification Alternative - Vitrification without Calcine Separations Option - Facility Disposition Employment.

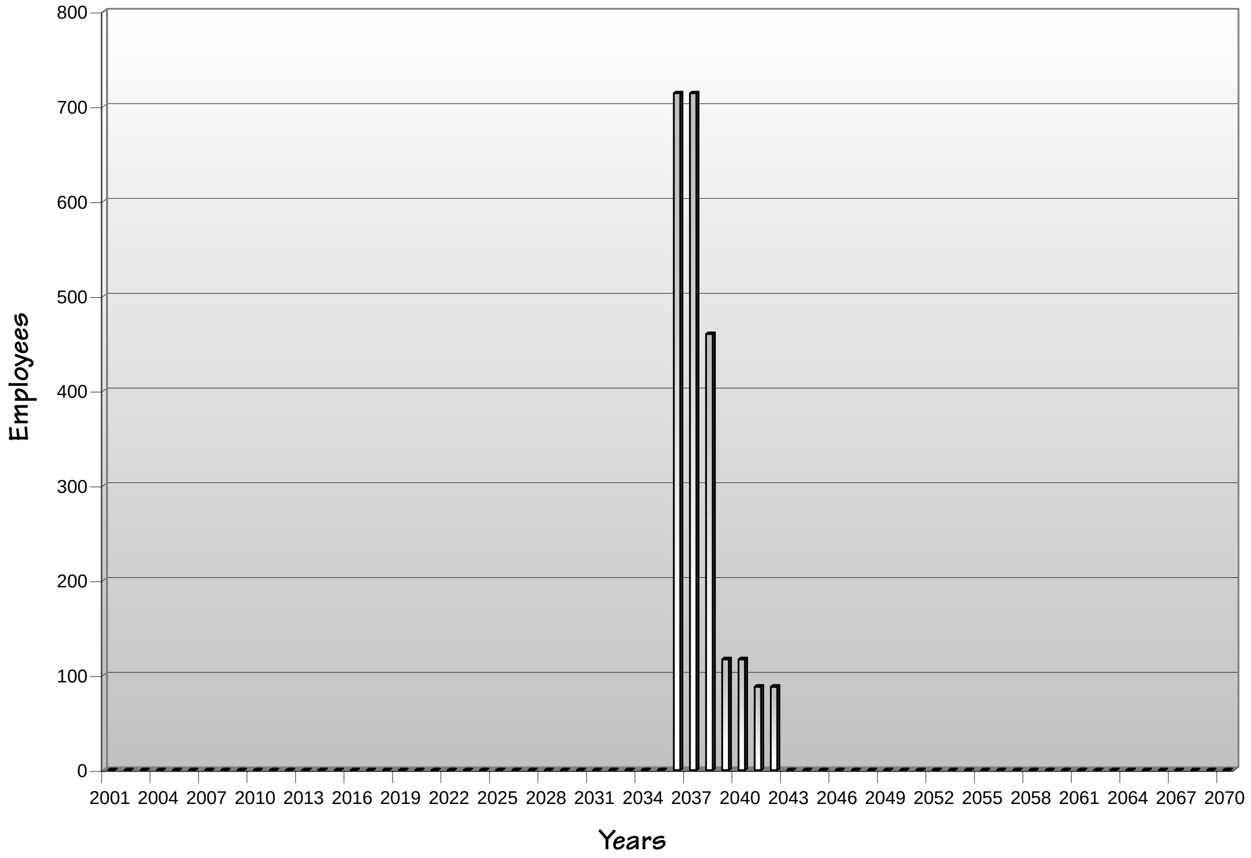

FIGURE C.1-33.
Direct Vitrification Alternative - Vitrification with Calcine Separations Option - Facility Disposition Employment.

Appendix C.1 References

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Appendix C.2

Air Resources

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Air Resources

C.2.1 INTRODUCTION

The characterization of air resources and assessment of impacts of waste processing and facility disposition alternatives required an extensive program of emissions estimation, air dispersion modeling, and evaluation of results. The complexity and scope of the required analyses were driven by factors such as the large number of projects encompassed by the waste processing and facility disposition alternatives, the large number of specific air pollutants (including various radionuclides, criteria air pollutants and toxic air pollutants) that are potentially associated with these projects, and the many air-quality related criteria against which impacts should be compared. As a result, the methodology and findings described in the main body of the text are primarily of a summary nature. The purpose of this appendix is to provide supporting information and additional detail to support those findings. In particular, this appendix supports the information presented in the air resources sections pertaining to the affected environment (Section 4.7), and environmental consequences of waste processing alternatives (Section 5.2.6) and facility disposition alternatives (Section 5.3.4).

The air resource assessments performed in support of this environmental impact statement (EIS) relied heavily on information contained in numerous technical reports, project-specific data summaries, and other related documents. The following are among the more important of these information sources:

- The SNF & INEL EIS (DOE 1995) was used as a source of information on existing air resource conditions and projected increases in pollutant emissions as a result of future operations not associated with waste processing. In some cases (e.g., emission rates and offsite radiation dose from existing facilities), the U.S. Department of Energy (DOE) supplemented this information with more recent data. In other cases, the data or assessment results were modified to reflect current conditions. These changes are described in the sections in which they are reported.

- The Idaho National Engineering and Environmental Laboratory (INEEL) radiological National Emission Standards for Hazardous Air Pollutants reports for the calendar years 1995 and 1996 (DOE 1996a, 1997a) were used to establish the existing radiological conditions in terms of airborne radionuclide emissions and highest dose to an offsite receptor. ***Reports for the years 1999 and 2000 (DOE 2000, 2001) were also used to present emissions data for more recent periods during which no waste calcining was performed.***

- INEEL air emissions inventory for the years 1996 and 1997 (DOE 1997b, 1998) were used to update the criteria pollutant emission rates from existing INEEL facilities. These were compared with the emission rates which were used in the SNF & INEL EIS to ensure that the current rates are within the bounds of those used in the SNF & INEL EIS as a basis for characterizing existing conditions through atmospheric dispersion modeling.

- ***The Prevention of Significant Deterioration/Permit to Construct (PSD/PTC) Application for the INTEC CPP-606 Boilers (Lane 2000), and the supporting analyses (Rood 2000a), were used to identify INEEL sources subject to PSD regulation, and as a data source for emission rates and associated release parameters. The amount of PSD increment consumption determined in support of the permit application was used to describe baseline PSD increment consumption from existing INEEL sources.***

- Project data summaries (Appendix C.6) and supporting engineering design files were used as sources of information for emissions-related parameters that pertain to the construction, startup and testing, operation, and decontamination and decommissioning of the proposed projects. These documents, which were prepared specifically for this EIS, provide information such as projected operating schedules, fossil fuel usage, fugitive dust generation, and radiological and non-radiological emission rates.

This appendix integrates the descriptions of methods, assumptions, results, and other key information from the technical evaluations and summaries cited above into a single source, ***as well as integrate newer analyses conducted specifically for this EIS***. The remainder of this section is organized as follows:

- Section C.2.2 contains a description of air quality standards and regulations and a discussion of how they apply to sources at the INEEL.
- Section C.2.3 provides supporting information on the methods and assumptions used to estimate emissions and assess baseline conditions and impacts of proposed facilities.
- Section C.2.4 provides supplemental detail on radionuclide emission rates from waste processing alternatives, as well as the potential radiation dose consequences of these emissions.
- Section C.2.5 provides supplemental detail on nonradiological pollutant emission rates from waste processing alternatives, as well as the potential environmental consequences of these emissions.
- Section C.2.6 describes radiological emissions and potential dose consequences of facility disposition alternatives.
- Section C.2.7 describes nonradiological emissions from facility disposition alternatives and potential environmental consequences of these emissions.

C.2.2 AIR QUALITY STANDARDS AND REGULATIONS

Air quality regulations have been established by Federal and State agencies to protect the public from potential harmful effects of air pollution. The Federal Clean Air Act establishes the framework to protect the nation's air resources and public health and welfare. The U.S. Environmental Protection Agency (EPA) and the State of Idaho are jointly responsible for establishing and implementing programs that meet the requirements of the Act. These regulations are based on an overall strategy that incorporates the following principal elements:

- Designation of acceptable levels of pollution in ambient air to protect public health and welfare
- Implementation of a permitting program to regulate (control) emissions from stationary (nonvehicular) sources of air pollution
- Issuance of prohibitory rules, such as rules prohibiting open burning.

Facilities planned or currently operating at the INEEL are subject to air quality regulations and standards established under the Clean Air Act and by the State of ***Idaho Department*** of Environmental Quality, and to internal policies and requirements developed by DOE for the protection of the environment and health. At the INEEL, programs have been developed and implemented to ensure compliance with air quality regulations by (a) identifying sources of air pollutants and obtaining necessary State and Federal permits, (b) providing adequate control of emissions of air pollutants, (c) monitoring emissions sources and ambient levels of air pollutants to ensure compliance with air quality standards, (d) operating within permit conditions, and (e) obeying prohibitory rules. Air quality standards and programs applicable to the INEEL operations are summarized in Table C.2-1 and are described in further detail below. This section also provides information on project design features to mitigate air quality impacts and operate within the bounds of regulatory requirements.

Table C.2-1. Overview of Federal, State, and DOE programs for air quality management.

Clean Air Act		
Federal Program	State of Idaho Administration Program	DOE Compliance Program
National Ambient Air Quality Standards • Set limits on ambient air concentrations of sulfur dioxide, nitrogen dioxide, respirable particulate matter, carbon monoxide, lead, and ozone (criteria pollutants). • Primary standards for protection of public health; secondary standards for protection of public welfare. **Prevention of Significant Deterioration** • Limits deterioration of air quality and visibility in areas that are better than the National Ambient Air Quality Standards. • Requires Best Available Control Technology on major sources in attainment areas. **New Source Performance Standards** • Regulate emissions from specific types of industrial facilities (for example, fossil fuel-fired steam generators and incinerators). **National Emission Standards for Hazardous Air Pollutants** • Control airborne emissions of specific substances harmful to human health. • Specific provisions regulate hazardous air pollutants and limit radionuclide dose to a member of the public to 10 millirem per year. • Control emission of hazardous air pollutants from combustion of hazardous waste***, as well as other categories of activities that may result in hazardous air pollutant emissions.*** **Clean Air Act Amendments of 1990** • Sweeping changes to the Clean Air Act, primarily to address acid rain, nonattainment of National Ambient Air Quality Standards, operating permits, hazardous air pollutants, potential catastrophic releases of acutely hazardous materials, and stratospheric ozone depletion. • Specific rules and policies not yet fully developed and implemented in all areas (for example, hazardous air pollutants).	**Rules for the Control of Air Pollution in Idaho** Current Regulations of the State of Idaho Department ***of Environmental Quality (IDEQ 2001)*** include: • **Idaho Ambient Air Quality Standards** - Similar to National Ambient Air Quality Standards but also include standards for total fluorides. • **New Source Program** - Permit to Construct is required for essentially any construction or modification of a facility that emits an air pollutant; major facilities require PSD analysis and Permit to Construct. • **Carcinogenic and Noncarcinogenic Toxic Air Pollutant Increments** - Defines acceptable ambient concentrations for many specific toxic air pollutants associated with sources constructed or modified after May 1, 1994; requires demonstration of preconstruction compliance with toxic air pollutant increments. • **Operating Permits** - Required for nonexempt sources of air pollutants; define operating conditions and emissions limitations, as well as monitoring and reporting requirements. **Rules and Standards for Hazardous Waste** • Includes standards for hazardous waste treatment facilities, including limits on emissions. • Consistent with Federal standards.	Policy to comply with applicable regulations and maintain emissions at levels as low as reasonably achievable. Policy implemented through DOE orders: • DOE (Headquarters) orders apply to all DOE and DOE-contractor operations. • DOE-Idaho Operations Office (DOE-ID) supplemental directives provide direction and guidance specific to the INEEL. The most relevant DOE orders and their DOE-ID supplemental directives are: • DOE Order 5400.1 establishes general environmental protection program requirements and assigns responsibilities for ensuring compliance with applicable laws, regulations, and DOE policy. • DOE Order 5400.5 provides guidelines and requirements for radiation protection of the public. • DOE Order 5480.1B establishes the Environment, Safety, and Health Program for DOE operations (implemented via DOE-ID Supplemental Directive 5480.1). • DOE Order 5480.4 prescribes the application of mandatory Environment, Safety, and Health standards that shall be used by all DOE and DOE-contractor operations (implemented via DOE-ID Supplemental Directive 5480.4). • DOE Order 5480.19 provides guidelines and requirements for plans and procedures in conducting operations at DOE facilities (implemented via DOE-ID Supplemental Directive 5480.19).

C.2.2.1 Ambient Air Quality Standards

The Federal Clean Air Act establishes National Ambient Air Quality Standards to protect public health and welfare. Primary standards define the ambient concentration of an air pollutant below which no adverse impact to human health is expected. A second category of standards (called secondary standards) has been established to prevent adverse impacts to public welfare, including aesthetics, property, and vegetation. Certain standards apply to long-term (annual average) conditions; others are short-term, applying to conditions that persist for periods ranging from one hour to three months, depending on the toxic properties of the pollutant in question. Ambient standards have been developed for only a few specific contaminants, namely, respirable particulate matter (particles not larger than 10 micrometers in diameter, which tend to remain in the lung when inhaled), sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and ozone. ***(EPA has also promulgated an ambient air quality standard for fine particulates [particulates not larger than 2.5 micrometers in diameter]. This standard, together with a standard promulgated for ozone averaged over an eight-hour period, have been challenged by ongoing litigation, and as such are not specifically addressed herein.)*** In addition, the State of Idaho has also established an additional State ambient air quality standard for fluorides in vegetation. This standard, however, is less restrictive than more recently promulgated increments for toxic air pollutants. In this EIS, "criteria air pollutant" standards are used in the regulatory compliance evaluations of projected emissions from ***waste*** processing alternatives.

The EPA and State of Idaho have monitored ambient air quality in an attempt to define areas as either attainment (that is, the standards are not exceeded) or nonattainment of the ambient air quality standards, although many areas are unclassified due to a lack of regional monitoring data. The attainment status is specific to each pollutant and averaging time. Designation as either attainment or nonattainment not only indicates the quality of the air resource, but also dictates the elements that must be included in local air quality regulatory control programs. Unclassified areas are generally treated as being in attainment. The elements required in nonattainment areas are more comprehensive (or stricter) than in attainment areas. The region that encompasses the INEEL has been classified as attainment or unclassified for all National Ambient Air Quality Standards, meaning that air pollution levels are considered ***healthy***. The nearest nonattainment area lies some 50 miles south of the INEEL in Power and Bannock Counties, which has been designated as nonattainment for the standards related to respirable particulate matter.

As stated, the INEEL lies in an area which is in attainment of all ambient air quality standards. In compliance with state and federal programs, detailed analyses are conducted to demonstrate that implementation of proposed alternatives will not result in violations of ambient air quality standards, or contribute to unacceptable increases in pollutant levels. If the INEEL were located in an area in which the attainment or maintenance of ambient air quality standards is not well established, the proposed alternatives would also be subject to Clean Air Act conformity reviews. A conformity review serves as a means to assure that a federal action does not hinder or interfere with programs developed by state and federal agencies to bring the area into compliance with ambient air standards. Within Idaho, there are currently five federally designated air quality nonattainment areas, and the Idaho Department of Environmental Quality has identified five additional areas of concern based on air monitoring data. Each of these areas is more that 50 miles from the INEEL and will not be impacted under any of the proposed alternatives.

C.2.2.2 Prevention of Significant Deterioration

The Clean Air Act contains requirements to prevent the deterioration of air quality in areas designated as attainment of the ambient air quality standards. These requirements are contained in the PSD amendments and are administered through a program that limits the increase in specific air pollutants above the levels that existed in what has been termed a baseline (or starting) year. The amendments specify maximum allowable ambient pollutant concentration increases, or increments. Increment limits for pollutant level increases are specified for the nation as a whole (designated as Class II areas), and more stringent increment limits (as well as ceilings) are prescribed for designated national resources, such as national forests, parks, and monuments (designated as Class I areas). In Southeastern Idaho, the Craters of the Moon Wilderness Area is the only Class I area. Increment values applicable to the INEEL are presented in Section 4.7 (see Tables 4-1***4*** and 4-1***5***).

The State of Idaho Department of Environmental Quality administers the PSD Program. Proposed new sources of emissions at the INEEL and modifications are evaluated to determine the expected level of emissions of all pollutants. The INEEL is considered a major source ***for the purposes of PSD, and*** as such, a PSD analysis must be performed whenever any modification would result in a significant net increase of any air pollutant. Levels of significance range from very small quantities (less than one pound) to over 100 tons per year, depending on the toxic nature of the substance. Significance levels specified by the State of Idaho for nonradiological pollutants are presented in Table C.2-2. For radionuclides, significance levels range from any increase in emissions to that which would result in an offsite dose of 0.1 millirem per year or greater, depending on total facility emissions.

If an INEEL facility requires a PSD permit, it must be demonstrated that the source:

- Will be constructed using best available control technology (a level of control which is technologically feasible and considered cost-effective) to reduce air emissions
- Will operate in compliance with all prohibitory rules
- Will not cause a detriment to ambient air quality at the nearby Craters of the Moon Wilderness Area, a PSD Class I area
- Will not cause exceedance of Class II increments at locations of ambient air
- Will not adversely affect visibility

The evaluation also includes an assessment of potential growth and associated impacts to air quality-related values-visibility, vegetation, and soils. Generally, all PSD projects must go through a public comment period with an opportunity for public review. ***Many sources at the INEEL have undergone PSD reviews, most recently the new INTEC CPP-606 boilers.***

Table C.2-2. Significance levels specified by the State of Idaho for nonradiological pollutants.[a]

Pollutant	Significance level (tons per year)	Pollutant	Significance level (tons per year)
Carbon monoxide	100	Beryllium	4.0×10^{-4}
Nitrogen oxides	40	Mercury	0.1
Sulfur dioxide	40	Vinyl chloride	1
Particulate matter		Fluorides	3
Total particulate matter	25	Sulfuric acid mist	7
Respirable particulates[b]	15	Hydrogen sulfide (H_2S)	10
Volatile organic compounds[c]	40	Total reduced sulfur (including H_2S)	10
Lead	0.6	Reduced sulfur compounds (including H_2S)	10
Asbestos	7.0×10^{-3}		

a. From IDAPA ***58***.01.01.006***.92*** (***IDEQ 2001***).
b. Airborne particulate matter with a particle diameter of 10 micrometers or less.
c. Used as a surrogate for ozone.

C.2.2.3 National Emission Standards for Hazardous Air Pollutants

In addition to ambient air quality standards and PSD requirements, the Clean Air Act designates requirements for sources that emit substances designated as hazardous air pollutants. These requirements are specified in a program termed National Emission Standards for Hazardous Air Pollutants. Title 40 of the Code of Federal Regulations Part 61, Subpart H, *National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities* ***directly applies to INEEL operations***. This regulation establishes a limit to the dose that may be received by a member of the public due to operations at INEEL. The annual dose limit (10 millirem) applies to the maximally exposed offsite individual and is designed to be protective of human health with an adequate margin of safety. The regulation also establishes requirements for monitoring emissions from facility operations and analysis and reporting of dose.

The INEEL complies with the requirements of the National Emission Standards for Hazardous Air Pollutants through programs to monitor radionuclide emissions, evaluate dose to nearby residences, and report doses annually to the EPA. Proposed new sources of emissions at the INEEL and modifications are evaluated to identify the expected contribution to dose to nearby residents. If specified levels (fractions of the acceptable dose for combined site operations) are exceeded, a National Emission Standards for Hazardous Air Pollutants permit application is prepared for submittal to the EPA. New sources are also evaluated to determine emissions monitoring requirements.

In addition to radionuclides, emissions standards have been established under the National Emission Standards for Hazardous Air Pollutants Program for several nonradiological hazardous air pollutants, including benzene, asbestos, and others, ***and many activities that may result in emissions of hazardous air pollutants.*** In accordance with Title III of the 1990 Amendments to the Clean Air Act, maximum achievable control technology ***is*** specified by the EPA for various source categories. Maximum achievable control technology ***requires*** a level of control at least as stringent as the best performing (i.e., best controlled) sources within each source category. Sources ***are*** required to implement programs or controls to comply with the maximum achievable control technology by the scheduled implementation date. Several maximum achievable control technology standards have been promulgated or proposed. ***The vast majority of these standards are applicable to major sources of hazardous air pollutants, although some are applicable to area sources. For purposes of this program, a "major source" is one which has a potential to emit 10 tons per year or more of any one of the 188 listed hazardous air pollutants, or 25 tons per year or more of any combination of listed hazardous air pollutants. Facilities that release lesser quantities are designated as "area sources."***

The INEEL currently is not a major source for HAP emissions. However, certain waste processing facilities, including the New Waste Calcining Facility and other facilities that include thermal treatment processes***, may be regulated under*** the maximum achievable control technology rule for hazardous waste combustion facilities, ***which is applicable to both area and major sources. In September 1999, EPA issued standards to control emissions of hazardous air pollutants from hazardous waste combustors (64 FR 52827). However, a number of parties sought judicial review of the rule, and subsequent agreements resulted in the issuance of interim standards on February 13, 2002 (67 FR 6792) somewhat less stringent than those of the September 30, 1999 ruling (see Table C.2-3). Facilities are required to comply with the interim standards by September 30, 2003. Final standards are expected to be issued by EPA by June 14, 2005.***

C.2.2.4 State of Idaho Permit Programs

The Idaho Air Pollution Control Program, administered by the ***Department*** of Environmental Quality, requires that permits be obtained for potential sources of air pollutants. Unless the source is specifically exempt ***[categorical exemptions are listed in IDAPA 58, Title 1, Chapter 1, Sections 220 - 225 of the Rules for Control of Air Pollution in Idaho (IDEQ 2001)]*** from permitting requirements,

Table C.2-3. *Interim* maximum achievable control technology standards for combustion of hazardous waste.

	Standard[a]	
Hazardous air pollutant or surrogate	***Existing Source***	***New Source***
Dioxins and furans (nanograms per dry standard cubic meter, as 2,3,7,8-TCDD equivalent)	0.20	***0.20***
Mercury (micrograms per dry standard cubic meter)	***130***	***45***
Particulate matter[b] (milligrams per dry standard cubic meter)	34	***34***
Hydrogen chloride and chlorine (parts per million by volume as hydrogen chloride equivalents)	***77***	***21***
Semi-volatile metals (total lead and cadmium; micrograms per dry standard cubic meter)	***240***	***120 (24)***[c]
Low-volatile metals (total antimony, arsenic, beryllium, and chromium; micrograms per dry standard cubic meter)	***97***	***97***
Carbon monoxide[d] (parts per million by volume)	100	***100***
Hydrocarbons[d] (parts per million by volume, as propane)	10	***10***

TCDD = Tetrachlorodibenzo-P-Dioxin.

a. All maximum achievable control technology concentrations are based on dry, standard conditions corrected to 7 percent oxygen.

b. Particulate matter is specified as a surrogate for control of non-mercury metals.

c. Interim standard is less stringent than that of the March 30, 1999 final rule (24 micrograms per dry standard cubic meter).

d. Pollutants are specified as surrogate indicators of good combustion control. ***Either pollutant can be used to demonstrate compliance.***

Permits to Construct and Operate must be obtained before a source can be constructed or operated. The permits specify requirements, such as monitoring, reporting and recordkeeping, or limitations on operating conditions, such as emission limits.

In addition to individual source permits, the INEEL is also required to ***comply with*** a sitewide Title V operating permit, as stipulated under the 1990 Clean Air Act Amendments. The INEEL Title V Operating Permit ***contains*** specific emissions limits and conditions for operation. This formal permitting process allows the State to determine that emissions will be adequately controlled, the source will comply with all emission standards and regulations, and public health and safety will be adequately protected. Generally, Operating Permit reviews must go through a public review period with an opportunity for public comment. The maximum achievable control technology program (Title III of the 1990 Clean Air Act Amendments which is discussed above) ***is*** administered under the Title V program and also ***calls*** for public review and comment.

C.2.2.5 State of Idaho Rules for Toxic Air Pollutants

The Idaho ***Department*** of Environmental Quality has promulgated rules and methodologies to estimate and control the potential human health impacts of toxic air pollutants (pollutants which by their nature are toxic to human or animal life or vegetation) from new or modified sources. The method used to assess cancer risk ***and other potential health impacts*** associated with air emissions from current INEEL facilities and proposed alternatives is summarized in Appendix E-4, Health and Safety. These rules are contained in ***IDAPA 58***, Title 1, Chapter 1, Sections 585 and 586 of the Rules for the Control of Air Pollution in Idaho (***IDEQ 2001***) and are implemented through the air quality permit program described above. Threshold emission levels have been established for about 700 toxic air pollutants, based on the known or suspected toxicity of these substances. Expected (uncontrolled) emissions above these screening thresholds must be evaluated using standard air dispersion modeling techniques and risk assessment methodologies to assess potential impacts.

As part of the permit evaluation process, requirements related to toxic air pollution control equipment, facility modifications, and materials substitutions may be specified to limit ambient levels of toxic air pollutants.

The State has defined acceptable ambient concentration levels for many toxic air pollutants, including both carcinogenic ***(cancer causing)*** and noncarcinogenic contaminants. These levels are increments over existing levels and apply only to sources that became operational after May 1, 1994. For contaminants known or suspected to cause cancer in humans, this level has been defined as the acceptable ambient concentration for a carcinogen. The acceptable ambient concentration for a carcinogen is based on risk and corresponds to that concentration at which the probability of contracting cancer is one in a million, assuming continuous exposure over a 70-year lifetime. This probability is often described as an "individual excess cancer risk." Excess, in the sense used here, means above the normal cancer incidence rate, which is currently about one in three for the U.S. population. An individual excess cancer risk of one in a million or less is generally considered an acceptable level of risk. The acceptable ambient concentration for a carcinogen differs for each carcinogenic substance due to its carcinogenic potency, as defined by the EPA. The State will grant a permit if the calculated incremental risk due to project emissions does not exceed the acceptable ambient concentration for a carcinogen (that is, does not result in an individual excess cancer risk greater than one in a million). If this level is expected to be exceeded, a permit may still be granted if (a) the calculated risk does not exceed ten in a million and (b) toxic reasonably achievable control technology (which is similar to best available control technology) is employed to limit emissions of carcinogenic substances.

Many air contaminants do not cause cancer but may contribute to other health impacts, such as respiratory or eye irritants, or impacts to the cardiovascular, reproductive, central nervous or other body systems. Levels of significance for noncarcinogenic substances are called acceptable ambient concentrations. Acceptable ambient concentrations are assigned for each of the listed non-carcinogenic toxic air pollutants based on acceptable exposure limits for occupational workers and other reference sources of information for the contaminant in question. For an added margin of safety, the State generally sets the acceptable ambient concentration at one-hundredth of the acceptable occupational exposure level. Permits are granted if incremental emissions from the new or modified source are expected to result in annual average concentrations below the acceptable ambient concentrations. However, if the acceptable ambient concentrations are expected to be exceeded, a permit may still be granted based on consideration of other factors, such as the toxicity of the substance and anticipated level of exposure.

C.2.2.6 Standards for Hazardous Waste and Toxic Substance Control

In addition to regulations designed specifically for air resource protection, projects which include handling or treatment of hazardous substances are required to comply with various Federal and State environmental regulatory programs, which incorporate certain requirements on releases to air. Among the most important of these requirements for hazardous waste incineration are the standards for the destruction of organic hazardous constituents in solid wastes prescribed by EPA (40 CFR 264, Subpart O) and ***Department of Environmental Quality*** (IDAPA ***58***.01.05.008) ***regulations***. Polychlorinated biphenyl incineration must achieve the minimum 99.9999 percent destruction and removal efficiency of the Toxic Substances Control Act, while incineration of other difficult-to-destroy compounds, such as chlorobenzene and carbon tetrachloride, must achieve a minimum 99.99 percent destruction and removal efficiency. The Resource Conservation and Recovery Act performance standards for hydrogen chloride emissions in IDAPA ***58***.01.05.008 require either 99 percent hydrogen chloride removal or less than 4 pounds per hour hydrogen chloride emission rate during the incineration of chlorinated wastes.

C.2.2.7 U.S. Department of Energy Orders and Guides

DOE has developed and issued a series of orders and guides to ensure that all operations comply with applicable environmental, safety, and health regulations and DOE internal policies, including the concept of maintaining emissions and exposures to the public and workers at levels that are as low as reasonably achievable. The as low as reasonably achievable concept is employed in the design and operation of all facilities and applies to all types of air pollutants (for example, radionuclides, carcinogens, toxic and criteria air pollutants).

C.2.3 AIR QUALITY IMPACT ASSESSMENT METHODOLOGY

Several distinct types of evaluations have been performed to assess air quality for existing conditions and future actions. These are:

- Radiological air quality assessments, which are performed for radionuclide emissions from stationary ***(stack and diffuse)*** sources
- Nonradiological air quality assessments, which are performed for criteria and toxic air pollutant emissions from stationary (stack and diffuse) operational sources
- Degradation of visibility assessments, which are performed for certain criteria emissions from stationary sources
- Fugitive dust and combustion product emissions associated with construction equipment and some operational sources
- Assessments of criteria pollutant emissions from mobile sources.

This section describes the methodology used in each type of air quality assessment, including the general approach to source term estimation and atmospheric dispersion modeling, and specific information on related assumptions, methods, and data used in the analyses.

C.2.3.1 Source Term Estimation

The type and quantity of pollutants emitted to air from a specific source, or group of sources, is often referred to as the source term. The baseline source term was compiled from INEEL emissions inventory reports (DOE 1996b, 1997b***, 1998***) and National Emission Standards for Hazardous Air Pollutants reports (DOE 1996a, 1997a***, 2000, 2001***), with projected increases as described in the SNF & INEL EIS (Section 5-7, and Appendix F-3). The source term for each of the proposed waste processing alternatives was developed using information contained in the project data summaries and supporting documentation. Emission rates were calculated for each project, and these were compiled, evaluated, and processed for use in dispersion modeling. The assumptions and methods used for specific project emission rate calculations are documented in the engineering data files which have been prepared to support each individual project. Emission rates for each alternative were determined by summing the emission rates for each project associated with that alternative. In the case of the waste processing alternatives, all facilities were assumed to operate concurrently. For some decommissioning activities, however, some corrections were applied to account for the fact that closure activities were sequential.

Process Emissions

The project data sheets and supporting documentation contain estimates of radionuclide and nonradiological pollutant emission rates for those projects that include waste handling or processing. DOE estimated these emissions for each project based on the nature of the process and the composition of process materials. The estimation method includes assumptions regarding the amount of material that could enter the process exhaust and the amount that would pass through air pollution control systems and be released to the atmosphere. Where applicable, release estimates relied on experience with facilities or processes similar to the one being evaluated.

The primary data source for radionuclide emissions from principal waste processing facilities is a report by McDonald (1999). ***This report was subsequently modified to revise information on tritium emissions for the Direct Vitrification Alternative (McDonald 2000). There was no change in the estimated amount of tritium emissions, but rather in the identity of the process facility at which the emissions would occur.*** For radionuclides other than tritium, release estimates are based on actual emissions released from existing waste processing facilities at the Idaho Nuclear Technology and Engineering Center (INTEC). ***This approach assumes that radionuclide concentrations in the gaseous effluent from waste treatment processes will be similar to historical levels (as measured in the INTEC Main Stack), and that the emission rate for these processes will be proportional to volumetric flow rate. This approach takes advantage of actual measurement data gathered during waste processing at INTEC, and does not rely on estimates of radionuclide inventory in the wastes. Thus, revised estimates of radionuclide inventory made since the issuance of the Draft EIS do not affect the validity of these emission rate estimates.***

Emissions released during 1996 (a year in which no calcining was performed) from the waste evaporator and fractionator were used as a basis for estimating emissions from the following projects associated with proposed waste processing alternatives:

- Newly Generated Liquid Waste and Tank Farm Heel Waste Management
- Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility
- No Action Alternative.

For proposed alternatives which involve calcination, emissions are patterned after releases from the INTEC main stack during 1997 (a year in which calcining was performed). The specific projects covered by this estimation method are:

- Calcining SBW including New Waste Calcining Facility Upgrades
- Vitrification of Separated High-Activity Waste
- Denitration and Grouting of Low-Activity, Class A Waste
- Denitration and Grouting of Low-Activity, Class C Waste
- Vitrification of Calcine and SBW.

For these projects, DOE calculated emissions by multiplying the concentration of radionuclides in the 1997 offgas by the annual volume of gas that each of the proposed projects would discharge.

DOE estimated tritium emissions by dividing the current inventory of tritium in mixed transuranic waste/sodium-bearing waste (SBW) (the only waste stream with a significant quantity of tritium) by the number of years that a thermal waste process would be applied to that waste.

For projects other than those listed above, DOE estimated building emissions using a general method based on the assumption that the primary radionuclides in building exhaust are present in the same proportion as in calcine or tank waste (whichever is more appropriate). The total activity is assumed for dose assessment purposes to be divided among strontium-90, cesium-137, and plutonium-239 according to the following table:

	Fraction of total activity	
Radionuclide	Calcine	Tank waste
Strontium-90	0.90	0.49
Cesium-137	0.10	0.51
Plutonium-239	2.6×10^{-5}	3.3×10^{-3}

It was further assumed that for general building ventilation, these radionuclides are present at a concentration of 1 percent of the derived air concentration, which is a limit for radionuclide concentration specified in 10 CFR 835. This general method was used for estimating emissions in general building ventilation during facility operation and dispositioning, as well as for processes associated with projects other than those specified above. This latter category includes projects such as Calcine Retrieval and Transport, Mixing and Hot Isostatic Pressing, and the Direct Cement Process.

Estimates of nonradiological air pollutant releases from thermal waste treatment processes have been performed by Kimmitt (1998) using release data previously developed by Abbott et al. (1999). These estimates are consistent with EPA guidance (EPA 1994) and are based on the following factors:

- Contaminant concentrations in the waste
- Formation of products of incomplete combustion (such as dioxins and furans)
- Material flow rates
- Air pollution control system performance.

Since little data are available on contaminant levels in the waste to be treated (for example, organic content of calcine), DOE assumed that up to 5 percent of the organic contaminants in the original liquid high-level waste (HLW) are retained in the calcine. The performance of air pollution control systems is based on vendor data and technical literature sources.

Fossil Fuel Combustion Byproducts

DOE estimated criteria and toxic air pollutant emissions associated with fossil fuel combustion for each project. These emission rates are based on the amount of fossil fuel that would be burned to produce an amount of steam required by the project for process use and building heating and air conditioning. A similar method was used to estimate emission from diesel fuel-burning equipment (cranes, loaders, haulers, etc.) that would be required to support project construction, operation, and decontamination and decommissioning at the end of its useful life. These calculations are documented in the Project Data Sheets for each project. In addition to the criteria pollutant emissions documented in the Project Data Sheets, the air resource assessment estimated toxic air pollutant emission rates associated with assumed fuel oil combustion rates. These estimates are based on the EPA-recommended emission factors [specified in EPA (1998)] for residual oil-fired boilers.

Table C.2-4 presents the emission factors used for nonradiological pollutant releases from fuel oil combustion. ***Sulfur dioxide emission rates are based on a maximum fuel sulfur content of 0.3 percent, which is a condition of the PSD permit issued for recently installed boilers at the INTEC Service Building Power House (CPP-606). The limit has been voluntarily applied sitewide. The assessment of cumulative sulfur dioxide impacts includes emissions from existing INEEL facilities that are based on a maximum fuel sulfur content of 0.5 percent, and are thus conservative.***

Radionuclide and Toxic Emission Screening

Numerous radionuclides or nonradiological toxic air pollutants could be present in airborne effluents from facilities associated with the waste processing alternatives. Typically, however, relatively few substances contribute significantly to the risk. DOE performed screening evaluations to identify the most significant substances, based on substance toxicity and emission rates, in an attempt to reduce the number of individual pollutants to be quantitatively assessed for impacts. The radionuclide screening was based on a screening factor (SF_{eff}) which is the product of the estimated radionuclide emission rate (Q, in curies per year) and an effective dose factor (DF_{eff}). The dose factors consider all important exposure pathways (inhalation, ingestion and external exposure) and were obtained from National Council on Radiation Protection Report No. 123 II, "Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground - Work Sheets" (NCRP 1996). Thus, for each radionuclide i:

$$SF_{eff,i} = Q_i \times DF_{eff,i}$$

The radionuclides which collectively accounted for a nominal 99 percent of the effective dose were retained for release modeling and dose assessment.

The inclusion of specific toxic air pollutants in emissions estimates is based on the guidance provided in EPA (1994). The process for selection and characterization of toxics is documented in Abbott et al. (1999).

Fugitive Dust Generation

DOE estimated the amount of fugitive dust generated from construction of facilities based on

Table C.2-4. Emission factors used for criteria and toxic air pollutants from fuel oil combustion.

Criteria pollutants and carbon dioxide	Emission factor (pounds/ 1,000 gallons)[a]	Emission factor (pounds/ 1,000 gallons)[b]	Organic compounds	Emission factor (pounds/ 1,000 gallons)[c]	Metals	Emission factor (pounds/ 1,000 gallons)[d]
	Steam generation	Diesel engines	Steam generation and diesel engines		Steam generation and diesel engines	
Sulfur dioxide	***43***	73	Benzene	2.4×10^{-4}	Antimony	5.3×10^{-3}
Particulate matter	2.0	27	Ethylbenzene	6.4×10^{-5}	Arsenic	1.3×10^{-3}
Carbon monoxide	5.0	470	Formaldehyde	0.030	Barium	2.5×10^{-3}
Nitrogen dioxide	20	400	Naphthalene	1.1×10^{-3}	Beryllium	2.8×10^{-5}
Total organic compounds	0.25	85	1,1,1-Trichloroethane (methyl chloroform)	2.4×10^{-4}	Cadmium	4.0×10^{-4}
Carbon dioxide	2.2×10^{4}	2.3×10^{4}				
			Toluene	6.2×10^{-3}	Chloride	0.35
			o-Xylene	1.1×10^{-4}	Chromium (total)	8.5×10^{-4}
			Acenaphthene	2.1×10^{-5}	Chromium (hexavalent)	2.5×10^{-4}
			Acenaphthylene	2.5×10^{-7}	Cobalt	6.0×10^{-3}
			Anthracene	1.2×10^{-6}	Copper	1.8×10^{-3}
			Benz(a)anthracene	4.0×10^{-6}	Fluoride	0.037
			Benzo(b,k)fluoranthene	1.5×10^{-6}	Lead	1.5×10^{-3}
			Benzo(g,h,i)perylene	2.3×10^{-6}	Manganese	3.0×10^{-3}
			Chrysene	2.4×10^{-6}	Mercury	1.1×10^{-4}
			Dibenzo(a,h)anthracene	1.7×10^{-6}	Molybdenum	7.9×10^{-4}
			Fluoranthene	4.8×10^{-6}	Nickel	0.085
			Fluorene	4.5×10^{-6}	Phosphorus	9.5×10^{-3}
			Indeno(1,2,3-cd)pyrene	2.1×10^{-6}	Selenium	6.8×10^{-4}
			Phenanthrene	1.1×10^{-5}	Vanadium	0.0318
			Pyrene	4.3×10^{-6}	Zinc	0.0291
			Chlorinated dibenzo-p-dioxins	3.1×10^{-9}		

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a. Source: Tables 1.3-1, 1.3-3, and 1.3-12 of EPA (1998) ***using 0.3 percent sulfur content of fuel***.
b. Source: Project Data Sheets (Appendix C.6).
c. Source: Table 1.3-8 of EPA (1998).
d. Source: Table 1.3-10 of EPA (1998).

the area of land that would be disturbed. The total amount of fugitive dust is estimated using the EPA-recommended factor of 1.2 tons per acre disturbed for each month of construction (EPA 1998). This same factor was used to estimate dust generation from disposition of facilities. In most cases, it was conservatively assumed that construction and dispositioning would persist for 12 months per year; however, some activities related to Tank Farm and bin set disposition assume that dust-generating activities would occur for only 6 months per year.

C.2.3.2 Radiological Assessment Methodology

This section summarizes information on the data and methods used to assess radiological conditions and dose to individuals at onsite and offsite locations due to routine emissions of radionuclides from existing and proposed INEEL facilities.

Model Selection and Application

The computer program GENII, Version 1.485 3-Dec-90 (Napier et al. 1988), was used to calculate doses from all pathways and modes of exposure likely to contribute significantly to the total dose from airborne releases. These are:

- External radiation dose from radionuclides in air
- External dose from radionuclides deposited on ground surfaces
- Internal dose from inhalation of airborne radionuclides
- Internal dose from ingestion of contaminated food products.

GENII incorporates algorithms, data, and methods for calculating doses to various tissues and organs and for determination of effective dose equivalent, based on the recommendations of the International Commission on Radiological Protection, as contained in Publications 26 and 30 (ICRP 1977, 1979). It should be noted that newer weighting factors for determination of effective dose are available in International Commission on Radiation Protection Publication 60 (ICRP 1991); however, International Commission on Radiation Protection 26/30 weighting factors are used here since these still form the basis for Federal regulations and DOE Orders (e.g., 10 CFR 20, 10 CFR 834, etc.). The newer weighting factors of International Commission on Radiation Protection 60 have not yet been adopted for use in the U.S., since their use would require a number of adjustments to existing regulations. Also, as pointed out in the Preface to Federal Guidance Report 12 (EPA 1993), for most radionuclides these dose coefficients are not very sensitive to the choice of weighting factors.

The GENII model has several technical advantages over other available methods, including the ability to assess dose from many different release scenarios and exposure pathways. In addition, it conforms to the strict quality assurance requirements of Quality Assurance Program Requirements for Nuclear Facilities [ASME (1989), Basic Requirement 3 (Design Control) and Supplementary Requirement 3S-1 (Supplementary Requirements of Design Control)], which includes requirements for verification and validation of computer codes.

Release Modeling

Releases from stacks or vents may be modeled as either elevated or ground-level releases. For this EIS, the decision whether to model a given emission point as a stack or ground-level release was based on guidance issued by the EPA (EPA 1995a). This guidance is used by the INEEL in the dose assessments performed annually to assess compliance with the National Emission Standards for Hazardous Air Pollutants dose limit. In general, if the height of the release point is less than or equal to 2.5 times the height of attached or nearby buildings, turbulent (wake and downwash) effects are assumed to influence the release, effectively lowering the release height to ground level. In some cases, stacks at existing facilities were modeled as individual release points; in other cases, sources were grouped together and treated as a single release point. For example, in the baseline modeling, elevated sources at the Power Burst Facility (the Waste Experimental Reduction Facility North and South Stacks and the Power Burst Facility

Stack) were modeled as individual elevated releases. Conversely, effluents from various vents at the Naval Reactors Facility were summed and treated as a single ground-level release.

The stack design for many of the proposed waste processing facilities are preliminary; however, it can be assumed that these stacks would conform to "good engineering practice" and would be tall enough to provide good dispersion. The stack parameters used for waste processing facility modeling are presented in Table C.2-5.

Meteorological Data

The atmospheric transport modeling performed as part of these radiological assessments was based on actual meteorological conditions measured at eight different locations at the INEEL. In particular, the data files prepared for these assessments were derived from observations at INEEL weather stations over the period 1987 through 1991. Radionuclide emissions from those current or proposed facilities at INTEC having tall stacks were modeled using meteorological data from the 200-foot (61-meter) level of the Grid III monitoring station, which is located about 1.5 kilometers north of INTEC. These data are presented in a format specifically prepared for the radiological impact assessment modeling as a joint frequency distribution of wind speed, direction, and atmospheric stability class in Table C.2-6. The data set shows the percent of time that the wind is blowing toward specific compass directions (S, SSW, SW, etc.), grouped first by atmospheric stability category and then by wind speed group. Meteorological data sets used in the baseline dose assessments for existing facilities are documented in DOE (1996a, 1997a). Meteorological data sets used in the dose assessments for future facilities not associated with waste processing alternatives are documented in Leonard (1992).

Receptor Locations

Doses were assessed for individuals located at the onsite and offsite locations of highest predicted dose and for the surrounding population, as described below.

Maximally Exposed Individual. The offsite individual whose assumed location and habits are likely to result in the highest dose is referred to as the maximally exposed individual. The location of the maximally exposed individual was identified on the basis of the source-receptor distance and direction combination that yielded the highest predicted offsite dose. In the SNF & INEL EIS, radiation dose was calculated for the minimum distance from each of the major INEEL source areas to the site boundary for each of the 16 compass directions. Since this location was assessed separately for emissions from each of the major INEEL facility areas, the maximally exposed individual receptor locations are merely points on the INEEL boundary and do not correspond to any actual residences or quarters. The maximum impacts at these points were conservatively summed to derive cumulative impacts, without consideration of the fact that the maximum impact points may be spatially separated. The actual maximally exposed individual locations for five of the eight major INEEL facility areas (INTEC, Central Facilities Area, Radioactive Waste Management Complex, Power Burst Facility/Waste Experimental Reduction Facility, and Test Reactor Area) are all located along a segment of the southern boundary; the maximally exposed individual locations for Naval Reactors Facility, Argonne National Laboratory-West, and Test Area North are all distantly located. Although unrealistic, this summation process served to establish the upper-bounding dose. Despite the inherent conservatism, the results obtained were low; further resolution of the actual maximally exposed individual location and dose was not necessary.

In this EIS, the dose to the maximally exposed individual from existing facilities (i.e., the baseline case) is taken from the annual National Emission Standards for Hazardous Air Pollutants compliance evaluations (DOE 1996a, 1997a). The highest of the ***values for 1995 and 1996 -*** two ***recent*** years ***when*** no calcining was performed - is used. The dose from reasonably foreseeable projects is assumed to be represented by the dose calculated for the SNF & INEL

Table C.2-5. Stack parameters for facilities associated with waste processing alternatives.

Project/Process	Stack identifier	***Base*** elevation (meters)	Stack height (feet)	Stack diameter (feet)	Exhaust temperature (^{o}Celcius)	Volumetric flow rate (actual cubic feet per minute)	Exit velocity (feet per minute)
			Proposed facilities				
Full Separations Stack	P9A	1,498	130	9.5	38	166,180	2,344
Vitrification Facility Stack	P9B	1,498	108	10	38	191,467	2,438
LAWT Facility Stack	P9C	1,498	152	5.0	38	49,639	2,528
Transuranic Separations Stack	P49A	1,498	130	9.5	38	166,180	2,344
Transuranic/Class C LAWT Stack	P49C	1,498	152	5.0	38	49,639	2,528
HIP Facility Stack	P71	1,498	108	10	38	172,000	2,190
Direct Cement Facility Stack	P80	1,498	243	10	38	262,000	3,336
Early Vitrification Facility Stack	P88	1,498	108	10	38	205,407	2,615
Steam Reforming Facility Stack	***P2002A***	***1,498***	***80***	***0.67***	***500***	***1,000***	***2,836***
Direct Vitrification Facility Stack	***P88***	***1,498***	***108***	***10***	***38***	***205,407***	***2,615***
Cs Ion Exchange Stack	P111	1,498	152	5.0	38	49,639	2,528
Alternate SBW Treatment Stack	P115	1,498	130	9.5	38	126,000	***1,778***
			Other INTEC facilities				
INTEC main stack[a]	708-001	1,498	250	6.5	33	100,000	3,014
Newly installed boiler[b]	***CPP-606***	***1,499***	***50***	***2.0***	***189***	***14,150***	***4,504***
			Ground-level Area Sources				
	Elevation (meters)			***Release Height***		***Area size***	
Diesel equipment area	***1,498***			***1 meter above ground level***		***100 meters by 100 meters***	

a. The INTEC main stack would be the release point for emissions from the Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility ***(as well as from other existing INTEC facilities including the*** Tank Farm and some of the calcine bin sets).

b. Used as a surrogate for future diesel-fuel burning equipment that could replace or supplement existing steam facilities to meet HLW processing steam demand. Stack parameters are patterned after stacks from existing fuel-burning equipment at this location.

Cs = cesium; HIP = Hot Isostatic Press; LAWT = low-activity waste treatment; ***SBW = sodium-bearing waste;*** TRU = transuranic.

Table C.2-6. Joint frequency distribution data set from the 61-meter level of the INEEL Grid III monitoring station for use in radiological impact assessment modeling.

INEL Grid III 61 M Level - 1987-1991

7 6 1 1 61.0[a]

1.04 2.46 4.47 6.93 9.61 13.19 19.00[b]

0.21	0.34	0.31	0.23	0.22	0.20	0.26	0.23	0.19	0.17	0.12	0.12	0.10	0.12	0.09	0.17
0.04	0.06	0.03	0.01	0.01	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.01
0.04	0.07	0.07	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01
0.17	0.29	0.17	0.09	0.03	0.06	0.05	0.08	0.08	0.08	0.05	0.05	0.06	0.06	0.05	0.10
0.16	0.19	0.17	0.09	0.07	0.08	0.04	0.06	0.06	0.07	0.07	0.05	0.05	0.05	0.07	0.07
0.44	0.51	0.49	0.33	0.25	0.22	0.18	0.20	0.15	0.17	0.17	0.17	0.18	0.17	0.20	0.30
0.25	0.45	0.58	0.49	0.40	0.34	0.31	0.49	0.63	0.66	0.57	0.32	0.24	0.14	0.18	0.18
0.06	0.18	0.21	0.11	0.03	0.02	0.02	0.05	0.08	0.12	0.08	0.05	0.03	0.01	0.01	0.02
0.15	0.35	0.40	0.09	0.02	0.01	0.02	0.05	0.11	0.10	0.12	0.03	0.04	0.02	0.01	0.03
0.55	1.78	1.05	0.20	0.07	0.04	0.08	0.10	0.17	0.30	0.32	0.20	0.10	0.07	0.08	0.12
0.32	0.75	0.52	0.15	0.07	0.04	0.06	0.09	0.09	0.17	0.15	0.18	0.07	0.06	0.07	0.09
0.77	1.65	1.38	0.67	0.34	0.24	0.21	0.27	0.31	0.51	0.47	0.48	0.35	0.32	0.34	0.38
0.02	0.05	0.05	0.03	0.02	0.01	0.02	0.04	0.08	0.10	0.09	0.08	0.02	0.02	0.02	0.01
0.07	0.12	0.16	0.09	0.04	0.03	0.04	0.12	0.20	0.39	0.40	0.20	0.10	0.05	0.08	0.06
0.07	0.19	0.33	0.13	0.02	0.02	0.02	0.08	0.14	0.33	0.58	0.21	0.07	0.05	0.03	0.06
0.45	2.59	2.36	0.33	0.07	0.05	0.08	0.22	0.36	0.91	1.18	0.70	0.22	0.12	0.12	0.21
0.34	1.26	0.93	0.17	0.04	0.03	0.06	0.11	0.21	0.34	0.49	0.38	0.15	0.08	0.12	0.17
0.35	1.20	1.25	0.37	0.12	0.06	0.04	0.15	0.17	0.33	0.43	0.34	0.18	0.08	0.12	0.16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.07	0.08	0.03	0.02	0.01	0.02	0.07	0.10	0.23	0.46	0.27	0.10	0.04	0.05	0.04
0.67	1.47	1.60	0.35	0.06	0.03	0.08	0.26	0.40	1.28	2.95	1.78	0.44	0.16	0.08	0.40
0.15	0.80	0.80	0.16	0.03	0.01	0.06	0.13	0.13	0.33	0.88	0.69	0.11	0.02	0.01	0.08
0.05	0.20	0.25	0.07	0.01	0.01	0.00	0.02	0.02	0.01	0.10	0.11	0.01	0.01	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
0.64	0.61	0.74	0.16	0.02	0.01	0.04	0.16	0.29	1.10	3.53	1.98	0.38	0.12	0.07	0.26
0.03	0.12	0.17	0.07	0.00	0.00	0.01	0.03	0.03	0.06	0.37	0.28	0.04	0.01	0.00	0.00
0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.25	0.18	0.05	0.00	0.00	0.02	0.08	0.16	0.55	2.88	2.13	0.18	0.11	0.01	0.05
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.47	0.48	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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a. Starting from left, these values indicate the number of wind speed data groups in the file, number of atmospheric stability data groups in file, number of seasonal data groups in file, number of time-of-day data groups in file, and the height (in meters) at which the joint frequency data applies.

b. These values represent the average wind speed for each wind speed group, in meters per second.

Preferred Alternative (modified as described below) and the Advanced Mixed Waste Treatment Project.

The maximally exposed individual dose from emissions associated with waste processing or facilities disposition alternatives was modeled using GENII, and then added to the baseline dose and projected increases to determine the cumulative offsite maximally exposed individual dose.

Population Dose. Population dose is not assessed annually as part of the National Emission Standards for Hazardous Air Pollutants assessment, so the baseline dose for this EIS is based on assessments performed for the SNF & INEL EIS. In the SNF & INEL EIS, dose was assessed for the collective population residing in a circular area defined by a radius of 50 miles extending out from each major INEEL facility. Population data used were based on 1990 census data provided by the U.S. Census Bureau. For projects associated with SNF & INEL EIS alternatives and projects expected to become operational before June 1, 1995, growth projections for the counties surrounding the INEEL were applied. These growth estimates are approximately 10 percent per decade. The period covered by the SNF & INEL EIS analysis extends to the year 2010, and the population doses reported in Section 5.7, Air Resources, of Volume 2 of that EIS are the highest obtained for any year throughout this period.

For this EIS, the population dose assessment applies only to the population residing within ***50 miles*** of the INTEC, where waste processing and facilities disposition alternatives are proposed to be implemented. The distribution of this population by distance and direction from INTEC, based on 1990 census data, is presented in Table C.2-7. ***Recently, 2000 census data became available, and the total population within this 50-mile radius was reassessed. The population increased from 118,664 in 1990 to 139,018 in 2000 (Pruitt 2002), representing an average growth of about 1.6 percent per year. It was assumed that the change in each distance and direction segment would be proportional to the change in total population, thereby allowing scaling of the dose calculated using the input file shown in Table C.2-7. A correction factor of 2.0 (equivalent to an annual growth rate of about 1.6 percent) was applied to this population dose assessment to account for growth over the period 1990 to approximately 2035.***

Noninvolved INEEL Worker. INEEL workers may be exposed to radiation attributable to INEEL sources both as a direct result of job performance (such as work within a radiologically controlled area) and incidentally (such as from airborne releases from facilities within their work area, as well as more distant sources within the INEEL). Direct job-related occupational exposure is beyond the scope of this section and is discussed in Sections 5.2.10 and 5.3.8 (Health and Safety) of this EIS. ***An INEEL*** worker incidentally exposed to onsite concentrations of radionuclides is referred to here as a "noninvolved worker." Exposures to noninvolved workers were assessed in the SNF & INEL EIS (for existing sources and future projects) and in this EIS (for proposed waste processing and facilities disposition alternatives). ***For this EIS, DOE reassessed the dose to the highest noninvolved worker using the most recently available data (1998) on emissions from existing INEEL facilities (RBA 2000).***

The dose to the maximally exposed noninvolved worker was assessed using the general methodology described in previous sections. However, worker dose calculations did not include the food ingestion pathway (since workers do not consume food products grown onsite), and exposure times were reduced to reflect the amount of time a worker would spend onsite (assumed to be 2,000 hours per year). As in the case of the offsite maximally exposed individual, the maximally exposed worker dose actually applies to a location and not a real individual. It is conservatively assumed that any location within a major INEEL facility area could be occupied by a worker on a full-time basis (i.e., 2000 hours per year). Doses were assessed for locations within INTEC and at ***all*** other ***major INEEL*** areas. ***The highest dose due to the existing sources was found to occur at the*** Radioactive Waste Management Complex.

Baseline Dose and Cumulative Dose Determination

DOE assessed cumulative radiological impacts by summing the doses from existing (baseline)

Table C.2-7. Population distribution within 50 miles of INTEC.[a]

Distance (miles)										Sector total	Direction
0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50		
0	0	0	0	0	0	6	22	350	2,394	2,772	S
0	0	0	0	0	0	0	0	0	29	29	SSW
0	0	0	0	0	0	0	2	0	0	2	SW
0	0	0	0	0	0	3	6	6	97	112	WSW
0	0	0	0	0	0	157	45	10	22	234	W
0	0	0	0	0	0	1,049	914	45	4	2,012	WNW
0	0	0	0	0	0	3	167	317	648	1,135	NW
0	0	0	0	0	0	52	32	11	10	105	NNW
0	0	0	0	0	0	113	46	15	6	180	N
0	0	0	0	0	0	0	0	199	38	237	NNE
0	0	0	0	0	0	0	403	663	196	1,262	NE
0	0	0	0	0	0	0	43	495	2,079	2,617	ENE
0	0	0	0	0	0	0	1	674	66,430	67,105	E
0	0	0	0	0	0	0	26	514	11,473	12,013	ESE
0	0	0	0	0	0	10	413	15,169	4,786	20,378	SE
0	0	0	0	0	0	30	135	1,528	6,758	8,451	SSE
0	0	0	0	0	0	1,423	2,255	19,996	94,970	118,664	Population total

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a. Based on 1990 Census; centered on Universal Transverse Mercator (UTM) Coordinates 343,924 meters East; 4,825,948 meters North. Values are number of people residing within sector of specified distance and direction ***(see text for adjustment based on 2000 census)***.

sources, foreseeable increases to the baseline, and projected doses associated with ***waste processing options.*** The bases used to estimate baseline doses and foreseeable increases are described below and summarized in Table C.2-8.

Maximally Exposed Individual. The baseline dose is determined from the 1996 National Emission Standards for Hazardous Air Pollutants evaluation as described above. It is assumed that the annual dose calculated for the SNF & INEL EIS Preferred Alternative and the Advanced Mixed Waste Treatment Project represents foreseeable increases to the baseline. However, the SNF & INEL EIS dose was modified to (a) eliminate the dose contributions that are from facilities that are no longer planned, are located at Test Area North, or are assessed under the waste processing impacts, and (b) add the dose contributions from the proposed Advanced Mixed Waste Treatment Project Preferred Alternative (Micoencapsulation Option). This results in a baseline dose of 0.031 millirem per year and a foreseeable increase of 0.13 millirem per year, resulting in a total baseline dose of 0.16 millirem per year.

Population Dose. The SNF & INEL EIS annual dose from existing sources and increases that were foreseeable at the time the analysis was performed was 0.32 person-rem, and the Preferred Alternative dose was 2.6 person-rem per year. The Idaho Waste Processing Facility (a conceptual facility which has since been replaced by the Advanced Mixed Waste Treatment Project) accounted for more than half of this dose. In addition to project-related modifications, the baseline population dose is also multiplied by ***1.5*** to account for estimated population growth between roughly 2010 and ***2035***. Upon modification, the maximum annual baseline population dose becomes ***1.1*** person-rem.

Noninvolved INEEL Worker. ***The maximum calculated dose for the maximally exposed noninvolved worker due to sitewide emissions in 1998 is 0.27 millirem and occurs at the Radioactive Waste Management Complex. This EIS conservatively assumes that the maximum baseline dose and the dose from projected increases both occur at the same location. Upon modification, the baseline noninvolved worker dose is 0.35 millirem per year (Table C.2-8). Additionally, the cumulative dose is assumed to be the sum of the maximum baseline dose and the maximum dose from waste processing alternative emissions, regardless of the respective locations.***

C.2.3.3 Nonradiological Assessment Methodology

Air pollutant levels have been estimated by application of air dispersion computer models that incorporate mathematical functions to simulate transport of pollutants in the atmosphere. The modeling methodology conforms to that recommended by the EPA (EPA 1995a) and the State of Idaho (***IDEQ 2001***) for such applications. The models and application methodology are designed to be conservative; that is, they employ data and algorithms designed to prevent underestimating the pollutant concentrations that would actually exist. In general, the methods used to assess consequences of proposed actions were identical to those used in the baseline assessments. Minor exceptions (such as the use of refined versus screening-level modeling) are noted where applicable. The primary objective of the assessments is to estimate nonradiological pollutant concentrations and other impacts in a manner that facilitates comparison between alternative courses of action, while also providing a measure of maximum potential impact and an indication of compliance with applicable standards or guidelines. The types of pollutants assessed ***in this EIS*** include the criteria pollutants and toxic air pollutants.

Criteria pollutant concentrations were estimated for locations and over periods of time corresponding to State of Idaho and National Ambient Air Quality Standards. Since these standards apply only to ambient air (that is, locations to which the general public has access), criteria pollutant concentrations were assessed for offsite locations and public roads traversing the INEEL. DOE did not quantitatively assess impacts related to ozone formation, although emissions of volatile organic compounds (which are precursors to ozone formation) were evaluated. ***At the time the EIS analyses were performed, EPA and the State of Idaho were not requiring the quantitative assessment of ozone formation potential, due primarily to the lack of any simple, well-defined model for this use. Further,*** ozone levels in the region are not generally recognized as problematic. This has been

Table C.2-8. Calculation of total baseline dose used in cumulative dose determinations.

Category	Value	Basis
Offsite maximally exposed individual dose in millirem per year		
Baseline	0.031	1996 National Emission Standards for Hazardous Air Pollutants dose assessment[a]
Increases	0.58	SNF & INEL EIS Preferred Alternative[b]
Modifications	-0.018	Waste Immobilization Facility
	-0.42	Idaho Waste Processing Facility
	-0.029	Waste Experimental Reduction Facility (incineration)
	-0.004	Facilities at Test Area North
	0.022	AMWTP Proposed Action (Microencapsulation Option)[c]
Total baseline plus increases	0.16	
Noninvolved worker dose in millirem per year		
Baseline	***0.27***	***Calculated from 1998 emissions data***[d]
Increases	0.14	SNF & INEL EIS Preferred Alternative
Modifications	0.058	AMWTP Proposed Action (Microencapsulation Option)
	-0.0001	Waste Immobilization Facility
	-0.11	Idaho Waste Processing Facility
	-0.007	Waste Experimental Reduction Facility (incineration)
Total baseline plus increases	***0.35***	
Population dose in person-rem per year		
Baseline	0.32	SNF & INEL EIS Table 5.7-4
Increases	2.6	SNF & INEL EIS Preferred Alternative
Modifications	-0.097	Waste Immobilization Facility
	-1.6	Idaho Waste Processing Facility
	-0.2	Waste Experimental Reduction Facility (compacting and sizing)
	-0.23	Waste Experimental Reduction Facility (incineration)
	-0.097	Waste Immobilization Facility
	0.009	AMWTP Proposed Action (Microencapsulation Option)
Total baseline plus increases	0.705	
	1.5	Factor for population growth between 2010 and ***2035***
Modified baseline dose	***1.1***	

a. ***Source: DOE (1997a).***

b. ***Source: DOE (1995).***

c. ***Source: DOE (1999). The Microencapsulation Option included incineration followed by microencapsulation. Currently, only nonthermal treatment is planned for this facility, and actual doses are likely to be less.***

d. ***Value of 0.27 used for Final EIS alternatives as calculated in RBA (2000).***

AMWTP = Advanced Mixed Waste Treatment Project.

confirmed by recent data collected by the National Park Service at Craters of the Moon National Monument where no exceedances of the primary ozone standard have been reported (DOI 1994).

Offsite levels of carcinogenic air pollutants were evaluated on the basis of annual average emission rates and compared to annual average standards (increments) specified by the State of Idaho (***IDEQ 2001***). For noncarcinogenic toxic air pollutants, DOE estimated maximum 24-hour levels at both offsite and public road locations and compared the results to applicable noncarcinogenic standards (***IDEQ 2001***). Air pollutant ***concentrations*** were also assessed for onsite locations because of potential worker exposure to ***chemical*** hazard***s***. Onsite levels of specific toxins were calculated using maximum hourly emission rates and compared to occupational exposure limits set for these substances by either the Occupational Safety and Health

Administration or the American Conference of Governmental Industrial Hygienists (the more restrictive of the two limits is used).

Model Description and Application

The EPA Industrial Source Complex-3 (ISCST-3, Version 96113) computer code (EPA 1995b) was the primary model used to evaluate impacts of waste processing alternatives reported in the Draft EIS. For the Final EIS, DOE used more recent releases of ISC together with the most recently available INEEL site meteorological data to assess cumulative impacts of waste processing alternatives. Specifically, DOE used Version 99155 and 00101 for this purpose. Although these models incorporate minor corrections and revisions to specific algorithms, for the types of analyses performed here these revisions do not result in noticeable changes from results obtained with the earlier version. The ISC-3 model incorporates site-specific data (such as meteorological observations from INEEL weather stations), and takes into account effects such as stack tip downwash and turbulence induced by the presence of nearby structures. In addition, the model accommodates multiple sources and calculates concentrations for user-specified receptor locations. Concentrations were calculated over a range of durations, from 1-hour maximum values to annual averages. This allows for comparison of standards based on specific averaging times. In summary, dispersion modeling using ISC-3 allows for a reasonable prediction of the impacts of proposed facilities and, therefore, is ideally suited for the comparative evaluation process used in this EIS.

The analyses performed for the SNF & INEL EIS which served to establish the bounding baseline conditions for this EIS made use of some additional models as described in Appendix F-3 of the SNF & INEL EIS. These models included an earlier version of ISC (ISC-2), and SCREEN, a screening-level model which was used in some cases where a source's contribution to toxic air pollutant concentrations was expected to be minimal (that is, well below acceptable standards). The EPA-recommended Fugitive Dust Model (Winges 1991) was used to assess fugitive dust impacts. SCREEN and the Fugitive Dust Model are not used in this EIS, as it was not necessary to repeat these analyses.

To complement the ISC assessments, in response to recommendations made by the U.S. Park Service, DOE performed additional modeling of potential impacts at locations 50 kilometers or more from INTEC using the CALPUFF model (Scire et al. 1999).

CALPUFF is a non-steady state Gaussian puff dispersion model designed for long-range transport and air quality assessment. It is capable of modeling both near- and far-field effects, and can include model domains up to hundreds of kilometers. Land use and topography can be spatially varied across the model domain. The model incorporates features to evaluate chemical reactions involving common air pollutants, and also calculates deposition rates and visibility impairment. In the refined mode of operation, meteorological algorithms generate 3-dimensional wind fields that are both spatially and temporally variable across the model domain. The regional meteorological data sets necessary to take full advantage of all the model's features were not available to DOE at the time these analyses were performed. Therefore, DOE used CALPUFF in the screening mode of operation to estimate impacts at Class I areas; specifically, Craters of the Moon Wilderness Area, Yellowstone National Park, and Grand Teton National Park. The screening mode of operation is acceptable to the National Park Service for impact assessments at Class I areas. The screening methodology used for the CALPUFF simulations is outlined in the text box on the following page.

The model domain used in the CALPUFF simulations is illustrated in Figure C.2-1. Six receptor rings (two for each Class I area) were evaluated; each ring required a separate CALPUFF run. At Craters of the Moon Wilderness Area, the nearest receptor ring is 50 kilometers from INTEC, even though portions of the site are actually closer to INTEC. This was done because the modeling approach applied for this EIS uses ISC-3 for dispersion modeling to distances of 50 kilometers. The simulations used 360 receptors (one receptor for each degree azimuth). Receptor elevations in each ring were determined by calculating the

average elevation in an arc that encompassed each Class I area using U.S. Geological Survey 1:24,000 digital elevation models. A roughness height of 0.1 meters (suitable for tall prairie grass) was used in all simulations.

CALPUFF calculates hourly average concentrations of primary pollutants at each receptor location for each hour in the simulation period. These data are stored for later access by the post-processing program, CALPOST. DOE used the CALPOST program to extract annual average concentrations of NO_2, SO_2, and PM-10, maximum 24-hour concentrations of SO_2 and PM-10, and 3-hour average concentrations of SO_2 at each receptor location in the model domain. It was conservatively assumed that all oxides of nitrogen were converted to NO_2. The maximum concentration determined for each receptor ring, regardless of direction, was selected for comparison with applicable PSD Class I increments.

CALPUFF analyses were performed only for the Planning Basis Option, which is the waste processing option with the highest criteria pollutant emission rates. Impacts for all other options are bounded by these results.

Major features of CALPUFF run in the screening mode.[a]

Model attributes

Meteorology	Five years of extended (including precipitation and relative humidity) data from a single surface (meteorological data observation) station and upper air data for the same time period. These data are processed through PCRAMMET (meteorological data preprocessor)
Dispersion	Pasquill-Gifford ISC rural dispersion coefficients for rural environments (applicable to conditions at the INEEL and surrounding Class I areas)
Chemistry	MESOPUFF (dispersion model) II chemistry
Receptors	Polar receptor rings that circle the proposed source and encompass the Class I area.
Terrain elevations	Single elevation for all receptors within a given ring. The elevation used is the average elevation of the arc that extends through the Class I area.
Terrain adjustment	Partial plume path adjustment

Class I area data

Receptor Ring Identifier	Class I Area Represented	Radial Distance from INTEC (kilometers)	Average Elevation within Park Boundaries (meters)
Craters	Craters of the Moon Wilderness Area	50	1,636
Grand Teton	Grand Teton National Park (near)	161	2,422
Moran Junction	Grand Teton National Park (far)	197	2,379
Bechler	Yellowstone National Park (near)	160	2,096
Heart Lake	Yellowstone National Park (far)	226	2,490

a. Source: Rood (2000b).

Emission Parameters

The use of air dispersion models requires emission parameters, such as stack height and diameter; exhaust gas temperature and flow rate; size of area (for example, disturbed areas related to construction sources); and pollutant emission rates. The SNF & INEL EIS analysis obtained emission parameter data from the INEEL air emissions inventories discussed above, as well as from project design documents.

As discussed in Section C.2.3.2, precise stack design information was not available for all facilities at the time the analysis was performed. However, DOE considers the data used (see Table C.2-5) to be representative of projected stack conditions, and modeling results based on these data to be valid for purposes of comparative analysis. For area sources such as ground-level emissions from diesel engine equipment, modeling was performed assuming a generic source with dimensions of 100 meters by 100 meters***, and a release height of 1 meter***.

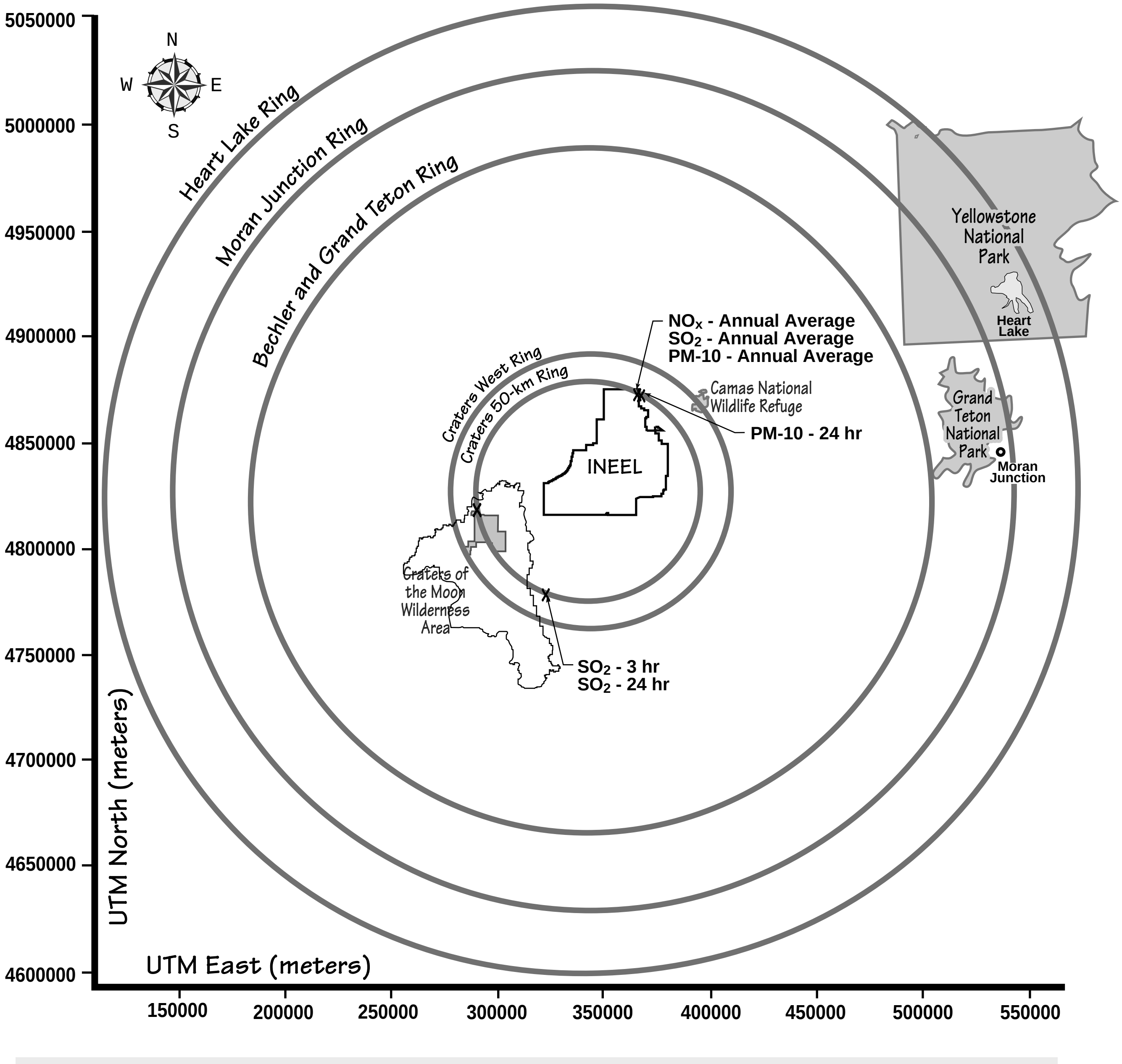

FIGURE C.2-1.
Model domain and polar receptor grid for the CALPUFF screening analysis of Class I Areas in the vicinity of INEEL where x denotes points of maximum impact.

Meteorological Data

DOE modeled emissions from the existing or proposed facilities at INTEC using meteorological data from the Grid III monitoring station. Elevated (tall stack) releases were modeled using observations from the 61-meter (200-foot) level, while ground-level releases were modeled using data from the 10-meter ***(33-foot)*** level of the Grid III monitoring station. These meteorological data sets contain hourly observations of wind speed, direction, temperature, and stability class for the years ***1996 through 1998***. ***DOE performed modeling using meteorological data from each of these years, and the highest of the predicted concentrations was selected.***

DOE used default mixing heights. For short-term assessments, a value of 150 meters, which represents the lowest value measured at the INEEL, was used (DOE 1991). For annual average evaluations, 800 meters was used. This value has been calculated by the National Oceanographic and Atmospheric Administration and is recommended for use in dispersion modeling assessments (Sagendorf 1991). Evaluations were conducted using meteorological data from each of these years, and the highest of the predicted concentrations was selected.

For the CALPUFF modeling, DOE, in consultation with the National Park Service, used meteorological data from the Pocatello Airport for the years 1986 to 1990. These data were coupled with upper air data taken at the Salt Lake City Airport during the same time period. Salt Lake City upper air meteorological data were obtained from EPA's SCRAM Web Page (www.epa.gov/scram001). Pocatello meteorological data were obtained from the SAMSON database (available from EPA) and provided by the National Park Service. Additional details of the meteorological data are contained in Rood (2000b).

Receptor Locations

The ISC-3 Model is capable of determining air quality impacts at receptor locations using either a grid layout pattern or user-specified receptor points. The receptor locations for the dispersion modeling were based on receptor arrays developed for the SNF & INEL EIS (described in Appendix F-3 of that document) and for other INEEL modeling applications. The main purpose of the array is to enable the identification of the point of maximum predicted impact and the quantification of pollutant levels at that location. The array developed for this EIS includes a portion of U.S. 20 as well as a grid that starts at the southwestern INEEL boundary and extends east for about 20 kilometers. The grid contains receptor points at 1,000-meter intervals and extends to a distance of 8 kilometers south of the boundary. The array also includes discrete receptor points at Big Southern Butte, Fort Hall Indian Reservation, and along the eastern and northern boundaries of Craters of the Moon Wilderness Area. The elevation of each receptor location has been included to better account for the effects of elevated terrain.

DOE calculated ambient air concentrations for each location specified in the receptor array; however, the regulatory compliance evaluations for carcinogenic toxic air pollutants were performed only for site boundary locations (and not transportation corridors), as provided by IDAPA ***58***.01.01.210.03.b (***IDEQ 2001***). Criteria and noncarcinogenic toxic air pollutants were assessed at all ambient air locations. DOE also assessed PSD increment consumption for Class II ambient air locations in and around INEEL and Craters of the Moon Wilderness Area, the Class I area nearest the INEEL. Class I area increments were assessed at discrete receptor locations along the eastern and northern boundaries of Craters of the Moon Wilderness Area at intervals of 500 meters.

DOE also assessed onsite concentrations of toxic air pollutants for which occupational exposure limits have been established. Preliminary modeling was performed and the results were used with those of previous assessments (including those performed for SNF & INEL EIS) to identify the onsite areas of highest impact. The area of highest onsite nonradiological impact was found to be within INTEC. This differs from the radiological assessment, which determined that a worker at Central Facilities Area would receive the highest dose. Factors which contribute to this disparity include (a) differences in dispersion models; (b) 8-hour (nonradiological) vs. annual average (radiological) averaging time; and (c) differences in stack parameters for fossil fuel combustion facilities (nonradiological) and waste processing facilities (radiological). The INTEC dose assessment used a grid centered on the main stack and extending to the INTEC area boundary. This grid used closely-spaced (50 meters) receptor points to identify the onsite location of highest impact.

Summation of Project Impacts *and Cumulative Impact Determinations*

The ISC-3 or CALPUFF modeling results for individual sources were summed to determine total impacts for each option. For evaluations performed to assess compliance with Ambient Air Quality Standards, DOE determined cumulative impacts by adding the modeled concentrations from baseline sources and other foreseeable sources to those of the option under evaluation. Foreseeable sources are those that were included in the SNF & INEL EIS Preferred Alternative (DOE 1995) and were still considered viable at the time of analysis. Specifically, these include:

- ***Advanced Mixed Waste Treatment Project (nonthermal treatment option)***
- ***Pit 9 Retrieval Project***
- ***Waste Handling Facility at Argonne National Laboratory-West***
- ***Fuel Cycle Facility at Argonne National Laboratory-West***
- ***Radiological and Environmental Services Laboratory Replacement***
- ***Transuranic Storage Area Enclosure and Storage Project***
- ***Plasma Hearth Process***

The baseline concentrations are presented in Section 4.7 of this EIS.

DOE extended this process for summation of results for PSD increment consumption analyses. In this case, it is assumed that each source group associated with a waste processing option will be subject to regulation under PSD. Cumulative PSD increment consumption was determined by preparing a modeling source term that included (a) sources associated with the SNF & INEL EIS Preferred Alternative and (b) existing sources subject to PSD regulation, including the newly installed boilers at the INTEC CPP-606 steam production facility.

Impacts on Visibility

Atmospheric visibility has been specifically designated as an air quality-related value under the 1977 PSD Amendments to the Clean Air Act. Therefore, in the assessment of proposed projects that invoke PSD review (see Section C.2.2.2), potential impacts to visibility must be evaluated and shown to be acceptable in designated Class I areas and associated integral vistas. Craters of the Moon Wilderness Area, located approximately ***27*** miles ***west***-southwest of the INTEC area (and about 12 miles from the nearest INEEL boundary), is the only Class I area in the Eastern Snake River Plain. However, recognizing the importance of the scenic views in and around the Fort Hall Indian Reservation, DOE performed additional analyses for this location.

The EPA has designed methodologies and developed computer codes to estimate potential visual impacts due to proposed emissions sources. The methodologies include three levels of sophistication. Level 1 is designed to be very conservative; it uses assumptions and simplifying methodologies that will predict plume visual impacts larger than those calculated with more realistic input and modeling assumptions. This conservatism is achieved by the use of worst-case meteorological conditions, including extremely stable (Class F) conditions coupled with a very low wind speed (1 meter per second) persisting for 12 hours, with a wind direction that would transport the plume directly adjacent to a hypothetical observer in the Class I or scenic area. The Level 1 analysis is implemented using the computer code VISCREEN to calculate the potential visual impact of a plume of specified emissions for the specified transport and dispersion conditions. If screening calculations using VISCREEN demonstrate that during worst-case meteorological conditions a plume is either imperceptible or, if perceptible, is not likely to be considered objectionable, further analysis of plume visual impact would not be required (EPA 1992). Level 2 visual impact modeling employs more site-specific information than that of Level

1. It is still conservative and designed to overestimate potential visibility deterioration. Level 3 visual impact modeling is even more intensive in scope and designed to provide a more realistic treatment of plume visual impacts. In both the SNF & INEL EIS and this EIS, DOE used Level 1 VISCREEN analyses to ensure conservatism.

Because within a range of wavelengths, a measure of contrast must recognize both intensity and perceived color, the VISCREEN model determines whether a plume would be visible by calculating contrast (brightness) and color contrast. Contrast is calculated at three visual wavelengths to characterize blue, green, and red regions of the visual spectrum to determine if a plume will be brighter, darker, or discolored compared to its viewing background. If plume contrast is positive, the plume is brighter than its viewing background; if negative, the plume is darker. To address the dimension of color as well as brightness, the color contrast parameter, termed "delta E," is used as the primary basis for determining the perceptibility of plume visual impacts in screening analyses. Delta E provides a single measure of the difference between two arbitrary colors as perceived by humans. If contrasts are different at different wavelengths, the plume is discolored. If contrasts are all zero, the plume is indistinguishable from its background.

In order to determine whether a plume has the potential to be perceptible to observers under worst-case conditions, the VISCREEN model calculates both delta E and contrast for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. The first criterion is a delta E value of 2.0; the second is a green contrast value of 0.05. Results are provided for two assumed worst-case sun angles (to simulate forward and backward scattering of light), with the sun in front and behind the observer, respectively. If either of two screening criteria is exceeded, more comprehensive and realistic analyses should be carried out. Regional haze, which is caused by multiple sources throughout a region, is not calculated or estimated with the VISCREEN model.

The EPA recommends default values for various model parameters. In this analysis, default values were used for all parameters with the exception of background ozone concentration. A value of 0.051 parts per million was assigned as a representative regional value for ozone (DOI 1994; Notar 1998a). DOE used a site-specific annual average background visual range, estimated to be 144 miles based on monitoring programs conducted by the National Park Service at Craters of the Moon Wilderness Area (Notar 1998b).

Visibility impacts were also evaluated with CALPUFF by computing the change (or delta, symbolized by D) in the light extinction coefficient (b_{ext}) relative to background conditions, which can be expressed as:

$$\mathbf{D}b_{ext} = \frac{(b_{ext})_{source}}{(b_{ext})_{bkg}}$$

where $(b_{ext})_{source}$ is the light extinction from the source and $(b_{ext})_{bkg}$ is the light extinction from background sources. Light extinction is caused by the absorption and scattering of light rays and involves hygroscopic and non-hygroscopic components, as well as Rayleigh scattering. The National Park Service provided values for the hygroscopic and non-hygroscopic components for background concentrations of primary pollutants (that is, pollutants that are directly emitted from a source, as opposed to secondary pollutants which are formed in the atmosphere from chemical reactions involving primary pollutants). Annual average hygroscopic background concentrations were set to 1.48 micrograms per cubic meter for Yellowstone National Park, and 1.39 micrograms per cubic meter for Grand Teton National Park and Craters of the Moon National Monument. Non-hygroscopic concentrations were obtained from these values using guidance from the National Park Service (Rood 2000b). In this way, DOE calculated annual average background non-hygroscopic concentrations of 4.48 micrograms per cubic meter for Yellowstone National Park, and 4.9 micrograms per cubic meter for Grand Teton and Craters of the Moon. Background contributions from NO_3 were set to zero. The default

Rayleigh scattering in the CALPOST module of CALPUFF (10 Mm^{-1})[1] was also used in the calculation. These values were then entered for background airborne soil.

Method 2 in the CALPOST visibility model options was used to calculate visibility reduction. This method uses hourly relative humidity values (capped by a maximum of 98%) to calculate a relative humidity-adjusted extinction coefficient for sulfates and nitrates. This is coupled with measured and modeled particulate matter concentrations and Rayleigh scattering to calculate extinction from background and modeled sources. The change in light extinction relative to background is then calculated and reported in the output. Light extinction calculations were based on a 24-hour averaging period. The acceptable target range for Db_{ext} is $\leq$ 5%. As with the PSD increment consumption, CALPUFF visibility analysis was performed only for the Planning Basis Option.

Methodology for Mobile Source Impacts

The SNF & INEL EIS contained an extensive analysis of the ambient air quality impacts at offsite receptor locations due to mobile sources associated with INEEL operations. Sources included the INEEL bus fleet operations, INEEL fleet light- and heavy-duty vehicles, privately-owned vehicles, and heavy-duty commercial vehicles servicing the INEEL facilities. These impacts were quantitatively assessed in the SNF & INEL EIS using emission factors and the computerized CALINE-3 methodology (Benson 1979). The model, which implements the recommended EPA methodology, is considered a screening-level model designed to simulate traffic flow conditions and pollutant dispersion from traffic. The model was used to predict maximum 1-hour ambient air concentrations of carbon monoxide and respirable particulate matter. Regulatory-approved averaging time adjustment factors were used to scale results for other applicable averaging times. All receptor locations were selected within 3 meters from the edge of the roadway, in accordance with EPA guidance. Modeling was conducted for 1993 to quantify the impact due to INEEL buses and traffic serving projects and activities on the INEEL at that time, the projected impact of projects planned for construction before 1995, and the projected impacts of environmental restoration and waste management alternatives given in the SNF & INEL EIS.

The impacts of mobile sources operating at INTEC in support of waste processing operations are qualitatively assessed in Section 5.2.6.7. These impacts are assumed to be bounded by the mobile source impacts assessed in the SNF & INEL EIS.

C.2.4 RADIOLOGICAL CONSEQUENCES OF WASTE PROCESSING ALTERNATIVES

This section provides detail which supplements the assessment results for airborne radionuclide emissions associated with waste processing alternatives presented in Section 5.2.6.3.

C.2.4.1 Radionuclide Emission Rates

Radionuclide emission rates for specific projects associated with proposed waste processing alternatives, estimated as described in Section C.2.3.1, are presented in Table C.2-9.

C.2.4.2 Radiation Doses

DOE has estimated radiation doses that would result from specific projects associated with waste processing alternatives. Table C.2-10 presents estimated radiation dose from airborne radionuclide emissions, averaged over an operational year, for (a) the offsite maximally exposed individual; (b) the collective offsite population within 80 kilometers of INTEC; and (c) the maximally exposed noninvolved INEEL worker. The organ receiving the highest weighted dose, the most important exposure pathway, and the radionuclide which is the highest contributor to the effective dose are also identified. In each case, the highest predicted noninvolved worker location is the Central Facilities Area.

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[1] The units of light extinction are inverse megameters (Mm^{-1})

Table C.2-9. Radionuclide emission rates (curies per year) for projects associated with waste processing alternatives.[a]

Project identifier[b]	P1A	P1B	P1C	P1D	P9A/ P23A	P9B/ P23B	P9C/ P23C	P26	P26	P26	P18	P18MC	P35D or E
Radionuclide	Calcine SBW with MACT	NGLW & Heel Waste Mgmt.	PEW Evap. And LET&D	No Action Alt.	Full Seps.	Vit. Plant	Class A Grout Plant	Tank Farm Closure	Bin sets Closure	Fill with Class A Grout	New Anal. Lab.	Remote Anal. Lab. Operation	Class A Grout Packaging
Americium-241	-	-	-	-	-	-	-	7.9×10^{-12}	1.6×10^{-8}	4.1×10^{-12}	-	-	-
Cobalt-60	1.1×10^{-6}	1.3×10^{-7}	1.3×10^{-7}	1.3×10^{-7}	-	-	2.8×10^{-8}	5.4×10^{-11}	-	2.8×10^{-11}	-	-	-
Cesium-134	6.2×10^{-6}	8.2×10^{-8}	8.2×10^{-8}	8.2×10^{-8}	-	2.9×10^{-10}	-	1.6×10^{-9}	-	8.6×10^{-10}	-	-	-
Cesium-137[c]	2.4×10^{-3}	2.4×10^{-4}	2.4×10^{-4}	2.4×10^{-4}	2.9×10^{-5}	1.2×10^{-7}	-	5.6×10^{-8}	8.6×10^{-6}	3.0×10^{-8}	5.1×10^{-8}	2.6×10^{-8}	4.5×10^{-9}
Europium-154	9.5×10^{-7}	2.0×10^{-7}	2.0×10^{-7}	2.0×10^{-7}	-	4.5×10^{-11}	-	5.1×10^{-10}	-	2.7×10^{-10}	-	-	-
Europium-155	-	-	-	-	-	-	-	2.4×10^{-10}	-	1.3×10^{-10}	-	-	-
Hydrogen-3 (tritium)	23	-	9.0	9.0	-	-	45[d]	7.5×10^{-11}	-	4.0×10^{-11}	-	-	-
Iodine-129	***0.058***	***0.031***	***0.031***	***0.031***	7.5×10^{-7}	-	***1.5×10^{-3}***	5.0×10^{-13}	-	2.6×10^{-13}	-	-	-
Nickel-63	-	-	-	-	-	-	-	3.3×10^{-12}	-	1.8×10^{-12}	-	-	-
Promethium-147	-	-	-	-	-	-	-	-	-	-	-	-	-
Plutonium-238	5.0×10^{-6}	6.2×10^{-6}	6.2×10^{-6}	6.2×10^{-6}	-	2.4×10^{-10}	-	1.4×10^{-10}	1.4×10^{-7}	7.3×10^{-11}	-	-	-
Plutonium-239	5.7×10^{-7}	1.0×10^{-7}	1.0×10^{-7}	1.0×10^{-7}	-	2.7×10^{-11}	-	9.8×10^{-11}	-	5.2×10^{-11}	1.3×10^{-11}	6.4×10^{-12}	1.1×10^{-12}
Plutonium-241	-	-	-	-	-	-	-	7.7×10^{-11}	5.5×10^{-8}	4.0×10^{-11}	-	-	-
Ruthenium-106	6.3×10^{-5}	2.4×10^{-6}	2.4×10^{-6}	2.4×10^{-6}	-	-	1.6×10^{-6}	4.7×10^{-10}	-	2.5×10^{-10}	-	-	-
Antimony-125	1.0×10^{-5}	1.5×10^{-6}	1.5×10^{-6}	1.5×10^{-6}	4.8×10^{-7}	-	2.7×10^{-7}	1.1×10^{-10}	-	5.7×10^{-11}	-	-	-
Samarium-151	-	-	-	-	-	-	-	-	2.0×10^{-7}	-	-	-	-
Strontium-90[e]	3.1×10^{-4}	2.0×10^{-5}	2.0×10^{-5}	2.0×10^{-5}	2.1×10^{-9}	1.5×10^{-8}	-	5.1×10^{-8}	1.1×10^{-5}	2.7×10^{-8}	4.5×10^{-7}	2.2×10^{-7}	3.9×10^{-8}
Technetium-99	-	-	-	-	1.8×10^{-5}	-	-	1.3×10^{-12}	3.0×10^{-9}	6.9×10^{-13}	-	-	-

Table C.2-9. Radionuclide emission rates (curies per year) for projects associated with waste processing alternatives[a] (continued).

Project identifier[b]	P49A	P49C	P49D	P51	P51	P51	P59A	P71	P80	P88	P111	P117	P133	***P2001***	***P2002A***
Radionuclide	TRU/ Class C Seps.	Class C Grout Plant	Class C Grout Packaging	Tank Farm Closure	Bin sets Closure	Fill with Class ***C*** Grout	Calcine Retrieval/ Transport	HIP Waste Treat.	Direct Cement. Treat.	Early/ Direct Vit.	Treat SBW/ NGLW with CsIX	Calcine/ Resin Packaging	Waste Treatment Pilot Plant	***NGLW Grouting***	***Steam Reforming***
Americum-241	-	-	-	7.9×10^{-12}	1.6×10^{-8}	4.1×10^{-12}	-	-	-	-	2.0×10^{-5}	-	-	-	-
Cobalt-60	-	8.1×10^{-9}	-	5.4×10^{-11}	-	2.8×10^{-11}	-	-	-	2.1×10^{-9}	9.8×10^{-6}	-	-	-	-
Cesium-134	-	4.5×10^{-8}	-	1.6×10^{-9}	-	8.6×10^{-10}	-	-	-	1.2×10^{-8}	2.1×10^{-8}	-	-	-	***7.0×10^{-8}***
Cesium-137[c]	2.9×10^{-5}	1.8×10^{-5}	4.5×10^{-9}	5.6×10^{-8}	8.6×10^{-6}	3.0×10^{-8}	***2.2×10^{-3}***	0.09	7.8×10^{-8}	4.7×10^{-6}	2.0×10^{-6}	8.6×10^{-6}	2.9×10^{-9}	***6.2×10^{-9}***	***2.8×10^{-5}***
Europium-154	-	-	-	5.1×10^{-10}	-	2.7×10^{-10}	-	-	-	1.8×10^{-9}	9.9×10^{-6}	-	-	-	***1.1×10^{-8}***
Europium-155	-	-	-	2.4×10^{-10}	-	1.3×10^{-10}	-	-	-	-	-	-	-	-	-
Hydrogen-3 (tritium)	-	45	-	7.5×10^{-11}	-	4.0×10^{-11}	-	-	-	45[d,f]	45	-	-	-	***45***
Iodine-129	7.5×10^{-7}	4.2×10^{-4}	-	5.0×10^{-13}	-	2.6×10^{-13}	-	-	-	1.1×10^{-3}	1.3×10^{-7}	-	-	-	-
Nickel-63	-	-	-	3.3×10^{-12}	-	1.8×10^{-12}	-	-	-	-	-	-	-	-	-
Promethium-147	-	-	-	-	-	-	-	-	-	-	5.2×10^{-5}	-	-	-	-
Plutonium-238	-	-	-	1.4×10^{-10}	1.4×10^{-7}	7.3×10^{-11}	3.2×10^{-5}	-	-	9.5×10^{-9}	5.2×10^{-5}	1.2×10^{-7}	-	-	***5.6×10^{-8}***
Plutonium-239	-	-	1.1×10^{-12}	9.8×10^{-11}	-	5.2×10^{-11}	-	-	2.0×10^{-11}	1.1×10^{-9}	3.1×10^{-6}	-	7.3×10^{-13}	***1.5×10^{-12}***	***6.4×10^{-9}***
Plutonium-241	-	-	-	7.7×10^{-11}	5.5×10^{-8}	4.0×10^{-11}	-	-	-	-	-	-	-	-	-
Ruthenium-106	-	4.6×10^{-7}	-	4.7×10^{-10}	-	2.5×10^{-10}	-	1.1×10^{-5}	-	1.2×10^{-7}	-	-	-	-	-
Antimony-125	4.8×10^{-7}	7.5×10^{-8}	-	1.1×10^{-10}	-	5.7×10^{-11}	-	8.2×10^{-8}	-	***2.0×10^{-8}***	3.8×10^{-6}	-	-	-	-
Samarium-151	-	-	-	-	2.0×10^{-7}	-	-	-	-	-	2.8×10^{-5}	-	-	-	-
Strontium-90[e]	2.1×10^{-9}	2.3×10^{-6}	3.9×10^{-8}	5.1×10^{-8}	1.1×10^{-5}	2.7×10^{-8}	***5.8×10^{-3}***	-	6.8×10^{-7}	6.0×10^{-7}	1.6×10^{-3}	2.3×10^{-5}	2.5×10^{-8}	***5.4×10^{-8}***	***3.5×10^{-6}***
Technetium-99	1.8×10^{-5}	-	-	1.3×10^{-12}	3.0×10^{-9}	6.9×10^{-13}	-	1.7×10^{-4}	-	-	8.0×10^{-7}	-	-	-	

a. ***See Section C.6.1 for listing of project names. Source: Project Data Sheets in Appendix C.6 and backup documentation (e.g., duration of air emissions).***

b. ***All other projects contribute less than one percent to the dose.***

c. ***The short-lived decay product Barium-137m would also be present.***

d. ***H-3 emissions for this project occur under Full Separations Option. For Vitrification with Calcine Separations Option, H-3 emissions are assigned to Project P88.***

e. ***An equal amount of the decay product Yttrium-90 would also be present.***

f. ***After SBW processing, tritium emissions cease.***

CsIX = cesium ion exchange; HIP = hot isostatic pressed; LET&D = Liquid Effluent Treatment and Disposal Facility; MACT = maximum achievable control technology; NGLW = newly-generated liquid waste; PEW = process equipment waste; ***SBW = sodium-bearing waste***; TRU = transuranic.

Table C.2-10. Summary of radiation dose impacts associated with airborne radionuclide emissions from waste processing alternatives.

				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Case[a] (units)	Applicable Standard	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vit. Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Dose to maximally exposed offsite individual (millirem per year)	10[b]	6.0×10^{-4}	1.7×10^{-3}	1.2×10^{-4}	1.8×10^{-3}	6.0×10^{-5}	1.8×10^{-3}	1.7×10^{-3}	8.9×10^{-4}	***6.2×10^{-4}***	9.5×10^{-4}	***6.5×10^{-4}***	***6.8×10^{-4}***
Controlling organ		Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	***Thyroid***	Thyroid	***Thyroid***	***Thyroid***
Controlling pathway		Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	***Ingestion***	Ingestion	***Ingestion***	***Ingestion***
Controlling radionuclide		I-129	I-129	I-129	I-129	H-3	I-129	I-129	I-129	***I-129***	I-129	***I-129***	***I-129***
Dose to maximally exposed noninvolved worker (millirem per year)[c]	5,000[d]	7.0×10^{-6}	1.8×10^{-5}	4.4×10^{-5}	9.0×10^{-5}	3.4×10^{-5}	3.6×10^{-5}	3.0×10^{-5}	4.8×10^{-5}	***2.2×10^{-5}***	1.0×10^{-4}	***2.3×10^{-5}***	***2.3×10^{-5}***
Controlling organ		Thyroid	Thyroid	Bone surface	Thyroid	Bone surface	Thyroid	Thyroid	Bone surface	***Bone surface***	Bone surface	***Bone surface***	***Bone surface***
Controlling pathway		Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	***Inhalation***	Inhalation	***Inhalation***	***Inhalation***
Controlling radionuclide		I-129	I-129	Pu-238	Pu-238	Pu-238	Pu-238	Pu-238	Pu-238	***Pu-238***	Pu-238	***Pu-238***	***Pu-238***
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[e,f]	N.A.	***0.038***	***0.11***	***6.6×10^{-3}***	***0.11***	***3.6×10^{-3}***	***0.11***	***0.11***	***0.056***	***0.040***	***0.056***	***0.045***	***0.047***

a. Doses are maximum values over any single year during which waste processing occurs; annual doses from waste stored on an interim basis after waste processing is completed would be much less.

b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.

c. Location of highest INEEL onsite dose is Central Facilities Area.

d. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.

e. ***Assessment conservatively assumes that exposed population is that which is projected for the year 2035. Based on 2000 census data and growth rate between 1990 and 2000, this population would be 242,000 (compared to 2000 population of 139,000).***

f. Controlling organ, pathway, and radionuclide are the same as for the maximally exposed offsite individual.

C.2.5 NONRADIOLOGICAL CONSEQUENCES OF WASTE PROCESSING ALTERNATIVES

This section provides detail which supplements the assessment results for nonradiological air consequences of waste processing alternatives presented in Sections 5.2.6.4 through 5.2.6.6.

C.2.5.1 Air Pollutant Emission Rates

This section presents nonradiological air pollutant emission rates for specific projects associated with proposed waste processing alternatives, estimated as described in Section C.2.3.1. The following tabulations are presented:

- Table C.2-11 presents a listing of estimated emissions of total and individual criteria pollutants, total toxic air pollutants, and carbon dioxide from fossil fuel combustion. Emissions are listed for individual projects and are summed for each waste processing alternative. The primary source of these emissions is fuel combustion to generate steam. Burning fuel to operate diesel equipment also contributes to these emissions.

- Table C.2-12 presents a listing of emissions estimates for individual toxic air pollutants produced by fossil fuel combustion.

- Table C.2-13 presents estimates of toxic air pollutant, criteria pollutant, and carbon dioxide emissions resulting from chemical processes (other than fossil fuel combustion) that would be used to treat waste under the proposed alternatives.

C.2.5.2 Concentrations of Nonradiological Air Pollutants at Ambient Air Locations

The following tabulations present the results of assessments for criteria and toxic air pollutant concentrations in ambient air (general public access) locations:

- Table C.2-14 presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations, including at or slightly beyond the INEEL boundary, along public roads traversing the INEEL, and at Craters of the Moon Wilderness Area. The table shows the incremental impacts of each alternative, along with the cumulative impacts when baseline levels are added.

- Table C.2-15 shows the baseline conditions used in cumulative effect determinations. These are the maximum impacts predicted for the indicated locations based on actual 1997 INEEL emissions ***(DOE 1998)*** plus other reasonably foreseeable increases. ***In some cases, 1997 emissions data were not available and 1996 data (DOE 1997b) were used. Forseeable*** increases include projects associated with the SNF & INEL EIS Preferred Alternative, ***which were*** modified to reflect current project plans ***(such as inclusion of the Advanced Mixed Waste Treatment Project). The emissions from the New Waste Calcining Facility (which is evaluated in some alternatives) and the Coal-Fired Steam Generating Facility are not included in the baseline for this EIS.***

- Table C.2-16 presents a summary of the highest predicted impacts of any single carcinogenic (and noncarcinogenic) toxic air pollutant at offsite and onsite locations. In each case, the maximum impact (in terms of percent of applicable standard) among carcinogens is for nickel, while vanadium is the highest noncarcinogen. As previously noted, toxic air pollutant increments promulgated by the State apply only to new or modified sources that become operational after May 1, 1994. Thus, the contribution from baseline sources is not included when comparing toxic air pol-

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion.[a]

		Category totals			Criteria pollutants					
Alternative and project	Description	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
				No Action Alternative						
P1D	No Action Alternative	***17***	290	5.2×10^3	***10***	0.48	1.2	4.8	0.061	0.73
P1E	Bin Set 1 Calcine Transfer	***4.2***	73	1.3×10^3	***2.6***	0.12	0.3	1.2	0.015	0.18
P18MC	Remote Analytical Lab - Minimum Compliance	***1.4***	22	390	***0.79***	0.04	0.16	0.42	0.017	0.055
Totals		***22***	390	6.9×10^3	***14***	0.64	1.7	6.4	0.093	0.96
				Continued Current Operations Alternative						
P1A	Calcine SBW incl. NWCF (MACT) Upgrades	***27***	290	5.2×10^3	***11***	0.73	5.8	8.6	0.9	0.73
P1B	NGLWM and TF Waste Heel Waste	***13***	230	4.1×10^3	***8.1***	0.38	1.0	3.9	0.056	0.58
P1E	Bin Set 1 Calcine Transfer	***4.2***	73	1.3×10^3	***2.6***	0.12	0.3	1.2	0.015	0.18
P18MC	Remote Analytical Lab - Minimum Compliance	***1.4***	22	390	***0.79***	0.04	0.16	0.42	0.017	0.055
Totals		***46***	620	1.1×10^4	***22***	1.3	7.3	14	0.98	1.5
				Full Separations Option						
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^3	***2.6***	0.12	0.30	1.2	0.015	0.18
P9A	Full (early) Separations	***130***	2.1×10^3	3.7×10^4	***74***	3.8	14	39	1.5	5.2
P9B	Vitrification Plant	***10***	140	2.5×10^3	***4.9***	0.29	1.7	3.2	0.23	0.34
P9C	Class A Grout Plant	***10***	130	2.4×10^3	***4.7***	0.28	1.7	3.1	0.23	0.33
P24	Vitrified Product Interim Storage	-[c]	-	-	-	-	-	-	-	-
P18	New Analytical Lab - Full Separations	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.03	0.067
P118	Separations Organic Incinerator Project	0.047	0.053	1.0	3.3×10^{-3}	1.2×10^{-3}	0.021	0.018	3.7×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Facility - Full Separations	***1.6***	27	480	***0.95***	0.046	0.13	0.46	0.01	0.067
and										
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
P27	Class A/C Grout in New Landfill Facility	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
or										
P35E	Class A Grout Packaging and Loading for Offsite Disposal	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
Totals		***170***	2.5×10^3	4.4×10^4	***89***	4.7	21	50	2.4	6.2

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

		Category totals			Criteria pollutants					
Alternative and project	Description	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
					Planning Basis Option					
P1A	Calcine SBW including. NWCF Upgrades (MACT)	***27***	290	5.2×10^{3}	***11***	0.73	5.8	8.6	0.90	0.73
P1B	NGLWM and TF Waste Heel Waste	***13***	230	4.1×10^{3}	***8.1***	0.38	1.0	3.9	0.056	0.58
P59A	Calcine Retrieval and Transport – Planning Basis	***4.2***	73	1.3×10^{3}	***2.6***	0.12	0.30	1.2	0.015	0.18
P23A	Full Separations	***130***	2.1×10^{3}	3.7×10^{4}	***74***	3.8	14	39	1.5	5.2
P23B	Vitrifcation Plant	***10***	140	2.5×10^{3}	***4.9***	0.29	1.7	3.2	0.23	0.34
P23C	Class A Grout Plant	***10***	130	2.4×10^{3}	***4.7***	0.28	1.7	3.1	0.23	0.33
P24	Vitrified Product Interim Storage	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.03	0.067
P118	Process Organic Incinerator – Planning Basis	0.047	0.053	1.0	3.3×10^{-3}	1.2×10^{-3}	0.021	0.018	4.0×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Plant – Plan Basis	***14***	240	4.2×10^{3}	***8.3***	0.39	1.0	3.9	0.053	0.59
P35E	Class A Grout Packaging and Loading for Offsite Disposal (Planning Basis)	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
Totals		***210***	3.2×10^{3}	5.7×10^{4}	***110***	6.0	26	64	3.0	8.1
					Transuranic Separations Option					
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^{3}	***2.6***	0.12	0.30	1.2	0.015	0.18
P49A	TRU-C Separations	***65***	980	1.8×10^{4}	***35***	1.8	8.1	20	0.93	2.5
P49C	Class C Grout Plant	***10***	130	2.4×10^{3}	***4.7***	0.28	1.7	3.1	0.23	0.33
P39A	Packaging and Loading TRU at INTEC for Shipment to WIPP	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab – Full or TRU Separations	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.030	0.067
P118	Separations Organic Incinerator Project	0.047	0.053	1.0	***3.3×10^{-3}***	1.2×10^{-3}	0.021	0.018	3.7×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Facility – TRU Separations	***6.8***	120	2.1×10^{3}	***4.1***	0.20	0.51	2.0	0.029	0.29
and										
P49D	Class C Grout Packaging and Shipping to INEEL Landfill	0.11	0.13	2.4	***7.8×10^{-3}***	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
P27	Class A/C Grout in New Landfill Facility	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
Totals		***93***	1.3×10^{3}	2.4×10^{4}	***48***	2.6	13	28	1.6	3.3

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

		Category totals			Criteria pollutants					
Alternative and project	Description	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
Hot Isostatic Pressed Waste Option										
P1A	Calcine SBW incl. NWCF Upgrades (MACT)	***27***	290	5.2×10^3	***11***	0.73	5.8	8.6	0.90	0.73
P1B	NGLWM and TF Waste Heel Waste	***13***	230	4.1×10^3	***8.1***	0.38	1.0	3.9	0.056	0.58
P18	New Analytical Lab	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.03	0.067
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^3	***2.6***	0.12	0.3	1.2	0.015	0.18
P71	Mixing and HIPing	***26***	440	7.9×10^3	***16***	0.74	1.9	7.4	0.10	1.11
P72	HIPed HLW Interim Storage	-	-	-	-	-	-	-	-	-
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – HIP	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.02	4.1×10^{-3}	1.5×10^{-4}
Totals		***72***	1.1×10^3	1.9×10^4	***38***	2.0	9.3	22	1.1	2.7
Direct Cement Waste Option										
P1A	Calcine SBW including NWCF Upgrades (MACT)	***27***	290	5.2×10^3	***11***	0.73	5.8	8.6	0.9	0.73
P1B	NGLWM and TF Waste Heel Waste	***13***	230	4.1×10^3	***8.1***	0.38	1.0	3.9	0.056	0.58
P18	New Analytical Lab	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.03	0.067
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^3	***2.6***	0.12	0.30	1.2	0.015	0.18
P71	Mixing and HIPing	***16***	270	4.9×10^3	***9.6***	0.45	1.2	4.6	0.066	0.68
P81	Unseparated Cementitious HLW Interim Storage	-	-	-	-	-	-	-	-	-
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Direct Cement	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.020	4.1×10^{-3}	1.5×10^{-4}
Totals		***62***	900	1.6×10^4	***32***	1.7	8.6	19	1.1	2.2
Early Vitrification Option										
P1C	PEW Evaporator and LET&D Operations	***3.4***	58	1.0×10^3	***2.0***	0.1	0.29	1.0	0.020	0.14
P18	New Analytical Lab	***1.8***	27	480	***0.95***	0.051	0.24	0.55	0.030	0.067
P59A	Calcine Retrieval and Transport	***4.2***	73	1.3×10^3	***2.6***	0.12	0.30	1.2	0.015	0.18
P61	Vitrified HLW Interim Storage	-	-	-	-	-	-	-	-	-
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	-	-	-	-	-	-	-	-	-

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

		Category totals			Criteria pollutants					
Alternative and project	Description	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
	Early Vitrification Option (continued)									
P88	Early Vitrification with MACT	***19***	330	5.9×10^{3}	***12***	0.54	1.4	5.4	0.069	0.82
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Early Vitrification	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.02	4.1×10^{-3}	1.5×10^{-4}
Totals		***29***	490	8.7×10^{3}	***17***	0.82	2.2	8.2	0.14	1.2
	Steam Reforming Option									
P1C	***Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility***	***4.8***	***58***	***1.0×10^{3}***	***2.0***	***0.10***	***0.29***	***1.0***	***0.020***	***0.14***
P18	***New Analytical Laboratory***	***1.9***	***22***	***390***	***0.79***	***0.040***	***0.16***	***0.42***	***0.017***	***0.055***
P59A	***Calcine Retrieval and Transport***	***5.9***	***73***	***1.3×10^{3}***	***2.6***	***0.12***	***0.30***	***1.2***	***0.015***	***0.18***
P117A SR	***Calcine Packaging and Loading to Hanford***	***3.1***	***37***	***670***	***1.3***	***0.062***	***0.16***	***0.63***	***0.010***	***0.093***
P2001	***NGLW Grout Facility***	***2.7***	***33***	***580***	***1.2***	***0.054***	***0.14***	***0.54***	***0.007***	***0.082***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***0.11***	***0.13***	***2.4***	***7.8×10^{-3}***	***2.8×10^{-3}***	***0.049***	***0.042***	***8.8×10^{-3}***	***3.1×10^{-4}***
P2002A	***Steam Reforming***	***4.1***	***22***	***390***	***0.84***	***0.10***	***1.2***	***1.3***	***0.21***	***0.054***
Totals		***23***	***240***	***4.4×10^{3}***	***8.7***	***0.47***	***2.3***	***5.1***	***0.29***	***0.61***

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

		Category totals			Criteria pollutants					
Alternative and project	Description	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
Minimum INEEL Processing Alternative										
P1C	PEW Evaporator and LET&D Operations	***3.4***	58	1.0×10^{3}	***2.0***	0.10	0.29	1.0	0.020	0.14
P18	New Analytical Lab	***1.8***	27	480	***1.0***	0.051	0.24	0.55	0.03	0.067
P24	Vitrified Product Interim Storage	-	-	-	-	-	-	-	-	-
P27	Class A/C Grout in New Landfill Facility	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
P111	SBW Treatment with CsIX	***1.5***	24	430	***0.86***	0.043	0.14	0.44	0.013	0.061
P112A	Packaging and Loading CH-TRU for Transport to WIPP	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Minimum INEEL Processing	***4.1***	71	1.3×10^{3}	***2.5***	0.12	0.32	1.2	0.019	0.18
and										
P59A	Calcine Retrieval and Transport – Minimum INEEL Processing	***4.2***	73	1.3×10^{3}	***2.6***	0.12	0.30	1.2	0.015	0.18
P117A	Packaging & Loading Calcine for Transport to Hanford	***2.2***	37	670	***1.3***	0.062	0.16	0.63	0.010	0.093
or										
P59B	Calcine Retrieval and Transport - JIT	-	-	-	-	-	-	-	-	-
P117B	Packaging & Loading Calcine for JIT Transport to Hanford	***2.5***	38	670	***1.3***	0.071	0.31	0.75	0.036	0.094
Totals		***22***	300	5.3×10^{3}	***11***	0.61	3.5	6.8	0.48	0.74
Vitrification without Calcine Separations Option										
P1C	***PEW Evaporator and LET&D Operations***	***3.4***	***58***	***1.0×10^{3}***	***2.0***	***0.10***	***0.29***	***0.99***	***0.020***	***0.14***
P18	***New Analytical Lab***	***1.8***	***27***	***480***	***0.95***	***0.051***	***0.24***	***0.55***	***0.030***	***0.067***
P59A EV	***Calcine Retrieval and Transport (EV)***	***4.2***	***73***	***1.3×10^{3}***	***2.6***	***0.12***	***0.30***	***1.2***	***0.015***	***0.18***
P88	***Vitrification with MACT***	***19***	***330***	***5.9×10^{3}***	***12***	***0.54***	***1.4***	***5.4***	***0.069***	***0.82***
P133 EV	***Waste Treatment Pilot Plant (EV)***	***0.052***	***0.059***	***1.1***	***$3.7\times10^{-}$***	***1.3×10^{-3}***	***0.023***	***0.020***	***4.1×10^{-3}***	***1.5×10^{-4}***
Totals		***29***	***490***	***8.7×10^{3}***	***18***	***0.82***	***2.2***	***8.2***	***0.14***	***1.2***

Table C.2-11. Summary of annual average nonradiological emissions associated with fuel combustion (continued).

Alternative and project	Description	Category totals: Criteria (ton/year)	Category totals: Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Criteria pollutants: Sulfur dioxide (ton/year)	Criteria pollutants: Respirable particulates (ton/year)	Criteria pollutants: Carbon monoxide (ton/year)	Criteria pollutants: Oxides of nitrogen (ton/year)	Criteria pollutants: Volatile organic compounds (ton/year)	Criteria pollutants: Lead (lbs/year)
	Vitrification with Calcine Separations Option									
P1C	***PEW Evaporator and LET&D Operations***	***3.4***	***58***	1.0×10^{3}	***2.0***	***0.10***	***0.29***	***0.99***	***0.020***	***0.14***
P9A	***Full Separations***	***130***	2.1×10^{3}	3.7×10^{4}	***74***	***3.8***	***14***	***39***	***1.5***	***5.2***
P9C	***Grout Plant***	***10***	***130***	2.4×10^{3}	***4.7***	***0.28***	***1.7***	***3.1***	***0.23***	***0.33***
P18	***New Analytical Lab***	***1.8***	***27***	***480***	***1.0***	***0.051***	***0.24***	***0.55***	***0.030***	***0.067***
P35E	***Grout Packaging & Loading for Offsite Disposal***	***0.11***	***0.13***	***2.4***	7.8×10^{-3}	2.8×10^{-3}	***0.049***	***0.042***	8.8×10^{-3}	3.1×10^{-4}
P59A Sep	***Calcine Retrieval and Transport (Sep)***	***4.2***	***73***	1.3×10^{3}	***2.6***	***0.12***	***0.30***	***1.2***	***0.015***	***0.18***
P88	***Vitrification with MACT***	***19***	***330***	5.9×10^{3}	***12***	***0.54***	***1.4***	***5.4***	***0.069***	***0.82***
P133 Sep	***Waste Treatment Pilot Plant (Seps)***	***14***	***240***	4.2×10^{3}	***8.3***	***0.39***	***1.0***	***3.9***	***0.053***	***0.59***
Totals		***190***	3.0×10^{3}	5.3×10^{4}	***100***	***5.2***	***19***	***55***	***1.9***	***7.4***

a. Emissions are from project data summaries and backup documentation.
b. Carbon dioxide has been associated with potential global warming.
c. Project is not expected to result in any usage of diesel fuel.

Table C.2-12. Projected emission rates (pounds per hour) of toxic air pollutants from combustion of fossil fuels to support waste processing operations.[a]

				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Carcinogens													
Arsenic	1.5×10^{-6}	9.6×10^{-5}	1.5×10^{-4}	6.2×10^{-4}	8.1×10^{-4}	3.3×10^{-4}	2.7×10^{-4}	2.2×10^{-4}	1.2×10^{-4}	***6.1×10^{-5}***	7.4×10^{-5}	***1.2×10^{-4}***	***7.4×10^{-4}***
Benzene	8.0×10^{-4}	1.6×10^{-5}	2.5×10^{-5}	1.0×10^{-4}	1.3×10^{-4}	5.4×10^{-5}	4.3×10^{-5}	3.6×10^{-5}	2.0×10^{-5}	***9.9×10^{-6}***	1.2×10^{-5}	***2.0×10^{-5}***	***1.1×10^{-4}***
Beryllium	2.8×10^{-5}	2.0×10^{-6}	3.2×10^{-6}	1.3×10^{-5}	1.7×10^{-5}	7.0×10^{-6}	5.6×10^{-6}	4.7×10^{-6}	2.6×10^{-6}	***1.3×10^{-6}***	1.6×10^{-6}	***2.6×10^{-6}***	***1.5×10^{-5}***
Cadmium	3.7×10^{-6}	2.9×10^{-5}	4.6×10^{-5}	1.9×10^{-4}	2.4×10^{-4}	1.0×10^{-4}	8.0×10^{-5}	6.7×10^{-5}	3.7×10^{-5}	***1.8×10^{-5}***	2.2×10^{-5}	***3.7×10^{-5}***	***2.2×10^{-4}***
Chromium (hexavalent)	5.6×10^{-7}	1.8×10^{-5}	2.9×10^{-5}	1.2×10^{-4}	1.5×10^{-4}	6.3×10^{-5}	5.0×10^{-5}	4.2×10^{-5}	2.3×10^{-5}	***1.1×10^{-5}***	1.4×10^{-5}	***2.3×10^{-5}***	***1.3×10^{-4}***
Formaldehyde	5.1×10^{-4}	2.4×10^{-3}	3.9×10^{-3}	0.016	0.02	8.3×10^{-3}	6.6×10^{-3}	5.6×10^{-3}	3.0×10^{-3}	***1.5×10^{-3}***	1.8×10^{-3}	***3.0×10^{-3}***	***0.018***
Nickel	2.7×10^{-5}	6.2×10^{-3}	9.9×10^{-3}	0.04	0.052	0.021	0.017	0.014	7.8×10^{-3}	***3.9×10^{-3}***	4.7×10^{-3}	***7.8×10^{-3}***	***0.047***
Polycyclic Aromatic Hydrocarbons	1.5×10^{-10}	9.6×10^{-7}	1.5×10^{-6}	6.2×10^{-6}	8.0×10^{-6}	3.3×10^{-6}	2.6×10^{-6}	2.2×10^{-6}	1.2×10^{-6}	***6.1×10^{-7}***	7.3×10^{-7}	***1.2×10^{-6}***	***7.4×10^{-6}***
Noncarcinogens													
Antimony	0.033	3.8×10^{-4}	6.1×10^{-4}	2.5×10^{-3}	3.2×10^{-3}	1.3×10^{-3}	1.1×10^{-3}	8.9×10^{-4}	4.8×10^{-4}	***2.4×10^{-4}***	2.9×10^{-4}	***4.8×10^{-4}***	***2.9×10^{-3}***
Barium	0.033	1.9×10^{-4}	3.0×10^{-4}	1.2×10^{-3}	1.6×10^{-3}	6.5×10^{-4}	5.2×10^{-4}	4.3×10^{-4}	2.4×10^{-4}	***1.2×10^{-4}***	1.4×10^{-4}	***2.4×10^{-4}***	***1.4×10^{-3}***
Chloride	0.20	0.025	0.041	0.16	0.21	0.088	0.070	0.059	0.032	***0.016***	0.019	***0.032***	***0.19***
Chromium (total)	0.033	6.2×10^{-5}	9.9×10^{-5}	4.0×10^{-4}	5.2×10^{-4}	2.1×10^{-4}	1.7×10^{-4}	1.4×10^{-4}	7.8×10^{-5}	***3.9×10^{-5}***	4.7×10^{-5}	***7.8×10^{-5}***	***4.7×10^{-4}***
Cobalt	3.3×10^{-3}	4.4×10^{-4}	7.0×10^{-4}	2.8×10^{-3}	3.7×10^{-3}	1.5×10^{-3}	1.2×10^{-3}	1.0×10^{-3}	5.5×10^{-4}	***2.8×10^{-4}***	3.4×10^{-4}	***5.5×10^{-4}***	***3.3×10^{-3}***
Copper	0.013	1.3×10^{-4}	2.1×10^{-4}	8.3×10^{-4}	1.0×10^{-3}	4.4×10^{-4}	3.5×10^{-4}	3.0×10^{-4}	1.6×10^{-4}	***8.1×10^{-5}***	9.8×10^{-5}	***1.6×10^{-4}***	***9.9×10^{-4}***
Ethyl benzene	29	4.8×10^{-6}	7.7×10^{-6}	3.1×10^{-5}	4.0×10^{-5}	1.7×10^{-5}	1.3×10^{-5}	1.1×10^{-5}	6.0×10^{-6}	***3.0×10^{-6}***	3.7×10^{-6}	***6.0×10^{-6}***	***3.6×10^{-5}***
Fluoride	0.17	2.7×10^{-3}	4.4×10^{-3}	0.018	0.023	9.4×10^{-3}	7.5×10^{-3}	6.3×10^{-3}	3.4×10^{-3}	***1.7×10^{-3}***	2.1×10^{-3}	***3.4×10^{-3}***	***0.020***
Lead	-	1.1×10^{-4}	1.8×10^{-4}	7.1×10^{-4}	9.2×10^{-4}	3.8×10^{-4}	3.1×10^{-4}	2.6×10^{-4}	1.4×10^{-4}	***7.0×10^{-5}***	8.4×10^{-5}	***1.4×10^{-4}***	***8.5×10^{-4}***
Manganese	0.33	2.2×10^{-4}	3.5×10^{-4}	1.4×10^{-3}	1.8×10^{-3}	7.6×10^{-4}	6.0×10^{-4}	5.1×10^{-4}	2.8×10^{-4}	***1.4×10^{-4}***	1.7×10^{-4}	***2.8×10^{-4}***	***1.6×10^{-3}***
Mercury	3.0×10^{-3}	8.2×10^{-6}	1.3×10^{-5}	5.3×10^{-5}	6.9×10^{-5}	2.9×10^{-5}	2.3×10^{-5}	1.9×10^{-5}	1.0×10^{-5}	***5.2×10^{-6}***	6.3×10^{-6}	***1.0×10^{-5}***	***6.3×10^{-5}***
Molybdenum	0.33	5.7×10^{-5}	9.2×10^{-5}	3.7×10^{-4}	4.8×10^{-4}	2.0×10^{-4}	1.6×10^{-4}	1.3×10^{-4}	7.2×10^{-5}	***3.6×10^{-5}***	4.4×10^{-5}	***7.3×10^{-5}***	***4.4×10^{-4}***
Naphthalene	3.3	8.2×10^{-5}	1.3×10^{-4}	5.3×10^{-4}	6.9×10^{-4}	2.9×10^{-4}	2.3×10^{-4}	1.9×10^{-4}	1.0×10^{-4}	***5.2×10^{-5}***	6.3×10^{-5}	***1.0×10^{-4}***	***6.3×10^{-4}***
Phosphorus	7.0×10^{-3}	6.9×10^{-4}	1.1×10^{-3}	4.5×10^{-3}	5.8×10^{-3}	2.4×10^{-3}	1.9×10^{-3}	1.6×10^{-3}	8.7×10^{-4}	***4.4×10^{-4}***	5.3×10^{-4}	***8.7×10^{-4}***	***5.3×10^{-3}***
Selenium	0.013	5.0×10^{-5}	8.0×10^{-5}	3.2×10^{-4}	4.2×10^{-4}	1.7×10^{-4}	1.4×10^{-4}	1.2×10^{-4}	6.3×10^{-5}	***3.2×10^{-5}***	3.8×10^{-5}	***6.3×10^{-5}***	***3.8×10^{-4}***
Toluene	25	4.5×10^{-4}	7.2×10^{-4}	2.9×10^{-3}	3.8×10^{-3}	1.6×10^{-3}	1.2×10^{-3}	1.0×10^{-3}	5.7×10^{-4}	***2.9×10^{-4}***	3.5×10^{-4}	***5.7×10^{-4}***	***3.4×10^{-3}***

Table C.2-12. Projected emission rates (pounds per hour) of toxic air pollutants from combustion of fossil fuels to support waste processing operations (continued).

				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Noncarcinogens (continued)													
1,1,1-Trichloroethane (methyl chloroform)	130	1.7×10^{-5}	2.8×10^{-5}	1.1×10^{-4}	1.4×10^{-4}	6.0×10^{-5}	4.8×10^{-5}	4.1×10^{-5}	2.2×10^{-5}	***1.1×10^{-5}***	1.3×10^{-5}	***2.2×10^{-5}***	***1.2×10^{-5}***
Vanadium	3.3×10^{-3}	2.3×10^{-3}	3.7×10^{-3}	0.015	0.019	8.0×10^{-3}	6.4×10^{-3}	5.4×10^{-3}	2.9×10^{-3}	***1.5×10^{-3}***	1.8×10^{-3}	***2.9×10^{-3}***	***1.7×10^{-3}***
Xylene	29	8.0×10^{-6}	1.3×10^{-5}	5.1×10^{-5}	6.6×10^{-5}	2.8×10^{-5}	2.2×10^{-5}	1.8×10^{-5}	1.0×10^{-5}	***5.0×10^{-6}***	6.1×10^{-6}	***1.0×10^{-5}***	***6.0×10^{-6}***
Zinc	0.067	2.1×10^{-3}	3.4×10^{-3}	0.014	0.018	7.4×10^{-3}	5.9×10^{-3}	4.9×10^{-3}	2.7×10^{-3}	***1.3×10^{-3}***	1.6×10^{-3}	***2.7×10^{-3}***	***1.5×10^{-3}***

a. Source: Project Data Sheets and backup documentation. Includes emissions due to steam production and diesel equipment operation.

b. Screening emission level listed in Rules for Control of Air Pollution in Idaho ***(IDAPA 58.01.01.585-586) (IDEQ 2001)***. Proposed new source emission rates exceeding these levels should be assessed for potential impacts on human health.

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations.[a]

				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Carcinogens													
Acetaldehyde	3.0×10^{-3}	-[c]	4.1×10^{-7}	3.0×10^{-9}	4.1×10^{-7}	3.0×10^{-9}	4.2×10^{-7}	4.1×10^{-7}	2.6×10^{-9}	-	-	***2.6×10^{-9}***	***5.6×10^{-9}***
Arsenic	1.5×10^{-6}	-	-	3.4×10^{-9}	3.4×10^{-9}	3.4×10^{-9}	7.8×10^{-9}	3.8×10^{-13}	2.9×10^{-9}	-	-	***2.9×10^{-9}***	***6.3×10^{-9}***
Benzene	8.0×10^{-4}	-	5.0×10^{-7}	1.8×10^{-9}	5.0×10^{-7}	1.8×10^{-9}	5.0×10^{-7}	5.0×10^{-7}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Benzo(a)pyrene	1.5×10^{-10}	-	2.8×10^{-9}	5.2×10^{-11}	2.9×10^{-9}	5.2×10^{-11}	2.9×10^{-9}	2.8×10^{-9}	1.2×10^{-6}	-	-	***1.2×10^{-6}***	***1.2×10^{-6}***
Beryllium	2.8×10^{-5}	-	6.2×10^{-12}	2.3×10^{-11}	2.9×10^{-11}	2.3×10^{-11}	5.9×10^{-11}	6.2×10^{-12}	2.6×10^{-11}	-	-	***2.0×10^{-11}***	***4.3×10^{-11}***
1,3-Butadiene	2.4×10^{-5}	-	2.1×10^{-8}	1.5×10^{-10}	2.1×10^{-8}	1.5×10^{-10}	2.1×10^{-8}	2.1×10^{-8}	1.3×10^{-10}	-	-	***1.3×10^{-10}***	***2.8×10^{-10}***
Cadmium	3.7×10^{-6}	-	-	3.9×10^{-8}	3.9×10^{-8}	3.9×10^{-8}	9.0×10^{-8}	4.3×10^{-12}	3.4×10^{-8}	***8.4×10^{-8}***	7.3×10^{-9}	***3.4×10^{-8}***	***7.3×10^{-8}***
Carbon tetrachloride	4.4×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Chloroform	2.8×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Chromium (hexavalent)	5.6×10^{-7}	-	-	8.1×10^{-10}	8.1×10^{-10}	8.1×10^{-10}	1.9×10^{-9}	9.0×10^{-14}	6.9×10^{-10}	***5.6×10^{-9}***	1.4×10^{-10}	***6.9×10^{-10}***	***1.5×10^{-9}***
1,2-Dichloroethane	2.5×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Dioxins and furans	1.5×10^{-10}	-	3.1×10^{-11}	5.6×10^{-13}	3.2×10^{-11}	5.6×10^{-13}	3.2×10^{-11}	3.1×10^{-11}	4.9×10^{-13}	-	-	***4.9×10^{-13}***	***1.1×10^{-12}***
Formaldehyde	5.1×10^{-4}	-	6.3×10^{-7}	4.7×10^{-9}	6.3×10^{-7}	4.7×10^{-9}	6.4×10^{-7}	6.3×10^{-7}	5.3×10^{-7}	-	-	***5.3×10^{-7}***	***5.3×10^{-7}***
Hydrazine	2.3×10^{-6}	-	4.6×10^{-8}	3.4×10^{-10}	4.6×10^{-8}	3.4×10^{-10}	4.7×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	-	-	***2.1×10^{-5}***	***2.1×10^{-5}***
Methylene chloride	1.6×10^{-3}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Nickel	2.7×10^{-5}	-	-	2.0×10^{-8}	2.0×10^{-8}	2.0×10^{-8}	4.7×10^{-8}	2.3×10^{-12}	1.8×10^{-8}	***5.6×10^{-9}***	3.3×10^{-9}	***1.8×10^{-8}***	***3.8×10^{-8}***
Polycyclic aromatic hydrocarbons	1.5×10^{-10}	-	2.1×10^{-8}	3.6×10^{-10}	2.2×10^{-8}	3.6×10^{-10}	2.3×10^{-8}	2.2×10^{-8}	3.1×10^{-10}	-	-	***3.1×10^{-10}***	***6.6×10^{-10}***
Paradioxane	0.71	-	1.0×10^{-6}	1.1×10^{-8}	1.0×10^{-6}	1.1×10^{-8}	1.0×10^{-6}	1.0×10^{-6}	4.6×10^{-4}	-	-	***4.6×10^{-4}***	***4.6×10^{-4}***
Perchloroethylene	9.1×10^{-5}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Thiourea	1.2×10^{-5}	-	5.6×10^{-11}	2.0×10^{-9}	2.1×10^{-9}	2.0×10^{-9}	4.8×10^{-9}	1.2×10^{-9}	2.7×10^{-8}	-	-	***2.5×10^{-8}***	***2.7×10^{-8}***
1,1,2-Trichloroethane	4.2×10^{-4}	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Trichloroethylene	5.1×10^{-4}	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Noncarcinogens													
Acetonitrile	4.5	-	1.3×10^{-8}	4.7×10^{-11}	1.3×10^{-8}	4.7×10^{-11}	1.3×10^{-8}	1.3×10^{-8}	5.8×10^{-6}	-	-	***5.8×10^{-6}***	***5.8×10^{-6}***
Acrolein	0.017	-	4.9×10^{-8}	3.6×10^{-10}	4.9×10^{-8}	3.6×10^{-10}	5.0×10^{-8}	4.9×10^{-8}	3.1×10^{-10}	-	-	***3.1×10^{-10}***	***6.7×10^{-10}***
Antimony	0.033	-	8.7×10^{-10}	3.2×10^{-10}	1.2×10^{-9}	3.2×10^{-10}	1.6×10^{-9}	8.7×10^{-10}	1.2×10^{-9}	-	-	***8.7×10^{-10}***	***1.2×10^{-9}***
Barium	0.033	-	-	1.4×10^{-9}	1.4×10^{-9}	1.4×10^{-9}	3.2×10^{-9}	1.6×10^{-13}	1.2×10^{-9}	-	-	***1.2×10^{-9}***	***2.6×10^{-9}***
Bromoform	0.33	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations[a] (continued).

				Separations Alternative			Non-Separations Alternative					*Direct Vitrification Alternative*	
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Noncarcinogens (continued)													
Carbon disulfide	2.0	-	1.1×10^{-7}	7.9×10^{-10}	1.1×10^{-7}	7.9×10^{-10}	1.1×10^{-7}	1.1×10^{-7}	4.9×10^{-5}	***4.0×10^{-3}***	-	***4.9×10^{-5}***	***4.9×10^{-5}***
Chloride	0.2	-	***0.026***	2.5×10^{-5}	***0.026***	2.5×10^{-5}	***0.026***	***0.026***	***0.039***	***0.017***	0.010	***0.026***	***0.026***
Chlorobenzene	23	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Chromium (total)	0.033	-	-	2.7×10^{-8}	2.7×10^{-8}	2.7×10^{-8}	6.3×10^{-8}	3.0×10^{-12}	2.3×10^{-8}	-	4.6×10^{-9}	***2.3×10^{-8}***	***5.0×10^{-8}***
Cobalt	3.3×10^{-3}	-	-	-	-	-	-	-	-	-	-	-	-
Copper	0.013	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	0.33	-	3.6×10^{-10}	6.6×10^{-12}	3.7×10^{-10}	6.6×10^{-12}	3.8×10^{-10}	3.6×10^{-10}	1.6×10^{-7}	-	-	***1.6×10^{-7}***	***1.6×10^{-7}***
Di-n-butyl phthalate	0.33	-	5.1×10^{-11}	9.4×10^{-13}	5.2×10^{-11}	9.4×10^{-13}	5.3×10^{-11}	5.2×10^{-11}	2.3×10^{-8}	-	-	***2.3×10^{-8}***	***2.3×10^{-8}***
di-n-octyl phthalate	0.33	-	5.1×10^{-13}	1.9×10^{-11}	2.0×10^{-11}	1.9×10^{-11}	4.4×10^{-11}	1.1×10^{-11}	2.5×10^{-10}	-	-	***2.3×10^{-10}***	***2.5×10^{-10}***
2,4-Dinitrophenol,	-	-	2.2×10^{-8}	2.4×10^{-10}	2.2×10^{-8}	2.4×10^{-10}	2.3×10^{-8}	2.2×10^{-8}	1.0×10^{-5}	-	-	***1.0×10^{-5}***	***1.0×10^{-5}***
Ethyl benzene	29	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	0.17	-	***0.057***	***1.4×10^{-3}***	***0.057***	***1.4×10^{-3}***	***0.057***	***0.057***	***0.057***	***0.017***	2.7×10^{-8}	***0.057***	***0.058***
Lead	-	-	9.6×10^{-8}	3.5×10^{-8}	1.3×10^{-7}	3.5×10^{-8}	1.8×10^{-7}	9.6×10^{-8}	1.3×10^{-7}	***1.1×10^{-6}***	6.4×10^{-9}	***9.6×10^{-8}***	***1.3×10^{-7}***
Manganese	0.33	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	3.0×10^{-3}	-	1.4×10^{-6}	5.4×10^{-5}	5.5×10^{-5}	5.4×10^{-5}	1.2×10^{-4}	3.0×10^{-5}	4.6×10^{-5}	***7.9×10^{-4}***	5.0×10^{-9}	***4.5×10^{-5}***	***9.7×10^{-5}***
Methyl ethyl ketone	39	-	4.6×10^{-8}	1.7×10^{-10}	4.6×10^{-8}	1.7×10^{-10}	4.6×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	-	-	***2.1×10^{-5}***	***2.1×10^{-5}***
Molybdenum	0.33	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	3.3	-	4.8×10^{-8}	5.3×10^{-10}	4.9×10^{-8}	5.3×10^{-10}	4.9×10^{-8}	4.8×10^{-8}	1.2×10^{-6}	-	-	***1.2×10^{-6}***	***1.2×10^{-6}***
Pentachlorophenol	0.023	-	2.7×10^{-9}	5.0×10^{-11}	2.8×10^{-9}	5.0×10^{-11}	2.8×10^{-9}	2.7×10^{-9}	1.2×10^{-6}	-	-	***1.2×10^{-6}***	***1.2×10^{-6}***
Phenol	1.3	-	4.6×10^{-8}	6.8×10^{-10}	4.7×10^{-8}	6.8×10^{-10}	4.8×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	-	-	***2.1×10^{-5}***	***2.1×10^{-5}***
Phosphorus	7.0×10^{-3}	-	-	-	-	-	-	-	-	-	-	-	-
Propylene (propene)	-	-	1.4×10^{-6}	1.0×10^{-8}	1.4×10^{-6}	1.0×10^{-8}	1.4×10^{-6}	1.4×10^{-6}	8.7×10^{-9}	-	-	***8.7×10^{-9}***	***1.9×10^{-8}***
Pyridine	1.0	-	3.9×10^{-6}	7.2×10^{-8}	4.0×10^{-6}	7.2×10^{-8}	4.1×10^{-6}	3.9×10^{-6}	***1.8×10^{-3}***	-	-	***1.8×10^{-3}***	***1.8×10^{-3}***
Selenium	0.013	-	4.3×10^{-10}	1.6×10^{-10}	5.9×10^{-10}	1.6×10^{-10}	7.9×10^{-10}	4.3×10^{-10}	5.7×10^{-10}	-	-	***4.3×10^{-10}***	***5.9×10^{-10}***
Silver	1.0×10^{-3}	-	-	5.3×10^{-10}	5.3×10^{-10}	5.3×10^{-10}	1.2×10^{-9}	5.8×10^{-14}	4.5×10^{-10}	-	6.0×10^{-11}	***4.5×10^{-10}***	***9.8×10^{-10}***
Thallium	7.0×10^{-3}	-	4.4×10^{-10}	1.6×10^{-9}	2.0×10^{-9}	1.6×10^{-9}	4.2×10^{-9}	4.4×10^{-10}	1.8×10^{-9}	-	-	***1.4×10^{-9}***	***3.0×10^{-9}***
Toluene	25	-	2.2×10^{-7}	8.1×10^{-10}	2.2×10^{-7}	8.1×10^{-10}	2.2×10^{-7}	2.2×10^{-7}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
1,2,4-Trichlorobenzene	2.5	-	8.1×10^{-11}	3.0×10^{-11}	1.1×10^{-10}	3.0×10^{-11}	1.5×10^{-10}	9.8×10^{-11}	3.7×10^{-8}	-	-	***3.7×10^{-8}***	***3.7×10^{-8}***

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations[a] (continued).

				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
							Noncarcinogens (continued)						
1,1,1-Trichloroethane (methyl chloroform)	130	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-	-	***6.0×10^{-7}***	***6.0×10^{-7}***
Vanadium	3.0×10^{-3}	-	-	-	-	-	-	-	-	-	-	-	-
Xylene	29	-	1.5×10^{-7}	5.6×10^{-10}	1.5×10^{-7}	5.6×10^{-10}	1.5×10^{-7}	1.5×10^{-7}	4.8×10^{-10}	-	-	***4.8×10^{-10}***	***1.0×10^{-9}***
Zinc	0.067	-	-	-	-	-	-	-	-	-	-	-	-
							Others						
Carbon dioxide	-	-	-	450	450	450	-	-	-	-	-	-	-
Carbon monoxide	-	-	0.19	***2.4×10^{-3}***	0.19	***2.4×10^{-3}***	0.20	0.19	0.28	-	-	***0.27***	***0.28***
Oxides of nitrogen	-	-	3.9	2.9	6.8	2.9	16	3.9	0.76	-	-	***0.38***	***3.1***
Particulate matter	-	-	1.5×10^{-6}	5.2×10^{-5}	5.4×10^{-5}	5.2×10^{-5}	1.2×10^{-4}	3.1×10^{-5}	4.7×10^{-5}	-	-	***4.5×10^{-5}***	***9.7×10^{-5}***
Sulfur dioxide	-	-	9.8	8.3	18	8.3	9.8	9.8	4.8	-	-	***2.5***	***11***
Total hydrocarbons	-	-	6.1×10^{-6}	8.8×10^{-8}	6.2×10^{-6}	8.8×10^{-8}	6.3×10^{-6}	6.1×10^{-6}	2.0×10^{-3}	-	-	***1.9×10^{-3}***	***1.9×10^{-3}***

a. ***Sources: Kimmit (1998), except for Steam Reforming, which is based on Studsvik (2002).*** Chemical process emissions do not include emissions formed by combustion of fossil fuels ***to support waste processing operations*** (see ***Table C.2-12***).

b. Screening emission level listed in Rules for Control of Air Pollution in Idaho ***(IDAPA 58.01.01.585-586) (IDEQ 2001)***. Proposed new source emission rates exceeding these levels should be assessed for potential impacts on human health.

c. Dash designates that emission rate is either 0 or is not specified in applicable reference.

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for waste processing alternatives.

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a,b]			Percent of standard		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
No Action Alternative										
Carbon monoxide	1-hour	0.56	1.2	0.050	220	330	8.5	0.54	0.83	0.021
	8-hour	0.18	0.30	0.012	54	69	3.5	0.54	0.69	0.035
Nitrogen dioxide	Annual	0.013	0.031	9.9×10^{-4}	1.1	2.2	0.085	1.1	2.2	0.085
Sulfur dioxide	3-hour	2.3	4.4	0.13	84	140	6.4	6.5	11	0.49
	24-hour	0.43	0.87	0.031	17	32	1.7	4.8	8.7	0.46
	Annual	0.026	0.064	2.0×10^{-3}	0.86	4.5	0.072	1.1	5.6	0.091
Respirable particulates[c]	24-hour	0.022	0.044	1.6×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	1.3×10^{-3}	3.1×10^{-3}	1.0×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.086
Lead	Quarterly	2.8×10^{-5}	7.5×10^{-5}	5.0×10^{-6}	5.4×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	0.36	0.37	0.026
Continued Current Operations Alternative										
Carbon monoxide	1-hour	10	28	2.3	220	350	11	0.56	0.86	0.027
	8-hour	3.5	6.8	0.53	56	71	3.9	0.56	0.71	0.039
Nitrogen dioxide	Annual	0.035	0.097	4.1×10^{-3}	1.1	2.3	0.088	1.1	2.3	0.088
Sulfur dioxide	3-hour	5.7	11	0.53	85	140	6.7	6.5	11	0.52
	24-hour	1.2	2.3	0.13	18	32	1.8	4.8	8.7	0.48
	Annual	0.066	0.18	7.6×10^{-3}	0.87	4.5	0.078	1.1	5.7	0.10
Respirable particulates[c]	24-hour	0.090	0.22	0.011	9.8	20	0.95	6.5	13	0.63
	Annual	2.4×10^{-3}	6.0×10^{-3}	2.0×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.086
Lead	Quarterly	1.8×10^{-3}	4.9×10^{-3}	2.9×10^{-4}	5.9×10^{-3}	8.1×10^{-3}	6.7×10^{-4}	0.40	0.54	0.045
Full Separations Option										
Carbon monoxide	1-hour	24	62	5.1	230	370	14	0.59	0.92	0.034
	8-hour	8.0	15	1.17	58	74	4.5	0.58	0.74	0.045
Nitrogen dioxide	Annual	0.11	0.27	9.4×10^{-3}	1.2	2.4	0.093	1.2	2.4	0.093
Sulfur dioxide	3-hour	18	34	1.1	86	140	7.3	6.6	11	0.56
	24-hour	3.5	6.9	0.29	18	32	1.9	4.9	8.8	0.52
	Annual	0.20	0.50	0.018	0.88	4.5	0.088	1.1	5.7	0.11
Respirable particulates[c]	24-hour	0.25	0.61	0.026	9.9	20	0.96	6.6	14	0.64
	Annual	9.1×10^{-3}	0.022	7.3×10^{-4}	0.40	1.3	0.043	0.81	2.6	0.087
Lead	Quarterly	3.8×10^{-3}	0.010	6.0×10^{-4}	6.5×10^{-3}	0.014	9.9×10^{-4}	0.43	0.90	0.066
Planning Basis Option										
Carbon monoxide	1-hour	30	78	6.4	240	380	15	0.60	0.94	0.04
	8-hour	10	19	1.5	59	75	4.8	0.59	0.75	0.05
Nitrogen dioxide	Annual	0.13	0.35	0.013	1.2	2.4	0.097	1.2	2.4	0.10
Sulfur dioxide	3-hour	24	46	1.6	88	150	7.8	6.7	11	0.60
	24-hour	4.7	9.4	0.43	18	32	2.0	5.0	8.9	0.55
	Annual	0.26	0.69	0.026	0.89	4.6	0.096	1.1	5.7	0.12
Respirable particulates[c]	24-hour	0.32	0.76	0.033	9.9	20	0.97	6.6	14	0.64
	Annual	0.011	0.028	9.2×10^{-4}	0.41	1.3	0.044	0.81	2.6	0.09
Lead	Quarterly	4.8×10^{-3}	0.013	7.6×10^{-4}	6.8×10^{-3}	0.016	1.1×10^{-3}	0.45	1.1	0.08

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for waste processing alternatives (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a,b]			Percent of standard		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
Transuranic Separations Option										
Carbon monoxide	1-hour	17	44	3.7	230	360	12	0.57	0.89	0.03
	8-hour	5.6	11	0.84	57	72	4.2	0.57	0.72	0.04
Nitrogen dioxide	Annual	0.064	0.17	6.0×10^{-3}	1.2	2.3	0.090	1.2	2.3	0.09
Sulfur dioxide	3-hour	11	20	0.77	85	140	7.0	6.6	11	0.54
	24-hour	2.1	4.1	0.19	18	32	1.8	4.9	8.8	0.50
	Annual	0.090	0.22	7.0×10^{-3}	0.87	4.5	0.077	1.1	5.7	0.10
Respirable particulates[c]	24-hour	0.16	0.39	0.018	9.8	20	0.95	6.6	13	0.64
	Annual	5.0×10^{-3}	0.012	4.1×10^{-4}	0.40	1.3	0.043	0.80	2.6	0.09
Lead	Quarterly	2.8×10^{-3}	7.6×10^{-3}	4.5×10^{-4}	6.2×10^{-3}	0.011	8.3×10^{-4}	0.42	0.72	0.06
Hot Isostatic Pressed Waste Option										
Carbon monoxide	1-hour	11	30	2.4	220	350	11	0.56	0.87	0.03
	8-hour	3.8	7.3	0.56	56	71	3.9	0.56	0.71	0.04
Nitrogen dioxide	Annual	0.084	0.22	0.011	1.2	2.4	0.094	1.2	2.4	0.09
Sulfur dioxide	3-hour	8.5	16	0.63	85	140	6.8	6.6	11	0.53
	24-hour	1.7	3.3	0.17	18	32	1.8	4.8	8.7	0.49
	Annual	0.096	0.26	0.010	0.87	4.5	0.081	1.1	5.7	0.10
Respirable particulates[c]	24-hour	0.11	0.28	0.012	9.8	20	0.95	6.5	13	0.63
	Annual	3.9×10^{-3}	9.6×10^{-3}	3.2×10^{-4}	0.40	1.3	0.043	0.80	2.6	0.09
Lead	Quarterly	1.8×10^{-3}	5.0×10^{-3}	3.0×10^{-4}	6.0×10^{-3}	8.2×10^{-3}	6.8×10^{-4}	0.40	0.55	0.05
Direct Cement Waste Option										
Carbon monoxide	1-hour	11	29	2.4	220	350	11	0.56	0.87	0.03
	8-hour	3.7	7.2	0.55	56	71	3.9	0.56	0.71	0.04
Nitrogen dioxide	Annual	0.035	0.087	3.0×10^{-3}	1.1	2.3	0.087	1.1	2.3	0.09
Sulfur dioxide	3-hour	7.3	14	0.59	85	140	6.8	6.6	11	0.52
	24-hour	1.5	2.9	0.15	18	32	1.8	4.8	8.7	0.49
	Annual	0.084	0.22	9.0×10^{-3}	0.87	4.5	0.079	1.1	5.7	0.10
Respirable particulates[c]	24-hour	0.10	0.26	0.012	9.8	20	0.948	6.5	13	0.63
	Annual	3.3×10^{-3}	8.1×10^{-3}	2.7×10^{-4}	0.40	1.3	0.043	0.80	2.6	0.09
Lead	Quarterly	1.8×10^{-3}	5.0×10^{-3}	3.0×10^{-4}	6.0×10^{-3}	8.2×10^{-3}	6.8×10^{-4}	0.40	0.55	0.05
Early Vitrification Option										
Carbon monoxide	1-hour	1.1	2.3	0.13	220	330	8.6	0.54	0.83	0.02
	8-hour	0.36	0.55	0.030	55	69	3.5	0.55	0.69	0.03
Nitrogen dioxide	Annual	0.019	0.043	1.7×10^{-3}	1.1	2.2	0.085	1.1	2.2	0.09
Sulfur dioxide	3-hour	4.8	7.5	0.24	84	140	6.5	6.5	11	0.50
	24-hour	0.87	1.3	0.071	18	32	1.7	4.8	8.7	0.47
	Annual	0.057	0.11	5.3×10^{-3}	0.86	4.5	0.076	1.1	5.7	0.09
Respirable particulates[c]	24-hour	0.028	0.057	2.0×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	1.6×10^{-3}	3.8×10^{-3}	1.2×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.09
Lead	Quarterly	8.3×10^{-5}	2.2×10^{-4}	1.3×10^{-5}	5.4×10^{-3}	5.6×10^{-3}	4.0×10^{-4}	0.36	0.37	0.03

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for waste processing alternatives (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a,b]			Percent of standard		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
Steam Reforming Option										
Carbon monoxide	1-hour	2.9	7.7	0.64	220	330	9.1	0.55	0.83	0.02
	8-hour	0.98	1.9	0.15	55	69	3.6	0.55	0.69	0.04
Nitrogen dioxide	Annual	0.010	0.024	8.3×10^{-4}	1.1	2.2	0.084	1.1	2.2	0.08
Sulfur dioxide	3-hour	1.7	3.4	0.10	84	140	6.3	6.4	11	0.49
	24-hour	0.32	0.66	0.023	17	32	1.7	4.8	8.7	0.46
	Annual	0.017	0.042	1.3×10^{-3}	0.86	4.5	0.072	1.1	5.6	0.09
Respirable particulates[c]	24-hour	0.028	0.069	3.1×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	9.3×10^{-4}	2.3×10^{-3}	8.0×10^{-5}	0.40	1.3	0.043	0.79	2.6	0.09
Lead	Quarterly	5.5×10^{-4}	1.5×10^{-3}	7.8×10^{-5}	5.6×10^{-3}	5.7×10^{-3}	4.6×10^{-4}	0.37	0.38	0.03
Minimum INEEL Processing Alternative										
Carbon monoxide	1-hour	5.1	14	1.1	220	340	9.6	0.55	0.84	0.02
	8-hour	1.7	3.3	0.26	55	70	3.7	0.55	0.70	0.04
Nitrogen dioxide	Annual	0.013	0.032	1.1×10^{-3}	1.1	2.2	0.085	1.1	2.2	0.08
Sulfur dioxide	3-hour	2.2	4.5	0.16	84	140	6.4	6.5	11	0.49
	24-hour	0.41	0.86	0.030	17	32	1.7	4.8	8.7	0.46
	Annual	0.021	0.051	1.6×10^{-3}	0.86	4.5	0.072	1.1	5.6	0.09
Respirable particulates[c]	24-hour	0.044	0.11	5.3×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	1.2×10^{-3}	2.9×10^{-3}	1.0×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.09
Lead	Quarterly	8.4×10^{-4}	2.3×10^{-3}	1.4×10^{-4}	5.7×10^{-3}	5.8×10^{-3}	5.2×10^{-4}	0.38	0.39	0.03
Vitrification without Calcine Separations Option										
Carbon monoxide	1-hour	1.0	2.3	0.13	220	330	8.6	0.54	0.83	0.02
	8-hour	0.34	0.53	0.029	55	69	3.5	0.55	0.69	0.03
Nitrogen dioxide	Annual	0.017	0.040	1.4×10^{-3}	1.1	2.2	0.085	1.1	2.2	0.09
Sulfur dioxide	3-hour	3.8	6.6	0.18	84	140	6.4	6.5	11	0.49
	24-hour	0.71	1.2	0.052	18	32	1.7	4.8	8.7	0.47
	Annual	0.045	0.097	3.9×10^{-3}	0.86	4.5	0.074	1.1	5.7	0.09
Respirable particulates[c]	24-hour	0.028	0.057	2.0×10^{-3}	9.8	20	0.94	6.5	13	0.63
	Annual	1.6×10^{-3}	3.8×10^{-3}	1.2×10^{-4}	0.40	1.3	0.043	0.79	2.6	0.09
Lead	Quarterly	8.0×10^{-5}	2.1×10^{-4}	1.3×10^{-5}	5.4×10^{-3}	5.6×10^{-3}	4.0×10^{-4}	0.36	0.37	0.03
Vitrification with Calcine Separations Option										
Carbon monoxide	1-hour	18	45	3.6	230	360	12	0.57	0.89	0.03
	8-hour	5.9	11	0.81	57	72	4.2	0.57	0.72	0.04
Nitrogen dioxide	Annual	0.12	0.27	0.010	1.2	2.4	0.094	1.2	2.4	0.09
Sulfur dioxide	3-hour	23	41	1.1	87	140	7.4	6.7	11	0.57
	24-hour	4.2	7.7	0.30	18	32	1.9	4.9	8.8	0.53
	Annual	0.25	0.56	0.022	0.89	4.6	0.092	1.1	5.7	0.12
Respirable particulates[c]	24-hour	0.23	0.54	0.020	9.9	20	0.96	6.6	13	0.64
	Annual	0.010	0.025	8.0×10^{-4}	0.40	1.3	0.044	0.81	2.6	0.09
Lead	Quarterly	2.6×10^{-3}	7.2×10^{-3}	4.2×10^{-4}	6.2×10^{-3}	0.010	8.1×10^{-4}	0.41	0.69	0.05

a. Cumulative impacts are assessed as the sum of the baseline plus the impacts of proposed projects. Baseline and standards are provided in Table C.2-15.

b. This summation is conservative since in most cases the highest concentration for each (baseline and alternative) would occur at different locations.

c. Values do not include contributions of fugitive dust.

Table C.2-15. Criteria pollutant ambient air quality standards and baseline used to assess cumulative impacts at public access locations.

Pollutant	Applicable standard[a] (micrograms per cubic meter)	Averaging time	Contribution of baseline and reasonable foreseeable increases[b] (micrograms per cubic meter)		
			At or beyond site boundary	Public roads	Craters of the Moon
Carbon monoxide	40,000	1-hour	***220***	***330***	***8.5***
	10,000	8-hour	***44***	***68***	***3.5***
Nitrogen dioxide	100	Annual	***1.0***	***2.2***	***0.084***
Sulfur dioxide	1,300	3-hour	***30***	***140***	***6.2***
	365	24-hour	***6.1***	***32***	***1.7***
	80	Annual	***0.26***	***4.5***	***0.070***
Respirable particulates	150	24-hour	***9.0***	***20***	***0.94***
	50	Annual	***0.39***	***1.3***	***0.043***
Lead	1.5	Quarterly	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***

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a. ***Modeled concentrations are compared to the applicable standards provided above (IDAPA 58.01.01.577) (IDEQ 2001).*** Primary standards are designed to protect public health. Secondary standards are designed to protect public welfare. The most stringent standard is used for comparison.

b. Baseline represents the modeled pollutant concentrations based on an actual operating emissions scenario***. Sources include existing INEEL facilities with actual 1997 INEEL emissions (DOE 1998), plus reasonably foreseeable sources such as the Advanced Mixed Waste Treatment Project. The newly installed CPP-606 steam production boilers are excluded, since they are assessed as elements of the waste processing alternatives (see Section 5.2.6).***

lutant impacts to these increments. For each alternative, maximum incremental impacts of carcinogenic air pollutants are projected to occur at or just beyond the southern INEEL boundary, while maximum noncarcinogenic air pollutant levels would occur along U.S. 20.

C.2.5.3 Concentrations of Toxic Air Pollutants at Onsite Locations

DOE estimated maximum onsite concentrations of toxic air pollutants for which occupational exposure limits have been established. ***All toxic air pollutant concentrations would be less than 10 percent of the applicable standards. Vanadium concentrations were the highest relative to the applicable standard by more than a factor of two compared to other toxic air pollutants. The vanadium concentrations*** are presented by waste processing alternative/option in Table C.2-***16***, and represent the maximum predicted levels at any point within a major INEEL facility area, averaged over an 8-hour period, to which workers might be incidentally exposed. These results are compared to occupational standards recommended by either the American Conference of Governmental Industrial Hygienists or the Occupational Safety and Health Administration, whichever standard is more restrictive. Unlike radiological impacts (for which the maximum dose to a non-involved worker occurs at Central Facilities Area), the maximally impacted area for toxic air pollutants is within INTEC. This is due to differences in dispersion models, averaging time (annual average for radionuclides versus 8 hours for toxics) and height of release (elevated releases for radionuclides versus both ground-level and elevated for toxics).

C.2.5.4 Visibility Impairment Modeling Results

DOE assessed cumulative emissions of proposed waste processing sources at the INTEC for potential impacts on the visual resource at Craters of the Moon Wilderness Area and the

Table C.2-16. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations by waste processing alternative.

	Highest percentage of applicable standard and identification of controlling pollutant											
			Separations Alternative			Non-Separations Alternative					Direct Vitrification Alternative	
Receptor	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Steam Reforming Option	Minimum INEEL Processing Alternative at INEEL	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Carcinogens: Maximum impact due to nickel[a,b]												
INEEL boundary areas	1.2	1.9	8.1	10	4.5	2.9	1.7	1.0	0.71	1.0	1.7	9.5
Craters of the Moon	<0.2	0.24	0.71	0.71	0.24	0.24	0.24	0.24	<0.2	<0.2	0.24	0.71
INEEL facility area[c]	0.01	0.32	0.69	0.88	0.49	0.33	0.33	0.02	0.08	0.16	0.02	0.49
Noncarcinogens: Maximum impact due to vanadium[a]												
INEEL boundary areas	0.01	0.02	0.09	0.11	0.05	0.04	0.03	0.02	0.01	0.01	0.02	0.10
Public road locations	0.03	0.05	0.18	0.23	0.10	0.08	0.07	0.03	0.02	0.02	0.03	0.20
Craters of the Moon	1.0×10^{-3}	2.0×10^{-3}	6.0×10^{-3}	8.0×10^{-3}	4.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	7.0×10^{-3}
INEEL facility area[c]	0.01	0.24	0.52	0.65	0.38	0.25	0.25	0.01	0.06	0.12	0.01	0.36

a. Applicable ambient air standards are specified in IDAPA 58.01.01.585-586 (IDEQ 2001) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; for existing sources, they are used here as reference values for purposes of comparison.

b. Aside from nickel, the only carcinogenic pollutants exceeding 1 percent of the ambient standard for the option with maximum impacts (Planning Basis Option) are arsenic (3 percent of the standard) and hexavalent chromium (1 percent).

c. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively. Location of highest onsite impacts is within INTEC.

Fort Hall Indian Reservation, in recognition of the importance of scenic views in and around each of these areas. For ***VISCREEN*** assessments, the potential impact of incremental emissions was evaluated using maximum hourly emission rates of particulates and nitrogen oxides and minimum and maximum distances from the source to the Class I area and Reservation. The analysis conservatively assumes that future fossil fuel-burning equipment will not have emission controls that reduce nitrogen dioxide and particulate matter emissions. ***DOE assessed potential visibility impacts from cumulative emissions using both the VISCREEN and CALPUFF models, as described in Section C.2.3.3. Table C.2-17 presents the results of the VISCREEN analysis.*** The results show that none of the alternatives would exceed the maximum screening values of 2.0 for color shift or 0.05 for contrast; that is, none would be expected to result in perceptible changes to visual resources around Craters of the Moon ***Wilderness Area*** or Fort Hall.

CALPUFF visibility impacts were performed only for the Planning Basis Option, which is the option with the highest emission rates of pollutants affecting visibility (nitrogen dioxide, sulfur dioxide, and particulate matter). For this option, the maximum 24-hour light extinction change would exceed the 5-percent criterion for 8 days of the 5-year simulation period, and the maximum value for light extinction change would be 8.4 percent. There are no exceedances at Yellowstone or Grand Teton National Parks under this option (Rood 2002).

C.2.6 RADIOLOGICAL CONSEQUENCES OF FACILITIES DISPOSITION

This section provides detail which supplements the radiological assessment results for facility disposition alternatives presented in Section 5.3.4. These results are presented separately for three categories of facilities: (a) facilities associated with waste processing alternatives; (b) the Tank Farm, calcine bin sets, and related facilities; and (c) other existing INTEC facilities.

C.2.6.1 Facilities Associated with Waste Processing Alternatives

Radionuclide emissions would result from the dispositioning of facilities associated with waste processing alternatives. These emissions are temporary in nature and would persist for a few (1 to 4) years following the operating lifetime of individual facilities. Table C.2-***18*** presents the radionuclide release estimates for the dispositioning of these facilities, while the calculated radiation doses that would result from these emissions are presented in Table C.2-***19***.

C.2.6.2 Tank Farm and Bin Sets

DOE estimated emissions and doses that would result from dispositioning the Tank Farm and calcine storage bin sets under different closure scenarios. These emissions could persist for over 20 years, reflecting the lengthy process of decontaminating and closing the waste storage tanks and calcine storage bins. Table C.2-***20*** presents the radionuclide release estimates for these closure scenarios, while the associated radiation doses are presented in Table C.2-***21***.

C.2.6.3 Other Existing INTEC Facilities

DOE estimated emissions and doses that would result from dispositioning various other facilities that either currently operate or have operated in the past in support of HLW management at INTEC. These estimates are presented in Tables C.2-***22*** and C.2-***23***.

Table C.2-17. Results of VISCREEN analysis for waste processing alternatives.

Option	Plume perceptibility/color shift parameter (delta E) (Maximum acceptable screening value = 2.0)				Contrast parameter (Maximum acceptable screening value = 0.05)			
Plume viewing background →	Horizon sky		Dark terrain object		Horizon sky		Dark terrain object	
Sun position with respect to the observer →	Front[a]	Behind[b]	Front[a]	Behind[b]	Front[a]	Behind[b]	Front[a]	Behind[b]
Maximum acceptable screening value	2.0	2.0	2.0	2.0	0.05	0.05	0.05	0.05
Craters of the Moon Wilderness Area								
No Action Alternative	0.037	0.023	0.044	0.006	0.000	0.000	0.000	0.000
Continued Current Operations Alternative	0.166	0.117	0.139	0.030	0.000	-0.001	0.001	0.000
Separations Alternative								
Full Separations	0.355	0.218	0.430	0.060	0.002	-0.003	0.003	0.000
Planning Basis Option	0.513	0.349	0.546	0.091	0.003	-0.004	0.004	0.000
Transuranic Separations	0.228	0.144	0.259	0.040	0.001	-0.002	0.002	0.000
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	0.479	0.345	0.209	0.089	-0.001	-0.003	0.002	0.000
Direct Cement Waste Option	0.192	0.134	0.172	0.035	0.001	-0.001	0.001	0.000
Early Vitrification Option	0.062	0.043	0.057	0.011	0.000	0.000	0.000	0.000
Steam Reforming Option	0.032	0.018	0.047	0.005	0.000	0.000	0.000	0.000
Minimum INEEL Processing Alternative	0.045	0.024	0.069	0.007	0.000	0.000	0.000	0.000
Direct Vitrification Alternative								
Vitrification without Calcine Separations Option	0.054	0.037	0.058	0.010	0.000	0.000	0.000	0.000
Vitrification with Calcine Separations Option	0.378	0.237	0.431	0.066	0.002	-0.003	0.003	0.000
Fort Hall Indian Reservation								
No Action Alternative	0.016	0.010	0.018	0.003	0.000	0.000	0.000	0.000
Continued Current Operations Alternative	0.071	0.048	0.056	0.016	0.000	-0.001	0.001	0.000
Separations Alternative								
Full Separations	0.155	0.093	0.174	0.032	0.001	-0.001	0.002	0.000
Planning Basis Option	0.222	0.139	0.222	0.048	0.001	-0.002	0.002	0.000
Transuranic Separations	0.099	0.061	0.105	0.021	0.001	-0.001	0.001	0.000
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	0.209	0.152	0.085	0.047	0.000	-0.001	0.001	0.000
Direct Cement Waste Option	0.082	0.056	0.069	0.018	0.000	-0.001	0.001	0.000
Early Vitrification Option	0.027	0.018	0.023	0.006	0.000	0.000	0.000	0.000
Steam Reforming Option	0.014	0.007	0.019	0.003	0.000	0.000	0.000	0.000
Minimum INEEL Processing Alternative	0.020	0.009	0.028	0.004	0.000	0.000	0.000	0.000
Direct Vitrification Alternative								
Vitrification without Calcine Separations Option	0.023	0.015	0.023	0.005	0.000	0.000	0.000	0.000
Vitrification with Calcine Separations Option	0.165	0.101	0.175	0.035	0.001	-0.001	0.002	0.000

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[a] With forward scatter, the sun is in front of the observer which will tend to maximize the light scattered by plume particles and maximize the brightness of the plume.

[b] With backward scatter, the sun is behind the observer, and the plume will likely appear darkest with such an angle.

Table C.2-18. Airborne radionuclide emissions estimates for disposition of proposed facilities associated with waste processing alternatives.

			Annual emission rate and total project emissions [a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Project number	Description	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
No Action Alternative										
P1D	No Action Alternative	-	-	-	-	-	-	-	-	-
Continued Current Operations Alternative										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
Totals			1.2×10^{-7}	2.3×10^{-7}	1.0×10^{-7}	2.1×10^{-7}	1.2×10^{-8}	2.4×10^{-8}	3.0×10^{-12}	6.0×10^{-12}
Full Separations Option[b]										
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P9A	Full (early) Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P9B	Vitrification Plant	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P9C	Class A Grout Plant	***2.5***	5.8×10^{-8}	***1.5×10^{-7}***	5.2×10^{-8}	***1.3×10^{-7}***	6.0×10^{-9}	***1.5×10^{-8}***	1.5×10^{-12}	***3.7×10^{-12}***
P24	Vitrified Product Interim Storage	3	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P27	Class A Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
Totals			3.5×10^{-7}	***7.9×10^{-7}***	3.2×10^{-7}	***7.1×10^{-7}***	3.6×10^{-8}	***8.1×10^{-8}***	9.0×10^{-12}	***2.0×10^{-11}***
Planning Basis Option[b]										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P23A	Full Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P23B	Vitrification Plant	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P23C	Class A Grout Plant	***1***	5.8×10^{-8}	***5.8×10^{-8}***	5.2×10^{-8}	***5.2×10^{-8}***	6.0×10^{-9}	***6.0×10^{-9}***	1.5×10^{-12}	***1.5×10^{-12}***
P24	Vitrified Product Interim Storage	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P35E	Class A Grout Packaging and Loading for Offsite Disposal	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
Totals			4.1×10^{-7}	***9.4×10^{-7}***	3.7×10^{-7}	***8.4×10^{-7}***	4.2×10^{-8}	***9.6×10^{-8}***	1.1×10^{-11}	***2.4×10^{-11}***

Table C.2-18. Airborne radionuclide emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

Project number	Description	Duration (years)	Annual emission rate and total project emissions [a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
			(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
Transuranic Separations Option[c]										
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P49A	Transuranic-C Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P49C	Class C Grout Plant	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P39A	Packaging and Loading Transuranic at INTEC for Shipment to WIPP	2	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P49D	Class C Grout Packaging & Shipping	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P27	Class C Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
Totals			2.9×10^{-7}	5.9×10^{-7}	2.6×10^{-7}	5.3×10^{-7}	3.0×10^{-8}	6.0×10^{-8}	7.5×10^{-12}	1.5×10^{-11}
Hot Isostatic Pressed Waste Option										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P71	Mixing and HIPing	5	5.8×10^{-8}	2.9×10^{-7}	5.2×10^{-8}	2.6×10^{-7}	6.0×10^{-9}	3.0×10^{-8}	1.5×10^{-12}	7.4×10^{-12}
P72	HIPed HLW Interim Storage	3	-	-	-	-	-	-	-	-
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	3	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			2.3×10^{-7}	7.0×10^{-7}	2.1×10^{-7}	6.3×10^{-7}	2.4×10^{-8}	7.2×10^{-8}	6.0×10^{-12}	1.8×10^{-11}
Direct Cement Waste Option										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P80	Mixing and FUETEP Grout	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P81	Unseparated Cementitious HLW Interim Storage	3	-	-	-	-	-	-	-	-
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	4	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			2.3×10^{-7}	5.8×10^{-7}	2.1×10^{-7}	5.2×10^{-7}	2.4×10^{-8}	6.0×10^{-8}	6.0×10^{-12}	1.5×10^{-11}

Table C.2-18. Airborne radionuclide emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual emission rate and total project emissions [a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Project number	Description	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
Early Vitrification Option										
P18	New Analytical Laboratory	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P61	Vitrified HLW Interim Storage	3	-	-	-	-	-	-	-	-
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	3	-	-	-	-	-	-	-	-
P88	Early Vitrification with MACT	5	7.3×10^{-8}	3.6×10^{-7}	6.5×10^{-8}	3.3×10^{-7}	7.4×10^{-9}	3.7×10^{-8}	1.9×10^{-12}	9.3×10^{-12}
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	2	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			1.9×10^{-7}	5.4×10^{-7}	1.7×10^{-7}	4.8×10^{-7}	1.9×10^{-8}	5.5×10^{-8}	4.8×10^{-12}	1.4×10^{-11}
Steam Reforming Option										
P13	***New Storage Tanks***	***2***	4.0×10^{-8}	8.0×10^{-8}	3.6×10^{-8}	7.2×10^{-8}	4.1×10^{-9}	8.2×10^{-9}	1.0×10^{-12}	2.1×10^{-12}
P59A	***Calcine Retrieval and Transport***	***2***	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P117A	***Calcine Packaging and Loading to Hanford***	***3***	-	-	-	-	-	-	-	-
P2001	***NGLW Grout Facility***	***1***	4.0×10^{-8}	4.0×10^{-8}	3.6×10^{-8}	3.6×10^{-8}	4.1×10^{-9}	4.1×10^{-9}	1.0×10^{-12}	1.0×10^{-12}
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P2002A	***Steam Reforming***	***1***	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
Totals			2.5×10^{-7}	4.1×10^{-7}	2.3×10^{-7}	3.7×10^{-7}	2.6×10^{-8}	4.2×10^{-8}	6.5×10^{-12}	1.1×10^{-11}

Table C.2-*18*. Airborne radionuclide emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual emission rate and total project emissions [a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Project number	Description	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
Minimum INEEL Processing Alternative[d]										
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P24	Vitrified Product Interim Storage	3	-	-	-	-	-	-	-	-
P27	Class A Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
P111	SBW Treatment with CsIX	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P112A	Packaging and Loading CH-Transuranic for Transport to WIPP	5	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P59B	Calcine Retrieval and Transport Just in Time	***2***	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	***1.0×10^{-7}***	6.0×10^{-9}	***1.2×10^{-8}***	1.5×10^{-12}	***3.0×10^{-12}***
P117B	Calcine Packaging & Loading Just in Time	3	1.7×10^{-7}	5.2×10^{-7}	1.6×10^{-7}	4.7×10^{-7}	1.8×10^{-8}	5.4×10^{-8}	4.5×10^{-12}	1.3×10^{-11}
Totals			3.5×10^{-7}	8.1×10^{-7}	3.1×10^{-7}	***7.3×10^{-7}***	3.6×10^{-8}	***8.3×10^{-8}***	8.9×10^{-12}	***2.1×10^{-11}***
Vitrification Without Calcine Separations Option										
P13	***New Storage Tanks***	***2***	***4.0×10^{-8}***	***8.0×10^{-8}***	***3.6×10^{-8}***	***7.2×10^{-8}***	***4.1×10^{-9}***	***8.2×10^{-9}***	***1.0×10^{-12}***	***2.1×10^{-12}***
P18	***New Analytical Lab***	***2***	***5.8×10^{-8}***	***1.2×10^{-7}***	***5.2×10^{-8}***	***1.0×10^{-7}***	***6.0×10^{-9}***	***1.2×10^{-8}***	***1.5×10^{-12}***	***3.0×10^{-12}***
P35E	***Class A Grout Packaging & Loading for Offsite Disposal***	***2***	***5.8×10^{-8}***	***1.2×10^{-7}***	***5.2×10^{-8}***	***1.0×10^{-7}***	***6.0×10^{-9}***	***1.2×10^{-8}***	***1.5×10^{-12}***	***3.0×10^{-12}***
P59A	***Calcine Retrieval and Transport***	***1***	***5.8×10^{-8}***	***5.8×10^{-8}***	***5.2×10^{-8}***	***5.2×10^{-8}***	***6.0×10^{-9}***	***6.0×10^{-9}***	***1.5×10^{-12}***	***1.5×10^{-12}***
P88	***Vitrification with MACT***	***5***	***7.3×10^{-8}***	***3.6×10^{-7}***	***6.5×10^{-8}***	***3.3×10^{-7}***	***7.4×10^{-9}***	***3.7×10^{-8}***	***1.9×10^{-12}***	***9.3×10^{-12}***
Totals			***2.9×10^{-7}***	***7.3×10^{-7}***	***2.6×10^{-7}***	***6.6×10^{-7}***	***2.9×10^{-8}***	***7.5×10^{-8}***	***7.4×10^{-12}***	***1.9×10^{-11}***
Vitrification With Calcine Separations Option										
P9A	***Full Separations***	***3***	***5.8×10^{-8}***	***1.7×10^{-7}***	***5.2×10^{-8}***	***1.6×10^{-7}***	***6.0×10^{-9}***	***1.8×10^{-8}***	***1.5×10^{-12}***	***4.5×10^{-12}***
P9C	***Grout Plant***	***2.5***	***5.8×10^{-8}***	***1.5×10^{-7}***	***5.2×10^{-8}***	***1.3×10^{-7}***	***6.0×10^{-9}***	***1.5×10^{-8}***	***1.5×10^{-12}***	***3.7×10^{-12}***
P13	***New Storage Tanks***	***2***	***4.0×10^{-8}***	***8.0×10^{-8}***	***3.6×10^{-8}***	***7.2×10^{-8}***	***4.1×10^{-9}***	***8.2×10^{-9}***	***1.0×10^{-12}***	***2.1×10^{-12}***
P18	***New Analytical Lab***	***2***	***5.8×10^{-8}***	***1.2×10^{-7}***	***5.2×10^{-8}***	***1.0×10^{-7}***	***6.0×10^{-9}***	***1.2×10^{-8}***	***1.5×10^{-12}***	***3.0×10^{-12}***
P35E	***Grout Packaging & Loading for Offsite Disposal***	***2***	***5.8×10^{-8}***	***1.2×10^{-7}***	***5.2×10^{-8}***	***1.0×10^{-7}***	***6.0×10^{-9}***	***1.2×10^{-8}***	***1.5×10^{-12}***	***3.0×10^{-12}***
P59A	***Calcine Retrieval and Transport***	***1***	***5.8×10^{-8}***	***5.8×10^{-8}***	***5.2×10^{-8}***	***5.2×10^{-8}***	***6.0×10^{-9}***	***6.0×10^{-9}***	***1.5×10^{-12}***	***1.5×10^{-12}***
P88	***Vitrification with MACT***	***5***	***7.3×10^{-8}***	***3.6×10^{-7}***	***6.5×10^{-8}***	***3.3×10^{-7}***	***7.4×10^{-9}***	***3.7×10^{-8}***	***1.9×10^{-12}***	***9.3×10^{-12}***
Totals			***4.0×10^{-7}***	***1.1×10^{-6}***	***3.6×10^{-7}***	***9.5×10^{-7}***	***4.1×10^{-8}***	***1.1×10^{-7}***	***1.0×10^{-11}***	***2.7×10^{-11}***

a. Annual emissions represent the highest projected emission rate for any single year. Total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Annual totals include only those projects which are projected to occur over a similar time frame. Source: Project Data Sheets (Appendix C.6).

b. Assumes disposal of Class A grout either offsite or in new INEEL landfill facility; ***emissions from*** disposal in Tank Farm and bin sets are addressed in ***Table C.2-22.***

c. Assumes disposal of Class C grout in new facility; ***emissions from*** disposal in Tank Farm and bin sets are addressed ***in Table C.2-22.***

d. Assumes "just-in-time" shipping scenario; emissions from option involving interim storage of calcine at Hanford would be somewhat less. Includes emissions at INEEL only.

Table C.2-19. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of facilities associated with waste processing alternatives.

		Impact of alternative[a]											
				Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Case (units)	Applicable Standard	No Action Alternative	Continued Current Operations Alternative	Full Separations Option[b]	Planning Basis Option	Transuranic Separations Option[c]	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL[d]	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Dose to maximally exposed offsite individual (millirem per year)	10[e]	-	1.1×10^{-10}	3.3×10^{-10}	3.9×10^{-10}	4.7×10^{-10}	1.8×10^{-10}	1.3×10^{-10}	1.4×10^{-10}	***2.4×10^{-10}***	5.6×10^{-10}	***2.1×10^{-10}***	***3.0×10^{-10}***
Dose to noninvolved worker (millirem per year)[f]	5,000[g]	-	2.0×10^{-11}	6.0×10^{-11}	7.0×10^{-11}	1.4×10^{-10}	3.7×10^{-11}	2.1×10^{-11}	2.8×10^{-11}	***4.3×10^{-11}***	1.6×10^{-10}	***4.3×10^{-11}***	***6.0×10^{-11}***
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[h]	N.A.	-	***4.0×10^{-9}***	***1.2×10^{-8}***	***1.4×10^{-8}***	***1.3×10^{-8}***	***5.7×10^{-9}***	***4.5×10^{-9}***	***4.6×10^{-9}***	***8.8×10^{-9}***	***1.6×10^{-8}***	***7.0×10^{-9}***	***9.9×10^{-9}***

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.

b. Impacts do not include disposal of Class A Grout in Tank Farm and bin sets, which are presented in Table ***5.3-6***.

c. Impacts do not include disposal of Class C Grout in Tank Farm and bin sets, which are presented in Table ***5.3-6***.

d. Assumes "just-in-time" shipping scenario; impacts of option involving interim storage of calcine at Hanford would be somewhat less. Does not include doses at Hanford.

e. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.

f. Location of highest onsite dose is Central Facilities Area.

g. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.

h. ***Assessment conservatively assumes that exposed population is that which is projected for the year 2035. Based on 2000 census data and growth rate between 1990 and 2000, this population would be 242,000 (compared to 2000 population of 139,000).***

Table C.2-20. Airborne radionuclide emissions estimates for disposition of the Tank Farm and bin sets under alternative closure scenarios.

			Annual emission rate and total project emissions [a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Project number	Description	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
					Tank Farm					
P59G	Clean Closure	17	8.6×10^{-7}	1.5×10^{-5}	4.2×10^{-7}	7.1×10^{-6}	4.4×10^{-7}	7.4×10^{-6}	2.8×10^{-9}	4.8×10^{-8}
P3B	Performance-Based Closure with Clean Fill	17	1.1×10^{-7}	1.8×10^{-6}	5.2×10^{-8}	8.8×10^{-7}	5.5×10^{-8}	9.3×10^{-7}	3.5×10^{-10}	5.9×10^{-9}
P3C	Closure to Landfill Standards	17	7.8×10^{-7}	1.3×10^{-5}	3.8×10^{-7}	6.4×10^{-6}	4.0×10^{-7}	6.7×10^{-6}	2.5×10^{-9}	4.3×10^{-8}
P26/51	Performance-Based Closure with Class A or C Fill	27	1.1×10^{-7}	2.4×10^{-6}	5.3×10^{-8}	1.2×10^{-6}	5.6×10^{-8}	1.2×10^{-6}	3.6×10^{-10}	7.9×10^{-9}
					Bin Sets					
P59F	Clean Closure	20	1.3×10^{-7}	2.6×10^{-6}	1.2×10^{-7}	2.3×10^{-6}	1.3×10^{-8}	2.7×10^{-7}	3.3×10^{-12}	6.7×10^{-11}
P59C	Performance-Based Closure with Clean Fill	20	1.7×10^{-7}	3.4×10^{-6}	***1.5×10^{-7}***	3.0×10^{-6}	1.7×10^{-8}	3.5×10^{-7}	4.3×10^{-12}	8.7×10^{-11}
P59D	Closure to Landfill Standards	20	1.2×10^{-6}	2.4×10^{-5}	1.1×10^{-6}	2.2×10^{-5}	1.2×10^{-7}	2.5×10^{-6}	3.1×10^{-11}	6.2×10^{-10}
P26/51	Performance-Based Closure with Class A or C Fill	18	1.7×10^{-7}	2.5×10^{-6}	1.5×10^{-7}	2.3×10^{-6}	1.7×10^{-8}	2.6×10^{-7}	4.3×10^{-12}	6.5×10^{-11}

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a. Annual emissions represent the highest projected emission rate for any single year. Total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Annual totals include only those projects which are projected to occur over a similar time frame. Source: Project Data Sheets (Appendix C.6).

Table C.2-21. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of the Tank Farm and bin sets under alternative closure scenarios.

		Maximum annual radiation dose[a]			
Case	Applicable Standard	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal
		Tank Farm			
Dose to maximally exposed offsite individual (millirem per year)	10[b]	1.2×10^{-9}	1.5×10^{-10}	1.1×10^{-9}	1.5×10^{-10}
Dose to maximally exposed onsite noninvolved worker (millirem per year)[c]	5,000[d]	1.2×10^{-9}	1.5×10^{-10}	1.1×10^{-9}	1.5×10^{-10}
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[e]	NA	***3.7×10^{-8}***	***4.6×10^{-9}***	***3.4×10^{-8}***	***4.7×10^{-9}***
		Bin Sets			
Dose to maximally exposed offsite individual (millirem per year)	10[b]	1.0×10^{-10}	1.3×10^{-10}	9.2×10^{-10}	1.3×10^{-10}
Dose to maximally exposed onsite noninvolved worker (millirem per year)[c]	5,000[d]	2.3×10^{-11}	3.0×10^{-11}	2.2×10^{-10}	3.0×10^{-11}
Collective dose to population within 80 km of INTEC (person-rem per year)[e]	NA	***6.6×10^{-9}***	***8.6×10^{-9}***	***6.1×10^{-8}***	***8.6×10^{-9}***

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.

b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.

c. Location of highest onsite dose is Central Facilities Area.

d. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.

e. ***Assessment conservatively assumes that exposed population is that which is projected for the year 2035. Based on 2000 census data and growth rate between 1990 and 2000, this population would be 242,000 (compared to 2000 population of 139,000).***

Table C.2-22. Airborne radionuclide emissions estimates for disposition of other existing facilities associated with HLW management.

			Annual emission rate and total project emissions [a]							
			Total Activity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Facility group	Closure method[b]	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
Tank Farm Related Facilities										
Waste Storage Control House (CPP-619)	Landfill	6	1.5×10^{-8}	***8.7×10^{-8}***	***7.0×10^{-9}***	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste Storage Control House (CPP-628)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste/Station Tank Transfer Bldg. (CPP-638)	Landfill	2	1.5×10^{-8}	2.9×10^{-8}	7.0×10^{-9}	1.4×10^{-8}	7.4×10^{-9}	1.5×10^{-8}	4.7×10^{-11}	9.5×10^{-11}
Instrument House (CPP-712)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
STR Waste Storage Tanks (CPP-717)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Total			***7.3×10^{-8}***	3.8×10^{-7}	3.5×10^{-8}	1.8×10^{-7}	***3.7×10^{-8}***	1.9×10^{-7}	***2.4×10^{-10}***	1.2×10^{-9}
Bin Set Related Facilities										
Instrument Bldg. for Bin Set 1 (CPP-639)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 2nd Set of calcined solids (CPP-646)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 3rd Set of calcined solids (CPP-647)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 4th Set of calcined solids (CPP-658)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 5th Set of calcined solids (CPP-671)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 6th Set of calcined solids (CPP-673)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Total			8.7×10^{-8}	5.2×10^{-7}	7.8×10^{-8}	4.7×10^{-7}	8.9×10^{-9}	5.4×10^{-8}	2.2×10^{-12}	***1.3×10^{-11}***
Process Equipment Waste Evaporator and Related Facilities										
Liquid Effluent Treat. & Disp. Bldg. (CPP-1618)	Clean	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste Holdup Pumphouse (CPP-641)	Clean	2	1.5×10^{-8}	2.9×10^{-8}	7.0×10^{-9}	1.4×10^{-8}	7.4×10^{-9}	1.5×10^{-8}	4.7×10^{-11}	9.5×10^{-11}
PEW Evaporator Bldg. (CPP-604)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Atmospheric Protection Bldg. (CPP-649)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Pre-Filter Bldg. (CPP-756)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Blower Bldg. (CPP-605)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Main Exhaust Stack (CPP-708)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Total			***8.7×10^{-8}***	***6.1×10^{-7}***	***2.6×10^{-7}***	***3.0×10^{-7}***	***2.7×10^{-7}***	***3.1×10^{-7}***	***1.7×10^{-9}***	***2.0×10^{-9}***
Fuel Processing Building and Related Facilities										
Fuel Processing Building (CPP-601)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Remote Analytical Facility Building (CPP-627)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Head End Process Plant (CPP-640)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Total			1.7×10^{-7}	1.7×10^{-6}	8.5×10^{-8}	8.5×10^{-7}	***8.9×10^{-8}***	8.9×10^{-7}	5.7×10^{-10}	5.7×10^{-9}

Table C.2-22. Airborne radionuclide emissions estimates for disposition of other existing facilities associated with HLW management (continued).

			Annual emission rate and total project emissions [a]							
			Total Activity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Facility group	Closure method[b]	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
Fluorinel and Storage Facility and Related Facilities										
FAST Facility and Stack	- [c]	6	5.8×10^{-8}	3.5×10^{-7}	2.8×10^{-8}	1.7×10^{-7}	***3.0×10^{-8}***	***1.8×10^{-7}***	***1.9×10^{-10}***	***1.1×10^{-9}***
New Waste Calcining Facility										
New Waste Calcining Facility	Perf.-Based or Landfill	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
Remote Analytical Laboratory										
Remote Analytical Laboratory (CPP-684)	Perf.-Based	6	2.9×10^{-8}	1.7×10^{-7}	1.4×10^{-8}	8.5×10^{-8}	1.5×10^{-8}	8.9×10^{-8}	9.5×10^{-11}	5.7×10^{-10}

a. Annual emissions represent the highest emission rate for any single year and are the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions are the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

b. See Table 3-***3*** for facility disposition alternatives that apply to each group. The Fuel Processing Building and Related Facilities and the New Waste Calcining Facility could be dispositioned by either performance-based closure or closure to landfill standards. Individual facilities within all other groups would be dispositioned according to a single closure method.

c. Project includes deactivation and demolition of the Fluorinel and Storage Facility building (CPP-666) and the associated stack (CPP-767). The Fluorinel and Storage Facility building would be closed according to performance-based closure criteria and the stack by clean closure. Emissions listed are totals from closure of both facilities.

Table C.2-23. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of other existing facilities associated with HLW management.

		Maximum annual radiation dose[a]							
Case	Applicable Standard	Tank Farm Related Facilities	Bin Set Related Facilities	Process Equip. Waste Evaporator and Related Facilities	Fuel Process. Building and Related Facilities	Fluorinel and Storage Facility and Related Facilities	Transport Lines Group	New Waste Calcining Facility	Remote Analytical Laboratory
Dose to maximally exposed offsite individual (millirem per year)	10[b]	8.1×10^{-11}	***6.7×10^{-11}***	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	-[c]	4.5×10^{-11}	4.1×10^{-11}
Dose to maximally exposed noninvolved worker (millirem per year)[d]	5,000[e]	8.1×10^{-11}	***1.6×10^{-11}***	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	-	1.0×10^{-11}	4.1×10^{-11}
Collective dose to population within 50 miles of INTEC (person-rem per year)[f]	NA	***2.5×10^{-9}***	***4.4×10^{-9}***	***3.7×10^{-9}***	***7.4×10^{-9}***	***2.5×10^{-9}***	-	***3.0×10^{-9}***	***1.2×10^{-9}***

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.

b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.

c. There would be no radionuclide emissions for this group under this closure option.

d. Location of highest onsite dose is Central Facilities Area.

e. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.

f. ***Assessment conservatively assumes that exposed population is that which is projected for the year 2035. Based on 2000 census data and growth rate between 1990 and 2000, this population would be 242,000 (compared to 2000 population of 139,000).***

C.2.7 NONRADIOLOGICAL CONSEQUENCES OF FACILITY DISPOSITION

This section provides detail which supplements the emissions estimates and assessment results for nonradiological air pollutants from the facilities disposition alternatives presented in Section 5.3.4. These emissions arise primarily through the operation of diesel-powered equipment (cranes, loaders, haulers, etc.). The emissions tabulations list the maximum annual and cumulative emissions for each pollutant category (criteria, toxic, and carbon dioxide). Criteria pollutant impacts are presented as concentrations in micrograms per cubic meter at the maximally-impacted location at or beyond the INEEL boundary, along public roads, and at Craters of the Moon Wilderness Area. These are specified both for the alternative or option alone and for the cumulative effect of the alternative added to the baseline conditions. The cumulative impact is also specified as a percent of the applicable standard. Toxic impacts are presented as maximum percent of the applicable standard (for ambient air locations) or occupational exposure limit (for INEEL areas). In all cases, the INEEL area of highest predicted concentration is INTEC.

C.2.7.1 Facilities Associated with Waste Processing Alternatives

The following tables of emissions and impacts are presented for dispositioning of facilities associated with waste processing alternatives. Table C.2-***24*** lists the annual and cumulative emissions estimates for individual projects associated with each alternative. Table C.2-***25*** presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations. Results include both the incremental impacts of each alternative and the cumulative impacts when baseline levels are added. Table C.2-***26*** presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

C.2.7.2 Tank Farm and Bin Sets

The following tables of emissions and impacts are presented for dispositioning of the Tank Farm and bin sets according to alternative closure scenarios. Table C.2-***27*** lists the annual and cumulative emissions estimates for each facility group by closure scenario. Table C.2-***28*** presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations, including both the incremental impacts of each alternative and the cumulative impacts when baseline levels are added. Table C.2-***29*** presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

C.2.7.3 Other Existing INTEC Facilities

DOE has also assessed emissions and impacts for dispositioning other existing INTEC facilities involved in HLW management. These facilities, which have been arranged in functional groups for purposes of analysis, are listed in Table 3-***3***. The following tables are presented for these facilities. Table C.2-***30*** lists the annual and cumulative emissions estimates. Table C.2-***31*** presents the maximum predicted incremental and cumulative impacts of criteria pollutant emissions at ambient air locations. Table C.2-***32*** presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives.

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
No Action Alternative										
P1D	No Action Alternative	-	-	-	-	-	-	-	-	-
Continued Current Operations Alternative										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	100	150	120	170	2.3×10^3	3.3×10^3	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P1F	Bin Set 1 Closure	2	7	14	8	16	150	307	11	22
Totals			150	200	170	230	3.3×10^3	4.4×10^3	35	51
Full Separations Option[d]										
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P9A	Full (early) Separations	3	120	360	140	409	2.6×10^3	7.9×10^3	64	190
P9B	Vitrification Plant	3	64	190	73	220	1.4×10^3	4.2×10^3	15	45
P9C	Class A Grout Plant	3	64	160	73	180	1.4×10^3	3.5×10^3	15	38
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1.1×10^3	43	120
P18	New Analytical Lab	2	83	160	95	190	1.8×10^3	3.7×10^3	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
P35D	Class A Grout Packaging & Shipping to INEEL Landfill	2	11	23	13	26	240	500	2	4
P27	Class A Grout in New Landfill Facility	2	32	64	36	72	700	1.4×10^3	310	620
Totals			490	1.1×10^3	550	1.3×10^3	1.1×10^4	2.5×10^4	480	1.1×10^3
Planning Basis Option[d]										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2.3×10^3	3.3×10^3	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P23A	Full Separations	3	120	360	140	409	2.6×10^3	7.9×10^3	64	190
P23B	Vitrification Plant	3	64	190	73	220	1.4×10^3	4.2×10^3	15	45
P23C	Class A Grout Plant	3	64	160	73	180	1.4×10^3	3.5×10^3	15	38
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1.1×10^3	43	120
P18	New Analytical Lab	2	83	160	95	190	1.8×10^3	3.7×10^3	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
P35E	Class A Grout Packaging and Loading for Offsite Disposal	2	11	23	13	26	250	500	2	4
Totals			590	1.3×10^3	680	1.4×10^3	1.3×10^4	2.8×10^4	190	480

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
Transuranic Separations Option[e]										
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P49A	Transuranic-C Separations	3	94	280	107	320	2.1×10^3	6.2×10^3	64	190
P49C	Class C Grout Plant	2	64	130	73	150	1.4×10^3	2.8×10^3	15	30
P39A	Packaging and Loading Transuranic at INTEC for Shipment to WIPP	2	29	43	33	49	630	950	-	-
P18	New Analytical Lab	2	83	170	95	190	1.8×10^3	3.7×10^3	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
P49D	Class C Grout Packaging & Shipping	2	11	23	13	26	250	500	2	4
P27	Class C Grout in New Landfill Facility	2	32	64	36	72	700	1.4×10^3	310	620
Totals			407	840	460	960	9.0×10^3	1.8×10^4	420	890
Hot Isostatic Pressed Waste Option										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2.3×10^3	3.3×10^3	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P18	New Analytical Lab	2	83	160	95	190	1.8×10^3	3.7×10^3	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P71	Mixing and HIPing	5	49	250	56	280	1.1×10^3	5.4×10^3	89	450
P72	HIPed HLW Interim Storage	3	38	110	43	130	830	2.5×10^3	43	130
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	3	29	72	33	82	630	1.6×10^3	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
Totals			430	900	490	1.0×10^3	9.4×10^3	2.0×10^4	180	650
Direct Cement Waste Option										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2.3×10^3	3.3×10^3	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P18	New Analytical Lab	2	83	170	95	190	1.8×10^3	3.7×10^3	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P80	Direct Cement Process	3	72	220	82	250	1.6×10^3	4.8×10^3	51	150
P81	Unseparated Cementitious HLW Interim Storage	3	66	200	75	230	1.4×10^3	4.3×10^3	130	390
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	4	29	100	33	110	630	2.2×10^3	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
Totals			480	990	550	1.1×10^3	1.1×10^4	2.2×10^4	230	610

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
			Early Vitrification Option							
P18	Calcine Retrieval and Transport	2	83	170	95	190	1.8×10^3	3.7×10^3	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1.3×10^3	1.3×10^3	7	7
P61	Vitrified HLW Interim Storage	3	53	160	61	180	1.2×10^3	3.5×10^3	72	220
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	3	29	86	33	98	630	1.9×10^3	-	-
P88	Early Vitrification with MACT	5	106	530	120	606	2.3×10^3	1.2×10^4	40	200
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	2	29	43	33	49	630	950	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
Totals			390	1.1×10^3	440	1.3×10^3	8.5×10^3	2.4×10^4	140	460
			Steam Reforming Option							
P13	***New Storage Tanks***	***2***	***8.0***	***16***	***9.1***	***18***	***180***	***350***	***35***	***70***
P59A	***Calcine Retrieval and Transport***	***2***	***57***	***110***	***65***	***130***	1.3×10^3	2.5×10^3	***7.0***	***14***
P117A	***Calcine Packaging and Loading to Hanford***	***3***	***4.9***	***15***	***5.6***	***17***	***110***	***330***	***17***	***51***
P2001	***NGLW Grout Facility***	***1***	***19***	***19***	***22***	***22***	***420***	***420***	***7.2***	***7.2***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	***11***	***23***	***13***	***26***	***250***	***500***	***2.0***	***4.0***
P2002A	***Steam Reforming***	***1***	***64***	***64***	***73***	***73***	1.4×10^3	1.4×10^3	***15***	***15***
Totals			***160***	***250***	***190***	***290***	3.6×10^3	5.5×10^3	***83***	***160***

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
			Minimum INEEL Processing Alternative[f]							
P18	New Analytical Lab	2	83	170	95	190	1.8×10^3	3.7×10^3	9	18
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1.1×10^3	43	120
P27	Class A Grout in New Landfill Facility	2	32	64	36	72	700	1.4×10^3	310	620
P111	SBW Treatment with CsIX	1	38	38	43	43	840	840	14	14
P112A	Packaging and Loading CH-Transuranic for Transport to WIPP	5	29	130	33	150	630	2.8×10^3	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1.4×10^3	8	17
P59B	Calcine Retrieval and Transport Just in Time	***2***	***51***	***100***	***58***	***120***	***1.1×10^3***	***2.2×10^3***	7	***14***
P117B	Calcine Packaging & Loading Just in Time	3	47	140	53	160	1.0×10^3	3.1×10^3	21	63
Totals			***330***	***750***	***370***	***850***	***7.2×10^3***	***1.6×10^4***	410	***870***
			Vitrification without Calcine Separations Option							
P13	***New Storage Tanks***	***2***	***3.8***	***7.7***	***4.4***	***8.8***	***85***	***170***	***17***	***35***
P18	***New Analytical Lab***	***2***	***83***	***170***	***95***	***190***	***1.8×10^3***	***3.7×10^3***	***9.0***	***18***
P59A	***Calcine Retrieval and Transport***	***1***	***57***	***57***	***65***	***65***	***1.3×10^3***	***1.3×10^3***	***7.0***	***7.0***
P61	***Vitrified HLW Interim Storage***	***3***	***53***	***160***	***61***	***180***	***1.2×10^3***	***3.5×10^3***	***72***	***220***
P62A	***Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR***	***3***	***29***	***86***	***33***	***98***	***630***	***1.9×10^3***	***-***	***-***
P88	***Vitrification with MACT***	***5***	***110***	***530***	***120***	***610***	***2.3×10^3***	***1.2×10^4***	***40***	***200***
P133	***Waste Treatment Pilot Plant***	***2***	***31***	***63***	***36***	***71***	***690***	***1.4×10^3***	***17***	***34***
Totals			***360***	***1.1×10^3***	***410***	***1.2×10^3***	***8.0×10^3***	***2.4×10^4***	***160***	***510***
			Vitrification with Calcine Separations Option							
P9A	***Full Separations***	***3***	***120***	***360***	***140***	***410***	***2.6×10^3***	***7.9×10^3***	***64***	***190***
P9C	***Grout Plant***	***2.5***	***64***	***160***	***73***	***180***	***1.4×10^3***	***3.5×10^3***	***15***	***38***
P13	***New Storage Tanks***	***2***	***3.8***	***7.7***	***4.4***	***8.8***	***85***	***170***	***17***	***35***
P18	***New Analytical Lab***	***2***	***83***	***170***	***95***	***190***	***1.8×10^3***	***3.7×10^3***	***9.0***	***18***
P24	***Vitrified Product Interim Storage***	***2.8***	***17***	***48***	***19***	***55***	***370***	***1.1×10^3***	***43***	***120***
P35E	***Grout Packaging & Loading for Offsite Disposal***	***2***	***11***	***23***	***13***	***26***	***250***	***500***	***2.0***	***4.0***
P59A	***Calcine Retrieval and Transport***	***1***	***57***	***57***	***65***	***65***	***1.3×10^3***	***1.3×10^3***	***7.0***	***7.0***

Table C.2-24. Summary of nonradiological air pollutant emissions estimates for disposition of proposed facilities associated with waste processing alternatives (continued).

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
			Vitrification with Calcine Separations Option(continued)							
P88	***Vitrification with MACT***	***5***	***110***	***530***	***120***	***610***	2.3×10^{3}	1.2×10^{4}	***40***	***200***
P133	***Waste Treatment Pilot Plant***	***2***	***31***	***63***	***36***	***71***	***690***	1.4×10^{3}	***17***	***34***
Totals			***490***	1.4×10^{3}	***560***	1.6×10^{3}	1.1×10^{4}	3.1×10^{4}	***210***	***650***

a. Maximum annual emissions represent the highest emission rate for any single year; total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Source: Project Data Sheets (Appendix C.6).

b. The specific pollutants and approximate relative percentages are as follows: carbon monoxide - 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

c. Carbon dioxide is listed because this gas has been implicated in global warming.

d. Assumes disposal of Class A grout either offsite (Full Separations and Planning Basis Options) or in new INEEL landfill facility (Full Separations Option); impacts of disposal in Tank Farm and bin sets are addressed in Section C.2.7.2.

e. Assumes disposal of Class C grout in new facility; impacts of disposal in Tank Farm and bin sets are addressed in Section C.2.7.2.

f. Assumes "just-in-time" shipping scenario; nonradiological emissions impacts of interim storage of calcine at Hanford would be somewhat less.

Table C.2-25. Maximum criteria pollutant impacts from disposition of facilities associated with waste processing alternatives.

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
Pollutant	Averaging time	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
No Action Alternative										
Carbon monoxide	1-hour	-	-	-	220	330	8.5	1	1	<1
	8-hour	-	-	-	44	68	3.5	<1	1	<1
Nitrogen dioxide	Annual	-	-	-	1.0	2.2	0.084	1	2	<1
Sulfur dioxide	3-hour	-	-	-	30	140	6.2	2	11	<1
	24-hour	-	-	-	6.1	32	1.7	2	9	<1
	Annual	-	-	-	0.26	4.5	0.070	<1	6	<1
Respirable particulates[c]	24-hour	-	-	-	9.0	20	0.94	6	13	<1
	Annual	-	-	-	0.39	1.3	0.043	<1	3	<1
Lead	Quarterly	-	-	-	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Continued Current Operations Alternative										
Carbon monoxide	1-hour	130	380	32	350	710	40	<1	2	<1
	8-hour	54	140	5.5	98	210	9.0	<1	2	<1
Nitrogen dioxide	Annual	0.13	0.51	0.012	1.1	2.7	0.10	1	3	<1
Sulfur dioxide	3-hour	14	33	2.3	44	170	8.5	3	13	<1
	24-hour	2.9	7.7	0.29	9.0	40	2.0	2	11	<1
	Annual	0.024	0.092	2.2×10^{-3}	0.28	4.6	0.072	<1	6	<1
Respirable particulates[c]	24-hour	1.1	2.8	0.11	10	23	1.0	7	15	<1
	Annual	8.7×10^{-3}	0.034	8.0×10^{-4}	0.40	1.3	0.044	<1	3	<1
Lead	Quarterly	1.9×10^{-6}	6.1×10^{-6}	1.8×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Full Separations Option										
Carbon monoxide	1-hour	440	1.3×10^{3}	100	660	1.6×10^{3}	110	2	4	<1
	8-hour	180	470	18	220	530	22	2	5	<1
Nitrogen dioxide	Annual	0.43	1.7	0.040	1.4	3.9	0.12	1	4	<1
Sulfur dioxide	3-hour	46	110	7.4	76	250	14	6	19	1
	24-hour	9.6	25	0.95	16	57	2.6	4	16	<1
	Annual	0.078	0.30	7.1×10^{-3}	0.34	4.8	0.077	<1	6	<1
Respirable particulates[c]	24-hour	3.5	9.2	0.35	13	29	1.3	8	19	<1
	Annual	0.029	0.11	2.6×10^{-3}	0.42	1.4	0.046	<1	3	<1
Lead	Quarterly	6.1×10^{-6}	2.0×10^{-5}	5.8×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Planning Basis Option										
Carbon monoxide	1-hour	540	1.5×10^{3}	130	762	1.9×10^{3}	130	2	5	<1
	8-hour	220	570	22	260	640	26	3	6	<1
Nitrogen dioxide	Annual	0.53	2.0	0.048	1.5	4.2	0.13	2	4	<1
Sulfur dioxide	3-hour	56	130	9.1	86	270	15	7	21	1
	24-hour	12	31	1.2	18	63	2.9	5	17	<1
	Annual	0.096	0.37	8.7×10^{-3}	0.36	4.9	0.079	<1	6	<1
Respirable particulates[c]	24-hour	4.3	11	0.43	13	31	1.4	9	21	<1
	Annual	0.035	0.13	3.2×10^{-3}	0.43	1.4	0.046	<1	3	<1
Lead	Quarterly	7.5×10^{-6}	2.4×10^{-5}	7.1×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

Table C.2-25. Maximum criteria pollutant impacts from disposition of facilities associated with waste processing alternatives (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
Pollutant	Averaging time	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Transuranic Separations Option										
Carbon monoxide	1-hour	370	1.1×10^{3}	87	590	1.4×10^{3}	96	1	3	<1
	8-hour	150	390	15	190	460	19	2	5	<1
Nitrogen dioxide	Annual	0.37	1.4	0.033	1.4	3.6	0.12	1	4	<1
Sulfur dioxide	3-hour	38	91	6.2	68	230	12	5	18	<1
	24-hour	8.1	21	0.80	14	53	2.5	4	15	<1
	Annual	0.066	0.25	6.0×10^{-3}	0.33	4.8	0.076	<1	6	<1
Respirable particulates[c]	24-hour	3.0	7.7	0.29	12	28	1.2	8	18	<1
	Annual	0.024	0.092	2.2×10^{-3}	0.41	1.4	0.045	<1	3	<1
Lead	Quarterly	5.1×10^{-6}	1.7×10^{-5}	4.9×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Hot Isostatic Pressed Waste Option										
Carbon monoxide	1-hour	390	1.1×10^{3}	91	610	1.4×10^{3}	100	2	4	<1
	8-hour	160	410	16	200	480	19	2	5	<1
Nitrogen dioxide	Annual	0.38	1.5	0.035	1.4	3.7	0.12	1	4	<1
Sulfur dioxide	3-hour	40	95	6.5	70	240	13	5	18	<1
	24-hour	8.5	22	0.84	15	54	2.5	4	15	<1
	Annual	0.069	0.26	6.3×10^{-3}	0.33	4.8	0.076	<1	6	<1
Respirable particulates[c]	24-hour	3.1	8.1	0.31	12	28	1.2	8	19	<1
	Annual	0.025	0.10	2.3×10^{-3}	0.42	1.4	0.045	<1	3	<1
Lead	Quarterly	5.4×10^{-6}	1.8×10^{-5}	5.1×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Direct Cement Waste Option										
Carbon monoxide	1-hour	440	1.2×10^{3}	100	660	1.6×10^{3}	110	2	4	<1
	8-hour	180	460	18	220	530	21	2	5	<1
Nitrogen dioxide	Annual	0.43	1.6	0.039	1.4	3.8	0.12	1	4	<1
Sulfur dioxide	3-hour	45	110	7.3	75	250	14	6	19	1
	24-hour	9.5	25	0.94	16	57	2.6	4	16	<1
	Annual	0.077	0.30	7.0×10^{-3}	0.34	4.8	0.077	<1	6	<1
Respirable particulates[c]	24-hour	3.5	9.1	0.34	12	29	1.3	8	19	<1
	Annual	0.028	0.11	2.6×10^{-3}	0.42	1.4	0.046	<1	3	<1
Lead	Quarterly	6.0×10^{-6}	2.0×10^{-5}	5.7×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Early Vitrification Option										
Carbon monoxide	1-hour	350	1.0×10^{3}	83	570	1.3×10^{3}	91	1	3	<1
	8-hour	140	370	14	190	440	18	2	4	<1
Nitrogen dioxide	Annual	0.35	1.3	0.032	1.3	3.5	0.12	1	4	<1
Sulfur dioxide	3-hour	37	86	5.9	67	230	12	5	17	<1
	24-hour	7.7	20	0.76	14	52	2.5	4	14	<1
	Annual	0.063	0.24	5.7×10^{-3}	0.32	4.7	0.076	<1	6	<1
Respirable particulates[c]	24-hour	2.8	7.4	0.28	12	27	1.2	8	18	<1
	Annual	0.023	0.088	2.1×10^{-3}	0.41	1.4	0.045	<1	3	<1
Lead	Quarterly	4.9×10^{-6}	1.6×10^{-5}	4.6×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

Table C.2-25. Maximum criteria pollutant impacts from disposition of facilities associated with waste processing alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter) INEEL boundary	Public roads	Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a] INEEL boundary	Public roads	Craters of the Moon	Percent of standard[b] INEEL boundary	Public roads	Craters of the Moon
Steam Reforming Option										
Carbon monoxide	1-hour	150	420	35	370	750	44	<1	2	<1
	8-hour	60	160	6.1	100	230	9.6	1	2	<1
Nitrogen dioxide	Annual	0.15	0.56	0.013	1.1	2.8	0.10	1	3	<1
Sulfur dioxide	3-hour	15	36	2.5	45	180	8.7	3	14	<1
	24-hour	3.3	8.5	0.32	9.4	41	2.0	3	11	<1
	Annual	0.026	0.10	2.4×10^{-3}	0.29	4.6	0.072	<1	6	<1
Respirable particulates[c]	24-hour	1.2	3.1	0.12	10	23	1.1	7	15	<1
	Annual	0.010	0.037	8.8×10^{-4}	0.40	1.3	0.04	<1	3	<1
Lead	Quarterly	2.1×10^{-6}	6.7×10^{-6}	2.0×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Minimum INEEL Processing Alternative[d]										
Carbon monoxide	1-hour	300	850	70	520	1.2×10^{3}	79	1	3	<1
	8-hour	120	320	12	160	380	16	2	4	<1
Nitrogen dioxide	Annual	0.29	1.1	0.027	1.3	3.3	0.11	1	3	<1
Sulfur dioxide	3-hour	31	73	5.0	61	210	11	5	16	<1
	24-hour	6.5	17	0.64	13	49	2.3	3	13	<1
	Annual	0.053	0.20	4.8×10^{-3}	0.31	4.7	0.075	<1	6	<1
Respirable particulates[c]	24-hour	2.4	6.2	0.23	11	26	1.2	8	17	<1
	Annual	0.019	0.074	1.8×10^{-3}	0.41	1.4	0.045	<1	3	<1
Lead	Quarterly	4.1×10^{-6}	1.3×10^{-5}	3.9×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1
Vitrification without Calcine Separations Option										
Carbon monoxide	1-hour	330	940	78	550	1.3×10^{3}	86	1	3	<1
	8-hour	130	350	14	180	420	17	2	4	<1
Nitrogen dioxide	Annual	0.33	1.2	0.030	1.3	3.4	0.11	1	3	<1
Sulfur dioxide	3-hour	34	81	5.6	64	220	12	5	17	<1
	24-hour	7.2	19	0.71	13	51	2.4	4	14	<1
	Annual	0.059	0.22	5.3×10^{-3}	0.32	4.7	0.075	<1	6	<1
Respirable particulates[c]	24-hour	2.6	6.9	0.26	12	27	1.2	8	18	<1
	Annual	0.021	0.082	1.9×10^{-3}	0.41	1.4	0.045	<1	3	<1
Lead	Quarterly	4.6×10^{-6}	1.5×10^{-5}	4.3×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

Table C.2-25. Maximum criteria pollutant impacts from disposition of facilities associated with waste processing alternatives (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
Pollutant	Averaging time	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Vitrification with Calcine Separations Option										
Carbon monoxide	1-hour	450	1.3×10^{3}	100	670	1.6×10^{3}	110	2	4	<1
	8-hour	180	470	18	220	540	22	2	5	<1
Nitrogen dioxide	Annual	0.44	1.7	0.040	1.4	3.9	0.12	1	4	<1
Sulfur dioxide	3-hour	47	110	7.5	77	250	14	6	19	1
	24-hour	9.8	26	1.0	16	58	2.7	4	16	<1
	Annual	0.080	0.30	7.2×10^{-3}	0.34	4.8	0.077	<1	6	<1
Respirable particulates[c]	24-hour	3.6	9.4	0.35	13	29	1.3	8	20	<1
	Annual	0.029	0.11	2.6×10^{-3}	0.42	1.4	0.046	<1	3	<1
Lead	Quarterly	6.2×10^{-6}	2.0×10^{-5}	5.9×10^{-7}	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}	<1	<1	<1

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.

b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)

c. Values do not include contributions of fugitive dust.

d. Impacts for the Minimum INEEL Processing Alternative do not include impacts at Hanford.

Table C.2-26. Summary of maximum toxic air pollutant concentrations at onsite and offsite ***locations from disposition of facilities associated with*** waste processing ***alternatives.***

	Highest percentage of applicable standard[a,b]											
			Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Receptor	No Action Alternative	Continued Current Operations	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Carcinogens[c,d]												
INEEL boundary areas	-	0.65	2.1	2.6	1.8	1.9	2.1	1.7	***0.72***	***1.4***	***1.6***	***2.2***
Craters of the Moon	-	0.060	0.19	0.24	0.16	0.17	0.19	0.15	***0.066***	***0.13***	***0.15***	***0.20***
INEEL facility area location[e]	-	6.5	21	26	18	19	21	17	***7.2***	***14***	***16***	***22***
Noncarcinogens[c]												
INEEL boundary areas	-	0.051	0.17	0.20	0.14	0.15	0.16	0.13	***0.056***	***0.11***	***0.12***	***0.17***
Craters of the Moon	-	0.005	0.016	0.020	0.014	0.014	0.016	0.013	***0.006***	***0.011***	***0.012***	***0.017***
Public road locations	-	0.13	0.43	0.53	0.36	0.38	0.43	0.35	***0.15***	***0.29***	***0.32***	***0.44***
INEEL facility area location[e]	-	4.9	16	20	13	14	16	13	***5.4***	***11***	***12***	***16***

a. Applicable ambient air standards are specified in IDAPA 58.01.01.585-586 (***IDEQ*** 2001) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. Carcinogenic evaluation and standards are based on annual average concentrations. Noncarcinogens are based on 24-hour maximum concentrations. It should be noted that these standards apply only to new sources; they are used here as reference values for purposes of comparison.

b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.

c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.

d. Carcinogenic impacts are not evaluated at public highways.

e. Location of highest onsite impacts is within INTEC.

Table C.2-27. Summary of nonradiological air pollutant emissions estimates for Tank Farm and bin set closure scenarios.

		Annual and cumulative project emissions[a]							
	Duration	Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Facilities	(years)	(tons/year)	(tons)	(lb/year)	(lb)	(tons/year)	(tons)	(tons/year)	(tons)
Tank Farm									
Clean Closure	17	43	730	48	820	1,500	2.6×10^4	130	2.2×10^3
Performance-Based Closure with Clean Fill	17	8.5	140	10	160	180	3.0×10^3	19	150
Closure to Landfill Standards	17	6.0	100	6.7	110	130	2.1×10^3	19	150
Performance-Based Closure with Class A or C Fill	27	5.3	110	***5.9***	***120***	110	2.2×10^3	37	670
Bin Sets									
Clean Closure	20	2.1	42	2.4	48	44	870	53	1.1×10^3
Performance-Based Closure with Clean Fill	20	1.8	36	2.0	40	37	740	33	660
Closure to Landfill Standards	20	1.8	36	2.0	40	38	760	33	660
Performance-Based Closure with Class A or C Fill	18	2.7	33	3.0	***30***	55	680	66	860

a. Annual emissions represent the highest emission rate for any single year and is the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions is the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

b. The specific pollutants and approximate relative percentages are as follows: carbon monoxide - 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

c. Carbon dioxide is listed because this gas has been implicated in global warming.

Table C.2-28. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios.

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
	Averaging time	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Tank Farm Closure Scenarios										
Clean Closure										
Carbon monoxide	1-hour	39	***110***	***9.2***	***260***	***440***	***18***	<1	1	<1
	8-hour	16	41	1.6	***60***	110	***5.1***	<1	1	<1
Nitrogen dioxide	Annual	0.04	0.15	***3.5×10^{-3}***	***1.0***	***2.3***	***0.088***	***1***	***2***	<1
Sulfur dioxide	3-hour	4.1	10	0.66	***34***	***150***	***6.9***	***3***	***12***	<1
	24-hour	***0.85***	2.2	***0.084***	***7.0***	***34***	***1.8***	2	***9***	<1
	Annual	***6.9×10^{-3}***	***0.027***	6.3×10^{-4}	***0.27***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.31	0.82	0.031	***9.3***	***21***	1.0	***6***	***14***	<1
	Annual	2.5×10^{-3}	0.010	2.3×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	5.4×10^{-7}	1.8×10^{-6}	5.1×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Performance-Based Closure										
Carbon monoxide	1-hour	7.7	22	1.8	***230***	***350***	***10***	<1	***<1***	<1
	8-hour	3.1	***8.2***	0.32	***47***	***76***	***3.8***	<1	<1	<1
Nitrogen dioxide	Annual	***7.6×10^{-3}***	***0.029***	***6.9×10^{-4}***	***1.0***	***2.2***	***0.085***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.80	1.9	0.13	***31***	***140***	***6.3***	2	***11***	<1
	24-hour	0.17	***0.44***	***0.017***	***6.3***	***32***	***1.7***	2	***9***	<1
	Annual	1.4×10^{-3}	***5.3×10^{-3}***	1.2×10^{-4}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.062	0.16	***6.1×10^{-3}***	***9.1***	***20***	***0.95***	***6***	***13***	<1
	Annual	5.0×10^{-4}	1.9×10^{-3}	4.6×10^{-5}	***0.39***	***1.3***	0.043	<1	***3***	<1
Lead	Quarterly	1.1×10^{-7}	3.5×10^{-7}	1.0×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Closure to Landfill Standards										
Carbon monoxide	1-hour	5.5	16	1.3	***230***	***350***	***10***	<1	***<1***	<1
	8-hour	2.2	5.8	0.22	***46***	***74***	***3.7***	<1	<1	<1
Nitrogen dioxide	Annual	5.4×10^{-3}	0.021	4.9×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.57	1.3	***0.092***	***31***	***140***	***6.3***	2	***11***	<1
	24-hour	0.12	0.31	***0.012***	***6.2***	***32***	***1.7***	***2***	***9***	<1
	Annual	***9.7×10^{-4}***	***3.7×10^{-3}***	8.8×10^{-5}	***0.26***	***4.5***	***0.07***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.044	0.11	4.3×10^{-3}	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	3.5×10^{-4}	1.4×10^{-3}	3.2×10^{-5}	***0.39***	***1.3***	0.043	<1	***3***	<1
Lead	Quarterly	7.5×10^{-8}	2.5×10^{-7}	7.2×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Performance-Based Closure with Class A or C Grout Disposal										
Carbon monoxide	1-hour	4.8	14	1.1	***220***	***340***	***10***	<1	***<1***	<1
	8-hour	1.9	5.1	0.20	***46***	***73***	***3.7***	<1	<1	<1
Nitrogen dioxide	Annual	***4.7×10^{-3}***	0.018	4.3×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.50	1.2	0.080	***31***	***140***	***6.3***	2	***11***	<1
	24-hour	0.11	0.27	0.010	***6.2***	***32***	***1.7***	***2***	***9***	<1
	Annual	8.5×10^{-4}	***0***	7.8×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	***0.039***	0.10	***3.8×10^{-3}***	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	3.1×10^{-4}	***1.2×10^{-3}***	2.8×10^{-5}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	6.6×10^{-8}	2.2×10^{-7}	6.3×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

Table C.2-28. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
	Averaging time	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Bin Set Closure Scenarios Clean Closure										
Carbon monoxide	1-hour	1.9	5.4	0.45	***220***	***340***	***8.9***	<1	***<1***	<1
	8-hour	0.77	2.0	***0.078***	***45***	***70***	***3.6***	<1	<1	<1
Nitrogen dioxide	Annual	***1.9×10^{-3}***	***7.2×10^{-3}***	1.7×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.20	0.47	***0.032***	***30***	***140***	***6.2***	2	***11***	<1
	24-hour	0.040	0.11	***4.1×10^{-3}***	***6.1***	***32***	***1.7***	***2***	***9***	<1
	Annual	3.4×10^{-4}	***1.3×10^{-3}***	3.1×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	***0.020***	0.040	1.5×10^{-3}	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	1.2×10^{-4}	4.8×10^{-4}	1.1×10^{-5}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	2.6×10^{-8}	8.6×10^{-8}	2.5×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Performance Based Closure										
Carbon monoxide	1-hour	1.6	4.7	0.38	***220***	***330***	***8.9***	<1	***<1***	<1
	8-hour	0.66	1.7	***0.067***	***45***	***70***	***3.6***	<1	<1	<1
Nitrogen dioxide	Annual	1.6×10^{-3}	***6.2×10^{-3}***	1.5×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.17	0.40	0.028	***30***	***140***	***6.2***	2	***11***	<1
	24-hour	0.036	0.093	3.5×10^{-3}	***6.1***	***32***	***1.7***	***2***	***9***	<1
	Annual	2.9×10^{-4}	***1.1×10^{-3}***	2.6×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.013	0.034	1.3×10^{-3}	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	1.1×10^{-4}	4.1×10^{-4}	9.7×10^{-6}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	2.3×10^{-8}	7.4×10^{-8}	2.2×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Closure to Landfill Standards										
Carbon monoxide	1-hour	1.6	4.7	0.38	***220***	***330***	***8.9***	<1	***<1***	<1
	8-hour	0.66	1.7	0.067	***45***	***70***	***3.6***	<1	<1	<1
Nitrogen dioxide	Annual	1.6×10^{-3}	***6.2×10^{-3}***	1.5×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.17	0.40	0.028	***30***	***140***	***6.2***	2	***11***	<1
	24-hour	0.036	0.093	3.5×10^{-3}	***6.1***	***32***	***1.7***	***2***	***9***	<1
	Annual	2.9×10^{-4}	***1.1×10^{-3}***	2.6×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.013	0.034	1.3×10^{-3}	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	1.1×10^{-4}	4.1×10^{-4}	9.7×10^{-6}	***0.39***	***1.3***	0.043	<1	***3***	<1
Lead	Quarterly	2.3×10^{-8}	7.4×10^{-8}	2.2×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

Table C.2-28. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
	Averaging time	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Performance-Based Closure with Class A or C Grout Disposal										
Carbon monoxide	1-hour	2.5	7.0	***0.58***	***220***	***340***	***9.1***	<1	***<1***	<1
	8-hour	1.0	2.6	0.10	***45***	***71***	***3.6***	<1	<1	<1
Nitrogen dioxide	Annual	2.0×10^{-3}	9.0×10^{-3}	2.2×10^{-4}	***1.0***	***2.2***	***0.084***	***1***	***2***	<1
Sulfur dioxide	3-hour	0.25	0.60	***0.041***	***30***	***140***	***6.2***	2	***11***	<1
	24-hour	***0.054***	0.14	***5.3×10^{-3}***	***6.2***	***32***	***1.7***	***2***	***9***	<1
	Annual	4.4×10^{-4}	***1.7×10^{-3}***	4.0×10^{-5}	***0.26***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.020	***0.051***	***1.9×10^{-3}***	***9.0***	***20***	***0.94***	***6***	***13***	<1
	Annual	1.6×10^{-4}	6.1×10^{-4}	1.5×10^{-5}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	3.4×10^{-8}	1.1×10^{-7}	3.2×10^{-9}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.

b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)

c. Values do not include contributions of fugitive dust.

Table C.2-29. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations from Tank Farm and bin set closure scenarios.

	Highest percentage of applicable standard[a,b]							
	Tank Farm				Bin sets			
Case	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal
Carcinogens[c]								
INEEL boundary areas	0.19	0.037	0.026	0.023	9.2×10^{-3}	7.9×10^{-3}	7.9×10^{-3}	0.012
Craters of the Moon	0.017	3.4×10^{-3}	2.4×10^{-3}	2.1×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	1.1×10^{-3}
INEEL facility area location[d]	1.9	0.37	0.26	0.23	0.092	0.079	0.079	0.12
Noncarcinogens[c]								
INEEL boundary areas	0.015	2.9×10^{-3}	2.1×10^{-3}	1.8×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$
Craters of the Moon	1.4×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$
Public road locations	0.038	7.6×10^{-3}	5.4×10^{-3}	4.7×10^{-3}	1.9×10^{-3}	1.6×10^{-3}	1.6×10^{-3}	2.4×10^{-3}
INEEL facility area location[d]	1.4	0.28	0.20	0.17	0.069	0.059	0.059	0.089

a. Applicable ambient air standards are specified in ***IDEQ (2001)*** for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; they are used here as reference values for purposes of comparison.

b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.

c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.

d. Location of highest onsite impacts is within INTEC.

Table C.2-30. Summary of nonradiological air pollutant emissions estimates for disposition of other existing INTEC facilities associated with HLW management.

			Annual and cumulative project emissions[a]							
			Criteria pollutants[d]		Toxic air pollutants		Carbon dioxide[e]		Fugitive dust	
Facility group	Closure method[b]	Duration (years)[c]	Tons/yr	Tons	Lb/yr	Lb	Tons/yr	Tons	Tons/yr	Tons
Tank Farm Related Facilities										
Waste Storage Control House (CPP-619)	Landfill	6	13	78	***15***	***87***	260	1.6×10^3	-	-
Waste Storage Control House (CPP-628)	Landfill	6	13	78	***15***	***87***	260	1.6×10^3	0.72	4.3
Waste /Station Tank Transfer Bldg. (CPP-638)	Landfill	2	13	26	15	***29***	260	520	-	-
Instrument House (CPP-712)	Landfill	6	13	78	***15***	***87***	260	1.6×10^3	-	-
STR Waste Storage Tanks (CPP-717)	Landfill	6	13	78	***15***	***87***	260	1.6×10^3	-	-
Total			65	***340***	***73***	***380***	1.3×10^3	***6.7×10^3***	0.72	4.3
Bin Set Related Facilities										
Instrument Bldg. for bin set 1 (CPP-639)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 2 (CPP-646)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 3 (CPP-647)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 4 (CPP-658)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 5 (CPP-671)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Instrument Bldg. for bin set 6 (CPP-673)	Landfill	6	75	450	84	500	1.6×10^3	9.3×10^3	-	-
Total			450	2.7×10^3	500	3.0×10^3	9.3×10^3	5.6×10^4	-	-
Process Equipment Waste Evaporator and Related Facilities										
Liquid Effluent Treat. & Disp. Bldg. (CPP-1618)	Clean	6	75	450	84	500	1.5×10^3	9.0×10^3	4.3	26
Waste Holdup Pumphouse (CPP-641)	Clean	2	13	26	15	29	260	520	-	-
PEW Evaporator Bldg. (CPP-604)	Landfill	6	33	200	37	220	660	4.0×10^3	16	96
Atmospheric Protection Bldg. (CPP-649)	Landfill	6	75	450	84	500	1.5×10^3	9.0×10^3	3.3	20
Pre-Filter Bldg. (CPP-756)	Landfill	6	75	450	84	500	1.5×10^3	9.0×10^3	4.3	26
Blower Bldg. (CPP-605)	Landfill	6	75	450	84	500	1.5×10^3	9.0×10^3	3.3	20
Main Exhaust Stack (CPP-708)	Landfill	6	75	450	84	500	1.5×10^3	9.0×10^3	35	210
PEW Equip. Waste and Cell Floor Drain Lines	Landfill	1	9	9	10	10	180	180	-	-
PEW Condensate Lines	Landfill	1	9	9	10	10	180	180	-	-
Total			***440***	2.5×10^3	***490***	2.8×10^3	***8.8×10^3***	***5.0×10^4***	66	390
Fuel Processing Building and Related Facilities[b]										
Fuel Processing Building (CPP-601)	Perf.-Based or Landfill	10	50	500	56	560	1.0×10^3	1.0×10^4	49	490
Remote Analytical Facility Building (CPP-627)	Perf.-Based or Landfill	10	50	500	56	560	1.0×10^3	1.0×10^4	10	100
Head End Process Plant (CPP-640)	Perf.-Based or Landfill	10	50	500	56	560	1.0×10^3	1.0×10^4	12	120
Total			150	1.5×10^3	170	1.7×10^3	3.0×10^3	3.0×10^4	71	710

Table C.2-*30*. Summary of nonradiological air pollutant emissions estimates for disposition of other existing INTEC facilities associated with HLW management (continued).

			Annual and cumulative project emissions[a]							
			Criteria pollutants[d]		Toxic air pollutants		Carbon dioxide[e]		Fugitive dust	
Facility group	Closure method[b]	Duration (years)[c]	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/year)	(tons)
Fluorinel and Storage Facility and Related Facilities										
FAST Facility and Stack	- [f]	6	50	300	56	340	1.0×10^3	6.0×10^3	***120***	690
Transport Lines Group										
Process Off-Gas Lines	Perf.-Based	1	9.0	9.0	10	10	190	190	2.9	2.9
Process (Dissolver) Transport Lines	Perf.-Based	1	9.0	9.0	10	10	190	190	1.4	1.4
High-Level Liquid Waste (Raffinate) Lines	Landfill	1	9.0	9.0	10	10	190	190	1.4	1.4
Calcine Solids Transport Lines	Landfill	1	9.0	9.0	10	10	190	190	1.4	1.4
Total			36	36	40	40	750	750	7.2	7.2
New Waste Calcining Facility[b,g]										
New Waste Calcining Facility	Perf.-Based or Landfill	3	50	150	56	170	1.0×10^3	3.1×10^3	6.3	190
Remote Analytical Laboratory										
Remote Analytical Laboratory (CPP-684)	Perf.-Based	6	33	200	37	220	680	4.1×10^3	8.6	52

a. Annual emissions represent the highest emission rate for any single year and is the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions are the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

b. See Table 3-***3*** for facility disposition alternatives that apply to each group. The Fuel Processing Building and Related Facilities and the New Waste Calcining Facility could be dispositioned by either performance-based closure or closure to landfill standards. Individual facilities within all other groups would be dispositioned according to a single closure method.

c. Duration refers to total number of calendar years during which dispositioning of facilities within the listed groups would occur.

d. The specific pollutants and approximate relative percentages are as follows: carbon monoxide – 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

e. Carbon dioxide is listed because this gas has been implicated in global warming.

f. Project includes deactivation and demolition of the Fluorinel Dissolution Process and Fuel Storage (FAST) building (CPP-666) and the associated stack (CPP-767). The FAST building would be closed according to performance-based closure criteria and the stack by clean closure. Emissions listed are totals from closure of both facilities.

g. The decontamination and decommissioning of this facility is also included in some of the waste processing alternatives.

Table C.2-31. Maximum criteria pollutant impacts from disposition of other existing INTEC facilities associated with HLW management.

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
		Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
					Tank Farm Related Facilities					
Carbon monoxide	1-hour	59	170	14	***280***	***500***	***22***	<1	1	<1
	8-hour	24	62	2.4	***68***	130	***5.9***	***<1***	1	<1
Nitrogen dioxide	Annual	0.058	0.22	5.3×10^{-3}	***1.1***	***2.4***	***0.089***	***1***	***2***	<1
Sulfur dioxide	3-hour	6.1	14	1.0	***36***	***150***	***7.2***	***3***	***12***	<1
	24-hour	1.3	3.4	0.13	***7.4***	***35***	***1.8***	2	***10***	<1
	Annual	0.010	0.040	***9.5×10^{-4}***	***0.27***	***4.5***	***0.071***	<1	***6***	<1
Respirable particulates[c]	24-hour	***0.47***	1.2	0.050	***9.5***	***21***	1.0	***6***	***14***	<1
	Annual	***3.8×10^{-3}***	0.015	3.5×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	8.2×10^{-7}	2.7×10^{-6}	7.8×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
					Bin Set Related Facilities					
Carbon monoxide	1-hour	410	1.2×10^{3}	96	***630***	***1.5×10^{3}***	***100***	2	4	<1
	8-hour	170	430	17	***210***	***500***	***20***	2	5	<1
Nitrogen dioxide	Annual	0.40	1.5	0.037	***1.4***	***3.7***	***0.12***	***1***	***4***	<1
Sulfur dioxide	3-hour	42	100	6.9	***72***	***240***	***13***	***6***	***18***	***1***
	24-hour	8.9	23	0.88	***15***	***55***	***2.6***	4	***15***	<1
	Annual	0.073	0.28	6.6×10^{-3}	***0.33***	***4.8***	***0.077***	<1	***6***	<1
Respirable particulates[c]	24-hour	3.3	8.5	0.32	***12***	***29***	1.3	***8***	***19***	<1
	Annual	0.027	0.10	2.4×10^{-3}	***0.42***	***1.4***	***0.045***	***<1***	***3***	<1
Lead	Quarterly	5.6×10^{-6}	1.8×10^{-5}	5.4×10^{-7}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
					Process Equipment Waste Evaporator and Related Facilities					
Carbon monoxide	1-hour	***400***	1.1×10^{3}	***94***	***620***	1.5×10^{3}	100	***2***	4	<1
	8-hour	***160***	***420***	16	***210***	***490***	20	2	5	<1
Nitrogen dioxide	Annual	***0.39***	***1.5***	***0.036***	***1.4***	***3.7***	***0.12***	***1***	***4***	<1
Sulfur dioxide	3-hour	***42***	***98***	***6.7***	***72***	***240***	***13***	***6***	***18***	<1
	24-hour	***8.7***	***23***	***0.86***	***15***	***55***	***2.6***	4	***15***	<1
	Annual	***0.071***	***0.27***	***6.5×10^{-3}***	***0.33***	***4.8***	***0.076***	<1	***6***	<1
Respirable particulates[c]	24-hour	***3.2***	***8.4***	***0.32***	***12***	***28***	1.3	***8***	***19***	<1
	Annual	***0.026***	0.10	***2.4×10^{-3}***	***0.42***	***1.4***	***0.045***	***<1***	***3***	<1
Lead	Quarterly	***5.5×10^{-6}***	***1.8×10^{-5}***	***5.3×10^{-7}***	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	***0***	<1
					Fuel Processing Building and Related Facilities					
Carbon monoxide	1-hour	140	390	32	***360***	***720***	***41***	<1	2	<1
	8-hour	55	140	5.6	***99***	210	***9.1***	***<1***	2	<1
Nitrogen dioxide	Annual	0.13	0.52	0.01	***1.1***	***2.7***	***0.10***	***1***	***3***	<1
Sulfur dioxide	3-hour	14	33	2.3	***44***	***170***	***8.5***	3	***13***	<1
	24-hour	3.0	7.8	0.29	***9.1***	***40***	***2.0***	2	***11***	<1
	Annual	0.020	0.090	2.0×10^{-3}	***0.28***	***4.6***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	1.1	2.8	0.11	***10***	***23***	***1.0***	***7***	***15***	<1
	Annual	9.0×10^{-3}	0.030	8.1×10^{-4}	***0.40***	***1.3***	***0.044***	<1	***3***	<1
Lead	Quarterly	1.9×10^{-6}	6.1×10^{-6}	1.8×10^{-7}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

Table C.2-31. Maximum criteria pollutant impacts from disposition of other existing INTEC facilities associated with HLW management (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
FAST and Related Facilities										
Carbon monoxide	1-hour	46	130	11	***270***	***460***	***19***	<1	1	<1
	8-hour	18	48	1.9	***62***	***120***	***5.4***	<1	1	<1
Nitrogen dioxide	Annual	0.040	0.17	4.0×10^{-3}	***1.0***	***2.4***	***0.088***	***1***	***2***	<1
Sulfur dioxide	3-hour	4.7	11	0.76	***35***	***150***	***7.0***	***3***	***12***	<1
	24-hour	1.0	2.6	0.10	***7.1***	***35***	***1.8***	2	***9***	<1
	Annual	8.0×10^{-3}	0.030	7.3×10^{-4}	***0.27***	***4.5***	***0.071***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.36	0.95	0.04	***9***	***21***	1.0	***6***	***14***	<1
	Annual	3.0×10^{-3}	0.010	2.7×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	6.3×10^{-7}	2.0×10^{-6}	6.0×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
Transport Line Group										
Carbon monoxide	1-hour	33	93	7.7	***250***	***420***	***16***	<1	1	<1
	8-hour	13	35	1.3	***57***	100	***4.8***	<1	1	<1
Nitrogen dioxide	Annual	0.030	0.12	3.0×10^{-3}	***1.0***	***2.3***	***0.087***	***1***	***2***	<1
Sulfur dioxide	3-hour	3.4	8.0	0.55	***33***	***150***	***6.8***	***3***	***12***	<1
	24-hour	0.72	1.9	0.07	***6.8***	***34***	***1.8***	2	***9***	<1
	Annual	6.0×10^{-3}	0.020	5.3×10^{-4}	***0.27***	***4.5***	***0.071***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.26	0.68	0.030	***9***	***21***	1.0	***6***	***14***	<1
	Annual	2.0×10^{-3}	8.0×10^{-3}	1.9×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	4.5×10^{-7}	1.5×10^{-6}	4.3×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1
New Waste Calcining Facility										
Carbon monoxide	1-hour	46	130	11	***270***	***460***	***19***	<1	1	<1
	8-hour	18	48	1.9	***62***	***120***	***5.4***	<1	1	<1
Nitrogen dioxide	Annual	0.045	0.17	4.0×10^{-3}	***1.0***	***2.4***	***0.088***	***1***	***2***	<1
Sulfur dioxide	3-hour	4.7	11	0.76	***35***	***150***	***7.0***	***3***	***12***	<1
	24-hour	1.0	2.6	0.10	***7.1***	***35***	***1.8***	2	***9***	<1
	Annual	8.0×10^{-3}	0.030	7.3×10^{-4}	***0.27***	***4.5***	***0.071***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.36	0.95	0.036	***9.4***	***21***	***0.98***	***6***	***14***	<1
	Annual	3.0×10^{-3}	0.011	2.7×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	6.3×10^{-7}	2.0×10^{-6}	6.0×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

Table C.2-31. Maximum criteria pollutant impacts from disposition of other existing INTEC facilities associated with HLW management (continued).

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon	Site boundary	Public roads	Craters of the Moon
Remote Analytical Laboratory										
Carbon monoxide	1-hour	30	85	7.1	***250***	***420***	***16***	<1	1	<1
	8-hour	12	32	1.2	***56***	***100***	***4.7***	<1	***1***	<1
Nitrogen dioxide	Annual	0.030	0.11	3.0×10^{-3}	***1.0***	***2.3***	***0.087***	***1***	***2***	<1
Sulfur dioxide	3-hour	3.1	7.3	0.50	***33***	***150***	***6.7***	***3***	***12***	<1
	24-hour	0.7	1.7	0.060	***6.8***	***34***	***1.8***	2	***9***	<1
	Annual	5.0×10^{-3}	0.02	4.8×10^{-4}	***0.27***	***4.5***	***0.070***	<1	***6***	<1
Respirable particulates[c]	24-hour	0.24	0.60	0.020	***9.2***	***21***	1.0	***6***	***14***	<1
	Annual	2.0×10^{-3}	7.0×10^{-3}	1.8×10^{-4}	***0.39***	***1.3***	***0.043***	<1	***3***	<1
Lead	Quarterly	4.1×10^{-7}	1.4×10^{-6}	3.9×10^{-8}	***1.8×10^{-3}***	***5.6×10^{-3}***	***3.9×10^{-4}***	<1	<1	<1

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.

b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)

c. Values do not include contributions of fugitive dust.

Table C.2-32. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations from disposition of other existing INTEC facilities associated with HLW management.

Receptor	Highest percentage of applicable standard[a,b]							
	Tank Farm Related Facilities	Bin Set Related Facilities	PEW Evaporator and Related Facilities	Fuel Processing Building and Related Facilities	FAST and Related Facilities	Transport Lines Group	New Waste Calcining Facility	Remote Analytical Laboratory
Carcinogens[c]								
INEEL boundary areas	0.29	2.0	***1.9***	0.66	0.22	0.16	0.22	0.14
Craters of the Moon	0.026	0.18	***0.18***	0.060	0.020	0.014	0.020	0.013
INEEL facility area location[d]	2.8	20	***19***	6.6	2.2	1.6	2.2	1.4
Noncarcinogens[c]								
INEEL boundary areas	***0.022***	0.15	***0.15***	0.051	0.017	0.012	0.017	0.010
Craters of the Moon	2.2×10^{-3}	0.015	***0.015***	5.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	0.002	1.0×10^{-3}
Public road locations	0.058	0.40	***0.39***	0.13	0.045	0.032	0.045	0.029
INEEL facility area location[d]	***2.1***	15	***15***	4.9	1.6	1.2	1.6	1.1

a. Applicable ambient air standards are specified in ***IDEQ (2001)*** for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; they are used here as reference values for purposes of comparison.

b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.

c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.

d. Location of highest onsite impacts is within INTEC.

C.2.8 ADDITIONAL ANALYSES

DOE performed additional nonradiological impacts analyses for the State of Idaho's Preferred Alternative (the Direct Vitrification Alternative) using the CALPUFF model. The application of the CALPUFF model is described in Section C.2.3.3.

Prevention of Significant Deterioration - Figure C.2-2 illustrates the receptor "rings" used in the CALPUFF simulations for the Direct Vitrification Alternative. Six receptor rings (two for each Class I area) were evaluated. DOE used the CALPOST program to extract annual average concentrations of NO_2, SO_2, and PM-10, maximum 24-hour concentrations of SO_2 and PM-10, and 3-hour average concentrations of SO_2 at each receptor location in the model domain. It was conservatively assumed that all oxides of nitrogen were converted to NO_2. The maximum concentration determined for each receptor ring, regardless of direction, was selected for comparison with applicable PSD Class I increments. The maximum amount of 3-hour sulfur dioxide increment is consumed within Craters of the Moon; however, maximum consumption of other increments occurs in directions that do not correspond to Class I area locations.

Table C.2-33 presents the results for the CALPUFF simulations. All projected concentrations at INEEL road and boundary locations, Craters of the Moon Wilderness Area, and Yellowstone and Grand Teton National Parks are well within allowable increments.

The amount of increment consumed by the combined effects of the Direct Vitrification Alternative and existing INEEL sources subject to PSD regulation does not differ significantly between the two options. This is because increment consumption is dominated by existing sources that were included in the PSD baseline assessment (see Section 4.7).

Visibility Impairment Modeling Results - The CALPUFF simulation results for Craters of the Moon are presented in Table C.2-34. Under the Vitrification with Calcine Separations Option, the maximum 24-hour light extinction change slightly exceeds the 5-percent criterion for three days in a five-year period. There are no exceedances at Craters of the Moon under the Vitrification without Calcine Separations Option, nor are there any exceedances at Yellowstone or Grand Teton National Parks under either option.

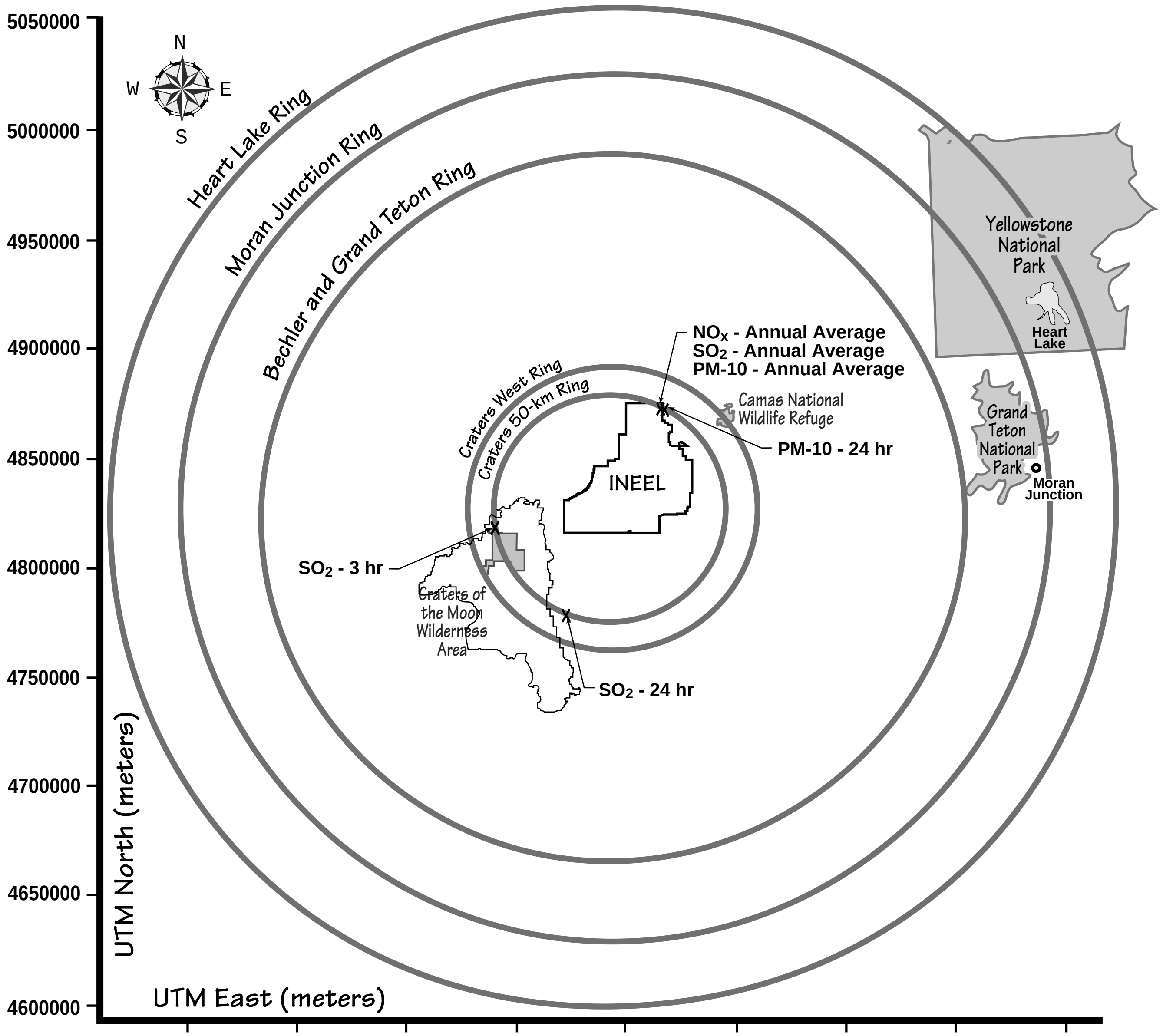

FIGURE C.2-2.
Model domain and polar receptor grid for the CALPUFF screening analysis of Class I Areas in the vicinity of INEEL (Direct Vitrification Alternative) where x denotes points of maximum impact.

Table C.2-33. Prevention of Significant Deterioration increment consumption at Class I Areas beyond 50 kilometers from INTEC for the combined effects of baseline sources and the Direct Vitrification Alternative.[a,b]

		Highest percentage of allowable PSD increment consumed	
	Averaging	Vitrification	
Pollutant	time	Without Calcine Separations	With Calcine Separations
Craters of the Moon[c]			
Sulfur dioxide	3-hour	28	29
	24-hour	40	45
	Annual	8.3	9.6
Particulate matter	24-hour	5.3	5.5
	Annual	0.72	0.75
Nitrogen dioxide	Annual	18	18
Yellowstone National Park			
Sulfur dioxide	3-hour	9.2	9.3
	24-hour	8.8	10
	Annual	1.0	1.2
Particulate matter	24-hour	1.7	1.7
	Annual	0.10	0.11
Nitrogen dioxide	Annual	0.87	0.88
Grand Teton National Park			
Sulfur dioxide	3-hour	8.9	9.0
	24-hour	8.8	10
	Annual	1.0	1.2
Particulate matter	24-hour	1.7	1.7
	Annual	0.10	0.11
Nitrogen dioxide	Annual	0.88	0.89

a. Source: Rood (2000b).
b. Assessed using CALPUFF.
c. Includes only that part of Craters of the Moon National Monument and Wilderness Area that is 50 kilometers or more from INTEC.
PSD = Prevention of Significant Deterioration.

Table C.2-34. Maximum calculated visibility impairment (light extinction change) at Craters of the Moon for the Direct Vitrification Alternative.[a]

	5-year analysis of light extinction change	
Option	Maximum 24-hour value (percent)	Number of days in excess of 5 percent acceptance criterion
Vitrification without Calcine Separations	1.1	0
Vitrification with Calcine Separations	6.7	3

a. Source: Rood (2000b). Performed using CALPUFF.

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Appendix C.3

Health and Safety

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Appendix C.3

Health and Safety

C.3.1 INTRODUCTION

Health and safety impacts to workers and the public can arise from various work-related activities associated with waste processing and facility disposition. Health impacts that were evaluated in this environmental impact statement (EIS) include those resulting from radiological and non-radiological activities and have been presented for the following three types of impacts:

- Radiological health impacts were evaluated for all radiological workers involved with waste processing and facility disposition based on the likelihood of developing a latent cancer fatality (LCF) from worker exposure to radiological air and surface contaminants. Radiological health impacts from facility emissions were also evaluated for the general public, maximally exposed individual, and noninvolved worker.

- Non-radiological health impacts were presented in terms of the hazard quotient for each type of carcinogenic and noncarcinogenic toxic air pollutant for all workers involved with waste processing and facility disposition activities and the public using estimated site boundary pollutant concentration levels.

- Occupational health and safety impacts were evaluated for all workers involved with waste processing and facility disposition activities based on historical injury and illness data at the Idaho National Engineering and Environmental Laboratory (INEEL).

These health impacts and the methodologies and results used to obtain them are presented in Sections 5.2.10 and 5.3.8 of this EIS. ***Groundwater impacts are not part of this appendix. They are addressed in Section 5.3.8.2 and Appendix C.9 of this EIS.***

C.3.2 RADIOLOGICAL HEALTH IMPACTS

For calculating worker radiological health impacts, Project Data Summaries and supporting Engineering Design Files (see Appendix C.6) were used as sources of information on the number of radiological workers and estimated average radiation dose per worker, and duration of each project within a specific option or alternative. Data were then used to determine the annual average collective dose (person-rem), the total project phase collective worker dose (person-rem), and the estimated increase in the number of LCFs from the total collective worker dose. The LCF value is calculated by multiplying the total collective worker dose by the appropriate dose-to-risk conversion factor based on the 1993 *Limitations of Exposure to Ionizing Radiation* (NCRP 1993). These risk factors are 0.0005 and 0.0004 LCFs per person-rem of radiation exposure to the general public and worker population, respectively. The factor for the population is slightly higher due to the presence of infants and children, ***who*** are more sensitive to radiation than the adult worker population. Data on worker radiological health impacts are presented separately for construction, operations, and disposition activities.

Radiological health impacts from facility emissions are presented for the maximally exposed offsite individual, the maximally exposed onsite worker, and the general public. Estimates of radiological dose are presented in Sections 5.2.6 and 5.3.4. These doses are then integrated for the duration of the project phase for each category above. LCF estimates are calculated for the population based on the total collective dose.

C.3.2.1 Waste Processing

Table C.3-1 provides radiological dose and LCFs during construction activities by project. Data are presented in terms of annual and integrated impacts to involved workers.

Table C.3-2 provides radiological dose and LCFs during operations activities by project. Data are presented in terms of annual and integrated impacts to involved workers.

Table C.3-1. Estimated radiological impacts during construction activities to involved workers by project.

Project	Description	***Radiation*** workers/ year[a]	***Construction*** time[a] (years)	Total workers	Collective dose[b] (person-rem)	Estimated increase in latent cancer fatalities[c]
No Action Alternative						
P1E	Bin Set 1 Calcine Transfer	21	***7***	***150***	***37***	***0.015***
Totals				***150***	***37***	***0.015***
Continued Current Operations Alternative						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	***48***	***5***	***240***	***60***	***0.024***
P1E	Bin Set 1 Calcine Transfer	21	***7***	***150***	***37***	***0.015***
Totals				***390***	***97***	***0.039***
Full Separations Option						
P59A	Calcine Retrieval and Transport	90	***6***	***540***	***140***	***0.054***
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	6	***24.75***	***150***	***37***	***0.015***
Totals				***690***	***170***	***0.069***
Planning Basis Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	***48***	***5***	***240***	***60***	***0.024***
P59A	Calcine Retrieval and Transport	90	***6***	***540***	***140***	***0.054***
Totals				***780***	***200***	***0.078***
Transuranic Separations Option						
P59A	Calcine Retrieval and Transport	90	***6***	***540***	***140***	***0.054***
P27	Class C Grout Disposal in a Low-Activity Waste Disposal Facility	6	***24.75***	***150***	***37***	***0.015***
Totals				***690***	***170***	***0.069***
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	***48***	***5***	***240***	***60***	***0.024***
P59A	Calcine Retrieval and Transport	90	***6***	***540***	***140***	***0.054***
Totals				***780***	***200***	***0.078***
Direct Cement Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	***48***	***5***	***240***	***60***	***0.024***
P59A	Calcine Retrieval and Transport	90	***6***	***540***	***140***	***0.054***
Totals				***780***	***200***	***0.078***
Early Vitrification Option						
P59A	Calcine Retrieval and Transport	90	***6***	***540***	***140***	***0.054***
Totals				***540***	***140***	***0.054***
Steam Reforming Option						
P59A	***Calcine Retrieval and Transport***	***90***	***6***	***540***	***140***	***0.054***
Totals				***540***	***140***	***0.054***
Minimum INEEL Processing Alternative						
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	6	***24.75***	***150***	***37***	***0.015***
P59A	Calcine Retrieval and Transport	90	***6***	***540***	***140***	***0.054***
Totals				***690***	***170***	***0.069***
Vitrification without Calcine Separations Option						
P59A	***Calcine Retrieval and Transport***	***90***	***6***	***540***	***140***	***0.054***
Totals				***540***	***140***	***0.054***
Vitrification with Calcine Separations Option						
P59A	***Calcine Retrieval and Transport***	***90***	***6***	***540***	***140***	***0.054***
Totals				***540***	***140***	***0.054***

a. Source: Project Data Sheets in Appendix C.6.

b. Based on INEEL statistics for construction workers of 0.25 rem per year.

c. Represents the number of latent cancer fatalities in addition to the baseline national cancer mortality rate. See text box, "Assessment of the Health Effects of Ionizing Radiation" in Section 5.2.9.

Table C.3-2. Estimated radiological impacts during operations to involved workers by project.

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
No Action Alternative						
P1D	No Action Alternative	42	***36***	***1.5×10^3***	***290***	***0.11***
P1E	Bin Set 1 Calcine Transfer	17	***1***	***17***	***3.2***	***1.3×10^{-3}***
P18MC	Remote Analytical Laboratory Operations	***10***	29	***290***	***55***	***0.022***
Totals				***1.8×10^3***	***350***	***0.14***
Continued Current Operations Alternative						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	6	580	110	***0.044***
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	21	1.3×10^3	240	***0.096***
P1E	Bin Set 1 Calcine Transfer	17	1	17	3.2	***1.3×10^{-3}***
P18MC	Remote Analytical Laboratory Operations	***10***	29	***290***	***55***	***0.022***
Totals				***2.1×10^3***	***410***	***0.16***
Full Separations Option						
P9A	Full Separations	30	21	630	120	***0.048***
P9B	Vitrification Plant	40	***20***	***800***	***150***	***0.061***
P9C	Class A Grout Plant	16	21	340	64	***0.026***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P24	Vitrified Product Interim Storage	5	***20***	***100***	***19***	***7.6×10^{-3}***
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	20	120	23	***9.1×10^{-3}***
P59A	Calcine Retrieval and Transport	10	***20***	***200***	***38***	***0.015***
P118	Separations Organic Incinerator	***8.5***	21	***180***	***34***	***0.014***
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	21	53	10	***4.0×10^{-3}***
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8	21	170	32	***0.013***
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				***4.1×10^3***	***780***	***0.31***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
Planning Basis Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	6	580	110	***0.044***
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	60	21	1.3×10^3	240	***0.096***
P59A	Calcine Retrieval and Transport	10	***16***	***160***	***30***	***0.012***
P23A	Full Separations	30	16	480	91	***0.036***
P23B	Vitrification Plant	40	15	600	110	***0.046***
P23C	Class A Grout Plant	16	16	260	49	***0.019***
P24	Interim Storage of Vitrified Waste	5	***20***	***100***	***19***	***7.6×10^{-3}***
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	20	120	23	***9.1×10^{-3}***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P118	Separations Organic Incinerator	***8.5***	16	***140***	***26***	***0.010***
P35***E***	Class A Grout Packaging and ***Loading for Offsite Disposal***	***8***	***16***	***130***	***24***	***9.7×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***33***	***21***	***690***	***130***	***0.053***
Totals				***5.1×10^3***	***980***	***0.39***
Transuranic Separations Option						
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P39A	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	2.5	***21***	***53***	***10***	***4.0×10^{-3}***
P49A	Transuranic/Class C Separations	50	21	1.1×10^3	200	0.080
P49C	Class C Grout Plant	16	21	340	64	***0.026***
P59A	Calcine Retrieval and Transport	10	21	210	40	***0.016***
P118	Separations Organic Incinerator	***8.5***	21	***180***	***34***	***0.014***
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	21	53	10	***4.0×10^{-3}***
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8.5	21	180	34	***0.014***
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				***3.6×10^3***	***680***	***0.27***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	6	580	110	***0.044***
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	21	1.3×10^3	240	***0.096***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P59A	Calcine Retrieval and Transport	10	21	210	40	***0.016***
P71	Mixing and Hot Isostatic Pressing	22	21	460	88	***0.035***
P72	Interim Storage of Hot Isostatic Pressed Waste	2.5	***21***	***53***	***10***	***4.0×10^{-3}***
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	2.5	20	50	9.5	***3.8×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				***4.1×10^3***	***790***	***0.31***
Direct Cement Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	6	580	110	***0.044***
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	21	1.3×10^3	240	***0.096***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P59A	Calcine Retrieval and Transport	10	21	210	40	***0.016***
P80	Direct Cement Process	93	21	2.0×10^3	370	0.15
P81	Unseparated Cementitious HLW Interim Storage	4.5	***21***	***95***	***18***	***7.2×10^{-3}***
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	2.5	20	50	9.5	***3.8×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				***5.7×10^3***	***1.1×10^3***	***0.43***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
			Early Vitrification Option			
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal	28	36	1.0×10^3	190	***0.077***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P59A	Calcine Retrieval and Transport	10	21	210	40	***0.016***
P61	Vitrified HLW Interim Storage	4.5	***21***	***95***	***18***	***7.2×10^{-3}***
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.5	20	50	9.5	***3.8×10^{-3}***
P88	Early Vitrification with Maximum Achievable Control Technology	39	21	820	160	***0.062***
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	2.5	***20***	***50***	***9.5***	***3.8×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***33***	***27***	***890***	***170***	***0.068***
Totals				***3.8×10^3***	***710***	***0.29***
			Steam Reforming Option			
P1C	***Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility***	***28***	***36***	***1.0×10^3***	***190***	***0.077***
P18MC	***Remote Analytical Laboratory Operation***	***10***	***29***	***290***	***55***	***0.022***
P59A	***Calcine Retrieval and Transport***	***10***	***20***	***200***	***38***	***0.015***
P117A	***Calcine Packaging and Loading to Hanford***	***44***	***24.25***	***1.1×10^3***	***200***	***0.081***
P2001	***NGLW Grout Facility***	***22***	***22.25***	***490***	***93***	***0.037***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***8***	***22.25***	***180***	***34***	***0.014***
P2002A	***Steam Reforming***	***40***	***2***	***80***	***15***	***6.1×10^{-3}***
Totals				***3.3×10^3***	***630***	***0.25***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
Minimum INEEL Processing Alternative						
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal	28	26	730	140	***0.055***
P18	New Analytical Laboratory	***30***	***21***	***630***	***120***	***0.048***
P24	Interim Storage of Vitrified Waste	5	***20***	***100***	***19***	***7.6×10^{-3}***
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	20	120	23	***9.1×10^{-3}***
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	21	53	10	***4.0×10^{-3}***
P111	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	33	***17***	***560***	***110***	***0.043***
P112A	Packaging and Loading Contact-Handled Transuranic (from SBW and Newly-Generated Liquid Waste Cesium Ion Exchange Grout Treatment) for Shipment to WIPP	2.5	***17***	***43***	***8.1***	***3.2×10^{-3}***
P59A	Calcine Retrieval and Transport	10	***15***	***150***	***29***	***0.011***
P117A	Calcine Packaging and Loading to Hanford	44	***15***	***660***	***130***	0.050
P133	***Waste Treatment Pilot Plant***	***33***	***17***	***560***	***110***	***0.043***
Totals				***3.6×10^{3}***	***690***	***0.27***

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project	Description	***Radiation*** workers/ year	Processing times (years)	***Total*** workers	Collective dose (person-rem)	Estimated increases in latent cancer fatalities
	Vitrification without Calcine Separations Option					
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	36	1.0×10^3	190	0.077
P18	New Analytical Laboratory	30	21	630	120	0.048
P59A	Calcine Retrieval and Transport	10	13.25	130	25	0.010
P61	Vitrified HLW Interim Storage	4.5	22.25	100	19	7.6×10^{-3}
P62A	Packaging and Loading Vitrified HLW for Shipment to NGR	2.5	20	50	10	3.8×10^{-3}
P88	Vitrification with Maximum Achievable Control Technology	39	13.25	520	98	0.039
P133	Waste Treatment Pilot Plant	33	6	200	38	0.015
Totals				2.6×10^3	500	0.20
	Vitrification with Calcine Separations Option					
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	36	1.0×10^3	190	0.077
P9A	Full Separations	30	13.25	400	76	0.030
P9C	Grout Plant	16	13.25	210	40	0.016
P18	New Analytical Laboratory	30	21	630	120	0.048
P24	Vitrified Product Interim Storage	5	20	100	19	7.6×10^{-3}
P25A	Packaging and Loading Vitrified HLW for Shipment to NGR	6	20	120	23	9.1×10^{-3}
P35E	Grout Packaging and Loading for Offsite Disposal	8	13.25	110	20	8.1×10^{-3}
P59A	Calcine Retrieval and Transport	10	13.25	130	25	0.010
P88	Vitrification with Maximum Achievable Control Technology	39	13.25	520	98	0.039
P133	Waste Treatment Pilot Plant	33	6	200	38	0.015
Totals				3.4×10^3	650	0.26

a. Project data from project data sheets are divided into two phases.

Radiological impacts from facility airborne emissions to the maximally exposed onsite and offsite individuals and general population within 50 miles of ***INTEC*** is based on worker and radiological dose data presented in Appendix C.2, Table C.2-***10***. Collective population ***dose*** from Table C.2-***10*** was multiplied by the dose-to-risk conversion factor of ***0.0005 LCFs per person-rem of radiation exposure to the general public*** to determine LCFs in Section 5.2.10.

C.3.2.2 Facility Disposition

Section C.3.4.2 discusses radiological impacts for the involved workers by project for the existing facilities during facility disposition activities.

C.3.3 NONRADIOLOGICAL HEALTH IMPACTS

For nonradiological health impacts from atmospheric releases, DOE used toxic air pollutant emissions data for each project under an alternative to estimate air concentrations at the INEEL site boundary. For the evaluation of occupational health effects, the modeled chemical concentration is compared with the applicable occupational standard that provides levels at which no adverse effects are expected, yielding a hazard quotient. The hazard quotient is a ratio between the calculated concentration in air and the applicable standard. For noncarcinogenic toxic air pollutants, if the hazard quotient is less than 1, then no adverse health effects would be expected. If the hazard quotient is greater than 1, additional investigation would be warranted. For carcinogenic toxic air pollutants, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen.

Section 5.2.10 presents the waste processing options with the maximum carcinogenic and noncarcinogenic pollutant maximum concentrations based on data from Appendix C.2, Table C.2-***14***. Table C.2-***14*** provides maximum pollutant concentrations by each of the projects within the waste processing options.

C.3.4 OCCUPATIONAL HEALTH AND SAFETY IMPACTS

Estimates of occupational illness and injury rates for workers involved with the waste processing alternatives are provided in terms of lost workdays and total recordable cases that would occur during a peak employment year and for the entire period of construction and operations for each of the alternatives. The lost workday values represent the number of workdays beyond the day of injury or onset of illness the employee was away from work or limited to restricted work activity because of an occupational injury or illness. The total recordable cases include work-related death, illness, or injury that resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

Historical total recordable cases and lost workday rates were obtained from the Computerized Accident/Incident Reporting System (CAIRS) database (***DOE 2001***) for ***INEEL*** construction and operations activities over a 5-year period ***from 1996-2000. Based on the available data, DOE concluded that the overall INEEL rates were representative of both construction and operations. These rates are 28.4 percent for lost workdays and 3.7 percent for total recordable cases. DOE lost workdays and total recordable cases rates have been trending downward. For example, in 2001, the INEEL rates were 15.4 percent and 2.3 percent for lost workdays and total recordable cases, respectively, compared to 23.0 and 2.3 percent for overall DOE rates.***

Section 5.2.10 provides estimates of annual and cumulative lost workdays and total recordable cases by alternative during construction and operations for the waste processing alternatives.

The following information is in support of the worker safety information provided in Section 5.2.10 and 5.3.8 for waste processing and facility disposition respectively:

C.3.4.1 Waste Processing

Tables C.3-3 and C.3-4 provide the number of peak-year and total workers and the lost workdays and total recordable cases by project during construction.

Tables C.3-5 and C.3-6 provide the number of peak-year and total workers and the lost workdays and total recordable cases by project during operations.

C.3.4.2 Facility Disposition

Table C.3-7 provides peak-year employment and worker safety data ***for disposition of new facilities*** by alternative. ***Alternative*** specific employment numbers are provided in Appendix C.1.

Table C.3-8 contains estimated radiological impacts and occupational worker data for ***disposition of*** existing facilities by project.

Table C.3-9 contains estimated radiological impacts to involved workers during disposition of new facilities.

Table C.3-10 contains estimated worker injury impacts during disposition activities of new facilities.

Table C.3-3. Worker safety during construction - peak year employment levels.

Project	Number of workers[a]	Lost workdays/year	Total recordable cases/year
No Action Alternative	21	***6.0***	***0.78***
Continued Current Operations Alternative	89	***25***	***3.3***
Separations Alternative			
Full Separations Option	850	***240***	32
Planning Basis Option	870	***250***	***32***
Transuranic Separations Option	680	***190***	***25***
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	360	***100***	***13***
Direct Cement Waste Option	400	***110***	15
Early Vitrification Option	330	***93***	***12***
Steam Reforming Option	***550***	***160***	***20***
Minimum INEEL Processing Alternative	200	***56***	***7.3***
Direct Vitrification Alternative			
Vitrification without Calcine Separations Option	***350***	***100***	***13***
Vitrification with Calcine Separations Option	***670***	***190***	***25***

a. For peak year employment levels, see Appendix C.1.

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative.

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
No Action Alternative							
P1E	Bin Set 1 Calcine Transfer	21	6.0	0.78	5	30	3.9
Continued Current Operations Alternative							
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	14	1.8	4	55	7.1
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	5.7	0.74	4	23	3.0
P1E	Bin Set 1 Calcine Transfer	21	6.0	0.78	5	30	3.9
Totals						110	14
Full Separations Option							
P9A	Full Separations	300	85	11	5	430	56
P9B	Vitrification Plant	280	80	10	5	400	52
P9C	Class A Grout Plant	160	45	5.9	2	91	12
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P24	Interim Storage of Vitrified Waste	110	31	4.1	3.8	120	15
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	78	22	2.9	7	160	20
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	22	6.2	0.81	4.2	26	3.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P118	Separations Organic Incinerator	10	2.8	0.37	3.3	9.4	1.2
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						1.5×10^3	190
Planning Basis Option							
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	14	1.8	4	55	7.1
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	5.7	0.74	4	23	3.0
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P23A	Full Separations	300	85	11	5	430	56
P23B	Vitrification Plant	280	80	10	5	400	52
P23C	Class A Grout Plant	160	45	5.9	5	230	30
P24	Interim Storage of Vitrified Waste	110	31	4.1	3.75	120	15

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
Planning Basis Option (continued)							
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P118	Separations Organic Incinerator	10	2.8	0.37	3.3	9.4	1.2
P35E	Grout Packaging and Loading for Offsite Disposal	22	6.2	0.81	4	25	3.3
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						1.5×10^3	200
Transuranic Separations Option							
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	78	22	2.9	7	160	20
P49A	Transuranic Waste /Class C Separations	300	85	11	5	430	56
P49C	Class C Grout Plant	200	57	7.4	5	280	37
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	22	6.2	0.81	4.2	26	3.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P118	Separations Organic Incinerator	10	2.8	0.37	3.3	9.4	1.2
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						1.1×10^3	150
Hot Isostatic Pressed Waste Option							
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	14	1.8	4	55	7.1
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	5.7	0.74	4	23	3.0
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
			Hot Isostatic Pressed Waste Option (continued)				
P71	Mixing and Hot Isostatic Pressing	100	28	3.7	4	110	15
P72	Interim Storage of Hot Isostatic Pressed Waste	92	26	3.4	3	78	10
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						520	67
			Direct Cement Waste Option				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	14	1.8	4	55	7.1
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	5.7	0.74	4	23	3.0
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P80	Direct Cement Process	130	37	4.8	4	150	19
P81	Unseparated Cementitious Waste Interim Storage	134	38	5.0	4	150	20
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Total						620	81
			Early Vitrification Option				
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P61	Vitrified HLW Interim Storage	110	31	4.1	4	130	16
P88	Early Vitrification Facility with Maximum Achievable Control Technology	110	31	4.1	5	160	20
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						530	69

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
Steam Reforming Option							
P13	New Storage Tanks	49	14	1.8	2.5	35	4.5
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P117A	Calcine Packaging and Loading	78	22	2.9	4	89	12
P2001	NGLW Grout Facility	50	14	1.9	4	57	7.4
P35E	Grout Packaging and Loading for Offsite Disposal	22	6.2	0.81	4	25	3.3
P2002A	Steam Reforming	295	84	11	5	420	55
Totals						770	100
Minimum INEEL Processing Alternative							
P18	New Analytical Laboratory	59	17	2.2	2	34	4.4
P24	Interim Storage of Vitrified Waste	110	31	4.1	3.8	120	15
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	78	22	2.9	7	160	20
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P111	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	20	5.7	0.74	3	17	2.2
P117A	Calcine Packaging and Loading to Hanford	78	22	2.9	4	89	12
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						620	81

- New Information -

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Construction time (years)	Total LWD	Total TRC
Vitrification without Calcine Separations Option							
P13	New Storage Tanks	49	14	1.8	2.5	35	4.5
P18	New Analytical Laboratory	59	17	2.2	4	67	8.7
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P61	Vitrified HLW Interim Storage	110	31	4.1	4	130	16
P88	Vitrification with Maximum Achievable Control Technology	120	34	4.4	8	270	36
P133	Waste Treatment Pilot Plant	63	18	2.3	4	72	9.3
Totals						710	93
Vitrification with Calcine Separations Option							
P9A	Full Separations	300	85	11	5	430	56
P9C	Grout Plant	160	45	5.9	2	91	12
P13	New Storage Tanks	49	14	1.8	2.5	35	4.5
P18	New Analytical Laboratory	59	17	2.2	4	67	8.7
P24	Vitrified Product Interim Storage	110	31	4.1	3.8	120	15
P35E	Grout Packaging and Loading for Offsite Disposal	22	6.2	0.81	4	25	3.3
P59A	Calcine Retrieval and Transport	100	28	3.7	5	140	19
P88	Vitrification with Maximum Achievable Control Technology	120	34	4.4	8	270	36
P133	Waste Treatment Pilot Plant	63	18	2.3	6	110	14
Totals						1.3×10^3	170

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a. LWD = lost workday. The number of workdays beyond the day of injury or onset of illness that the employee was away from work or limited to restricted work activity because of an occupational injury or illness.

b. TRC = total recordable case. A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

Table C.3-5. Worker safety during operations - peak year employment levels.

Project	Number of workers[a]	Lost workdays/year	Total recordable cases/year
No Action Alternative	***73***	***21***	***2.7***
Continued Current Operations Alternative	280	***79***	***10***
Separations Alternative			
Full Separations Option	440	***130***	***16***
Planning Basis Option	***480***	***140***	***18***
Transuranic Separations Option	320	***90***	***12***
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	460	***130***	***17***
Direct Cement Waste Option	530	***150***	***19***
Early Vitrification Option	330	***93***	***12***
Steam Reforming Option	***170***	***49***	***6.4***
Minimum INEEL Processing Alternative	330	***93***	***12***
Direct Vitrification Alternative			
Vitrification without Calcine Separations Option	***310***	***87***	***11***
Vitrification with Calcine Separations Option	***440***	***130***	***16***

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a. For peak year employment levels, see Appendix C.1.

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative.

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
		No Action Alternative					
P1D	No Action Alternative	62	18	2.3	17	300	39
P1E	Bin Set 1 Calcine Transfer	18	5.1	0.67	17	87	11
P4	Long-Term Storage of Calcine in Bin Sets	3	0.85	0.11	36	31	4.0
P18MC	Remote Analytical Laboratory Operations	52	15	1.9	29	430	56
Totals						850	110
		Continued Current Operations Alternative					
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	43	5.6	6	260	33
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	22	2.8	5	110	14
P1B(II)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	16	2.1	14	220	29
P1E	Bin Set 1 Calcine Transfer	18	5.1	0.67	17	87	11
P4	Long-Term Storage of Calcine in Bin Sets	3	0.85	0.11	36	31	4.0
P18MC	Remote Analytical Laboratory Operations	52	15	1.9	29	430	56
Totals						1.1×10^3	150
		Full Separations Option					
P9A	Full Separations	120	34	4.4	21	720	93
P9B	Vitrification Plant	90	26	3.3	18	460	60
P9C	Class A Grout Plant	38	11	1.4	21	230	30
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P24	Interim Storage of Vitrified Waste	6.5	1.8	0.24	36	67	8.7
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	7	2.0	0.26	20	40	5.2
P59A	Calcine Retrieval and Transport	11	3.1	0.41	20	63	8.1
P118	Separations Organic Incinerator	8.5	2.4	0.31	21	51	6.6
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	4.8	0.63	21	100	13
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	9.5	2.7	0.35	21	57	7.4
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						3.0×10^3	400

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
Planning Basis Option							
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	43	5.6	6	260	33
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	130	37	4.8	21	780	100
P59A	Calcine Retrieval and Transport	11	3.1	0.41	16	50	6.5
P23A	Full Separations	120	34	4.4	16	550	71
P23B	Vitrification Plant	90	26	3.3	15	380	50
P23C	Class A Grout Plant	38	11	1.4	16	170	23
P24	Interim Storage of Vitrified Waste	6.5	1.8	0.24	36	66	8.7
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	7	2.0	0.26	20	40	5.2
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P118	Separations Organic Incinerator	8.5	2.4	0.31	21	51	6.6
P35E	Grout Packaging and Loading for Offsite Disposal	8.5	2.4	0.31	23	56	7.2
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						3.7×10^3	480
Transuranic Separations Option							
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	4.8	0.63	21	100	13
P39A	Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant	6.5	1.8	0.24	19	35	4.6

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
Transuranic Separations Option (continued)							
P49A	Transuranic Waste/Class A Separations	84	24	3.1	21	500	65
P49C	Class C Grout Plant	40	11	1.5	21	240	31
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8.5	2.4	0.31	21	51	6.6
P59A	Calcine Retrieval and Transport	11	3.1	0.41	21	66	8.5
P118	Separations Organic Incinerator	8.5	2.4	0.31	21	51	6.6
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.3×10^3	300
Hot Isostatic Pressed Waste Option							
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	43	5.6	6	260	33
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	22	2.8	5	110	14
P1B(II)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	16	2.1	14	220	29
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P59A	Calcine Retrieval and Transport	11	3.1	0.41	21	66	8.5
P71	Mixing and Isostatic Pressing	78	22	2.9	21	470	61
P72	Interim Storage Isostatic Pressed Waste	6.5	1.8	0.24	36	67	8.7
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	6.5	1.8	0.24	20	37	4.8
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.5×10^3	320

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Direct Cement Waste Option				
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	43	5.6	6	260	33
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	22	2.8	5	110	14
P1B(II)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	16	2.1	14	220	29
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P59A	Calcine Retrieval and Transport	11	3.1	0.41	21	66	8.5
P80	Direct Cement Process	140	40	5.2	21	840	110
P81	Unseparated Cementitious HLW Interim Storage	6.5	1.8	0.24	34	63	8.2
P83A	Packaging & Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	11	3.1	0.41	20	62	8.1
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.9×10^3	380
			Early Vitrification Option				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	36	290	37
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P59A	Calcine Retrieval and Transport	11	3.1	0.41	21	66	8.5
P61	Vitrified HLW Interim Storage	6.5	1.8	0.24	36	67	8.7
P62A	Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository	6.5	1.8	0.24	20	37	4.8
P88	Early Vitrification with Maximum Achievable Control Technology	130	37	4.8	21	780	100
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	6.5	1.8	0.24	18	33	4.3
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.5×10^3	330

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Steam Reforming Option				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	36	290	37
P18MC	Remote Analytical Laboratory Operations	52	15	1.9	29	430	56
P59A	Calcine Retrieval and Transport	11	3.1	0.41	20	63	8.1
P117A	Calcine Packaging and Loading	48	14	1.8	25	340	44
P2001	NGLW Grout Facility	25	7.1	0.93	23	160	21
P35E	Grout Packaging and Loading for Offsite Disposal	8.5	2.4	0.31	23	56	7.2
P2002A	Steam Reforming	46	13	1.7	2	26	3.4
Totals						1.4×10^3	180
			Minimum INEEL Processing Alternative				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	26	210	27
P18	New Analytical Laboratory	100	28	3.7	34	970	130
P24	Interim Storage of Vitrified Waste	6.5	1.8	0.24	36	67	8.7
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	1.7	0.22	20	34	4.4
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	4.8	0.63	21	100	13
P59A	Calcine Retrieval and Transport	11	3.1	0.41	15	47	6.1
P111A	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	33	9.4	1.2	5	47	6.1

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
Minimum INEEL Processing Alternative (continued)							
P112A	Packaging and Loading Contact-Handled Transuranic Waste for Shipment to WIPP	18	5.1	0.67	15	77	10
P117A	Packaging and Loading Calcine to Hanford	48	14	1.8	15	200	27
P133	Waste Treatment Pilot Plant	39	11	1.4	27	300	39
Totals						2.0×10^3	270
Vitrification without Calcine Separations Option							
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	35	280	36
P18	New Analytical Laboratory	110	31	4.1	21	660	86
P59A	Calcine Retrieval and Transport	11	3.1	0.41	13	41	5.3
P61	Vitrified HLW Interim Storage	6.5	1.8	0.24	22	41	5.3
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6.5	1.8	0.24	20	37	4.8
P88	Vitrification with Maximum Achievable Control Technology	130	37	4.8	22	810	110
P133	Waste Treatment Pilot Plant	39	11	1.4	6	67	8.7
Totals						1.9×10^3	250

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total LWD	Total TRC
			Vitrification with Calcine Separations Option				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	8.0	1.0	35	280	36
P9A	Full Separations	120	34	4.4	13	440	58
P9C	Grout Plant	38	11	1.4	13	140	18
P18	New Analytical Laboratory	110	31	4.1	21	660	86
P24	Vitrified Product Interim Storage	6.5	1.8	0.24	22	41	5.3
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	7	2.0	0.26	20	40	5.2
P35E	Grout Packaging and Loading for Offsite Disposal	8.5	2.4	0.31	13	31	4.1
P59A	Calcine Retrieval and Transport	11	3.1	0.41	6.0	19	2.4
P88	Vitrification with Maximum Achievable Control Technology	130	37	4.8	22	810	110
P133	Waste Treatment Pilot Plant	39	11	1.4	6	67	8.7
Totals						2.5×10^3	330

a. LWD = lost workdays. The number of workdays beyond the day of injury or onset of illness that the employee was away from work or limited to restricted work activity because of an occupational injury or illness.

b. TRC = total recordable case. A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

c. Project data from project data sheets are divided into two phases.

Table C.3-7. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative.

Project	Dispositioning peak year employment levels		
	Number of workers[a]	Lost workdays/year	Total recordable cases/year
No Action Alternative	***0***	***0***	***0***
Continued Current Operations Alternative	***58***	***16***	***2.1***
Separations Alternative			
Full Separations Option	790	***220***	***29***
Planning Basis Option	***660***	***190***	***24***
Transuranic Separations Option	730	***210***	***27***
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	450	***130***	17
Direct Cement Waste Option	420	***120***	***15***
Early Vitrification Option	320	***91***	12
Steam Reforming Option	***280***	***79***	***10***
Minimum INEEL Processing Alternative	320	***92***	12
Direct Vitrification Alternative			
Vitrification without Calcine Separations Option	***340***	***97***	***13***
Vitrification with Calcine Separations Option	***710***	***200***	***26***

a. For peak year employment levels, see Appendix C.1.

Table C.3-8. Estimated radiological impacts for ***disposition of*** existing facilities by project.

Project	Radiological workers per year[a]	Annual collective dose (person-rem)[b]	Number of years	Total collective dose (person-rem)	***Increase in latent cancer fatalities***
Tank Farm					
Clean Closure	280	***70***	27	***1.9×10^{3}***	***0.76***
Performance-Based Closure	***20***	***5.0***	***21***	***110***	***0.042***
Closure to Landfill Standards	12	***3.0***	***17***	***51***	***0.020***
Performance-Based Closure with Class A Fill	***11***	***2.8***	***24***	***66***	***0.026***
Performance-Based Closure with Class C Fill	***11***	***2.8***	***24***	***66***	***0.026***
Tank Farm related facilities					
CPP-619	***0***	***0***	6	***0***	***0***
CPP-628	***0***	***0***	6	***0***	***0***
CPP-638	***0***	***0***	2	***0***	***0***
CPP-712	***0***	***0***	6	***0***	***0***
CPP-717	***1***	***0.25***	6	***1.5***	***6.0×10^{-4}***
Total				***1.5***	***6.0×10^{-4}***
Bin sets					
Clean Closure	58	***15***	***26***	***380***	***0.15***
Performance-Based Closure	***55***	***14***	***21***	***290***	***0.12***
Closure to Landfill Standards	27	***6.8***	21	***140***	***0.057***
Performance-Based Closure with Class A Fill	***47***	***12***	***17***	***200***	***0.080***
Performance-Based Closure with Class C Fill	***47***	***12***	***17***	***200***	***0.080***
Bin sets related facilities					
CPP-639	***0***	***0***	6	***0***	***0***
CPP-646	***0***	***0***	6	***0***	***0***
CPP-647	***0***	***0***	6	***0***	***0***
CPP-658	***0***	***0***	6	***0***	***0***
CPP-671	***0***	***0***	6	***0***	***0***
CPP-673	***0***	***0***	6	***0***	***0***
Total				***1.5***[c]	***6.0×10^{-4}***[c]

Table C.3-8. Estimated radiological impacts for ***disposition of*** existing facilities by project (continued).

Project	Radiological workers per year [a]	Annual collective dose (person-rem) [b]	Number of years	Total collective dose (person-rem)	***Increase in latent cancer fatalities***
Process Equipment Waste Evaporator and related facilities					
CPP-604	***25***	***6.3***	6	***38***	***0.015***
CPP-605	***1***	***0.25***	6	***1.5***	***6.0×10^{-4}***
CPP-641	***0***	***0***	***2***	***0***	***0***
CPP-649	1	0.25	6	1.5	***6.0×10^{-4}***
CPP-708	6	1.5	6	9.0	***3.6×10^{-3}***
CPP-756	***1***	***0.25***	6	***1.5***	***6.0×10^{-4}***
CPP-1618	***1***	***0.25***	6	***1.5***	***6.0×10^{-4}***
PEWE Condensate Lines	***2***	***0.50***	***1***	***0.5***	***2.0×10^{-4}***
PEWE Condensate Lines and Cell Floor Drain Lines	***2***	***0.50***	***1***	***0.5***	***2.0×10^{-4}***
Total				***54***	***0.021***
Fuel Processing Building and related facilities – Performance-Based Closure					
CPP-601	13	3.3	10	***33***	***0.013***
CPP-627	6	1.5	10	15	***6.0×10^{-3}***
CPP-640	6	1.5	10	15	***6.0×10^{-3}***
Total				***63***	***0.025***
Fuel Processing Building and related facilities – Closure to Landfill Standards					
CPP-601	10	2.5	10	***25***	***0.010***
CPP-627	***5***	1.3	10	***13***	***5.0×10^{-3}***
CPP-640	***5***	1.3	10	13	***5.0×10^{-3}***
Total				***50***	***0.020***
FAST and related facilities					
CPP-666	34	***8.5***	6	***51***	***0.020***
CPP-767	***34***	***8.5***	***6***	***51***	***0.020***
Total				***51*** [d]	***0.020*** [d]

Table C.3-8. Estimated radiological impacts for *disposition of* existing facilities by project (continued).

Project	Radiological workers per year [a]	Annual collective dose (person-rem) [b]	Number of years	Total collective dose (person-rem)	***Increase in latent cancer fatalities***
		Transport Lines Group			
Process Offgas Lines	***1***	***0.25***	***1***	***0.25***	1.0×10^{-4}
High-Level Liquid (Raffinate) Lines	***0***	***0***	***1***	***0***	***0***
Process (Dissolver) Transport Lines	***0***	***0***	***1***	***0***	***0***
Calcine Solids Transport Lines	***0***	***0***	***1***	***0***	***0***
Total				***0.25***	1.0×10^{-4}
		Other HLW facilities			
CPP-659					
Performance-Based Closure	35	8.8	***3***	***26***	***0.011***
Closure to Landfill Standards	32	8.0	***3***	***24***	9.6×10^{-3}
CPP-684	4	1.0	***3***	***3.0***	1.2×10^{-3}
Total				***29***[e]	***0.012***[e]

a. Workers per year of zero occurs when the annual average is much less than one or the workers are accounted for elsewhere.

b. Based on 250 millirem per worker per year.

c. Total is calculated assuming one worker over six years.

d. Disposition of FAST facilities would be accomplished by one project using 34 workers over 6 years. These buildings are listed separately because CPP-666 is Performance-Based Closure and CPP-707 is Clean Closure.

e. Total represents maximum option for CPP-659.

Table C.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities.[a,b,c]

Project Number	Description	Radiation workers/ year	Disposition time (years)	Total workers	Collective dose (person-rem)	Estimated increase in latent cancer fatalities
Continued Current Operations Alternative						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	7.4×10^{-3}
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	6.2×10^{-3}
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	3.6×10^{-3}
Totals				170	43	0.017
Full Separations Option						
P9A	Full Separations	100	3	310	77	0.031
P9B	Vitrification Plant	45	3	140	34	0.014
P9C	Class A Grout Plant	74	2.5	190	46	0.019
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P24	Vitrified Product Interim Storage	3	1.8	5.4	1.4	5.4×10^{-4}
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	88	2	180	44	0.018
P35D	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	20	2	40	10	4.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1.0	4.0×10^{-4}
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				1.1×10^{3}	270	0.11
Planning Basis Option						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	7.4×10^{-3}
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	6.2×10^{-3}
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	3.6×10^{-3}
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P23A	Full Separations	100	3	310	77	0.031
P23B	Vitrification Plant	49	2.8	140	34	0.014
P23C	Class A Grout Plant	67	2.8	190	47	0.019
P24	Vitrified Product Interim Storage	3	1.8	5.4	1.4	5.4×10^{-4}
P35E	Class A Grout Packaging and Shipping for Offsite Disposal	20	2	40	10	4.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1	4.0×10^{-4}
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				1.1×10^{3}	270	0.11

Table C.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities [a,b,c] (continued).

Project Number	Descrition	Radiation workers/ year	Disposition time (years)	Total workers	Collective dose (person-rem)	Estimated increase in latent cancer fatalities
Transuranic Separations Option						
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	49	2	98	25	9.8×10^{-3}
P49A	Transuranic/Class C Separations	81	3	240	61	0.024
P49C	Class C Grout Plant	64	2	130	32	0.013
P49D	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	41	2	82	21	8.2×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1	4.0×10^{-4}
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				770	190	0.077
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	7.4×10^{-3}
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	6.2×10^{-3}
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	3.6×10^{-3}
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P71	Mixing and Hot Isostatic Pressing	150	5	730	180	0.073
P72	Interim Storage of Hot Isostatic Pressed Waste	16	3	48	12	4.8×10^{-3}
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				1.2×10^{3}	290	0.12
Direct Cement Waste Option						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	7.4×10^{-3}
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	6.2×10^{-3}
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9.0	3.6×10^{-3}
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P80	Direct Cement Process	120	3	360	91	0.036
P81	Unseparated Cementitious HLW Interim Storage	88	1	88	22	8.8×10^{-3}
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				840	210	0.084

Table C.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities [a,b,c] (continued).

Project Number	Descrition	Radiation workers/ year	Disposition time (years)	Total workers	Collective dose (person-rem)	Estimated increase in latent cancer fatalities
Early Vitrification Option						
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P61	Vitrified Product Interim Storage	25	3	75	19	7.5×10^{-3}
P88	Early Vitrification Facility	78	5	390	98	0.039
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				680	170	0.068
Steam Reforming Option						
P13	New Storage Tanks	19	2	38	10	3.8×10^{-3}
P35E	Class A Grout Packaging and Loading for Offsite Disposal	20	2	40	10	4.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P117A	Calcine Packaging and Loading	33	3	99	25	0.010
P2001	NGLW Grout Facility	9	1	9	2	9.0×10^{-4}
P2002A	Steam Reforming Facility	45	1	45	11	4.5×10^{-3}
Totals				330	83	0.033
Minimum INEEL Processing Alternative						
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P24	Vitrified Product Interim Storage	3	1.8	5.4	1.4	5.4×10^{-4}
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	88	2	180	44	0.018
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout & LLW Grout	59	1	59	15	5.9×10^{-3}
P117A	Calcine Packaging and Loading	33	3	99	25	0.010
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				550	140	0.055
Vitrification without Calcine Separations Option						
P13	New Storage Tanks	15	2	30	7.5	3.0×10^{-3}
P18	New Analytical laboratory	30	2	60	15	6.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P61	Vitrified Product Interim Storage	25	3	75	19	7.5×10^{-3}
P88	Vitrification with MACT	78	5	390	98	0.039
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				710	180	0.071

Table C.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities [a,b,c] (continued).

Project number	Description	Radiation workers/ year	Disposition time (years)	Total workers	Collective dose (person-rem)	Estimated increase in latent cancer fatalities
Vitrification with Calcine Separations Option						
P9A	Full Separations	100	3	310	77	0.031
P9C	Grout Plant	74	2.5	190	46	0.019
P13	New Storage Tanks	15	2	30	7.5	3.0×10^{-3}
P18	New Analytical Laboratory	30	2	60	15	6.0×10^{-3}
P24	Vitrified Product Interim Storage	3	1.8	5.4	1.4	5.4×10^{-4}
P35E	Grout Packaging and Loading for Offsite Disposal	20	2	40	10	4.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P88	Vitrification with MACT	78	5	390	98	0.039
P133	Waste Treatment Pilot Plant	25	2	50	13	5.0×10^{-3}
Totals				1.2×10^{3}	290	0.12

a. Source: Data from Project Data Sheets in Appendix C.6.

b. Only includes projects with potential for radiation exposure during disposition.

c. The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.

d. For the New Waste Calcining Facility MACT Facility.

e. For the liquid waste storage tank.

CH TRU = contact-handled transuranic waste; CsIX = cesium ion exchange; LLW = low-level waste; MACT = maximum achievable control technology; NGLW = newly generated liquid waste; TRU = transuranic.

Table C.3-10. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative.[a]

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
Continued Current Operations Alternative						
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
Totals				250	70	9.2
Full Separations Option						
P9A	Full Separations	220	3	670	190	25
P9B	Vitrification Plant	72	3	220	61	8.0
P9C	Class A Grout Plant	120	2.5	300	85	11
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P35D	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.0×10^3	570	74
Planning Basis Option						
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P23A	Full Separations	220	3	660	190	24
P23B	Vitrification Plant	72	2.8	200	57	7.5
P23C	Class A Grout Plant	120	2.8	340	95	12
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P35E	Class A Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.0×10^3	570	74

Table C.3-10. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative[a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
	Transuranic Separations Option					
P18	New Analytical Laboratory	88	2	180	50	6.5
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P39A	Packaging and Loading TRU at INTEC for Shipment to the Waste Isolation Pilot Plant	7	1.5	11	3.0	0.39
P49A	Transuranic/Class C Separations	150	3	450	130	17
P49C	Class C Grout Plant	93	2	190	53	6.9
P49D	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	57	2	110	32	4.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.5×10^3	420	54
	Hot Isostatic Pressed Waste Option					
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P71	Mixing and Hot Isostatic Pressing	200	5	1.0×10^3	280	37
P72	Interim Storage of Hot Isostatic Pressed Waste	150	3	450	130	17
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	7	1	7	2.0	0.26
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.1×10^3	610	79
	Direct Cement Waste Option					
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.2
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P80	Direct Cement Process	160	3	480	140	11
P81	Unseparated Cementitious HLW Interim Storage	290	1	290	82	11
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	7	1	7	2.0	0.26
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.4×10^3	410	54

Table C.3-10. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative[a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
			Early Vitrification Option			
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P61	Unseparated Vitrified Product Interim Storage	250	3	750	210	28
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	10	3	30	8.5	1.1
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to Waste Isolation Pilot Plant	7	1.5	11	3.0	0.39
P88	Early Vitrification Facility	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.8×10^3	510	67
			Steam Reforming Option			
P13	New Storage Tanks	19	2	38	11	1.4
P35E	Class A Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P117A	Calcine Packaging and Loading	52	3	160	44	5.8
P2001	NGLW Grout Facility	16	1	16	4.5	0.59
P2002A	Steam Reforming Facility	72	1	72	20	2.7
Totals				500	140	19
			Minimum INEEL Processing Alternative			
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.19
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout & LLW Grout	100	1	100	28	3.7
P112A	Packaging and Loading Contact Handled TRU for Shipment to WIPP	7	4.5	32	8.9	1.2
P117A	Calcine Packaging and Loading	110	3	330	94	12
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.2×10^3	350	45

Table C.3-10. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative[a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
Vitrification without Calcine Separations Option						
P13	New Storage Tanks	19	2	38	11	1.4
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P61	Vitrified HLW Interim Storage	250	3	750	210	28
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	10	3	30	8.5	1.1
P88	Vitrification with MACT	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.8×10^3	520	68
Vitrification with Calcine Separations Option						
P9A	Full Separations	220	3	670	190	25
P9C	Grout Plant	120	2.5	300	85	11
P13	New Storage Tanks	19	2	38	11	1.4
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P35E	Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P88	Vitrification Facility with MACT	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.1×10^3	610	79

a. The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.

b. The number of workdays beyond the day of injury or onset of illness the employee was away from work or limited to restricted work activity because of an occupational injury or illness.

c. A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

d. For the New Waste Calcining Facility with Maximum Achievable Control Technology upgrades.

e. For the liquid waste storage tank.

CH TRU = contact-handled transuranic waste; CsIX = cesium ion exchange; FUETAP = formed under elevated temperature and process; HLW = high-level waste; LLW = low-level waste; MACT = maximum achievable control technology; NGLW = newly generated liquid waste; TRU = transuranic waste; WIPP = Waste Isolation Pilot Plant.

Appendix C.3 References

DOE (Department of Energy), 2001, Occupational Injury and Property Damage Summary, January-December 2001, available online http://tis-hq.eh.doe.gov/cairs/cairs/summary/oipds014/sum.html, accessed April 17, 2002.

NCRP (National Council on Radiation Protection and Measurements), 1993, *Limitations of Exposure to Ionizing Radiation*, Report Number 116, Washington, D.C.

Appendix C.4

Facility Accidents

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Facility Accidents

C.4.1 FACILITY OPERATIONAL ACCIDENTS FOR WASTE PROCESSING ALTERNATIVES

C.4.1.1 Introduction

C.4.1.1.1 *Purpose*

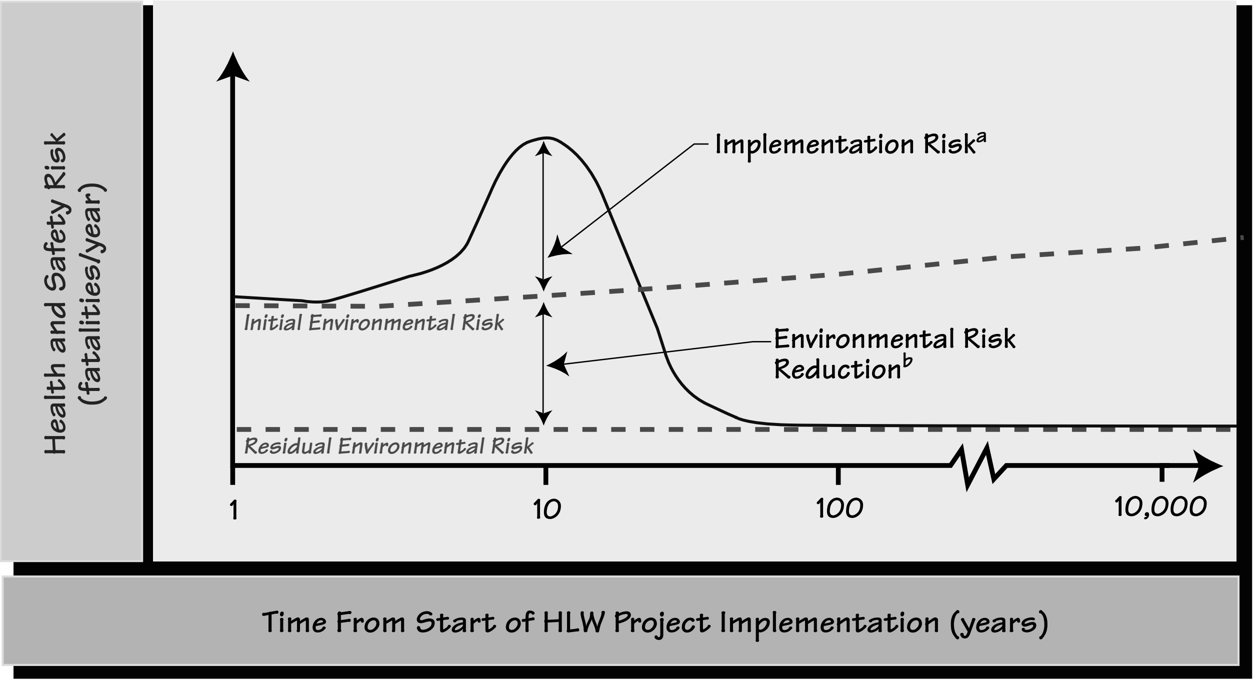
The purpose of Section C.4.1 is to present supporting analysis information for Section 5.2.14, Facility Accidents, including the three potential bounding accidents (abnormal events, design basis events, and beyond design basis events) for each of the waste processing alternatives. This appendix provides a descriptive interface between this environmental impact statement (EIS) and the technical analysis.

C.4.1.1.2 *Accident Analysis Definitions*

Accidents are unplanned, unexpected, and undesired events, or combinations of events, that can occur during or as a result of implementing an alternative and that have the potential to result in human health and environmental impacts. Human health effects could result from exposure to direct health impacts, such as exposure to fires or explosions, ionizing radiation, radiological or chemically hazardous releases, or combinations of these hazards. Environmental impacts include such effects as land use restrictions, ecological damage, and damage to or loss of natural resources. Facility accidents may provide a key discriminator among waste processing alternatives, particularly if the potential for accident impacts varies substantively for the different facilities and operations associated with the alternatives.

Environmental impacts are associated with existing environmental contamination or with materials that could constitute a hazard to humans or the ecology if released during an accident. The purpose of implementing any of the waste processing alternatives is to reduce existing impacts posed by calcine and mixed transuranic waste/sodium-bearing waste (referred to as mixed transuranic waste/SBW) in their present forms. In addition, the waste processing alternatives are associated with high-level waste (HLW) management facilities that may require eventual dispositioning. Reduction of environmental risk is accomplished by elimination or control of hazards associated with materials at a facility by removing them, rendering them immobile, or rendering them otherwise inaccessible to human or environmental contact. This constitutes a reduction in the potential for long-term exposures to the public or the environment. Existing hazards that would represent a risk to humans and the ecological environment, if they are not mitigated, may be thought of as the "risk of doing nothing." The effectiveness of environmental risk reduction is a discriminator among the potential waste processing alternatives.

During implementation, each of the waste processing alternatives temporarily adds risk to humans and the environment during the life of the project. This implementation risk is illustrated qualitatively in Figure C.4-1 as the potentially negative impact of a waste processing alternative (solid line). Implementation risk to humans is the sum of risk from facility accidents, transportation accidents, industrial accidents, and accrued occupational exposures during operations. Since the potential for facility accidents to contribute to implementation risk varies substantively for the different facilities and operations associated with waste processing alternatives, facility accidents may provide a key discriminator among the waste processing alternatives. Environmental risk is that risk associated with the existing condition that the waste processing alternative is intended to address (e.g., liquid waste stored long term in the below grade tanks). This risk is represented on Figure C.4-1 as both the initial environmental risk (upper dashed line) and the long-term residual environmental risk (lower dashed line). The impact of implementing the waste processing alternatives is to reduce the long-term environmental risk (difference between the upper and lower dashed lines) and the tradeoff, in a risk sense, is the acceptance of a short-term implementation risk versus a long-term environmental risk. In Figure C.4-1, human impacts (fatalities) are the primary focus since accidents with the



[a] Implementation Risk is that which results from the activities associated with implementing the waste processing alternative. Implementation Risk includes risk to involved workers, co-located workers, the public, and the environment. Implementation Risk is the sum of risk from facility accidents (i.e., release of radioactive and chemical materials), industrial accidents, and accrued occupational exposures during normal operations. Significant disparities in the expected Implementation Risk can be a discriminator among waste processing alternatives.

[b] Environmental Risk is associated with existing environmental contamination or with materials that could constitute a hazard to humans or the environment, if released. The purpose of the waste processing alternatives is the reduction of environmental risk associated with past processes at the Idaho Nuclear Technology and Engineering Center (INTEC) that resulted in accumulation of mixed HLW and related wastes. Environmental Risk Reduction involves removal of contamination or the hazards associated with materials at a facility by removing them, by rendering them immobile, or by otherwise rendering them inaccessible to human or environmental contact. The effectiveness of Environmental Risk Reduction is a potential discriminator among waste processing alternatives.

FIGURE C.4-1.
Conceptual relationship of implementation risk to environmental risk.

potential to have impacts on humans can be assumed to have a proportional impact on other life forms, including local flora and fauna.

Consequences of industrial accidents can involve fatalities, injuries, or illnesses. Fatalities can be prompt (immediate), such as in construction accidents, or latent (delayed), such as cancer caused from radiation exposure. While public comments received in scoping meetings for this EIS included concerns about potential accidents, the historical record shows the industrial accident rate for the U.S. Department of Energy (DOE) facilities at the Idaho National

Engineering and Environmental Laboratory (INEEL) is somewhat lower (Millet 1998) compared to the rate in the DOE complex overall. The historic accident rate also compares favorably to national average rates compiled for various industrial groups by the National Safety Council (NSC 1993) and Idaho averages compiled from state statistics (DOE 1993a).

One measure of the expected effectiveness of site management in controlling facility accident risks at future facilities is the effectiveness of current management in controlling risk to workers. The Computerized Accident Incident Reporting System database that chronicles injuries, accidents, and fatalities to workers at the INEEL can be used as a measure of management effectiveness in controlling the risk of fatal industrial accidents to involved and noninvolved workers. This assumption is based on the fact that control over all accidents in the workplace is a requirement for controlling fatal accidents. Historically at the INEEL, fatal accidents represent approximately 0.1 percent of all accidents.

Accident data is typically collected in terms of different types of activities. From the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS* (SNF & INEL EIS) (DOE 1995), the rate of injury/illness for construction activities in the DOE complex was 6.2/100 worker-years, and the rate of injury/illness for construction activities in private industry was 13/100 worker-years from 1988-1992. From 1993-1997, the rate of injury/illness for construction activities at the INEEL was 5.4 per 100 worker-years (Fong 1999). This data supports the conclusion that the injury/illness rate at the INEEL is slightly lower than DOE as a whole and significantly lower than private industry. The fatality rate from 1993-1997 was 0.05 per 100 worker-years which is higher than the previously reported fatality rate for the period 1988-1992 and is due to the occurrence of a fatality at the INEEL in 1996. An additional INEEL fatality occurred in 1998. Incorporating this 1998 fatality into the industrial accident rate using a Bayesian update results in a fatality rate of 0.14 per 100 worker-years, which is clearly greater than the fatality rate for the DOE complex as a whole. However, a comprehensive correction action effort is currently being implemented to control and reduce the industrial accident rate at the INEEL. Over the time period of this EIS it can be assumed that the fatality rate at the INEEL will be similar to or lower than that of the DOE complex as a whole.

Waste processing alternatives and options being considered in this EIS require an analysis of facility accidents as one of the impacts associated with implementation. The scope of the accident analysis is to evaluate, for each waste processing alternative, the potential for facility accidents that would not necessarily occur but which are reasonably foreseeable and could result in significant impacts (DOE 1993b). The accident analysis must be sufficiently comprehensive to inform the public and other stakeholders of possible impacts and tradeoffs among major waste processing alternatives. Although most safety assurance evaluations of facility accidents indicate that industrial accidents are the largest single contributor to the overall health and safety risk to workers associated with the implementation of an alternative, industrial accident risks are evaluated separately in this EIS and are not part of the scope of the accident analysis.

C.4.1.2 Methodology of the Facility Accidents

The accident analysis requires technical information that includes descriptions of potentially bounding accident scenarios, as well as the likelihood, source term, and predicted health impacts of each accident. The extensive number of activities associated with implementing each of the waste processing alternatives required development of a comprehensive technical basis for identifying and evaluating potentially bounding accidents.

The accident analysis was developed during the course of the EIS process to provide a basis for information used in the evaluation of facility accidents and facility disposition accidents. The Final EIS accident analysis contains the most recent technical information.

The scope of the accident analysis consists of a systematic review of treatment alternatives for the purpose of identifying potentially bounding accidents for each waste processing alternative.

The scope of the accident analysis does not include:

- Evaluation of facility accidents occurring at sites other than the INEEL
- Evaluation of accidents associated with transportation of radioactive or hazardous material, other than transportation within a site as part of facility operations

Evaluation of environmental impacts are focused on human rather than flora or fauna impacts. The accident analysis mainly evaluates air release inhalation pathways for impacts on potential receptors. Ingestion and groundwater pathways have not been evaluated systematically for all facility accident scenarios in the document. Early sensitivity evaluations of health impacts from these two pathways performed during the development of the Draft EIS identified groundwater health impacts as a minor health risk driver when compared to air release pathways. Accident scenarios that result in major groundwater releases (and not air releases) were evaluated in the accident analysis.

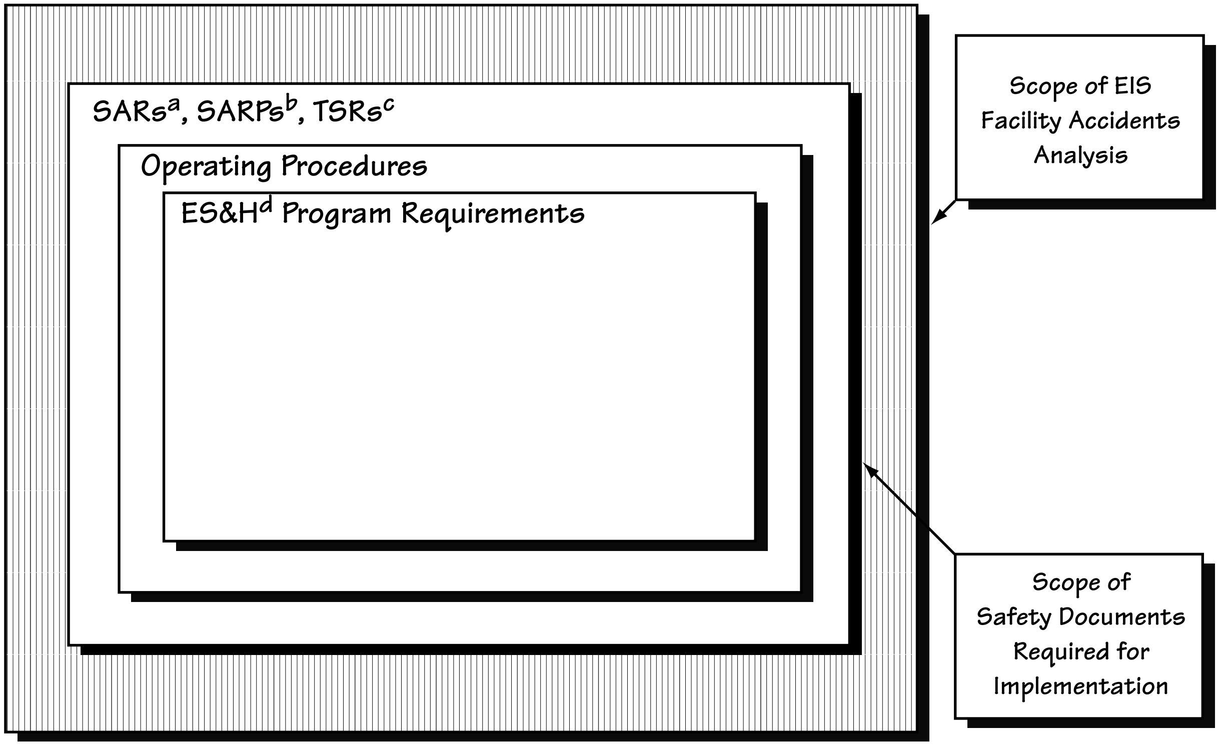
Since future facilities must be designed and operated to mitigate the risk of accidents, the accident analysis is intended to form a functional safety envelope for the safety assurance program for the waste processing alternative chosen for implementation. Subsequent programs such as the development of technical safety requirements, environmental safety and health programs, and safety analysis reports provide the protective features that ensure that safety is not compromised. The EIS facility accident analysis scope encompasses the limits of safety concerns for the future facilities needed to implement waste processing alternatives. At the time these facilities are designed, built, and operated, the safety documentation needed to maintain safety assurance at these facilities would use information in the accident analysis to bound concerns as well as to focus assessments and commitments. Safety analysis reports for packaging do not define new areas of concern but represent scenarios that are contained within the set of accidents outlined in this EIS. The EIS facility analysis scope as compared to future safety documentation is shown in Figure C.4-2.

The accident analysis provides input information to a consequence assessment that, in turn, provides estimated doses and health consequences to individuals and exposed populations. These results are presented in this appendix and Section 5.2.14. The relationship between the accident analysis and Sections 5.2.14 and 5.3.12 is shown in Figure C.4-3.

Source Term Identification

Radiological Releases - Most of the accidents analyzed in this EIS result in releases to the atmosphere. This is because air release accidents generally show the highest potential to result in health impacts. For non-criticality radiological releases, the source term is defined as the amount of respirable material released to the atmosphere from a specific location. The radiological source term for non-criticality events is dependent upon several factors including the material at risk, material form, initiator, operating conditions, and material composition. The technical approach described in DOE-STD-3010 (DOE 1994) is modified in the Safety Analysis and Risk Assessment Handbook (Peterson 1997) and was used to estimate source term for radioactive releases. This approach applies a set of release factors to the material at risk constituents to produce an estimated release inventory. The release inventory was combined with the conditions under which the release occurs and other environmental factors to produce the total material released for consequence estimation.

The potential for a criticality was assessed in each accident analysis evaluation. Only one reasonably foreseeable criticality accident scenario was identified in the accident analysis evaluations. An inadvertent criticality during transuranic waste shipping container-loading operations results from a vulnerability to loss of control over storage geometry. This scenario is identified under both the Transuranic Separations Option and the Minimum INEEL Processing Alternative. The frequency for this accident is estimated to be between once in a thousand years and once in a million years of facility operations. This event could result in a large dose to a nearby, unshielded maximally exposed worker that is estimated to be 218 rem, representing a 1 in 5 chance of a latent cancer



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☐	Since the facility accidents analysis includes information on process element hazards, material inventories at risk, accident initiators of concern, bounding accident descriptions, and source term assumptions, its scope also bounds the scope of other safety documentation that would be required for implementation of the waste processing alternative selected in the forthcoming Record of Decision.
▥	The scope of the EIS facility accidents analysis is intended to bound the potential realm of phenomena, hazards, and safety concerns that could impact the selection of waste processing alternatives. As such, the EIS scope includes sufficient information to assess hybrid waste processing alternatives as systems descriptions.

[a] Safety Analysis Reports

[b] Safety Analysis Reports for Packaging

[c] Technical Safety Requirements

[d] Environmental, Safety, and Health

FIGURE C.4-2.
Scope of EIS facility accidents analysis.

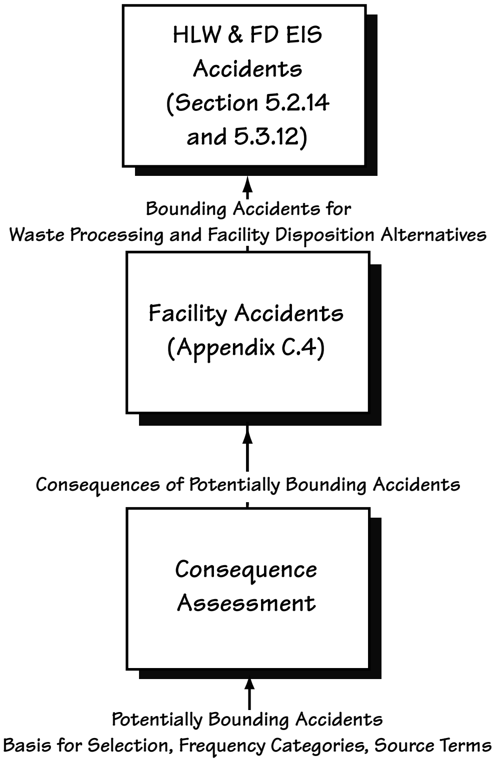


FIGURE C.4-3.
Facility Accidents Analysis relationship to sections of this EIS.

fatality. However, this same analysis estimates a dose to the maximally exposed offsite individual at the site boundary (15,900 meters down wind at the nearest public access) to be only 3 millirem, representing a 2 per million increase in cancer risk to the receptor.

Chemical Releases - Facility accidents may include sets of conditions leading to the release of hazardous chemicals that directly or indirectly threaten involved workers and the public. This EIS facility accident review includes an evaluation of the potential for chemical release accidents. Currently, there is insufficient information on chemical inventories of proposed future waste processing facilities to support a comprehensive and systematic review of chemical release accidents. However, the assumption was made that future requirements for hazardous chemicals during waste processing would be similar to present requirements. Chemicals that pose the greatest hazard to workers and the public are gases at ambient temperatures and pressures. An example of this type of gas is ammonia, which is stored under pressure as a liquid but quickly flashes to a vapor as it is released. Chemicals such as nitric acid that are liquids at ambient conditions also could pose a toxic hazard to involved workers. However, the potential for these types of chemicals to become airborne and travel to nearby or offsite facilities is low. The facility accident analysis focused on those chemicals that are gases at ambient conditions.

Receptor Identification

Radiological Releases - Human receptors are people who could potentially be exposed to or affected by radioactive releases resulting from accidents associated with the waste processing alternatives.

For radiological releases, DOE calculated the health impact of the bounding accidents by estimating the dose to human receptors. Four categories of human receptors are considered in this EIS:

- **Involved Worker:** A worker who is associated with a treatment activity or operation of the HLW treatment facility itself.
- **Maximally Exposed Individual:** A hypothetical individual located at the nearest site boundary from the facility location where the release occurs and in the path of an air release.
- **Noninvolved Worker:** An onsite employee not directly involved in the site's HLW management operations.
- **Offsite Population:** The population of persons within a 50-mile radius of INTEC and in the path of an air release.

Doses to individual receptors from a radiological release are estimated in rem. Doses to receptor populations are estimated in person-rem. A person-rem is the product of the number of persons exposed to radiation from a single release and the average dose in rem.

Most bounding accidents evaluated in this EIS impact the receptor population by releasing radioactive particles into the environment, which are then inhaled or settle on individuals or surfaces such that humans are exposed. Such exposures usually result in chronic health impacts that manifest over the long-term and are calculated as latent cancer fatalities. Consequences to receptors impacted by a radiological release are expressed as an increase in the probability of developing a fatal cancer (for an individual) or as an increase in the number of latent cancer fatalities (for a population).

Chemical Releases - To determine the potential health effects to workers and the public that could result from accidents involving releases of chemicals and hazardous materials, the airborne concentrations of such materials released during an accident at varying distances from the point of release were compared to Emergency Response Planning Guideline (ERPG) values. The American Industrial Hygiene Association established ERPG values, which are specific to hazardous chemical substances, to ensure that necessary emergency actions are taken in the event of a release. ERPG severity levels are as follows:

- **ERPG-3.** Exposure to airborne concentrations greater than ERPG-3 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop life-threatening health effects.

- **ERPG-2.** Exposures to airborne concentrations greater than ERPG-2 but less than ERPG-3 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop irreversible or other serious health effects or symptoms that could impact a person's ability to take protective action.

- **ERPG-1.** Exposure to airborne concentrations greater than ERPG-1 but less than ERPG-2 values for a period of greater than 1 hour results in an unacceptable likelihood that a person would experience mild transient adverse health effects or perception of a clearly defined objectionable odor.

The facility accident analysis assumes that accident scenarios with the potential for ERPG-2 or ERPG-3 health impacts are bounding scenarios for the waste processing alternatives.

Consequence Assessment

DOE used the "Radiological Safety Analysis Computer Program (RSAC-5)" to estimate human health consequences for radioactive releases. Radiological source terms were used as input to the computer program to determine radiation doses at receptor locations for each potentially bounding facility accident scenario. Meteorological data used in the program are consistent with previous INEEL EIS analyses (i.e., SNF & INEL EIS; DOE 1995) for 95 percent meteorological conditions (i.e. conditions whose severity, from the standpoint of induced consequences to an offsite population, is not exceeded more than 5 percent of the time).

DOE converted radiation doses to various receptors into potential health effects using dose-to-risk conversion factors recommended by the National Council on Radiation Protection and Measurements (NCRP). For conservatism, the NCRP guidelines assume that any additional exposure to radiation carries some incremental additional risk of inducing cancer. In the evaluation of facility accident consequences, DOE adopted the NCRP dose-to-risk conversion factor of 5×10^{-4} latent cancer fatalities for each person-rem of radiation dose to the general public. DOE calculated the expected increase in the number of latent cancer fatalities above those expected for the potentially exposed population. For individual receptors, a dose-to-risk conversion factor of 5×10^{-4} represents the increase in the probability of cancer for an individual member of the general public per rem of additional exposure. For larger doses, where the total exposure during an accident could exceed 20 rem, the increased likelihood of latent cancer fatality is doubled, assuming the body's diminished capability to repair radiation damage.

The consequences from accidental chemical releases were calculated using the computer program "Areal Locations of Hazardous Atmospheres (ALOHA)." Because chemical consequences are based on concentration rather than dose, the computer program calculated air concentrations at receptor locations. Meteorological assumptions used for chemical releases were the same as used for radiological releases. For each accident evaluation, conservative assumptions were applied to obtain bounding results. For the most part, the assumptions in this EIS are consistent with those applied in other EIS documents prepared at the INEEL, such as the SNF & INEL EIS. However, there were some assumptions that differed.

In this EIS, DOE performed a comprehensive evaluation of accidents that could result in an air release of radioactive or chemically hazardous materials to the environment. The reason for this simplification was that the short time between the occurrence of an air release and the time it would impact human health through respiration would not allow for mitigation measures other than execution of the site emergency plan. Accidents that resulted in a release only to groundwater were not generally evaluated since the time between their occurrence and their impact on the public was assumed to be long enough to take comprehensive mitigation measures. The one exception is that DOE did analyze bounding groundwater release accidents for which effective mitigation might not be feasible.

In this EIS, DOE focused on the human health and safety impacts associated with air release accidents. Other environmental impacts would also result from such events, such as loss of farm production, land usage, and ecological harm. However, these consequences were not evaluated directly in this EIS. Preliminary sensitivity calculations indicate that accidents which bound the potential for human health impacts also bound the potential for land contamination and other environmental impacts.

DOE decided not to evaluate impacts from some initiators (i.e., volcanoes) because they determined that such analysis would not provide new opportunities to identify bounding accidents. Based on evaluations in the accident analysis, volcanic activity impacting INTEC was considered a beyond design basis event. This would place the event with initiators such as an external event and beyond design basis earthquakes. However, based on the phenomena associated with these initiators, volcanic activity initiated events are considered bounded by other initiators. This is because the lava flow from the eruption (basaltic volcanism) would likely cover some affected structures, limiting the amount of hazardous and radioactive waste that is released from process vessels and piping. Therefore, the impacts due to a lava flow event are assumed to be bounded by other external events, where the entire inventory would be impacted and available for release.

C.4.1.2.1 Basis for Selection of Potentially Bounding Accidents

For the accident analysis, the process of identifying potentially bounding accidents and source terms is initiated with screening evaluations to determine activities to implement waste processing alternatives that could result in bounding accidents. In addition, the process includes identification of accident scenarios, development of frequencies for accident scenarios, development of source terms for accident scenarios, and selection of potentially bounding accident scenarios for consequence evaluation. This systematic process includes the following functional actions:

- Identification of hazardous process elements - Involves identification of activities, projects, and facility operations that are required to implement the alternative, and that potentially pose a risk of health impacts to various receptor populations (i.e., the hazardous process elements.)
- Accident analysis - Provides an accident analysis for each identified hazardous process element to identify potentially significant accident scenarios. Each accident scenario consists of a set of events that could result in health impacts to one or more receptor populations. Development of each accident scenario includes hazard assessment, evaluation of accident phenomena, quantification of release frequency, and quantification of accident source terms.
- Identification of potentially bounding accident scenarios - Involves selection of a subset of accident scenarios that are potentially bounding based on size and

makeup of source terms and frequency of occurrence. All accident scenarios are categorized in three frequency classes: abnormal (greater than once per thousand years), design basis (less than once per thousand years but greater than once per million years), and beyond design basis (less than once per million years). Bounding accidents for each waste processing alternative in each frequency category are selected based on the largest projected health impacts. Where the highest consequence accident scenario changes for different receptor populations, the bounding accident scenario is chosen on the basis of health impacts to the offsite population. Where two accident scenarios pose a similar potential for health impacts, the bounding accident will be chosen on the basis of estimated frequency of occurrence.

- Estimation of health impacts - Consists of estimating the potential for health impacts to result from each potentially bounding accident scenario in the three frequency classes.

- Identification of bounding accidents - Involves identifying the accident scenario that bounds the potential for health impacts in each frequency class for each alternative based on the information developed for the functional activities.

C.4.1.2.2 *Process Elements for Waste Processing Alternatives*

Each of the waste processing alternatives consists of a series of processes that must be implemented. Implementing each of these processes results in the temporary addition of risk to involved workers, noninvolved onsite workers, and the offsite public. Hazard evaluations of these processes form the basis of the facility accident analysis. The major process elements for the alternatives are shown in Table C.4-1.

For each waste processing alternative, those processes that have the most significant potential to result in additional health and safety risk to one or another of the major classes of receptors are described below.

C.4.1.2.3 *Technical Approach*

The technical approach and methods used in the accident analysis are intended to be fully compliant with DOE technical guidelines for accident analysis (DOE 1993b). These guidelines suggest exclusion of information that is previously addressed in other EIS documents. For example, the impacts of accidents at the Waste Isolation Pilot Plant have been excluded from predicted impacts. Such exclusions constitute a reasonable method of assuring that there is not a "double counting" of impacts associated with DOE activities. Technical guidelines require the identification of accidents for each alternative that are reasonably foreseeable and bounding. A bounding accident is defined as the reasonably foreseeable event that has the highest potential for environmental impacts, particularly human health and safety impacts, among all reasonably foreseeable accidents.

For the accident analysis, the term "reasonably foreseeable" is defined as the combined probability and consequences of accident events to include those scenarios with the potential for contributing a human health risk of once in 10 million years or greater. An accident that occurs with a frequency of once in 10 million years and would likely result in one or more fatalities is reasonably foreseeable.

Accident analysis of HLW management facilities that are currently operating has incorporated data from facility safety assurance documentation, facility operating experience, and probabilistic data from similar facilities and operations. Accident analyses of facilities that have not as yet been designed rely mainly on information from technical feasibility studies that establish basic design parameters and process implementation costs. Information used in the accident analyses included preliminary facility inventories, material at risk for major process streams within a facility, process design data, and some overall design features. Considering the early state of knowledge on most facility designs, methods used to assess the potential for facility accidents were based mainly on DOE guidance, experience with similar systems, and an understanding of the INTEC site layout. Documents such as safety analysis reports, safety reviews, and unresolved safety question determinations that routinely evaluate the poten-

Table C.4-1. Accident evaluations required.

Waste Processing Alternatives												
Process Elements	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Steam Reforming	Min. INEEL Processing	Vitrification without Calcine Separations	Vitrification with Calcine Separations
SBW/Newly Generated Liquid Waste Processing[a]		X		X		X	X		X			
New Waste Calcining Facility High Temperature and MACT Modifications		X		X		X	X					
Calcine Retrieval and Onsite Transport[b]	c	c	X	X	X	X	X	X	X	X	X	X
Full Separations[d]			X	X								X
Transuranic Separations					X							
Cesium Separations		X[e]								X		X
Class C Grout					X					X		
Borosilicate Vitrification (cesium, transuranic, strontium)[f]			X	X								X
Borosilicate Vitrification (Calcine and SBW)[g]								X			X	
HLW/SBW Immobilization for Transport (Calcine & Cs IX)										X		
HLW/SBW Immobilization for Transport (HIP)						X						
HLW/SBW Immobilization for Transport (Direct Cement)							X					
HLW/SBW Immobilization for Transport (Calcine & SBW)[h]												
Liquid Waste Stream Evaporation[i,j]		X	X	X	X	X	X		X			X
Additional Offgas Treatment[k]			X	X	X	X	X	X	X	X	X	X
Class C Grout Disposal					X							
HLW Interim Storage for Transport									X	X		
HLW/HAW Stabilization and Preparation for Transport (Calcine and Cs Resin Feedstocks)										X		
HLW/HAW Stabilization and Preparation for Transport (Calcine and SBW Feedstocks)[h]												
Storage of Calcine in Bin Sets[l,m]	X[n]	X[n]	X	X	X	X	X	X	X	X	X	X
Transuranic Waste Stabilization and Preparation for Transport					X					X		

Table C.4-1. Accident evaluations required (continued).

Process Elements	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Steam Reforming	Min. INEEL Processing	Vitrification without Calcine Separations	Vitrification with Calcine Separations
	Waste Processing Alternatives											
Storage of SBW[o]	X	X	X	X	X	X	X	X	X	X	X	X
SBW Stabilization and Preparation for Transport[p]								X	X		X	X
SBW Retrieval and Transport[q]		X	X	X	X	X	X	X	X	X	X	X

HAW = high-activity waste; SBW = mixed transuranic waste/SBW

a. Title reflects completion of liquid HLW calcining mission. DOE has placed calciner in standby.

b. Process elements associated with calcine retrieval are assumed to be identical to the calcine retrieval process for other waste processing alternatives.

c. Prior engineering assessment indicated bin set 1 to be potentially structurally unstable under static load thus possibly unable to meet requirements of DOE Order 420.1. This condition resulted in an Unresolvd Safety Question, and an assumption that retrieval of calcine from bin set 1 was required to implement any of the waste processing alternatives. Additional structural evaluation since that time resolved this Unresolved Safety Question and calcine retrieval from bin set 1 for the No Action and Continued Current Operations Alternatives is not anticipated.

d. Assumed to be identical to full separations process for Full Separations Option.

e. Requirement for Cs separations for Continued Current Operations Alternative was based on concern that treatment of mixed transuranic waste/SBW, newly generated liquid waste, and tank heels may require additional or alternate processing other than calcination. Currently, DOE has no planned Cs separations facility although Vitrification With Calcine Separations may utilize a partial separations process.

f. Smaller borosilicate vitrification process is analyzed for immobilization of HAW fractions after separation.

g. For Vitrification Without Calcine Separations, process element is assumed to be identical to Borosilicate Vitrification process for Early Vitrification Option.

h. Defined and analyzed based on preliminary descriptions of treatment alternatives and implementing processes. Later information indicated that modeled processes were identical to others or similar to and bounded by other processes (in terms of potential for health impacts) so this accident is not required for analysis.

i. Analyzed liquid waste stream evaporation as post-treatment for separations process. Application to mixed transuranic waste/SBW pretreatment, requires elimination of accidents with no physical basis.

j. Smaller borosilicate vitrification process requires mixed transuranic waste/SBW volume reduction beyond what is currently planned for near term management of mixed transuranic waste/SBW inventories, prior to vitrification.

k. In this EIS, all borosilicate vitrification and separation processes are assumed to require offgas treatment. Continued Current Operations Alternative would rely on current evaporators, which are also analyzed.

l. Identical to equivalent process element for other waste processing alternatives that address calcine waste and includes accidents covering short-term storage of calcine over a 35-year period of vulnerability.

m. Accident analysis process element assumes vulnerability to short term storage accidents over a 35-year period of vulnerability except for the No Action and Continued Current Operations Alternatives, where storage of calcine in the bin sets is permanent.

n. Includes long-term storage accidents that could occur over a 10,000 year period of vulnerability.

o. Evaluation of this process element addresses accidents involving long-term storage and degradation of mixed transuranic waste/SBW storage facilities (10,000 year exposure). However, potentially bounding design basis and beyond design basis accident scenarios could occur at any time. Therefore, the analysis has been expanded to evaluate design basis and beyond period of vulnerability.

p. Process element is assumed to be identical to mixed transuranic waste/SBW stabilization and preparation process for Early Vitrification Option. The radiological source term in a container of vitrified mixed transuranic waste/SBW is about twice the source term in a container of vitrified calcine. Therefore, accident for mixed transuranic waste/SBW provides a bounding analysis.

q. Process element is assumed to be identical to mixed transuranic waste/SBW retrieval process for waste processing alternatives.

tial for harm to human health were not available to support many of the accident analyses.

Data for identification of and initial screening of process elements, came by and large from feasibility studies conducted by the HLW technical sub-contractor, Fluor Daniel. These studies are part of the EIS administrative record and are referenced in the accident analysis. Data from these feasibility studies is used throughout the accident analysis and is the principle source of information for the description of facility design data in the accident analysis.

Detailed accident analysis included the description of activities, inventories, and conditions pertinent to the accident analysis, as well as development of a set of accident initiators. Accident initiating events consisted of conditions with varying frequency and severity that could challenge and degrade the safety functions of a facility. In the accident analysis, a standard set of "accident initiating events" was compared with the described set of activities, inventories, and operating conditions to identify and describe "accident scenarios." Six categories of initiators were used in the accident analysis:

- Failures resulting in fires during facility operations
- Failures resulting in explosions during facility operations
- Failures resulting in inventory spills
- Operational failures resulting in occurrence of criticality
- Occurrence of natural phenomena (such as seismic events or floods) that induce damage to a facility and require safe shutdown
- Occurrence of external events (usually human-initiated events not occurring in a facility)

Accident scenarios were defined consisting of a related set of causal events, starting with an initiating event, ultimately leading to release of radioactive or hazardous materials with the potential to impact workers or the public.

The accident analysis provides summaries of the accident evaluations for all potentially risk contributing process elements, using the accident analysis evaluation methodology. Data used to establish frequencies and frequency categories of accident scenarios were derived from numerous external sources. The accident analysis provided an appraisal of the frequency of "external" accident initiating events (i.e., events, such as external events, that are not the result of equipment failures or human errors in a facility, but can result in failure of facility equipment or containment); and natural phenomena (such as floods and earthquakes) that could impact HLW facilities at the INEEL. A basis for upgrading the second level screening to reflect additional vulnerabilities that may be discovered over time or may result of proposed future projects was described in the accident analysis.

HLW feasibility studies provided inventories of radioactive and chemically hazardous materials that could be released given the accidents defined for each process element. The feasibility study inventories were based mainly on material balances for the processes that were modeled in the feasibility evaluations. Bounding material at risk inventories of radioactive and chemically hazardous materials were provided in each accident analysis. Several of the material at risk evaluations (particularly those for the bin sets storing calcine) were updated over the course of the development of the accident analysis, based on information provided by the site management and operations contractor. These upgraded material at risk values and the basis for their inclusion are discussed in the accident analysis .

Source terms, or the amount of material that could be released in a specific accident scenario, were a critical element of the accident analysis procedure. A procedure for estimating source terms for specific accident scenarios, based on DOE guidance is discussed in the accident analysis.

The results of accident analyses provided include potentially bounding accident scenarios, sufficient data on probability of occurrence to place them in frequency "bins," and the predicted source terms if they were to occur. Potentially bounding accident scenarios for each of the accident analyses include radioactive and chemical release accidents, respectively, and the consequences (potential health impacts on downwind receptors) associated with the accident scenarios.

In general, the accident analysis considered accident scenarios that could result in air releases of radioactive or chemically hazardous material; releases that could adversely affect downwind receptors through inhalation of or direct contact pathways. The basis for excluding ingestion and drinking water pathways from the accident analyses was primarily that for the material at risk and source terms describing each accident, the major contribution to health impacts came from downstream inhalation of released material. Technical data, based on detailed assessments of the sensitivity of accident consequences, performed for a small subset of radioactive release accidents. Some exceptions were made to this rule, particularly for releases to groundwater that might not be fully remediated or interdicted, either because they were too large, or because they occur after the period of institutional control. The basis for these bounding groundwater evaluations is described in the accident analysis.

Based on the results of the consequence assessments, potentially bounding radiological accident scenarios for each of the waste processing alternatives and options were selected. These potentially bounding events were chosen primarily based on their potential to add risk to one or more downstream receptors, particularly the offsite public.

Of the potentially bounding radiological events, one in each of the three probability categories was chosen to be the bounding accident, in accordance with DOE National Environmental Policy Act guidance, again primarily based on their risk potential. The bounding radiological accidents for each of the EIS alternatives and options are listed in the accident analysis and Section 5.2.14 of this EIS. Bounding chemical release accidents are provided in Section 5.2.14 of this EIS. Potentially bounding groundwater release accidents are provided in the accident analysis.

C.4.1.3 Natural Phenomena/ External Events

A number of natural phenomena and external events could potentially impact the site and result in releases of radiological and/or chemical inventories. For natural phenomena hazards, DOE-STD-1021 has established performance categorization guidelines for structures, systems, and components (DOE 1996a). The rating system is out of a scale from one (PC-1) to four (PC-4) with four being the most restrictive. However, the PC-4 categorization is reserved for facilities that could result in offsite release consequences greater than or equal to the unmitigated release from a large (>20 MW) Category A reactor accident. The INEEL facilities pose potential adverse release consequences but do not fall within the definition of a PC-4 facility. Therefore, most INEEL HLW management facilities are classified as PC-3.

Per DOE-STD-1020, PC-3 structures, systems, and components are assigned mean annual probabilities of exceeding acceptable behavior limits of 1.0×10^{-4} per year (DOE 1996b). The natural phenomena evaluations in this analysis are linked to the design criteria associated with the 10,000-year event (1.0×10^{-4} per year). Since the structures, systems, and components are to be designed to these criteria, they are not anticipated to fail until a larger magnitude-initiating event with a lower frequency ($<1.0\times10^{-4}$ per year) occurs. Even with larger magnitude initiating events, there is still only a conditional probability (e.g., fragility curves for seismic evaluations) that a structure, system, or component will fail. However, these conditional probabilities vary with the types of initiators and are also dependent upon specific design details of the structure, system, or components. Although this approach may appear overly conservative from a frequency standpoint, there may be no impact from a relative frequency standpoint. The following paragraphs define the frequency ranges assigned to various natural phenomena in this EIS.

Range Fire

A range fire could result in loss of offsite power that, in turn, results in loss of ventilation to the facility and a slow release of radioactive or hazardous material. Range fires have occurred on or in the vicinity of the INEEL during 1994, 1995, 1996, 1999, and 2000. While a range fire would not endanger the process element under consideration, due to defoliated zones, location of the facility fences, etc., smoke from the fire could require personnel evacuation and disrupt operations. Loss of building confinement would create leakage pathways through doorways, airlocks, loading docks, and other building access points. The consequences associated with a range fire are anticipated to be minimal and in most cases would be bounded by operational events such as an electrical panel/motor fire. Unless specific design features of the process element warrant a lower frequency, range fires are generally placed in the abnormal event frequency bin.

Design Basis Seismic Event

A design basis event seismic event could cause failure of the facility structure and/or equipment such that a release occurs with a pathway to the environment. The design basis event seismic scenario frequency is dominated by failure of bin set 1 since its seismically induced failure frequency (5.0×10^{-3} per year) is substantially greater than that of the other six bin sets (5.0×10^{-5} per year). The frequency 5.0×10^{-3} per year was assumed for bin set 1 since the DOE-STD-1021 prescribes that Category 3 facilities withstand a 1.0×10^{-4} per year earthquake (DOE 1996a). Bin set 1 does not meet this standard and its probabilistic performance has been degraded by a factor 5. So instead of a 10,000 year earthquake failing bin set 1, it was evaluated as failing at a 2,000 year return period.

The analysis of design basis event seismic initiators in the accident analysis implies that under severe seismic loading one bin set may fail catastrophically. A question has been raised as to why only one bin set may fail, and not the other six bin sets. Failure of bin sets is considered a design basis event. The seismic "fragility" curve shows that although a failure could occur at a specific seismic level, it probably will not. Thus, seismicity as a common cause source for failures does not prevent one unit failing and the others not. In fact, reviews of seismic damage to commercial facilities routinely reveal one specific component failing while all others, more or less with the same loading, do not. Thus, it would be overly conservative to assume "complete coupling" in seismic failures of multiple bin sets.

Flood-Induced Failure

A major flood could cause damage to the facility structure and subsequent equipment failures, thereby causing a release of materials from the facility to the environment. In particular, bin set 1 has been determined, by analysis, to be statically unstable. Under flood conditions, the berm surrounding bin set 1 could be undermined with subsequent collapse of the cover onto the four internal vaults. Material released from the vaults would then be transported by floodwaters to the surrounding area and released to the environment as dust once the flood recedes. Early predictions of the frequency of such a flood were 1.0×10^{-4} per year at a maximum elevation of 4,916.6 feet mean sea level, above the 4,912 feet needed to wet the bottom of the bin set 1 berm. The site design accounts for this restriction and new facilities are (or would be designed to be) located above this elevation. Additionally, since floodwaters in relatively flat terrain such as the INEEL rise slowly, adequate time should be available to take protective measures to prevent water from entering the facility (DOE orders require re-evaluation if there has been a significant change in understanding that results in an increase in the site natural phenomena hazard). Given that flood induced failure of bin set 1 was estimated at a frequency of 1.0×10^{-4} per year and failure of one of the remaining bin sets is an order of magnitude less likely, the total probability of a flood-induced release would be 6.4×10^{-3} per year.

More recent flood data indicate that a flood threatening bin set 1 may be much less likely than the 10,000-year flood assumed above and that flood-induced failure of bin sets 2 to 7 are not credible events. If the present frequency of bin set 1 failure (1.0×10^{-4}) is assumed to be a 95 percent (upper) confidence bound on frequency and a 5 percent (lower) confidence bound of

1.0×10^{-7} is used, then a geometric mean of 3.2×10^{-6} per year for flood failure of bin set 1 is estimated. Therefore, the total probability of a flood induced release would be 2.0×10^{-5}, again a design basis event. From this data, it is concluded that the frequency of a flood at the INTEC makes this scenario a design basis event.

No arguments have been made that preclude 1.0×10^{-4} from being an upper bound. In addition, even if a lower bound probability of a flood 3 to 4 orders of magnitude lower were used, the geometric mean of two referenceable sources would be 4.0×10^{-4}. Unless specific design features of the process element warrant a lower frequency, flood-induced failure of bin set 1 is placed in the design basis events frequency bin.

External Event

NRC's Standard Review Plan [Section 3.5.1.6 in NRC (1997)] assesses the risk of external events involving nuclear facilities to be on a sliding scale ranging from 1.67×10^{-7} to 1.2×10^{-9} events per square mile. INTEC facilities occupy nearly a square mile of area at the INEEL. However, critical facilities such as the bin sets, Tank Farm tanks, and future waste processing facilities associated with various waste processing alternatives do not occupy nearly as much surface area of land. As such, the average surface area of a critical facility is estimated to be approximately 6 acres or 9.4×10^{-3} square miles. Therefore, the frequency of critical facility external events at INTEC is 2.1×10^{-8} per year.

It is noted that this frequency is outside the 1.0×10^{-6} per year to 1.0×10^{-7} per year range for beyond design basis events. However, due to the potentially catastrophic effects of external events to INTEC, such events are included as an accident initiator in the beyond design basis frequency category.

Extreme-Lightning Damage

Lightning strikes could cause damage to facility structures, loss of electric power, and damage to operating and safety equipment. The result could be a release of material and a direct pathway to the environment. Three or four lightning strikes have occurred at INTEC in the last 20 years. These lightning strikes resulted in minor damage but did not lead to releases of radiological and/or chemical inventories. The facility structures will be equipped with lightning protection systems designed in accordance with the requirements of the National Fire Protection Association (NFPA 1997); thus, failures as a result of lightning strikes would be extremely unlikely. In addition to defeating the lightning protection system, a lightning strike would have to be powerful enough to damage facility structures to create a direct leak path to the environment. The frequency of such a strike is deemed to be in the beyond design basis bin, although a lightning-initiated fire could be self-sustaining in many locations and could raise the likelihood of a material release.

High Wind-Induced Failure

High winds, in the form of tornadoes or straight-line winds, could cause failure of facility structures, operating equipment, safety equipment, or electric power and may result in releases of material and creation of pathways to the environment. The design basis wind for PC-3 facilities is 95 miles per hour with an annual probability of 1.0×10^{-4} per year. The INEEL Wind Hazard Curve indicates that a straight-line wind with this return frequency would be approximately 90 miles per hour. The wind design criteria for the newly constructed buildings would exceed this threshold. Stronger winds would have an annual probability of less than 1.0×10^{-4} per year and would have to be strong enough to breach the facility structure and internal process systems in order to create a leakage pathway to the environment. Little if any material is at risk. Although the high wind initiator itself is placed in the design basis frequency bin, the high wind-induced failure scenarios are placed in the beyond design basis frequency bin. Unlike seismic events, which impact the facility structure and internal equipment concurrently, high winds primarily impact the external facility structure. An additional sequence of events would have to occur before contained material inventories were impacted.

Beyond Design Basis Seismic Event

The beyond design basis event earthquake would have a peak ground acceleration that exceeds the design capacity of the facilities and would have a return period greater than 1,000,000 years (1.0×10^{-6} to 1.0×10^{-7} per year). The event would be powerful enough to breach internal process systems (high-efficiency particulate air filters, doors, airlocks, etc.) in order to create a leakage pathway(s) to the environment. This event could be as severe as the external event in the bounding accident determination. The frequency of such an event is deemed to be in the beyond design basis event bin.

Volcanism

Volcanic activity (volcanism) occurring at near field and distant volcanic sources represents a potential external event that could lead to releases of radiological or chemical inventories associated with the waste processing alternatives.

The information in the INEEL Three Mile Island-2 Safety Analysis Report (DOE 1998) and EDF-TRA-ATR-804 (Hackett and Khericha 1993) indicates that the bounding volcanism-related hazard is due to basaltic volcanism (Hackett and Khericha 1993). Impact to the INTEC due to the other volcanism initiators is considered very unlikely due to geologic changes in the region over millions of years, limited impact areas, and the physical distance to the potential sources. When considering volcanism, mitigation measures to either divert the lava flow or cool the lava are likely to be effective, due mainly to the relatively long period of time (up to a month) between the time of an eruption and the time at which the flow reaches the INTEC facilities. The frequency of a basaltic eruption that impacts facilities at INTEC is on the order of 7.0×10^{-7} per year, which places it in the beyond design basis frequency range. This places basaltic eruptions in the same frequency bin as initiators such as external events.

C.4.1.4 Facility Accident Consequences Assessment

In the consequence evaluation discussed in the accident analysis, radiological source terms were used as input for the Radiological Safety Analysis Computer Program (RSAC-5) to estimate human health consequences for radioactive releases (King 1999). DOE used this program to determine the radiation doses at receptor locations from the airborne release and transport of radionuclides from each accident sequence. Meteorological data used in the program were selected to be consistent with previous INEEL EIS analyses (i.e., SNF & INEL EIS) for 95 percent meteorological conditions, that is, the condition which is not exceeded more than 5 percent of the time or is the worst combination of weather stability class and wind speed.

Computed radiological doses to various receptor populations were converted into expected latent cancer fatalities using dose-to-risk conversion factors recommended by the NCRP (NCRP 1993). Conservatively, the NCRP assumes that any amount of radiation carries some risk of inducing cancer. DOE has adopted the NCRP factor of 5×10^{-4} latent cancer fatalities for each person-rem of radiation dose to the general public for doses less than 20 rem. For larger doses, when the rate of exposure would be greater than 10 rad (radiation absorbed dose) per hour, the increased likelihood of a latent cancer fatality is doubled to account for the human body's diminished capability to repair radiation damage. DOE calculated the expected increase in the number of latent cancer fatalities above those expected for the population.

Accident analysis consequences were directly estimated using RSAC for three groups of receptors:

- the maximally exposed individual
- a noninvolved worker
- the offsite population (collective dose)

The approach taken in the accident analysis consequence modeling was to ensure that a "safety envelope" was provided. This approach differs from the approach taken in other EISs, such as the SNF & INEL EIS, where certain mitigation actions were credited up front and other probabilistic arguments were applied to reduce the predicted consequences. As a result of this conservatism, health impacts presented in the accident analysis are larger than the results that would have been obtained by applying the SNF & INEL EIS assumptions (DOE 1995). Thus, consequence evaluations discussed in the accident analysis provide a likely upper bound to the potential consequences for the accidents associated with the candidate alternatives.

Consequences from accidental releases of hazardous chemicals were calculated using the computer program Areal Locations of Hazardous Atmospheres (ALOHA). Because chemical consequences are based on concentration rather than dose, the computer program calculated air concentrations at a selected receptor location. Meteorological assumptions used for chemical releases were the same as used for radiological releases.

Selected bounding accidents that resulted in a release only to groundwater were evaluated in the accident analysis using data derived from the environmental restoration Remedial Investigation/Feasibility Study for INTEC (Rodriguez et al. 1997).

Some initiators (i.e., volcanoes) were eliminated from consideration as a source of accidental releases in the accident analysis. These initiators would not provide additional potential for identifying bounding accidents. As an example, based on evaluations in the accident analysis, volcanic activity impacting INTEC was considered a beyond design basis event. This places the event with initiators such as external events and beyond design basis earthquakes. However, based on the phenomena associated with these initiators, volcanic activity-initiated events are considered bounded by other initiators. Lava flow from an eruption (basaltic volcanism) would likely cover the affected structures. Therefore, the amount of material that is released from process vessels and piping due to lava flow would be limited and would be bounded by events such as the external event, where the entire inventory would be impacted and available for release.

The systematic accident analysis process employed identified potentially bounding accidents for each of the identified alternatives and options. The results for radiological releases were expressed in terms of the estimated impacts for the maximally exposed individual, a noninvolved worker, the offsite population, and the latent cancer fatalities for the offsite population. After evaluating the human health consequences associated with these potentially bounding accidents, three bounding accidents (one abnormal, one design basis, and one beyond design basis) were selected for each of the waste processing alternatives and options. Consequences for each of the potentially bounding accident scenarios are given in the tabular summaries associated with each alternative and each frequency category in the accident analysis. Using the process element analogies identified in Table C.4-1, potentially bounding accidents were selected from the accident analysis for inclusion in Section 5.2.14.

C.4.1.4.1 *Methodology for Integrated Analysis of Risk to Involved Workers*

Health and safety risk to involved workers (workers associated with the construction, operation, or decontamination/decommissioning of facilities that implement a process element associated with one of the waste processing alternatives) constitutes a potentially significant impact of implementation. Unlike other receptors of health impacts from HLW treatment implementation, impacts to involved workers could occur as a result of accidents that do not result in radiological releases. Thus the consideration of involved worker impacts for waste processing alternatives requires that risks to involved workers be evaluated in an integrated way. Together with health and safety risk to the public, evaluation of involved worker risk provides a comprehensive basis for comparing waste processing alternatives on the basis of contribution to the implementation risk due to accidents. The following sources of involved workers risk are evaluated in the accident analysis.

- Industrial accident risk to involved workers is the result of accidents that may occur during industrial activities that implement major process elements. Industrial accidents may occur during any of the three major phases of a project; construction, operation, or decontamination/decommissioning.

- Occupational risk to involved workers results from exposure to radioactive materials during normal operations. While occupational risk is not the result of accidents, it is considered along with accident risks as part of the total risk to involved workers during alternative implementation. Occupational exposures occur mainly during the operation and decontamination/decommissioning phases of a project and include unanticipated exposures due to procedural breakdowns or inadequate work planning.

- Facility accident risk to involved workers results from accidents that release radioactive or chemically hazardous materials, accidents that could result in direct exposure to radiation (e.g., criticality), or energetic accidents that can directly harm workers (e.g., explosions). For purposes of this EIS, facility accidents are assumed to occur mainly during the operational phase of a project or during the decontamination/decommissioning phase of project activity. However, an accident analysis of facility disposition alternatives showed that the potential for accidents during the decontamination/decommissioning of existing facilities is several orders of magnitude smaller than for the same facilities during operation. New facilities needed to implement any of the waste processing alternatives are required (DOE 430.1) to make provisions for decontamination and decommissioning in the design process. Such facilities would be expected to pose a substantially lower risk of facility disposition accident than existing facilities. Therefore, consideration of facility accident risk is confined to the operational phase of a project.

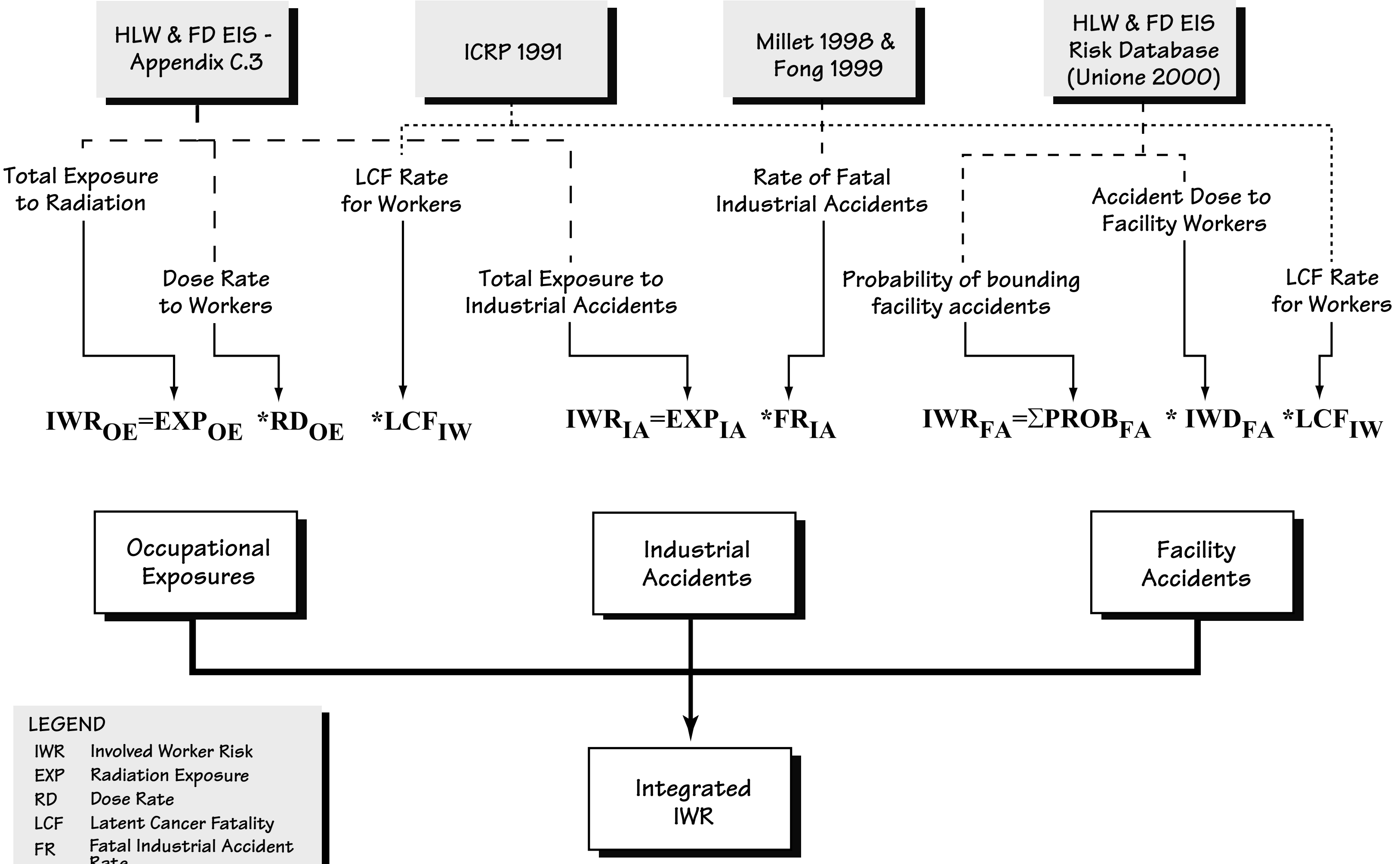
Risk to involved workers from occupational exposures and industrial accidents is appraised as part of the health and safety evaluation in this EIS (Appendix C.3). The evaluations in the accident analysis integrate industrial accidents and occupational exposures with results of the facility accidents evaluation to produce a comprehensive perspective on involved worker risk.

The method used in the accident analysis to evaluate integrated involved worker risk over the life cycle of a waste processing alternative is shown in Figure C.4-4. If the total commitment of risk required to implement a waste processing alternative can be referred to as a life cycle risk, the life cycle risk to involved workers is the sum of worker risks associated with major activities and projects. Figure C.4-4 describes how the three types of risk to involved workers are evaluated.

- Industrial accident risk is the product of total exposure to industrial accidents over the implementation life cycle and the rate of fatalities due to industrial accidents (fatalities per 100 worker years).

- Occupational risk is the product of total life cycle exposure time in a radiation environment (worker-years), the average annual dose to workers (rem per worker-year) for specific activities, and the rate of latent cancer fatalities to workers (4×10^{-4} latent cancer fatalities per person-rem of exposure).

- Facility accident risk to involved workers is estimated as the sum of contributions of potentially bounding accidents identified for that alternative. Over the implementation life cycle, each contribution is the product of the total probability of accident occurrence (anticipated events during the life cycle), dose to a population of workers as a result of the accident, and the rate of latent cancer fatalities. Consequences for involved workers are estimated for potentially bounding accidents identified in the accident analysis. For radioactive releases, doses to involved workers from an accidental release (of radioactivity) are assumed to be equivalent to doses to persons at 100 meters



LEGEND

IWR	Involved Worker Risk
EXP	Radiation Exposure
RD	Dose Rate
LCF	Latent Cancer Fatality
FR	Fatal Industrial Accident Rate
PROB	Probability of Bounding Facility Accidents
OE	Occupational Exposure
FA	Facility Accidents
IA	Industrial Accidents
IW	Involved Workers

FIGURE C.4-4.
Methodology for integrated involved worker risk evaluation.

> from the release site [for consistency with the definition of facility worker utilized in the SNF & INEL EIS (DOE 1995)] and proportional to doses to non-involved workers at 640 meters. An evaluation of radionuclide contributors to dose at 100 meters for a select set of potentially bounding accidents identified five radionuclides as responsible for nearly all the dose to workers. On average, the dose at 100 meters was approximately 9 times greater than that at 640 meters. Due to limitations on the accuracy of the consequence code at locations near the origin of a release, a factor of 9 was applied to noninvolved worker doses identified for radiological accidents.

Point estimates of involved worker risk, based on single "best" values of probabilistic parameters in Figure C.4-4, were developed in the accident analysis to compare involved worker risks with facility accident risks to the public for each of the waste processing alternatives. These point estimates are presented in Section C.4.1.8 of this appendix.

C.4.1.4.2 Accidents with Potential Release of Radioactive Materials

Accidents that result in the release of radioactivity are of interest to the general public near nuclear facilities and to both involved workers and non-involved workers in and near those facilities. An individual can be exposed to direct ionizing radiation during an accident and can also be exposed to airborne emissions that are released as a result of the accident. Radiation can cause a variety of ill-health effects to the individual and, in the worst case, may cause death. Generally, the effects of environmental and occupational radiation exposures are depicted in terms of induced latent cancer fatalities. It may take many years for cancer to develop and for death to occur. In addition to latent cancer fatalities, other health effects could result from environmental and occupational exposures to radiation. These effects include nonfatal cancers among the exposed population and genetic effects in subsequent generations. To allow for ready comparison with other health effects, this EIS presents estimated effects of radiation only in terms of latent cancer fatalities.

A systematic review of accidents with the potential for releasing significant radioactivity has been performed. In order to perform this assessment, each waste processing alternative was compared to the process elements associated with the alternative and the process elements were ranked as follows:

- Inventory at risk and frequency of accidental release are likely to produce a bounding accident for the treatment alternative.
- Inventory at risk and frequency of accidental release could credibly produce a bounding accident scenario.
- Process element does not contain sufficient inventory or driving release energy to result in bounding accident scenario.

This ranking led to a determination of the potential severity of the accident.

C.4.1.4.3 Accidents with Potential Release of Toxic Chemicals

Accidents involving the release of toxic and energetic chemical compounds are a significant concern for HLW processing. Accidents could result in significant risks, particularly to involved and noninvolved worker populations. A systematic review of the potential for chemical release accidents has been performed.

Hazardous chemical releases may directly result in offsite injuries, illnesses, or fatalities. Direct impact from a release of a toxic gas such as ammonia in sufficient quantity to form a vapor cloud could endanger involved workers at the facility, noninvolved workers on the site, and members of the general public traveling on or near the site boundaries. Alternatively, such releases may initiate a sequence of unintended events that result in a release of radioactive materials. An example would be an undetected release of a toxic chemical such as chlorine, that finds its way into a building ventilation system and incapacitates operators in the facility, thus preventing the shutdown process for equipment containing radioactive materials. Without operator control, process equipment malfunctions could result in an accidental release of radioactive material. Chemical release accidents could result in groundwater contamination from materials (such as kerosene). In theory, groundwater releases of chemicals can be mitigated, with little ultimate impact on the public. However, both of these accident scenarios are described below.

The accident analysis includes a screening evaluation to identify conditions associated with implementation of the waste processing alternatives, such as the presence of significant hazardous material inventories in or near facilities or use of several incompatible materials in proximity to each other, that could be initiators of accident scenarios.

The accident analysis also provides a systematic review of process elements. This was performed to identify conditions where hazardous chemical inventories were required, processes could result in the formation of hazardous chemicals, or equipment accidents could result in conditions where hazardous chemicals could be produced and released.

The accident analysis review of process elements yielded the following observations:

- Several HLW treatment processes such as separations require additional offgas treatment capabilities not currently in use at the INEEL. Current feasibility studies for several waste processing alternatives identify a need for additional offgas treatment to meet EPA environmental requirements during separation, vitrification, and other functions associated with alternative implementation. These same feasibility studies have identified an ammonia-based treatment process as being most likely to meet the technical requirements of the waste processing alternatives. Thus, ammonia has been identified as a chemical substance posing a potentially significant hazard to workers and the public during waste processing alternative implementation. Recent design studies have identified alternative processes for meeting environmental compliance requirements. However, at this time the ammonia-based process is still considered a potential source of bounding accidents.

- Some batch processes, such as cesium separation, require the use of potentially incompatible chemicals to clean and revitalize equipment.

- Fires in some process equipment could result in the evolution and release of hazardous materials.

Using this screening approach, the accident analysis identified a kerosene leak through failed process connections, an ion exchange toxic release, an explosion from the reaction of incompatible chemicals during TRUEX separations, and an ammonia tank failure as being "abnormal events" with potential hazardous chemical release scenarios. The kerosene leak and ammonia tank failure were also identified as "design basis events" and "beyond design basis" events. These accidents are defined in the accident analysis. The screening approach employed here is considered sufficient to identify accidents resulting from chemical releases in the process.

C.4.1.5 Radiological Impacts of Implementing the Alternatives

This section analyzes the radiological impacts or consequences of implementing the waste processing alternatives. It describes (1) the major processes of each alternative, (2) the bounding accident scenarios applicable to the major processes, and (3) the resulting impact to INEEL workers and the general public. The systematic accident analysis process employed by DOE identified potentially bounding accidents for each waste processing alternative. The results for radiological releases are expressed in terms of the estimated impacts for the maximally exposed individual, noninvolved worker, offsite population, and the latent cancer fatalities for the offsite population. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the processes associated with the particular alternative.

Each waste processing alternative is made up of a number of projects and process elements that are necessary to facilitate the alternative. Each alternative and its processes must be understood to the extent that will allow the analyst to determine potential drivers for accidents. Those processes that have the most significant potential to result in additional health and safety risk to one or another of the major classes of receptors are described below by waste processing alternative.

C.4.1.5.1 *Process Descriptions*

No Action Alternative

Two major risk accruing processes form the basis of the accident analysis for the No Action Alternative.

- **Long-term Storage of Calcine in Bin Sets.** DOE currently stores calcine in a series of bin sets at INTEC. For the No Action Alternative, the facility accident analysis assumes that the stored calcine would continue to be stored in the bin sets and would not be moved for any purpose.
- **Long-term Storage of Mixed Transuranic Waste/SBW.** Mixed transuranic waste/SBW is currently stored in the Tank Farm at INTEC. For the No Action Alternative, the facility accident analysis assumes that 5 tanks identified as pillar and panel tanks would be emptied to their heels by 2003, 5 tanks would be completely filled with mixed transuranic waste/SBW by 2016, and one tank currently empty would remain empty for emergency storage capability. The 5 full tanks would continue to store mixed transuranic waste/SBW indefinitely.

Continued Current Operations Alternative

Seven major risk accruing processes form the basis of the accident analysis for the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW and Newly Generated Liquid Waste Processing.** This process involves the continued calcination of mixed transuranic waste/SBW and newly generated liquid waste in the New Waste Calcining Facility. Liquid waste feed is pumped from the Tank Farm, atomized by air, and sprayed onto a bed of heated spherical particles maintained at a temperature of approximately 500°C by in-bed combustion of kerosene. The calcine product from the bed and the fines removed from the offgas in the cycle are pneumatically transferred to the bin sets for storage. Offgas from the fluidized bed is processed through high-efficiency particulate air filters. From the accident analysis standpoint, the focus for this process element would be on the potential for a kerosene fire in the calciner cell.
- **New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (Offgas Treatment Facility Only).** The process involves the continued calcination of mixed transuranic waste/SBW and newly generated liquid waste as described above except that the fluidized bed would potentially operate at 600°C. To meet the Maximum Achievable Control Technology standards, a multi-stage combustion control system is needed to achieve emission goals for carbon monoxide and various nitrogen oxides and a mercury removal system is needed to achieve goals for mercury emissions. The differences in calcining operations using Maximum Achievable

Control Technology are not expected to increase the hazards. This process element takes into consideration the large quantities of kerosene that must be stored in the proximity of the New Waste Calcining Facility. The primary focus from an accident analysis standpoint for this process element would be on the potential for major leaks of kerosene.

- **Cesium Separation (Cesium Ion Exchange Only).** For the Continued Operations Alternative, the process element assumes that cesium separations would be used to process tank heels and newly generated liquid waste. This process takes liquid mixed transuranic waste/SBW and/or tank heel material and feeds this waste into an ion exchange column where cesium would be separated from the actinides and strontium. This separation allows the actinide and strontium waste to be processed for disposal as transuranic waste. The cesium rich resin waste from the ion exchange column would be managed as HLW and transferred to the bin sets for storage in the case of the Continued Current Operations Alternative or vitrified.

- **Liquid Waste Stream Evaporation.** This process would reduce the volume of both mixed transuranic waste/SBW and newly generated liquid waste. It represents the existing Process Equipment Waste and Liquid Effluent Treatment and Disposal Facility evaporators at INTEC but could also consider a new evaporator if current evaporators are insufficient to handle the volumes of newly generated liquid waste expected after the INTEC tanks are closed. Existing mixed transuranic waste/SBW and newly generated liquid waste, currently stored in the Tank Farm, is withdrawn from the tanks and sent to the evaporators. Following evaporation, the liquid waste is sent back to the tanks to await calcination. Following completion of mixed transuranic waste/SBW calcination under this alternative, the existing Tank Farm would be closed and newly generated liquid waste would be sent to Resource Conservation and Recovery Act (RCRA) compliant tanks. The newly generated liquid waste would continue to be generated, stored, and evaporated to reduce the volume, then grouted and disposed.

- **Long-term Storage of Calcine in Bin Sets.** This process element is described under the No Action Alternative.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** Mixed transuranic waste/SBW is currently stored in the Tank Farm at INTEC. For all waste processing alternatives and options except the No Action Alternative, the facility accident analysis assumes that mixed transuranic waste/SBW would be continued to be stored in the Tank Farm until removed for processing (i.e., short-term). The primary focus of the accident analysis is a seismically induced failure of a single tank filled with mixed transuranic waste/SBW.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process involves retrieval of mixed transuranic waste/SBW from the Tank Farm, transportation of the waste onsite, and storage of the waste prior to processing. For the most part, existing retrieval, transport, and storage systems at INTEC would be used (i.e., pumps, transfer tanks, piping, evaporators, etc.). Approximately 1.2 million gallons of mixed transuranic waste/SBW would be retrieved and transported. Liquid waste from other sources also would be transferred by the mixed transuranic waste/SBW retrieval and transport system into storage tanks, blended, characterized, and stored for later processing. Mixed transuranic waste/SBW retrieval includes retrieval of tank "heels" to the extent feasible with the existing waste retrieval equipment.

Separations Alternative - Full Separations Option

Eight major risk accruing processes form the basis of the accident analysis for the Full Separations Option.

- **Calcine Retrieval and Onsite Transport.** This process involves removal of calcine from bin sets 1 through 6 for processing to a road-ready condition. Retrieval of calcine from the bin sets includes four distinct operational functions (1) accessing the existing bin set outer containment and vaults, (2) retrieving the calcine from the bin set structures, (3) transporting the calcine to the processing facility, and (4) storing the calcine in the processing facility for an interim period. The calcine transport subsystem would carry the calcine from the bins to the final destination. An intermediate facility may be required to increase suction if the distance between the bin sets and the processing facility exceeds 1,000 feet.

- **Full Separations (Cesium Ion Exchange, Transuranic and Strontium Extraction).** This process takes liquid mixed transuranic waste/SBW and dissolved calcine, and partitions the liquid waste stream into mixed HLW and mixed low-level waste fractions. The process includes 4 major process elements: (1) dissolution of the calcine and preparation of the waste stream for partitioning, (2) feeding mixed transuranic waste/SBW and dissolved calcine through a cesium ion exchange column to remove cesium, (3) feeding the liquid waste through a TRUEX process to remove actinides, and (4) feeding the remainder of the liquid waste through a SREX process to remove strontium. Since the calcine waste is currently in a solid form, it must be dissolved and filtered prior to feeding to the cesium ion exchange column. The TRUEX process, for removing transuranics from the liquid mixed HLW stream from dissolved calcine, includes use of an organic extractant to separate actinides from the solution. The SREX extraction process uses an organic extractant to separate strontium from the solution with subsequent stripping to remove strontium from the organic phase.

- **Borosilicate Vitrification (Cesium, Transuranic, and Strontium Feedstock).** After separations, the separated mixed HLW fraction and a frit material would be mixed in a melter to form a HLW glass that can be sent to the repository. Mixed transuranic waste/SBW would be processed in the liquid form before calcine is retrieved and processed. Calcine would then be retrieved, dissolved, separated and vitrified. Major borosilicate vitrification facility functions include: (1) receiving the mixed HLW fraction from the waste separations facility, (2) blending the waste, (3) sampling the blended waste, (4) selecting the proper glass frit, (5) delivering the waste and frit mixture to the melter, (6) vitrifying the mixture in the melter, (7) pouring the glass into canisters, (8) welding, leak checking, and decontaminating the canisters, and (9) processing the melter offgas stream.

- **Liquid Waste Stream Evaporation.** An additional evaporation process would be required to handle mixed HLW and mixed low-level waste fractions during the separations process. Mixed low-level waste fractions, produced during the separation of the mixed HLW fraction from the mixed transuranic waste/SBW and dissolved calcine wastes, contain a substantial excess of water and nitric acid that must be removed prior to grouting. These streams would be evaporated to remove excess water and then distilled to concentrate and recycle acid. The estimated flows for the low-level waste fraction are likely to exceed the capacity of current volume reduction facilities, and a new full capacity evaporator would be installed. The facility accident analysis focuses on the mixed HLW evaporator operation due to the high activity in the evaporation process.

- **Additional Offgas Treatment.** An additional offgas treatment process would be required to handle effluents from the mixed HLW and mixed low-level waste fractions. The core activity for offgas treatment design is assumed to involve the use of ammonia to control nitrogen oxide emissions in a selective catalytic reduction process. From the accident analysis standpoint, the focus for this process element would be the use of ammonia in the selective catalytic reduction.

- **Short-term Storage of Calcine in Bin Sets.** DOE currently stores calcine in a series of bin sets at the INTEC. For this option, calcine would be stored in the bin sets for a limited period of time until removed for processing.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

Separations Alternative - Planning Basis Option

Ten major risk accruing processes form the basis of the accident analysis for the Planning Basis Option.

- **Mixed Transuranic Waste/SBW and Newly Generated Liquid Waste Processing.** This process element is described under the Continued Current Operations Alternative.

- **New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (Offgas Treatment Facility Only).** This process element is described under the Continued Current Operations Alternative.

- **Calcine Retrieval and Onsite Transport.** This process element is described under the Full Separations Option.

- **Full Separations (Cesium Ion Exchange, Transuranic and Strontium Extraction).** This process element is described under the Full Separations Option.

- **Borosilicate Vitrification (Cesium, Transuranic, and Strontium Feedstock).** This process element is described under the Full Separations Option.

- **Liquid Waste Stream Evaporation.** This process element is described under the Full Separations Option.

- **Additional Offgas Treatment.** This process element is described under the Full Separations Option.

- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

Separations Alternative - Transuranic Separations Option

Ten major risk accruing processes form the basis of the accident analysis for the Transuranic Separations Option.

- **Calcine Retrieval and Onsite Transport.** This process element is described under the Full Separations Option.

- **Transuranic Separations (Transuranic Extraction Only).** The transuranic separations process takes liquid mixed transuranic waste/SBW and dissolved calcine material and partitions the actinide waste from the remaining waste stream. The process includes three major steps: (1) retrieval and processing of mixed transuranic waste/SBW to separate the actinides, (2) retrieval and dissolution of calcine in preparation for treatment and partitioning, and (3) processing of liquid HLW from calcine to separate the actinides. The Transuranic Separations Option is assumed to use the TRUEX extraction purification process to separate waste streams. This process includes use of an organic extractant to separate actinides from the solution and acidic stripping to remove actinides from the organic phase. The aqueous raffinate stream would be denitrated and grouted to form a Class C-type grout. The transuranic waste would be packaged for disposal at a suitable repository.

- **Class C Grout.** This process involves converting an aqueous raffinate stream from the Transuranic Separations Option into Class C-type low-level waste grout. The aqueous raffinate stream would be free of actinide elements but would contain the principal fission products associated with waste processing activities. The process involves denitrating and solidification of the mixed low-level waste fraction from the separations process, combining the solids with Portland cement, blast furnace slag, and flyash, and mixing the materials with additives, water, and a plasticizer to form a Class C-type grout. The grout would be placed into canisters for interim storage and ultimate disposal.

- **Liquid Waste Stream Evaporation.** This process element is described under the Full Separations Option.

- **Additional Offgas Treatment.** This process element is described under the Full Separations Option.

- **Class C Grout Disposal.** This process involves separating the mixed low-level waste fraction from the actinides during the transuranic separations process, denitrating the waste, and combining the denitrated waste with cement and other additives to produce a Class C-type grout. The Class C-type grout would be pumped to a container filling facility, containerized, and disposed of at an INEEL landfill or offsite. Because of the presence of cesium and strontium in the waste stream, the grout is much more radioactive and requires additional shielding and remote handling as compared to Class A-type grout. Generally the grout would be loaded into concrete landfill containers with a capacity of about 1 m^3. After filling, these containers are allowed to set, then capped, loaded in a shielded transport cask, and transported to a disposal or interim storage location.

- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.

- **Transuranic Waste Stabilization and Preparation for Transport.** This process involves the handling and loading of transport casks with remote-handled transuranic waste destined for the Waste Isolation Pilot Plant. This waste would be generated as a result of the TRUEX separations process. Separated transuranic waste would be evaporated and dried prior to packaging. The transport casks are assumed to be loaded with Waste Isolation Pilot Plant-type half-containers. Handling and loading of casks and containers would be performed in the Waste Separations Facility where limited lag storage would be available. Each half-container produced from mixed transuranic waste/SBW would hold about 0.1 m^3 of remote-handled transuranic waste. Each half-container produced from calcine would hold about 0.2 m^3 of remote-handled transuranic waste material. All containers would be remote handled due to calculated maximum gamma radiation levels.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

Non-Separations Alternative - Hot Isostatic Pressed Waste Option

Nine major risk accruing processes form the basis of the accident analysis for the Hot Isostatic Pressed Waste Option.

- **Mixed Transuranic Waste/SBW and Newly Generated Liquid Waste Processing.** This process element is described under the Continued Current Operations Alternative.

- **New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (Offgas Treatment Facility Only).** This process element is described under the Continued Current Operations Alternative.

- **Calcine Retrieval and Onsite Transport.** This process element is described under the Full Separations Option.

- **HLW and Mixed Transuranic Waste/SBW Immobilization for Transport (HIP).** The Hot Isostatic Pressed Waste Option would calcine the remaining mixed transuranic waste/SBW, retrieve the calcine from the bin sets, and then immobilize the calcined product. The process involves: (1) receiving calcine from the Calcine Retrieval and Transport System, (2) blending and sizing the calcine in batches, (3) sampling the blended calcine, (4) selecting the proper amorphous silica and titanium powder mixture, (5) mixing the calcine and additives and delivering the mixture to the canning station, (6) devolatilizing the mixture, (7) hot isostatic pressing the cans, (8) welding, leak checking, and decontaminating the cans, and (9) processing the devolatilization offgas. The Hot Isostatic Press facility is designed to process only dry material. The Hot Isostatic Press ovens would operate at about 1050°C and 20,000 psi.

- **Liquid Waste Stream Evaporation.** This process element is described under the Full Separations Option. Although the process is generally adapted to the separations options, it is anticipated that current evaporators will be required to process newly generated liquid waste during Hot Isostatic Press operations.

- **Additional Offgas Treatment.** This process element is described under the Full Separations Option.

- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

Non-Separations Alternative - Direct Cement Waste Option

Nine major risk accruing process form the basis of the accident analysis for the Direct Cement Waste Option.

- **Mixed Transuranic Waste/SBW and Newly Generated Liquid Waste Processing.** This process element is described under the Continued Current Operations Alternative.

- **New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (Offgas Treatment Facility Only).** This process element is described under the Continued Current Operations Alternative.

- **Calcine Retrieval and Onsite Transport.** This process element is described under the Full Separations Option.

- **HLW and Mixed Transuranic Waste/SBW Immobilization for Transport (Direct Cement).** The Direct Cement Waste Option would calcine the remaining mixed transuranic waste/SBW, retrieve the calcine from the bin sets and process the calcined waste into HLW grout. The process involves: (1) receiving the calcine from the Calcine Retrieval and Transport System, (2) blending and sampling the calcine, (3) selecting the proper clay, blast furnace slag, and caustic soda mixture, (4) mixing the calcine and additives to form a HLW grout, (5) delivering the mixture to the waste canister fill station and filling the canisters, (6) autoclaving and de-watering the canisters, and (7) sealing the canisters and processing the offgas. Following this process, the canisters would be interim stored awaiting shipment to the geologic repository. Autoclaving would be performed at about 250°C and 1,500 psi.

- **Liquid Waste Stream Evaporation.** This process element is described under the Full Separations Option. Although the process is generally adapted to separations options, it is anticipated that current evaporators will be required to process newly generated liquid waste during Direct Cement Waste Option operations.

- **Additional Offgas Treatment.** This process element is described under the Full Separations Option.

- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

Non-Separations Alternative - Early Vitrification Option

Seven major risk accruing process form the basis of the accident analysis for the Early Vitrification Option.

- **Calcine Retrieval and Onsite Transport.** This process element is described under the Full Separations Option.

- **Borosilicate Vitrification (Calcine and Mixed Transuranic Waste/SBW Feedstock).** The Early Vitrification Option would vitrify mixed transuranic waste/SBW and newly generated liquid waste followed by vitrificaiton of mixed HLW calcine. The process would retrieve the mixed transuranic waste/SBW and newly generated liquid waste from the Tank Farm, filter the liquid waste to remove solids, blend the waste with glass frit, and feed the slurry to a melter for vitrification. Glass from the process would be poured into standard Waste Isolation Pilot Plant remote-handled transuranic waste containers or containers suitable for disposal at a geologic repository. Once mixed transuranic waste/SBW processing is complete, the calcine is retrieved from the bin sets, blended with glass frit, and vitrified. In the melter cell, the waste mixture is fed to a melter that operates at about 1,200°C. The glass product is gravity discharged to the container. Major activities associated with the process element are: (1) receiving the waste in batches and blending the waste with the proper glass frit, (2) sampling the slurry to assure glass quality, (3) delivering the mixture to the melter cell, (4) vitrifying the mixture, (5) pouring the glass into containers, delivering the containers to interim storage to await shipment, and (6) processing the melter offgas.

- **Additional Offgas Treatment.** This process element is described under the Full Separations Option.

- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW Stabilization and Preparation for Transport.** This process involves the handling and loading of shipping casks with Waste Isolation Pilot Plant-type containers containing remote handled transuranic waste. These containers would be stored in the Interim Storage Facility. From there, the containers would be loaded onto rail cars or truck for shipment to the Waste Isolation Pilot Plant or other geologic repository. All containers would be remote handled using standard techniques since gamma radiation levels would approach 170 R/hr at contact and 73 R/hr at one meter. From an accident standpoint, the issue is a spill of liquid glass from the container during a seismic event. The radiological source term in a container of vitrified mixed transuranic waste/SBW is about twice the source term in a container of vitrified HLW calcine. Therefore, process element Mixed Transuranic Waste/SBW Stabilization and Preparation for Transport is a bounding analysis for a vitrified HLW spill.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

Non-Separations Alternative - Steam Reforming Option

Eight major risk accruing processes form the basis of the accident analysis for the Steam Reforming Option.

- **Liquid Waste Stream Evaporation.** This process element is described under the Full Separations Option. Although the process is generally adapted to separations options, it is anticipated that current evaporators will be required to process newly generated liquid waste during Steam Reforming Option operations.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.

- **Calcine Retrieval and Transport.** This process element is described under the Full Separations Option.

- **Calcine Packaging and Loading.** This process involves retrieving calcine from the bin sets and transporting the calcine to the Waste Packaging Facility where it would be loaded into canisters. The canisters would be sealed and transported to the geologic repository for disposal.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

- **NGLW Grout Facility.** This process involves grouting all the NGLW generated from 2013 through 2035. The concentrated NGLW would be blended with other materials to form a grouted waste product. Although the radioactive characteristics of such a waste form are uncertain at this time, it is believed that this grouted waste would be classified as mixed, remote-handled transuranic waste. As such, it could only be sent to the Waste Isolation Pilot Plant for disposal. The grout would be loaded into containers, each of which holds 0.4 m^3 of remote-handled transuranic waste.

- **Steam Reforming.** The Steam Reforming Facility would process the liquid SBW from the Tank Farm as well as other newly generated liquid waste. The central feature of the Steam Reforming Facility is the Reformer, a fluidized bed reactor in which steam is used as the fluidizing gas and a refractory oxide material is used as the bed medium. The liquid would be converted into a dry powder that would be canned and shipped to the Waste Isolation Pilot Plant as mixed, remote-handled transuranic waste. The primary focus from an accident standpoint for this process element would be the potential for vessel explosion.

Minimum INEEL Processing Alternative

Eleven major risk accruing processes form the basis of the accident analysis for the Minimum INEEL Processing Alternative.

- **Calcine Retrieval and Onsite Transport.** This process element is described under the Full Separations Option.

- **Cesium Separation (Cesium Ion Exchange Only).** This process element is described under the Continued Current Operations Alternative.

- **Class C Grout.** This process element is described under the Transuranic Separations Option.

- **HLW and Mixed Transuranic Waste/SBW Immobilization for Transport (Calcine and Cesium Ion Exchange Resin Feedstock).** This process involves retrieving calcine from the bin sets and transporting the calcine to the Waste Packaging Facility where it would be loaded into waste containers. The containers would be fitted with a removable lid, sealed, and transported to Hanford for vitrification of the calcined waste. The mixed transuranic waste/SBW would be retrieved, filtered, and transported to an ion exchange facility for processing through an ion exchange column to remove cesium. The waste stream would be grouted and managed as contact-handled transuranic waste. The high-activity waste resins from the ion exchange column would be dried, packaged, and transported to Hanford for vitrification.

- **Additional Offgas Treatment.** This process element is described under the Full Separations Option.

- **HLW Interim Storage for Transport.** This process involves the interim storage of packaged calcine material awaiting shipment to Hanford for vitrification. As containers are filled and the lids secured, they would be moved to an interim storage location and loaded into a transport cask aboard a transport vehicle (nominally a rail car). Shipment to Hanford would take place as soon as the cask is loaded. For each shipment to Hanford, four casks are assumed to be loaded with three waste containers in each cask. The interim storage process is considered an extension of the packaging facility operations and subject to accidents during loading of the transport casks or after the casks are placed on the transport vehicle. Spills or other accidents are capable of releasing calcined material and fines.

- **HLW and HAW Stabilization and Preparation for Transport (Calcine and Cesium Resin Feedstock).** This process involves loading containers with calcine. The loading operation has 5 distinct operations: (1) lowering the container from the main operating floor to the filling cell level, (2) transfer of the container through an airlock into the filling cell where it is raised to mate with the transfer mechanism, (3) attaching a fill spout to the container to receive the calcine, (4) filling the container, and (5) moving the container to a separate location in the filling cell where a cover is attached to the container. Both the cover and the lid must be removable since the containers will be emptied at Hanford and returned for reuse. The calcine will be delivered from the calcine storage bins at the rate of 2,700 kg/hr and will be separated from its airstream by a cyclone separator. The calcine would flow into the container by gravity.

- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.

- **Transuranic Waste Stabilization and Preparation for Transport.** This process involves the handling and loading of transport casks with contact-handled transuranic waste destined for the Waste Isolation Pilot Plant. For this alternative, mixed transuranic waste/SBW would be fed to a cesium ion exchange column that would remove the cesium and leave the transuranic and strontium wastes. The transuranic and strontium wastes would be grouted and the grout loaded into 55-gallon drums. The containers would be loaded into transport casks and shipped to the Waste Isolation Pilot Plant. Each container would hold about 0.1 m^3 of contact-handled transuranic waste.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

Direct Vitrification Alternative - Vitrification without Calcine Separations Option

Seven major risk accruing processes form the basis of the accident analysis for the Vitrification without Calcine Separations Option.

- **Calcine Retrieval and Onsite Transport.** This process element is described under the Full Separations Option.

- **Borosilicate Vitrification (Calcine and Mixed Transuranic Waste/SBW Feedstock).** This process element is described under the Early Vitrification Option.

- **Additional Offgas Treatment.** This process element is described under the Full Separations Option.

- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.

- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.

- **Mixed Transuranic Waste/SBW Stabilization and Preparation for Transport.** This process element is described under the Early Vitrification Option.

- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

Direct Vitrification Alternative - Vitrification with Calcine Separations Option

Ten major risk accruing processes form the basis of the accident analysis for the Vitrification with Calcine Separations Option.

- **Calcine Retrieval and Onsite Transport.** This process element is described under the Full Separations Option.
- **Full Separations (Cesium Ion Exchange, Transuranic and Strontium Extraction).** This process element is described under the Full Separations Option.
- **Cesium Separation (Cesium Ion Exchange Only).** This process element is described under the Continued Current Operations Alternative.
- **Borosilicate Vitrification (Cesium, Transuranic, and Strontium Feedstock).** This process element is described under the Full Separations Option.
- **Liquid Waste Stream Evaporation.** This process element is described under the Full Separations Option.
- **Additional Offgas Treatment.** This process element is described under the Full Separations Option.
- **Short-term Storage of Calcine in Bin Sets.** This process element is described under the Full Separations Option.
- **Short-term Storage of Mixed Transuranic Waste/SBW.** This process element is described under the Continued Current Operations Alternative.
- **Mixed Transuranic Waste/SBW Stabilization and Preparation for Transport.** This process element is described under the Early Vitrification Option.
- **Mixed Transuranic Waste/SBW Retrieval and Transport.** This process element is described under the Continued Current Operations Alternative.

C.4.1.5.2 *Bounding Radiological Impacts for Waste Processing Alternatives*

The approach used to evaluate facility accident impacts for this EIS is to utilize evaluations of common process elements from the accident analysis to identify and evaluate potentially bounding accidents. In general, the process used in selecting the bounding accident scenario was to select the scenario with the highest consequence within each frequency bin. In some cases, one scenario had the highest consequence for the maximally exposed individual and noninvolved worker but another scenario had higher consequences for the offsite population and latent cancer fatalities. In these cases, the scenario with the higher consequences for the offsite population/latent cancer fatalities was generally selected. Some exceptions to this rule are:

- **Cross-Cutting Accidents -** Some potential accidents are common to all alternatives. For example, operational failures associated with the removal of calcine from the bin sets and flood-induced failure of bin set 1 are bounding abnormal and design basis events respectively that generally affect all waste processing alternatives. In order to compare waste processing alternatives, cross-cutting accidents are shown separately in the accident analysis as accidents that cross cut alternatives. In many cases, the cross-cutting accidents are the highest risk events. However, in order to provide additional resolution in determining the highest risk alternatives, the scenario with the second highest consequence is also highlighted as a potential "bounding" scenario in the accident analysis database.

- **Highest Risk vs. Highest Consequence Scenario -** Risk is defined as the product of frequency and consequence. In some cases, the scenario with the perceived higher risk was selected even though another scenario may have had higher consequences. The frequency bands considered in the analysis were fairly wide. For instance, the design basis frequency band is from 1.0×10^{-3} per year to 1.0×10^{-6} per year. From a risk standpoint, a scenario that is a 1,000 times more likely (e.g., 1.0×10^{-3} per year vs. 1.0×10^{-6} per year), has a higher risk than another scenario that has a consequence that is 100 times greater. Therefore, the approach taken was to select the higher frequency/lower consequence scenario as the bounding scenario.

Summary tables in the accident analysis describe potentially bounding accidents and their forecasted consequences. The accident analysis also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-2 provides a summary of bounding radiological events for the various waste processing alternatives.

C.4.1.6 Chemical Impacts of Implementing the Alternatives

This section analyzes the impacts or consequences of chemical releases from accidents that could occur as a result of implementing the waste processing alternatives. It identifies (1) the major processes that contribute chemicals to the atmosphere during an accident and (2) the impacts to INEEL workers and the general public in terms of ERPG values at 3,600 meters.

Alternative/Process Data - Two major processes or functions can produce chemical releases from accidents resulting during implementation of waste processing alternatives.

- New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications.
- Additional Offgas Treatment.

Accident Consequence - Table C.4-3 presents the chemical accidents and the impacts of these accidents.

C.4.1.7 Groundwater Impacts of Implementing the Alternatives

The bounding accident scenarios described in the preceding sections produce human health consequences mainly as a result of inhalation of air releases. In the National Environmental Policy Act accident analysis, it is generally assumed that the inhalation pathway is the predominant source of human health consequences since an air release does not provide an opportunity for intervention and mitigation.

A few potentially bounding accident scenarios from the detailed accident evaluation process produced groundwater releases. Although groundwater releases can sometimes be mitigated with little ultimate impact on the public, significant groundwater releases could produce a substantive risk to the environment. The impact of accident scenarios resulting in groundwater releases is considered in the facility accidents evaluation.

Environmental risk is usually presented in the Remedial Investigation/Feasibility Study process in terms of expected groundwater contamination at the site boundary as a function of time. Therefore, the measures of environmental risk such as the U.S. Environmental Protection Agency (EPA) drinking water standards or maximum contaminant levels can be used to estimate the potential for future adverse human health impacts. Specifically, expected contamination due to a postulated release can be compared with maximum contaminant level values to assess the severity of environmental risk associated with a release. In this way, accident scenarios resulting in a release to groundwater can be appraised for their potential contribution to environmental risk and the overall economic impact of the accident.

Three major process elements or functions can produce groundwater releases from accidents resulting during implementation of waste processing alternatives.

Table C.4-2. Summary of bounding facility accidents for the waste processing alternatives.

Frequency	Process title	Event description	Bounding accident frequency (accidents/ year)	Window of exposure (years)	Probability accident occurs (probability)	Maximally exposed individual dose (millirem)	Noninvolved worker dose (millirem)	Offsite public dose (person-rem/ event)	Offsite public LCFs (LCFs/ event)	Per capita risk to offsite population (LCFs/120,000 person-event)
No Action Alternative										
ABN	Long-term Storage of Calcine in bin sets	Seismic induced failure of a bin set	2.5×10^{-4}	9.5×10^{3}	1.00	8.3×10^{4}	5.7×10^{6}	5.3×10^{5}	270	2.2×10^{-3}
DBE	Short-term Storage of Calcine in bin sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-term Storage of Calcine in bin sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.1×10^{-4}
Continued Current Operations Alternative										
ABN	Long-term Storage of Calcine in bin sets	Seismic induced failure of a bin set	2.5×10^{-4}	9.5×10^{3}	1.00	8.3×10^{4}	5.7×10^{6}	5.3×10^{5}	270	2.2×10^{-3}
DBE	Short-term Storage of Calcine in bin sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-term Storage of Calcine in bin sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.1×10^{-4}
Full Separations Option										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Borosilicate Vitrification	External event results in a release (HAW) from borosilicate vitrification facility	2.6×10^{-8}	20	5.3×10^{-7}	1.7×10^{4}	1.2×10^{6}	1.5×10^{5}	76	6.3×10^{-4}

Table C.4-2. Summary of bounding facility accidents for the waste processing alternatives (continued).

Frequency	Process title	Event description	Bounding accident frequency (accidents/ year)	Window of exposure (years)	Probability accident occurs (probability)	Maximally exposed individual dose (millirem)	Noninvolved worker dose (millirem)	Offsite public dose (person-rem/ event)	Offsite public LCFs (LCFs/ event)	Per capita risk to offsite population (LCFs/120,000 person-event)
Planning Basis Option										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Borosilicate Vitrification	External event results in a release (HAW) from borosilicate vitrification facility	2.6×10^{-8}	20	5.3×10^{-7}	1.7×10^{4}	1.2×10^{6}	1.5×10^{5}	76	6.3×10^{-4}
Transuranic Separations Option										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-Term Storage of Calcine in Bin Sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.7×10^{-4}
Hot Isostatic Pressed Waste Option										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-term Storage of Calcine in Bin Sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.7×10^{-4}

Table C.4-2. Summary of bounding facility accidents for the waste processing alternatives (continued).

Frequency	Process title	Event description	Bounding accident frequency (accidents/ year)	Window of exposure (years)	Probability accident occurs (probability)	Maximally exposed individual dose (millirem)	Noninvolved worker dose (millirem)	Offsite public dose (person-rem/ event)	Offsite public LCFs (LCFs/ event)	Per capita risk to offsite population (LCFs/120,000 person-event)
Direct Cement Waste Option										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-term Storage of Calcine in Bin Sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.7×10^{-4}
Early Vitrification Option										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-term Storage of Calcine in Bin Sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.7×10^{-4}
Steam Reforming Option										
vABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-term Storage of Calcine in Bin Sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.7×10^{-4}

Table C.4-2. Summary of bounding facility accidents for the waste processing alternatives (continued).

Frequency	Process title	Event description	Bounding accident frequency (accidents/ year)	Window of exposure (years)	Probability accident occurs (probability)	Maximally exposed individual dose (millirem)	Noninvolved worker dose (millirem)	Offsite public dose (person-rem/ event)	Offsite public LCFs (LCFs/ event)	Per capita risk to offsite population (LCFs/120,000 person-event)
Minimum INEEL Processing Alternative										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-term Storage of Calcine in Bin Sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.1×10^{-4}
Vitrification without Calcine Separations Option										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Short-term Storage of Calcine in Bin Sets	External event causes failure of bin set structure	2.6×10^{-8}	35	5.5×10^{-6}	1.4×10^{4}	9.3×10^{5}	1.2×10^{5}	61	5.1×10^{-4}
Vitrification with Calcine Separations Option										
ABN	Calcine Retrieval and Onsite Transport	Equipment failure results in release of calcine	3.0×10^{-3}	35	0.11	40	2.7×10^{3}	470	0.23	2.0×10^{-6}
DBE	Short-term Storage of Calcine in Bin Sets	Short-term flood induced failure of a bin set structure	1.3×10^{-4}	35	5.8×10^{-3}	880	5.9×10^{4}	5.7×10^{4}	29	2.4×10^{-4}
BDB	Borosilicate Vitrification	External event results in a release (HAW) from borosilicate vitrification facility	2.6×10^{-8}	20	5.3×10^{-7}	1.7×10^{4}	1.2×10^{6}	1.5×10^{5}	76	6.3×10^{-4}

ABN = abnormal; BDB = beyond design basis; DBE = design basis; HAW = high-activity waste; LCF = latent cancer fatality

Table C.4-3. Summary of events that produce chemical impacts.

Process title	Event description	Contaminant	Peak atmospheric concentration (ERPG)
	Abnormal Events		
Additional Offgas Treatment	Failure of ammonia tank connections results in a spill of 150 pounds per minute of liquid ammonia for 10 minutes. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	Ammonia	Less than ERPG-2 at 3,600 meters
	Design Basis Events		
New Waste Calcining Facility High Temperature & Maximum Achievable Control Technology Modifications	A carbon filter bed fire. Inadequate nitrous oxide destruction in the reduction chamber of the multi-stage combustion system leads to exothermic reactions in the filter bed. The heat buildup could result in a carbon bed fire and a release of radioactive material (iodine-129) and mercury embedded in the filter bed and corresponding HEPA filter fire.[a]	Mercury	Greater than ERPG-2[b] at 3,600 meters.
Additional Offgas Treatment	Failure of ammonia tank connections results in a spill of 1,500 pounds per minute of liquid ammonia for 10 minutes. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	Ammonia	Greater than ERPG-2 at 3,600 meters
	Beyond Design Basis Events		
Additional Offgas Treatment	Failure of ammonia tank connections results in a spill of 15,000 pounds per minute of liquid ammonia for one minute. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	Ammonia	Greater than ERPG-2 at 3,600 meters

a. This accident also results in a chemical release to the atmosphere. This accident has been evaluated as a potential atmospheric release to assess its potential as an additional source of human health and environmental risk.

b. There is no standard ERPG value for mercury vapor. However, there is a standard method to calculate an ERPG using the Threshold Limit Value – Time Weighted Average (TLV-TWA). In this case the equivalent ERPG-2 value is [(3) (TLV-TWA)] = 0.1 ppm.

ERPG = Emergency Response Planning Guideline; HEPA = high efficiency particulate air.

- New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications.
- Storage of Mixed Transuranic Waste/SBW.
- Storage of Calcine in Bin Sets.

For the purposes of this EIS, the complex subsurface transport calculations used to negotiate performance requirements for the INEEL Environmental Management Program are not needed. Potential impacts that could result from previous spills have already been evaluated for Waste Area Group 3 using subsurface modeling at INTEC as well as a simple screening model approach.

DOE calculated the groundwater impacts beneath the mixed transuranic waste/SBW tanks at INTEC. These impacts are provided for comparison purposes between alternatives under accident conditions and are not meant to fulfill the needs of or replace a performance assessment or INEEL-wide composite analysis as required by DOE Order 435.1. Facilities disposition and closure activities would eventually require such assessments but it is premature to attempt performance assessments until the waste processing technology is selected and the facilities to implement the selected technology are chosen.

The migration of the contaminants from the top of the soil column to the aquifer was evaluated using the same approach for assessing the potential risk via groundwater ingestion as outlined in Rodriguez et al. (1997). This approach evaluates risk via ingestion of groundwater based on modeling of geologic and hydrologic conditions, natural and anthropogenic sources of water, contaminant source locations, contaminant masses and concentrations, as well as release history and geochemical characteristics of existing contaminants. Numerical models were utilized to predict peak groundwater concentrations resulting from bin set failure and mixed transuranic waste/SBW tank failures. Detailed explanations of models and parameters are provided in Schafer (2001) and Rodriguez et al. (1997). A screening analysis was performed to assess the impact of the modeled peak groundwater concentrations by comparing the modeled concentrations to maximum contaminent levels. The results of the groundwater analysis are provided below.

New Waste Calcining Facility High Temperature and MACT Modifications

The New Waste Calcining Facility requires large quantities of kerosene to support the fluidized bed burner. Abnormal and beyond design basis events for calcining is a leak of kerosene to the environment due to equipment failures. This is assumed to result in the release of 15,000 gallons and 30,000 gallons, respectively, of kerosene to the surface soil and subsequent infiltration through the vadose zone to groundwater. The primary concern is the migration of the toxic constituents of the kerosene. A primary toxic constituent of kerosene is benzene, a carcinogen, which has an EPA maximum contaminant level of 5 micrograms/liter. The expected peak groundwater concentration of benzene for the 15,000-gallon spill is approximately 120 micrograms/liter at the edge of the spill when assuming infiltration from normal precipitation. For the beyond design basis event, an external event is assumed to rupture both kerosene tanks and cause a fire. The expected peak groundwater concentration of benzene for the beyond design basis 30,000-gallon spill is approximately 180 micrograms/liter at the edge of the spill when assuming infiltration from normal precipitation. The groundwater impact from such spills would exceed the maximum contaminant level for benzene by a factor of 24 for the 15,000-gallon spill and a factor of 36 for the 30,000-gallon spill. Both accidents assume that the kerosene would form a pool about 3 inches deep before seeping into the subsurface. The benzene component of the kerosene may require about 200 years to reach the groundwater under normal precipitation conditions. Since INTEC would be operational during a kerosene spill, emergency crews would be available to stop the spill, halt the spread of the kerosene, and dispose of contaminated soil. The minimum volume of soil that would be contaminated due to a 15,000 gallon spill is estimated to be 250 cubic yards (Jenkins 2001a). The 30,000 gallon spill would at least double the estimated contaminated soil volume. The results of the abnormal and beyond design basis events are shown in Table C.4-4.

For the abnormal and beyond design basis kerosene spill accidents, DOE analyzed the risk to a resident drinking 2 liters per day of the benzene contaminated groundwater from beneath the INTEC Tank Farm. The additional risk for developing cancer over a 30-year lifetime due to these accidents is 1.9×10^{-4} for the abnormal event and 2.9×10^{-4} for the beyond design basis event (Jenkins 2001b). Cancer fatalities were not estimated for either event.

Storage of Mixed Transuranic Waste/SBW

Three accidents are associated with storage of mixed transuranic waste/SBW. These are:

- Failure of a full mixed transuranic waste/SBW tank vault in the year 2001 with subsequent tank rupture and a release of liquid waste directly to the soil column due to an earthquake. This is considered a design basis event and is assumed to occur in the next 35 years.
- The accidental intrusion by unauthorized persons into a full mixed transuranic waste/SBW tank. This is considered an abnormal event, which cannot take place until after 2095 when it is assumed INEEL institutional control is lost. The results of this scenario are bounded by the failure of a single

tank in 2001 and therefore not analyzed further.

- Degradation and eventual simultaneous failure of 5 full mixed transuranic waste/SBW tanks and their vaults after 500 years with a release of liquid waste directly to the soil column. Although not a true "accident", this event is considered to be an abnormal event under the No Action alternative since it is assumed that the tanks break after 500 years.

The results for the accidents associated with storage of mixed transuranic/SBW are shown in Table C.4-4.

Failure of a full mixed transuranic waste/SBW tank in the year 2001. The rupture of a full mixed transuranic waste/SBW tank in the year 2001 due to a seismic event is assumed to release liquid waste directly to the soil column, where it infiltrates and disperses through the vadose zone and migrates in the groundwater. The impacts for this accident were analyzed using similar modeling assumptions to those considered for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) analyses in the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL, Part A, RI/BRA Report* (Rodriguez et al. 1997). Under these assumptions, the predicted peak groundwater concentration for iodine-129 is 0.13 pCi/L, which is 13 percent of the maximum contaminant level of 1.0 pCi/L. The peak iodine-129 concentration would occur in the year 2075. The predicted groundwater concentration for total plutonium (plutonium-239, plutonium-240, and plutonium-242) is 1.1 pCi/L, which does not exceed the maximum contaminant level of 15 pCi/L for alpha-particle emitters such as plutonium. The peak plutonium concentration would occur in the year 6000. The predicted groundwater concentrations for technetium-99 and neptunium-237 are 100 pCi/L and 0.030 pCi/L, respectively, well below their maximum contaminant levels of 900 pCi/L and 15 pCi/L. The peak concentration for these radionuclides would occur in the years 2075 and 3500, respectively (Bowman 2001a).

Table C.4-4. Summary of accidents resulting in groundwater impacts.

Process title	Event	Accident Frequency	Constituent	Peak groundwater concentration (µg/L or pCi/L)	MCL (µg/L or pCi/L)
New Waste Calcining Facility High Temperature & MACT Modifications	A leak through failed process connections leaks 15,000 gallons of kerosene.	Abnormal Event	Benzene in kerosene	120	5[a]
New Waste Calcining Facility High Temperature & MACT Modifications	An external event results in the failure of both kerosene storage tanks and a subsequent fire.	Beyond Design Basis Event	Benzene in kerosene	180	5
Long-Term Storage of SBW-Single Tank	A seismic event causes the failure of a single full SBW tank and a release of SBW directly to the soil column in the year 2001.	Design Basis Event	I-129	0.13	1
			Tc-99	100	900
			Np-237	0.030	15
			Total Pu	1.1	15
Long-Term Storage of SBW-5 Tank	Degradation and simultaneous failure of 5 full SBW tanks in 2500.	Abnormal Event	I-129	0.47	1
			Tc-99	380	900
			Np-237	0.34	15
			Total Pu	8.6	15

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a. Based on benzene component.

MCL = maximum contaminant level; µg/L=micrograms per liter; pCi/L= picocuries per liter;
SBW = mixed transuranic waste/SBW

Degradation and simultaneous failure of 5 full mixed transuranic waste/SBW tanks after 500 years. For the No Action Alternative, mixed transuranic waste/SBW would be stored in the below grade tanks indefinitely. The impact of the tank failures has been analyzed under the assumptions that (a) all five tanks fail simultaneously and (b) prior to failure all other tank contents and tank heels have been pumped into the five tanks. Although five times more mixed transuranic waste/SBW would be released to the soil column (relative to the single tank failure described above), many of the radionuclides would have decayed to very low activities over the 500 years. The impacts for this accident were analyzed using similar modeling assumptions to those considered for the CERCLA analyses in Rodriguez et al. (1997). Under these assumptions, the analysis shows that the impact from the tank failures would result in peak concentrations of iodine-129 at 0.47 pCi/L in the year 2575, technetium-99 at 380 pCi/L in the year 2595, neptunium-237 at 0.34 pCi/L in the year 4000, and total plutonium at 8.6 pCi/L in the year 6500. Thus, the peak concentrations for these key radionuclides would be less than current drinking water standards (Bowman 2001b).

The risk to an assumed long-term resident drinking the groundwater from beneath the INTEC Tank Farm was analyzed for this accident. Using the concentration-to-dose conversion factor from DOE (1998), and assuming 72 years of water ingestion at 2 liters per day, DOE estimated a lifetime whole-body dose equivalent to 420 millirem due to total plutonium for this accident. This equates to a 210 per million increase in the probability of a fatal cancer. As for the single tank failure, these results could be non-conservative depending on the assumed mass release time for the 5-tank failure. Since doses are directly related to concentrations, a faster release time would be expected to increase concentration and doses accordingly.

This accident would release at least 5 times more source term to the soil column than considered for the single tank failure. Nevertheless, the concentrations of nonradionuclide contaminants in the aquifer would be less than the drinking water standards. The analysis for the 5-tank failure shows the greatest impact would be due to cadmium which would be about 41 percent of its maximum contaminent level. The next most impacting contaminant, uranium, would be about 0.5 percent of its maximum contaminant level based on the CERCLA model.

Storage of Calcine in Bin Sets

For this accident a seismic event is assumed to damage a degraded bin set facility structure and equipment such that a release occurs with a direct pathway to the environment. Bin set 5 was analyzed for this event since it has the largest bin set source term. A seismic event that exceeds the design capacity of the structure would be powerful enough to breach passive berms thus providing a direct leakage pathway to the environment. Although the frequency of the seismically induced failure involving the bin set would be less than 1×10^{-4}, the accident is assumed to occur within 500 years and is treated as an abnormal event. The bin set breach is assumed to release calcine directly to the environment and would result in both air and groundwater impacts. The impacts to the environment are much larger for the air releases, however, all calcine would be subjected to gradual dissolution with subsequent infiltration directly to the soil column.

The accident analysis conservatively assumed that all calcine is released from the stainless-steel bin sets and deposited on the floor of the calcine solids storage facility. It is further conservatively assumed that the calcine is subjected to normal precipitation and that all leachate dissolved from the calcine is deposited directly to the soil column with no holdup in the basemat (Jenkins 2001c). Even under these very conservative conditions, the inventory of key radionuclides and nonradionuclides deposited to the soil column is a fraction of the inventory due to the 5 full mixed transuranic waste/SBW tanks failure accident discussed for storage of mixed transuranic waste/SBW. For the bin set failure in 500 years, the percent of the radionuclide inventory released the first year compared to the inventory released from the 5-tank failure is: I-129 (1 percent); Tc-99 (11 percent); Np-237 (7 percent); and total plutonium (< 1 percent). For the nonradionuclides, the percentage of the inventory released the first year compared to the 5-tank failure for the most impacting species is: beryllium (8 percent) and molybdenum (4 percent). All other nonradionuclides are less than 1 percent of the inventory released from the 5-tank failure. Therefore, this accident is bounded by the 5-tank failure accident at 500 years described under storage of mixed transuranic waste/SBW.

C.4.1.8 Integrated Risk to Involved Workers

In accordance with the methodology described in Section C.4.1.4.1, point estimates for involved worker risk have been derived and are depicted on Table C.4-5. This table presents the relative contributions from industrial accidents, occupational exposures, and facility accidents for each waste processing alternative. The involved worker risks do not include risks posed by transportation or facility disposition. From Table C.4-5 several conclusions can be drawn:

- Involved worker risk for all alternatives are sensitive to parameters such as the number of worker years of exposure, the rate of industrial accident fatalities, and the frequency of radiological release accidents. Consistent with the state of knowledge regarding projects and activities associated with implementation of alternatives, the point estimates provide a means for comparison of the alternatives.

- Estimates of involved worker risk due to industrial accidents do not favor alternatives that require large amounts of manpower during implementation. Thus, alternatives such as the Planning Basis Option that encompass the largest requirements for facility construction as well as the longest facility operation campaigns, could pose risk to involved workers from industrial accidents that is a full order of magnitude higher than that posed by less ambitious alternatives.

- Industrial accidents are, for most of the alternatives, the largest contributors to involved worker risk. Therefore, estimates of integrated involved worker risk (including all sources) typically favor the Minimum INEEL Processing Alternative, Steam Reforming Option, and Vitrification without Calcine Separations Option that involve less site activity over time. However, the risks posed by transportation and activities at the Hanford site are not included in the estimates of involved worker risk for the Minimum INEEL Processing Alternative.

In additon, only one reasonably foreseeable criticality accident scenario was identified in the accident analysis evaluations. Transuranic Waste Stabilization and Preparation for Transport identified an inadvertent criticality during transuranic waste shipping container-loading operations as a result of vulnerability to loss of control over storage geometry. This scenario is identified under both the Transuranic Separations Option and the Minimum INEEL Processing Alternative. The frequency for this bounding accident is estimated to be between once in a thousand years and once in a million years of facility operations. This event could result in a large dose to a nearby, unshielded maximally exposed worker that is estimated to be 218 rem, representing a 1 in 5 chance of a latent cancer fatality. However, this same bounding analysis estimates a dose to the maximally exposed offsite individual at the site boundary (15,900 meters down wind at the nearest public access) to be only 3 millirem, representing a 2 per million increase in cancer risk to the receptor.

Example of Methodology - The Integrated Involved Worker Risk (IWR) calculation includes three separate components and two separate time periods. The three components are the risks from (1) industrial accidents, (2) occupational radiation doses, and (3) facility accidents. The two time periods are the construction period, which includes systems operations and startup testing, and the operations period. Summing the appropriate components for the two time periods produces the Integrated IWR. Mathematically, this is shown below:

Construction Period (sum of Occupational Risk + Industrial Risk) + Operations Period
(sum of Occupational Risk + Industrial Risk + Facility Accident Risk) = Integrated IWR

Table C.4-5. Point estimates of integrated involved worker risk for the waste processing alternatives.

	Involved worker risk (fatalities) [a]			
Alternative	Industrial accidents[b]	Occupational radiation dose[b]	Facility accidents[b]	Integrated worker risk[b]
No Action Alternative	0.44	0.15	21	21
Continued Current Operations Alternative	0.54	0.20	21	21
Separations Alternative				
Full Separations Option	1.8	0.38	2.3×10^{-3}	2.2
Planning Basis Option	1.9	0.47	2.3×10^{-3}	2.4
Transuranic Separations Option	1.2	0.36	2.3×10^{-3}	1.6
Non-Separations Alternative				
Hot Isostatic Pressed Waste Option	1.2	0.44	2.3×10^{-3}	1.6
Direct Cement Waste Option	1.4	0.51	2.3×10^{-3}	1.9
Early Vitrification Option	1.1	0.37	2.3×10^{-3}	1.5
Steam Reforming Option	0.82	0.31	2.3×10^{-3}	1.1
Minimum INEEL Processing Alternative[c]	0.92	0.32	2.3×10^{-3}	1.2
Direct Vitrification Alternative				
Vitrification without Calcine Separations Option	0.90	0.29	2.3×10^{-3}	1.2
Vitrification with Calcine Separations Option	1.6	0.31	2.3×10^{-3}	1.9

a. Does not include risk associated with decontamination and decommissioning (addressed in Section 5.3.12) or transportation (addressed in Section 5.2.9) activities.

b. Fatalities over life of activities.

c. Does not include activities at the Hanford Site.

To calculate the Integrated IWR one needs both alternative specific information as well as generic information. The alternative specific information includes the number of projects, the number of total worker hours for each project, the number of total radiation worker hours for each of the project, and the duration of the projects. This information is needed for both construction and operations phases. Also needed are the estimated fatalities associated with facility accidents. The generic information includes the average radiation exposure during construction and operations, the industrial accident rate, and the exposure risk factor, which translates the person-rem doses to latent cancer fatalities.

As an example, consider the Direct Cement Waste Option. This option consists of eight separate projects:

P1A	Calcine SBW Including New Waste Calcining Facility Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P18	New Analytical Laboratory
P59A	Calcine Retrieval and Transport
P80	Direct Cement Process
P81	Unseparated Cementitious HLW Interim Storage
P83A	Packaging and Loading Cementitous Waste at INTEC for Shipment to a Geologic Repository
P133	Waste Treatment Pilot Plant

Considering one of the projects, P1A, the project data sheet in Section C.6.2.1 of Appendix C.6, indicates that there are 96 construction workers per year for 5 years. In this total of 96 construction workers, there are 48 radiation workers per year. With respect to operations, the project data sheet indicates there will be 148 total workers for 6 years. Of the 148 operations workers, there are 96 radiation workers.

To calculate the occupational risks, DOE summed the risks from radiation exposure during construction and during operations. The total number of radiation worker hours for both time periods was multiplied by the average exposure rate for each period and then summed to get the total exposure. For Project P1A, there are 48 radiation workers per year times 5 years for the construction period (a total of 240 worker-years) and 96 radiation workers per year times 6 years for the operations period (a total of 576 worker-years). For this EIS, DOE assumed an average radiation worker exposure of 0.25 rem/year for the construction period and 0.19 rem/year for operations. Multiplying these two factors times the associated radiation worker-years and summing the two products will give the total worker exposure. In the P1A example, there are 240 radiation worker-years at 0.25 rem/year for a total construction exposure of 60 person-rem and 576 radiation worker-years at 0.19 rem/year for a total operations exposure of 109 person-rem. Summing the two yields a total exposure of 169 person-rem. To calculate the occupational exposure risk, DOE converted the total worker exposure to the number of latent cancer fatalities by multiplying by a dose-to risk conversion factor of 4×10^{-4} latent cancer fatalities per person-rem of exposure. In the P1A example, 169 person-rem at 4×10^{-4} latent cancer fatalities per person-rem results in 0.068 latent cancer fatalities.

To calculate the industrial risks, DOE summed the risks from industrial accidents during the construction and operations phases. To do this, DOE took the total number of worker-hours for both time periods and multiplied by the industrial accident rate for the INEEL. In Project P1A, there are 96 workers per year times 5 years for the construction period (a total of 480 worker-years), and 148 workers per year times 6 years for operations (a total of 888 worker-years) for a grand total of 1,370 worker-years. This EIS uses an accident rate of 0.011 fatalities per 100 worker-years or 0.00011 fatalities per worker-year. Multiplying this accident rate by the total number of worker-years provides the number of fatalities for this task from industrial accidents. For Project P1A, there are 1,370 worker-years at 0.00011 fatalities per worker-year, which results in 0.150 fatalities.

The third component of Integrated IWR is the risk from facility accidents. The methodology for determining facility accident risk is described in Section C.4.1.4.1.

If the alternative consisted of just this one project, the three risk components described above would be summed to calculate the Integrated IWR. For the Direct Cement Waste Option, DOE performed the risk calculations for all eight projects and then summed the results. A straightforward way to perform these multiple calculations is with a spreadsheet. A sample spreadsheet to show how one might be constructed is shown in Figure C.4-5. Project specific information for each of the projects comprising the Direct Cement Waste Option has been included in this spreadsheet. The data described above for Project P1A appears in Step 1 of the spreadsheet.

DOE identified all of the projects for the Direct Cement Waste Option, and determined the associated worker and radiation worker hours. The next step was to sum these values for the two time periods as follows. As was done for Project P1A, the radiation worker subtotals for the Direct Cement Waste Option (see Step 2 in Figure C.4-5) were used to calculate the occupational risks. The total radiation worker-years for construction (780) were multiplied by 0.25 rem/yr to get the total radiation exposure during construction of 195 person-rem. Similarly, the total radiation worker exposure during operations was determined by multiplying the total radiation worker-years (5,664.5) by 0.19 rem/yr to get 1,076 person-rem. To determine the occupational risk, DOE added the exposures for construction (195) and operations (1,076) to get 1,271 person-rem. This total worker exposure was multiplied by the dose-to risk conversion factor (4×10^{-4} latent cancer fatalities per person-rem) to determine the risk from radiation exposure. For the Direct Cement Waste Option, this occupational exposure risk is 0.509 latent cancer fatality.

To calculate the industrial risks, DOE used the total worker years (12,293) and multiplied by the industrial accident rate of 0.00011 fatalities per worker-year to determine the total number of fatalities from industrial accidents. For the Direct Cement Waste Option, this industrial accident risk is 1.352 fatalities.

The last component of the Integrated IWR calculation is the risk from facility accidents. This risk is not only a function of the type of accidents, but also the probability of the accidents and the consequences thereof. The methodology is described in detail in Section C.4.1.4.1. Basically, it is sum of the probability of the bounding accident occurring for each of three time periods multiplied by the consequences of those accidents and a conversion factor. Mathematically, this can be shown as:

Σ Probability x Consequences x Dose to Fatality Conversion Factor = Facility Accident Risk

For the Direct Cement Waste Option, the risk from facility accidents is 0.002 fatalities.

The last step is to add the components of the Integrated IWR to get the final result, which is 1.863 fatalities as shown in Step 3 of Figure C.4-5.

C.4.1.9 Comparison of Waste Processing Alternatives Based on Facility Accidents

Bounding accident scenarios in this EIS bound the consequences of accidents that could occur as a result of implementing a waste processing alternative. Bounding accident scenarios contribute much but not all of the risk associated with implementation of an alternative. In order to compare the risk of implementing a waste processing alternative based on facility accidents, it is appropriate to construct a basis for estimating the total risk of implementation rather than simply comparing the largest accidents posed by an alternative. As a prelude to this comparison, an understanding of the relationship between risk due to bounding accident scenarios and the total risk of implementation must be developed.

The process used to compare health and safety risk to the public as a result of implementing each of the waste processing alternatives is shown in Table C.4-2 and its accompanying descriptive information. This table provides an integrated perspective on risk to the public as a result of bounding facility accidents for all the waste processing alternatives. In Table C.4-2, the contribution to public risk (in latent cancer fatalities) from identified bounding accident sce-

DIRECT CEMENT WASTE OPTION

①

PROJECT P1A	CONSTRUCTION	OPERATIONS
workers/year	96	148
radiation workers/year	48	96
duration	5	6
total worker-years	480	888
total radiation worker-years	240	576
average exposure rem/yr	0.25	0.19

PROJECT P1B	CONSTRUCTION	OPERATIONS
workers/year	20	76
radiation workers/year	0	60
duration	4	21
total worker-years	80	1596
total radiation worker-years	0	1260
average exposure rem/yr	0	0.19

PROJECT P18	CONSTRUCTION	OPERATIONS
workers/year	59	105
radiation workers/year	0	30
duration	4	21
total worker-years	236	2205
total radiation worker-years	0	630
average exposure rem/yr	0	0.19

PROJECT P59A	CONSTRUCTION	OPERATIONS
workers/year	100	11.25
radiation workers/year	90	10
duration	6	21
total worker-years	600	236.25
total radiation worker-years	540	210
average exposure rem/yr	0.25	0.19

PROJECT P80	CONSTRUCTION	OPERATIONS
workers/year	100	140
radiation workers/year	0	93
duration	7	21
total worker-years	700	2940
total radiation worker-years	0	1953
average exposure rem/yr	0	0.19

FIGURE C.4-5. (1 of 2) Sample integrated involved worker risk calculation.

PROJECT P81	CONSTRUCTION		OPERATIONS
workers/year	134		6.5
radiation workers/year	0		4.5
duration	5		21
total worker-years	670		136.5
total radiation worker-years	0		94.5
average exposure rem/yr	0		0.19
PROJECT P83A	**CONSTRUCTION**		**OPERATIONS**
workers/year	0		11
radiation workers/year	0		2.5
duration	0		20
total worker-years	0		220
total radiation worker-years	0		50
average exposure rem/yr	0		0.19
PROJECT P133	**CONSTRUCTION**		**OPERATIONS**
workers/year	63		39
radiation workers/year	0		33
duration	4		27
total worker-years	252		1053
total radiation worker-years	0		891
average exposure rem/yr	0		0.19

②

SUBTOTALS	CONSTRUCTION		OPERATIONS
total worker-years	3018		9274.75
total radiation worker-years	780		5664.5

GRAND TOTALS			
worker-years		12292.75	
radiation worker-years		6444.5	
FACILITY ACCIDENTS	**Abnormal**	**Design Basis**	**Beyond Design Basis**
Accident ID	ABN03	DBE20A	BDB20A
Probability Accident Occurs	0.11	5.80E-03	5.50E-06
Noninvolved Worker Dose - rem	2.7	59	930
Involved Worker Dose - rem	24.3	531	8370
Accident Risk	0.001069	1.23E-03	1.84E-05
Total Facility Accident Risk		2.32E-03	

③

Life Cycle Integrated Worker Risk (IWR), Point Estimate (fatalities)

Industrial Accidents		Occupational Exposures		Facility Accidents		Integrated Worker Risk
1.352	+	0.509	+	0.002	–	1.863

FIGURE C.4-5. (2 of 2) Sample integrated involved worker risk calculation.

narios is presented as a fractional increase over the background cancer rates for the total affected population analyzed.

The information in Table C.4-2 supports comparison of waste processing alternatives based on the risk of facility accidents and shows:

- Alternatives that are vulnerable to bounding accident scenarios with the highest probabilities of occurrence and estimated consequences exhibit the highest potential for risk due to facility accidents. Those alternatives that do not address the basic issue of reducing releasable material inventories have the highest predicted combinations of likelihood and consequences for bounding accidents, thus posing risk to the public several orders of magnitude greater than alternatives that actively reduce risk over time.

- Alternatives requiring the use of separation and vitrification technologies could pose relatively high risk from facility accidents. Historical experience indicates that such processes could have a relatively high likelihood of accidents that result in significant and energetic release of materials.

C.4.2 FACILITY DISPOSITION ACCIDENTS

C.4.2.1 Derivation of Facility Disposition Accidents

The accident analysis provides a systematic review of alternatives for the disposition of INTEC facilities. Each facility disposition alternative requires an analysis of potential facility accidents as one of the environmental impacts, particularly to human health and safety, associated with its implementation. DOE has performed an accident analysis to identify environmental impacts associated with accidents that would not necessarily occur, but which are reasonably foreseeable and could result in significant impacts. Since the potential for accidents and their consequences varies among different facility disposition options, accidents provide a discriminator among the facility disposition alternatives. Accidents were defined according to the National Environmental Policy Act as undesired events that could occur during or as a result of implementing an alternative and that would have the potential to result in human health impacts or indirect environmental impacts.

Potential facility disposition accidents pose health risk to several groups of candidate recipients. Along with workers performing disposition activities at each facility (involved workers), workers at nearby INEEL facilities (noninvolved workers) and the offsite population could be exposed to hazardous materials released during some accident scenarios. Potential facility disposition impacts to human health arise from the presence of radiological, chemical, and industrial (physical) hazards. Clean closure, performance-based closure, and closure to landfill standards were the three major alternatives considered in the accident analysis for disposition of existing INTEC HLW management facilities.

The approach for evaluation of facility disposition accidents in the accident analysis is illustrated in Figure C.4-6. Potential facility disposition impacts for noninvolved workers and members of the offsite population are analyzed differently than for involved workers. Only involved workers are subject to industrial accident hazards, such as falls or electrical shocks; however, all three groups could be exposed to radioactivity and/or hazardous chemicals released in a severe accident.

For noninvolved workers and the offsite population, a maximum reasonably foreseeable accident for facility disposition activities was identified in the accident analysis. The maximum reasonably foreseeable disposition accident for each facility was compared to the maximum credible accident postulated for normal operation of that facility. The comparative approach was adequate for National Environmental Policy Act purposes, since the facilities currently manage nuclear and chemical risks through the safety authorization basis. If the maximum credible accident during facility operation bounds the maximum reasonably foreseeable accident during facility disposition, then facility disposition activities would not be

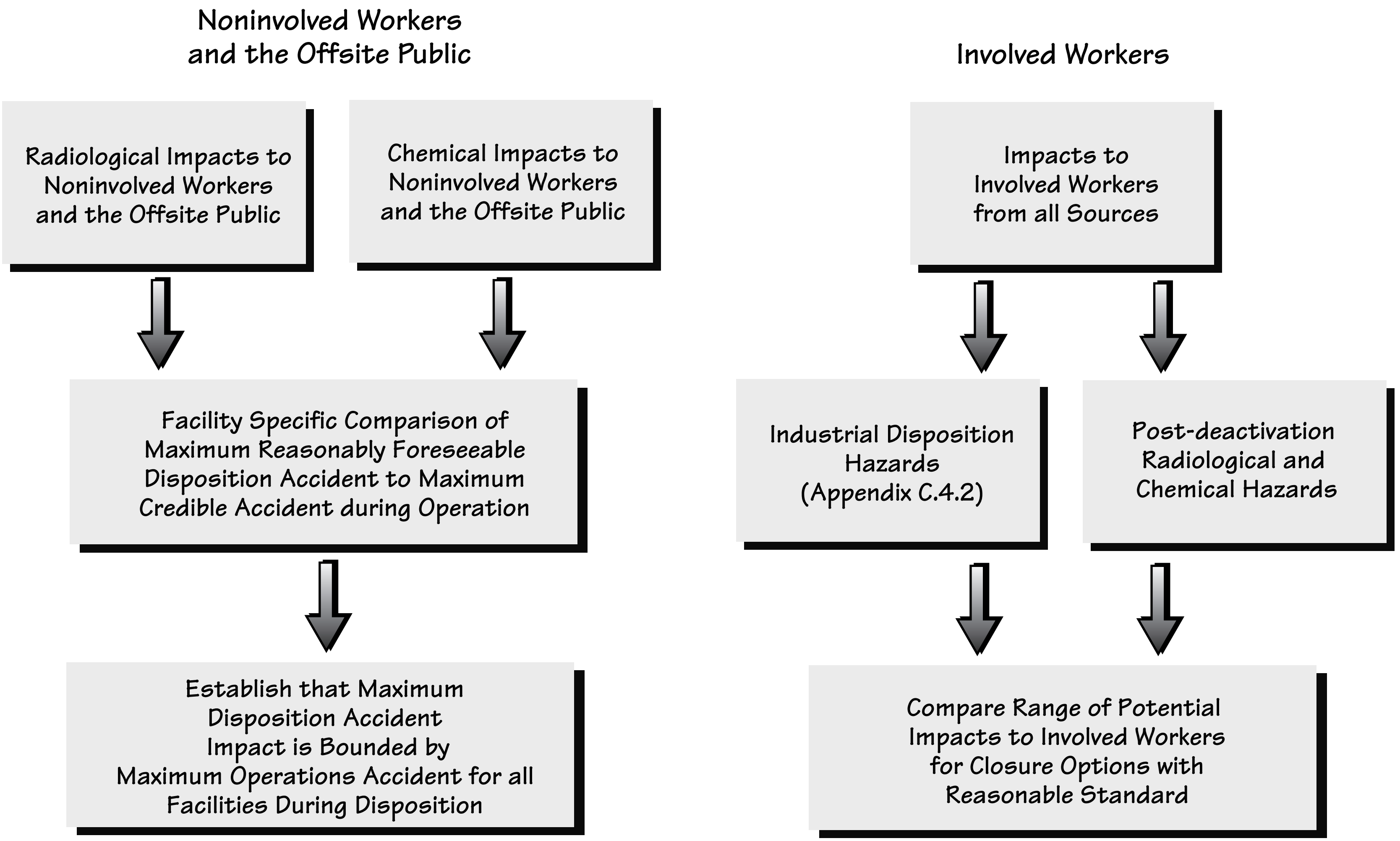

FIGURE C.4-6.
Impact assessment methodology for hypothetical disposition accidents in INTEC facilities.

expected to introduce new or previously undisclosed sources of risk to noninvolved workers and the offsite population.

Data sources used to establish maximum reasonably forseeable facility accidents during facility operation included safety assurance documents and EIS estimates for bounding facility accidents. Comparisons between disposition events and corresponding operations accidents were based on relative differences in inventories of radioactive materials and hazardous chemicals, changes in mobility of these substances, and changes in the energy available for accident initiation and propagation. For individual facilities, the combination of inventory reductions, immobilization of residues, and removal of energy sources resulted in a significantly reduced potential for health impacts when compared to current operations, inferring that risk to noninvolved workers and the offsite public would not be increased by prospective actions taken to implement the facility disposition alternatives.

Involved workers could be exposed to industrial hazards, and hazards from residual chemicals and radioactive materials during deactivation. These hazards to involved workers would not necessarily diminish when major inventories of chemicals and radioactive substances are removed or immobilized. The likelihood of industrial accidents could increase during facility disposition because more industrial labor is required during active phases of disposition. Likewise, the potential for inadvertent exposure to excessive radioactivity or chemical hazards may increase due to loss of monitoring capabilities and relaxation of mechanisms to control exposure during operation

For these reasons the strategy for evaluating the facility disposition alternatives in the accident analysis was to compare the potential for health impacts to involved workers from disposition activities with a standard of acceptability used to validate facility operations. Industrial hazards were estimated using the disposition health and safety information from Appendix C.3. Impacts of radiological hazards were estimated on the basis of hours worked in a radiation environment, the dose rate, and the correlation between exposure and latent cancer fatalities for workers. Impacts of inadvertent exposure to residual radioactive or chemically hazardous materials were estimated based on assumptions regarding the potential for human errors and breakdowns during facility disposition activities.

C.4.2.2 Scope of the Analysis

This analysis postulates accidents that could occur during disposition of INTEC facilities and have the potential to harm workers, the offsite population, and the environment. This analysis of facility disposition accidents was applied only to those existing INTEC facilities that are significant to the treatment, storage, or generation of HLW. New facilities required for the waste processing alternatives are not considered in the analysis because the design of these facilities has not been finalized, and the designs would include features to facilitate dispositioning (DOE 1989). Thus, new HLW management facilities are assumed to have minimal radioactive and hazardous material inventories remaining at the time of disposition and a low potential for significant accidents.

As described in Section 3.2.2 of this EIS, DOE used a systematic process to identify which existing INTEC facilities would be analyzed in detail for this EIS. Facilities that pose short-term radiological and chemical hazards to noninvolved workers and the offsite population are presented in Table C.4-6; the emphasis was on those facilities where potential accidents could rapidly disperse radionuclides and/or hazardous chemicals beyond the immediate working area. Selection guidance was obtained from a prior study, the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL Part A, RI/BRA Report* (Rodriguez et al. 1997), which identified those facilities with airborne release and direct exposure pathways.

For purposes of the facility disposition accident analysis, HLW management facilities that have only "groundwater pathways" for hazardous material releases were not assessed for potential impacts to noninvolved workers and the offsite population. Facility disposition accident releases to the groundwater pathway would not be expected to produce a short-term health impact to the public because DOE could remediate the affected media or restrict public access to it. Also, due to limitations on material, accessibility, and available energy for release, the possi-

Table C.4-6. Existing INTEC HLW management facilities with significant risk of accidental impacts to noninvolved workers and to the offsite population.[a]

	Tank Farm
CPP-713	Vault containing Tanks VES-WM-187, 188, 189, and 190 with supporting equipment and facilities
CPP-780	Vault containing Tank VES-WM-180 with supporting equipment and facilities
CPP-781	Vault containing Tank VES-WM-181 with supporting equipment and facilities
CPP-782	Vault containing Tank VES-WM-182 with supporting equipment and facilities
CPP-783	Vault containing Tank VES-WM-183 with supporting equipment and facilities
CPP-784	Vault containing Tank VES-WM-184 with supporting equipment and facilities
CPP-785	Vault containing Tank VES-WM-185 with supporting equipment and facilities
CPP-786	Vault containing Tank VES-WM-186 with supporting equipment and facilities
	Bin Sets
CPP-729	Calcined Solids Storage Facility 1 with supporting equipment and facilities
CPP-742	Calcined Solids Storage Facility 2 with supporting equipment and facilities
CPP-746	Calcined Solids Storage Facility 3 with supporting equipment and facilities
CPP-760	Calcined Solids Storage Facility 4 with supporting equipment and facilities
CPP-765	Calcined Solids Storage Facility 5 with supporting equipment and facilities
CPP-791	Calcined Solids Storage Facility 6 with supporting equipment and facilities
CPP-795	Calcined Solids Storage Facility 7 with supporting equipment and facilities
	Process Equipment Waste Evaporator and Related Facilities
CPP-604	Process Equipment Waste Evaporator
CPP-605	Blower Building
CPP-649	Atmospheric Protection Building
CPP-708	Main Exhaust Stack
CPP-756	Prefilter Vault
CPP-1618	Liquid Effluent Treatment and Disposal Facility
	Fuel Processing Building and Related Facilities
CPP-601	Fuel Processing Building
CPP-627	Remote Analytical Facility
CPP-640	Head End Process Plant
	Other Facilities
CPP-659	New Waste Calcining Facility
CPP-666/767	Fluorinel Dissolution Process and Fuel Storage (FAST) Facility and Stack
CPP-684	Remote Analytical Laboratory

a. Derived from Harrell (1999) and Rodriguez et al. (1997).

bility of such large events can be categorically eliminated or assumed to be bounded by the facility accidents already considered.

Because current facility data on the type and quantities of miscellaneous hazardous materials were not available, no definitive analysis was done with respect to the chemical content and potential impact of incidental hazardous materials at the facilities. Hazardous materials expected to be present during facility disposition activities include kerosene, gasoline, nitric acid, decontamination fluids, and paints. The assumption was made that closure activities would include the disposal and cleanup of hazardous materials to the maximum extent practicable in accordance with the current decommissioning manuals and regulations. In any event, during INTEC-wide operations, the bounding release scenario for hazardous chemicals with the greatest potential consequences to noninvolved workers and the offsite population is a catastrophic failure of a 3,000-gallon ammonia tank. This scenario results in ammonia releases greater than ERPG-2 concentrations at 3,600 meters and would require immediate evacuation of nearby personnel. This accident scenario would also bound potential chemical releases for the facility disposition analysis cases thus negating the necessity to analyze specific chemical releases facility by facility.

There are two end products of this HLW management facility disposition analysis: (1) for potential impacts to noninvolved workers and to members of the offsite population, a comparison of "Maximum Plausible Accident Scenarios" for each applicable facility disposition activity and closure option with impacts anticipated during facility operation and (2) for involved workers, estimates of relative health and safety risk among the facility closure options. In both cases risks will not be estimated in terms of absolute impact on the health and the environment but can be used for comparison purposes.

C.4.2.3 Facility Disposition Alternatives

The three facility disposition alternatives considered by DOE and included in this analysis are defined below.

Clean Closure

Hazardous wastes and radiological and chemical contaminants, including contaminated equipment, would be removed from the facility or treated so that residual radiological and chemical contamination is indistinguishable from background concentrations. Use of facilities (or the facility sites) after clean closure would present no risk to workers or the public from radiological or chemical hazards. Clean closure may require total dismantlement and removal of facilities.

Performance-Based Closure

For radiological and chemical hazards, performance-based closure would be in accordance with risk-based criteria. The facilities would be decontaminated so that residual waste and contaminants no longer pose any unacceptable exposure (or risk) to workers or to the public. Post-closure monitoring may be required on a case-by-case basis. Closure methods would be dictated on a case-by-case basis depending on risk.

Closure to Landfill Standards

The facilities would be closed in accordance with Federal, state, and/or DOE requirements for closure of landfills. Closure to landfill standards is intended to protect the health and safety of the workers and the public from releases of contaminants. This could be accomplished by installing an engineered cap; establishing a groundwater monitoring system; and providing post-closure monitoring and care of the waste containment system, depending on the type of contaminants.

C.4.2.4 Analysis Methodology for Noninvolved Workers and the Offsite Population

For the facility disposition options, DOE performed a systematic review of available data from applicable INTEC safety analysis reports, safety reviews, HLW management facility closure studies, and EIS technical requirements data that were presented in the accident analysis. The maximum plausible accident scenario, selected for the HLW management facilities with airborne release and direct exposure pathways, is compared to a bounding accident scenario that was postulated during normal facility operations in safety analysis reports or in the accident analysis. In some cases, references have not been updated to reflect cessation of fuel processing operations at INTEC. Criticality may still be cited as the maximum postulated operations accident as a result of previous processing or storage operations at the facility. Although such an event would no longer be possible, its potential for occurrence has been evaluated and "accepted" as part of the facility safety management requirements by DOE.

A seven-step process, as described in the accident analysis, was used to select and compare the bounding accident scenarios for facility disposition activities. This process included:

- Review of facility descriptions including material inventories.
- Facility closure condition and type of closure expected to be implemented.
- Material at risk and likelihood of significant material remaining in the facility.
- Contaminant mobility at closure and likelihood of contaminants being available for release during disposition activities.
- Available energy during the accident at closure including accidents involving fires, explosions, spills, nuclear criticality, natural phenomena, and external events.
- Maximum plausible accident at closure, which is the largest credible accident during facility closure that could be hypothesized using available information.
- Comparison to maximum credible accident during facility operation.

Table C.4-7 summarizes the results of the analyses of facility disposition accidents

C.4.2.5 Industrial Hazards to Involved Workers During Facility Disposition

The risk of impacts to noninvolved workers and the public as a result of radiological and chemical release accidents during facility disposition is small. However the risk to involved workers is important and can be a discriminator among facility disposition alternatives. Involved workers may incur health effects from three sources during the implementation of facility disposition alternatives.

- Industrial accidents, particularly those occurring in the course of decontamination, construction, and demolition activities.
- Increased occupational doses as a result of exposure to contaminated ground and facilities, under conditions where exposures are unplanned for or the level of shielding and protection is reduced.
- Chemical release accidents that impact involved workers but not uninvolved workers or the public.

Specific hazards and their relative contributions to involved worker risk will vary among facilities and the closure options selected for them. In general, clean closure requires more interaction between workers and hazards than a performance-based closure, while a closure to landfill standards requires the least interaction.

Nonradiological Hazards. This section analyzes the potential impacts to involved workers from these hazards during disposition of the HLW management facilities pertinent to this EIS. Industrial impacts are estimated in terms of injuries, illnesses, and fatalities that are sustained on the job and reported according to Occupational Safety and Health Administration regulations. The total number of injuries/illness and fatalities that could occur at each of the existing HLW management facilities during the facility disposition period are estimated according to total labor hours. This provides an additional discriminator, a relative assessment of the total number of reportable injuries/illness and fatalities for disposition of the existing HLW management facilities. The absolute numbers of calculated industrial incidents are dependent on preliminary estimates of disposition labor for each facility, which are uncertain given the preliminary nature of facility disposition plans. For example, the estimates do not include disposition of transport lines between individual facilities, for which projection of labor are not yet available. Nevertheless, the relative numbers of injuries/illnesses and fatalities among facility

Table C.4-7. Facility disposition accidents summary.

Facility number	Facility title	Clean closure	Performance-based	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident[a]
CPP-601	Fuel Processing Building		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Radiological: criticality event of 4.0×10^{19} fissions that released 3.0×10^{5} curies to the atmosphere
CPP-604	Waste Treatment Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Radiological: criticality event of 4.0×10^{19} fissions that released 3.0×10^{5} curies to the atmosphere
CPP-605	Blower Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Chemical release due to ammonia gas explosion in the former NO_x Pilot Plant during New Waste Calcining Facility testing
CPP-627	Remote Analytical Facility		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Radionuclide spill in the CPP-627 cave that resulted in 0.23 rem (MEI) and 7.4×10^{-6} rem (OSP).
CPP-640	Head End Process Plant		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Cask criticality initiated by a flood that resulted in 0.051 rem (MEI) and 1.2×10^{-3} rem (OSP).
CPP-659	New Waste Calcining Facility		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Crane drops or equipment malfunctions during decontamination or demolition activities	An external event results in 0.34 rem (MEI), 23 rem (NIW), 5,700 rem (OSP), and 2.9 LCF.

Table C.4-7. Facility disposition accidents summary (continued).

Facility number	Facility title	Clean closure	Performance-based	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident[a]
CPP-666 and 767	Fluorinel Storage Facility and Stack	●	●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Radiological: criticality event in the SNF Storage Area of 3.0×10^{19} fissions resulted in 2.4 rem (MEI); 0.033 rem (OSP).
CPP-684	Remote Analytical Laboratory		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	High winds disperse residual contaminants freed during routine demolition activities	Failure of CPP-684 containment releasing contents of Analytical Cell.
CPP-1618	Liquid Effluent Treatment & Disposal Building	●			Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Fractionator explosion: 50 curies of tritium; doses of 1.0×10^{-3} rem (MEI) and 3.0×10^{-4} rem (OSP).
CPP-708	Main Stack			●	Low levels of radioactive and hazardous material	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to gradual disassembly of stack	Accidental drop of stack segment during disassembly	Main stack toppled westward by earthquake, crushing CPP-756 prefilters and CPP-604 offgas filter
CPP-713	Vault for Tanks VES-WM-187, 188, 189, and 190	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the tanks with Class C-type grout or clean fill material	Low energy sources during mixed transuranic waste/SBW retrieval, removal of combustible materials, and routine decontamination	Rupture or break in the mixed transuranic waste/SBW transfer lines during retrieval operations	An external event results in 0.34 rem (MEI), 23 rem (NIW), 3,500 rem (OSP), and 1.8 LCF.
CPP-729	Bin set 1	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C-type grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine decontamination	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF.

Table C.4-7. Facility disposition accidents summary (continued).

Facility number	Facility title	Clean closure	Performance -based	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident[a]
CPP-742	Bin set 2	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C-type grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF.
CPP-746	Bin sets 3	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C-type grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF.
CPP-756 and 649	Prefilter Vault and Atmospheric Protection System Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility ensured by pipe capping and installation of a site protective cover during closure activities	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Prefilter fire that results in 43 curies of radioactivity; doses of 6.69 rem (MEI) and 0.042 rem (OSP).
CPP-760	Bin set 4	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C-type grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF.
CPP-765	Bin set 5	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C-type grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF.

Table C.4-7. Facility disposition accidents summary (continued).

Facility number	Facility title	Clean closure	Performance-based	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident[a]
CPP-780 through CPP-786	Vaults for Tanks VES-WM-180-186	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the tanks with Class C-type grout or clean fill material	Low energy sources during SBW retrieval, removal of combustible materials, and routine dispositioning	Rupture or break in the SBW transfer lines during SBW retrieval operations	An external event results in 0.34 rem (MEI), 23 rem (NIW), 3,500 rem (OSP), and 1.8 LCF.
CPP-791	Bin set 6	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C-type grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF.
CPP-795	Bin set 7	●	●	●	Very low levels of radioactive and hazardous material; bin sets did not contain calcine	Low mobility ensured by pipe capping and filling the bin sets with Class C-type grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF.

a. In addition to the "bounding operational scenario" for *radiological and hazardous material releases* shown in the last column of this table for all the facilities, the following bounding accident scenario for *hazardous chemical releases* should be included for all facilities, except CPP-605. As described in the introduction of this facility analysis, the bounding accident scenario for *hazardous chemical releases* is a catastrophic failure of a 3,000-gallon ammonia tank and formation of cloud of toxic vapor. This chemical accident postulated during INTEC-wide operations has the greatest potential consequences to workers and the offsite population.

LCF = latent cancer fatality; MEI = maximally exposed individual; NIW = noninvolved worker; OSP = offsite population; SBW = mixed transuranic waste/SBW; SNF = spent nuclear fuel.

disposition options offers a valuable perspective on the potential impacts to involved workers.

For this analysis the total number of injury/illnesses and fatality cases for each existing facility is determined by multiplying the estimated total worker hours during facility disposition times an assumed incident rate for injuries/illnesses and fatalities. The exact frequency of injuries/illnesses and fatalities is less critical than the consistency with which these rates are applied to different facility disposition alternatives, so that the impact of facility disposition to involved workers can be put in perspective as a potential discriminating factor for evaluating EIS alternatives.

The estimated total worker hours for each facility disposition were obtained from Lockheed Martin Idaho Technologies Company Engineering Design Files and Project Data Sheets performed for the existing facility closures associated with this EIS.

The average hazard incident rates were obtained by reviewing several historical DOE and U.S. Government records for actual injury/illness and fatality rates during construction work in the recent past. The average INEEL and private industry injury/illnesses and fatality incident rates were extracted from the SNF & INEL EIS (DOE 1995), from the Computerized Accident Incident Reporting System industrial accident database from 1993 through 1997, and from a Bayesian update to include 1998 data (Fong 1999).

The incident rates are per 100 man-years or 200,000 construction hours, which is a common benchmark used by DOE, Occupational Safety and Health Administration, and the Bureau of Labor Statistics. These selected rates are 6.2 and 13.0 injuries/illnesses per 200,000 worker hours, and 0.011 and 0.034 fatalities per 200,000 worker hours for INEEL and private industry, respectively. Actual rates for INTEC HLW management facility disposition activities likely would be equal to or greater than the DOE construction rates but less than the private industry construction rates. Thus, the lower and upper estimates of expected incidents were averaged for calculating the results.

Table C.4-8 presents the analysis results for industrial impacts to involved workers. The available DOE data do not consistently disclose the type of facility closure assumed for the "Other Facilities." Therefore, for purposes of this table, the estimated total labor hours and resultant incidents for the "Other Facilities" are assumed to be equal for all three types of closure.

This table shows that the estimated number of incidents varies considerably with the facility disposition alternative. The Clean Closure Alternative has by far the greatest number of injuries/illnesses and fatalities; the Performance-Based Closure Alternative has fewer incidents and the Closure to Landfill Standards Alternative has the least number of estimated incidents. This result can be attributed to the large number of disposition man-hours and project years required by the Clean Closure Alternative. This option also involves more demolition and heavy equipment operation than the other two facility disposition alternatives. The total number of incidents for the Performance-Based and Landfill Closure Alternatives are nearly equal, within the limitations on the data currently available for the "Other Facilities."

Radiological Hazards. In addition to estimating the nonradiological impacts of occupational hazards to the INTEC involved worker, it is impor-

Table C.4-8. Industrial hazard impacts during disposition of existing HLW management facility groups using "average DOE-private industry incident rates" (per 200,000 hours).

Facility groups	Clean closure		Performance-based closure/clean fill		Closure to landfill standards/clean fill	
	Injuries/illnesses	Fatalities	Injuries/illnesses	Fatalities	Injuries/illnesses	Fatalities
Tank Farm	770	1.8	30	0.07	16	0.04
Bin sets	130	0.32	100	0.24	48	0.11
Other facilities	150	0.33	150	0.33	150	0.33
Total incidents	1,100	2.4	280	0.64	210	0.48

tant to estimate the radiological impacts that could be sustained during facility disposition. For this purpose, estimates for the total radiation dosage sustained by the involved workers during the facility disposition period were used for this analysis. Data for this radiological parameter were obtained from Engineering Design Files and Project Data Sheets referenced in the accident analysis and provide the EIS analyst additional inputs for relative comparisons among the EIS alternatives. As for industrial hazards, specific information is not currently available for transport lines that are not associated with any individual facility. This omission could be significant if any contamination has leaked from transport lines to the surrounding soil, which could pose a distinct risk of accidental radiation exposure to unsuspecting involved workers.

Facility totals for worker radiation dosage are assumed to be directly proportional to the total number of radiation worker-years needed for each facility disposition alternative. Radiation worker-years are defined as the product of the number of workers working in radiation areas times the number of closure years for each facility. Thus, to determine the total radiation dosage per facility, the number of radiation man-years was multiplied by the dosage rate, i.e. total rem per worker per year.

Table C.3-8 presents the total radiation dosage to the exposed radiation workers for each facility group by closure type. An average dosage rate for each facility closure was obtained from the Engineering Design Files and Project Data Sheets mentioned previously. The available DOE data do not disclose the type of facility closure assumed for the "Other Facilities." Therefore, for purposes of this table, the estimated total labor hours and resultant incidents for the "Other Facilities" are assumed to be equal for all three types of closure. The latent cancer fatalities that result from this population exposure can be estimated by multiplying the total dosage (person-rem) by 4×10^{-4} latent cancer fatalities per person-rem. This dose-to-risk factor is based on the 1990 Recommendations of the International Commission on Radiation Protection (ICRP 1991).

Appendix C.4 References

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Appendix C.5

Transportation

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Transportation

C.5.1 INTRODUCTION

This appendix supports the results of the transportation analyses presented in Section 5.2.9 of this document. The types of waste being considered are identified in Table C.5-1.

In this environmental impact statement (EIS), the U.S. Department of Energy (DOE) evaluates ***six*** alternatives under which ***twelve*** treatment options occur. The No Action Alternative does not involve shipping and therefore is not analyzed in this appendix. Many options have multiple waste shipments. Within some options different possibilities of shipping and storing waste exist.

Following publication of the Draft EIS, DOE obtained updated information indicating that vitrification of the Idaho National Engineering and Environmental Laboratory (INEEL) mixed high-level waste (HLW) at the Hanford Site would result in a larger volume of HLW glass than was analyzed in the Draft EIS. Under the Minimum INEEL Processing Alternative, DOE had estimated that 730 cubic meters of vitrified mixed HLW (approximately 625 Hanford canisters) would be produced and transported back to the INEEL. DOE now estimates that 3,500 cubic meters of vitrified mixed HLW (approximately 3,000 Hanford canisters) would be produced under that alternative. Tables C.5-1, C.5-11, C.5-12, and C.5-13 present revised transportation impacts for the Minimum INEEL Processing Alternative associated with this larger vitrified waste volume.

C.5.2 ROUTE SELECTION

In order to evaluate transportation impacts, DOE chose reasonable shipment routes to each destination. These routes do not necessarily reflect DOE's ultimate choice, which has yet to be determined.

In addition, the destination for some waste types is not finalized. Class A grout is assumed to be shipped to the Envirocare Facility in Utah, but DOE has not identified an offsite low-level waste disposal facility. ***Because*** the proposed site at Yucca Mountain in Nevada is the only site currently under consideration, DOE assumed that Yucca Mountain is the destination of any HLW ***for*** disposal. Transuranic waste is assumed to be sent to the Waste Isolation Pilot Plant.

The impacts of transporting Class C grout for offsite disposal were analyzed ***as well as*** disposing of this waste at a new INEEL landfill. As with the previously mentioned waste types, the location of a disposal facility for Class C grout has not been selected, but for the purpose of this analysis a ***reasonable*** route to Barnwell, South Carolina is ***evaluated***.

C.5.2.1 Truck Route Selection

Route selection for waste shipments by truck was determined by the HIGHWAY 3.3 computer code (Johnson et al. 1993a). HIGHWAY is a computerized road atlas that details more than 240,000 miles of interstate and other highways. The user can specify the routing criteria to constrain the route selection.

HIGHWAY calculates the total route length and the distances traveled through rural, suburban, and urban population zones. The HIGHWAY code determines population densities (people per square mile) for each of three population zones (urban, suburban, and rural) along the route using 1990 census data.

The HIGHWAY model contains a Waste Isolation Pilot Plant default routing option and a HM-164 option. The HM-164 option, when activated, specifies a route that would comply with the U.S. Department of Transportation regulations for highway route-controlled quantities of radioactive material. The Waste Isolation Pilot Plant default routing option provides the New Mexico-specified routes to the Waste Isolation Pilot Plant. For purposes of this EIS, HIGHWAY was run using the following conditions:

- 70 percent emphasis on time and 30 percent emphasis on mileage
- HM-164 routing for all destinations except New Mexico
- The Waste Isolation Pilot Plant default routing for all shipments to New Mexico

Table C.5-1. Transportation analyses required by alternative.

	Waste type	Origin	Destination	Truck shipments	Rail shipments
	Continued Current Operations Alternative				
RH-TRU ***Solids***	110 cubic meters of RH-TRU grout from tank heels packaged in 280 WIPP half-containers at 0.4 cubic meter per half-container	INTEC	WIPP	140	70
	Full Separations Option				
Vitrified ***HLW (at INEEL)***	470 cubic meters of vitrified HAW packaged in 780 HLW canisters.	INTEC	NGR	780	160
Class A ***Type*** grout	27,000 cubic meters of Class A grout packaged in 25,100 concrete cylinders of approximately 1 cubic meter each.	INTEC	Envirocare	4,200	1,300
Solidified HAW	250 cubic meters packaged in 1,200 55-gallon drums which are placed into casks.	INTEC	Hanford	80	40
Vitrified ***HLW (at Hanford)***	***3,500*** cubic meters of vitrified HAW packaged in ***3,000*** Hanford HLW canisters.	Hanford	INTEC	***3,000***	***750***
	Planning Basis Option				
Vitrified ***HLW (at INEEL)***	470 cubic meters of vitrified HAW packaged in 780 HLW canisters.	INTEC	NGR	780	160
Class A ***Type*** grout	30,000 cubic meters of Class A grout packaged in 27,900 concrete cylinders of approximately 1 cubic meter each.	INTEC	Envirocare	4,700	1,400
RH-TRU ***Solids***	110 cubic meters of RH-TRU grout from tank heels packaged in 280 WIPP half-containers at 0.4 cubic meter per half-container.	INTEC	WIPP	140	70
	Transuranic Separations Option				
RH-TRU ***Fraction***	220 cubic meters of granular solids packaged in 550 RH-TRU containers	INTEC	WIPP	280	140
Class C ***Type*** grout	23,000 cubic meters of Class C grout packaged in 21,000 concrete cylinders of approximately 1 cubic meter each.	INTEC	Barnwell	7,000	2,100
	Hot Isostatic Pressed Waste Option				
HIP HLW	3,400 cubic meters of HIPed HLW packaged in 5,700 Type B canisters.	INTEC	NGR	5,700	1,100
RH-TRU ***Solids***	110 cubic meters of RH-TRU grout from tank heels packaged in 280 WIPP half-containers at 0.4 cubic meter per half-container.	INTEC	WIPP	140	70

Table C.5-1. Transportation analyses required by alternative (continued).

	Waste type	Origin	Destination	Truck shipments	Rail shipments
	Direct Cement Waste Option				
Cementitious HLW	13,000 cubic meters of cemented HLW packaged in 18,000 Type B canisters.	INTEC	NGR	18,000	3,600
RH-TRU ***Solids***	110 cubic meters of RH-TRU grout from tank heels packaged in 280 WIPP half-containers at 0.4 cubic meter per half-container.	INTEC	WIPP	140	70
	Early Vitrification Option				
Early Vitrified HLW	8,500 cubic meters of vitrified calcine packaged in 11,800 Type B canisters.	INTEC	NGR	12,000	2,400
Early Vitrified RH-TRU	360 cubic meters of vitrified SBW/NGLW packaged in 900 RH-TRU containers.	INTEC	WIPP	450	230
	Steam Reforming Option				
Calcine	***4,400 cubic meters of calcine packaged in 6,100 HLW canisters***	***INTEC***	***NGR***	***6,100***	***1,200***
Steam Reformed SBW	***1,300 cubic meters of steam reformed SBW packaged in 3,300 WIPP half-containers***	***INTEC***	***WIPP***	***1,600***	***810***
NGLW grout	***1,300 cubic meters of NGLW grout packaged in 3,200 containers***	***INTEC***	***WIPP***	***1,600***	***800***
	Minimum INEEL Processing Alternative				
Calcine and Cs IX resin	4,300 cubic meters of calcine and Cs-IX resin (included with calcine) packaged in 3,700 Hanford HLW canisters.	INTEC	Hanford	3,700	920
Grouted CH-TRU	7,500 cubic meters of grouted CH-TRU from SBW packaged in 36,000 55-gallon drums.	INTEC	WIPP	1,300	670
Vitrified ***HLW (at Hanford)***	***3,500*** cubic meters of vitrified HAW packaged in ***3,000*** Hanford HLW canisters.	Hanford	INTEC	***3,000***	***750***
Vitrified ***LLW Fraction (at Hanford)***	14,000 cubic meters of vitrified LAW packaged in 5,600 LAW containers.	Hanford	INTEC	620	310
Vitrified ***HLW (at Hanford)***	***3,500*** cubic meters of vitrified HAW packaged in ***3,000*** Hanford HLW canisters.	INTEC	NGR	***3,000***	***750***
Vitrified ***LLW Fraction (at Hanford)***	14,000 cubic meters of vitrified LAW packaged in 5,600 LAW containers.	INEEL	Envirocare	620	310

Table C.5-1. Transportation analyses required by alternative (continued).

	Waste type	Origin	Destination	Truck shipments	Rail shipments
	Vitrification without Calcine Separations Option				
Vitrified Calcine	***8,500 cubic meters of vitrified calcine packaged in 12,000 HLW canisters.***	***INTEC***	***NGR***	***12,000***	***2,400***
Vitrified SBW	***440 cubic meters of vitrified SBW packaged in 610 HLW canisters.***	***INTEC***	***WIPP***	***610***	***120***
Vitrified SBW	***440 cubic meters of vitrified SBW packaged in 610 HLW canisters.***	***INTEC***	***NGR***	***610***	***120***
NGLW grout	***1,300 cubic meters of NGLW grout packaged in 3,300 WIPP half-containers.***	***INTEC***	***WIPP***	***1,600***	***800***
	Vitrification with Calcine Separations Option				
Class A Type Grout	***24,000 cubic meters of LLW grout packaged in 22,000 concrete cylinders of approximately 1 cubic meter each.***	***INTEC***	***Envirocare***	***3,700***	***1,100***
Vitrified Calcine (separated)	***470 cubic meters of vitrified calcine (separated) packaged in 650 HLW canisters.***	***INTEC***	***NGR***	***650***	***130***
Vitrified SBW	***440 cubic meters of vitrified SBW packaged in 610 HLW canisters.***	***INTEC***	***WIPP***	***610***	***120***
Vitrified SBW	***440 cubic meters of vitrified SBW packaged in 610 HLW canisters.***	***INTEC***	***NGR***	***610***	***120***
NGLW grout	***1,300 cubic meters of NGLW grout packaged in 3,300 WIPP half-containers.***	***INTEC***	***WIPP***	***1,600***	***800***

CH = contact-handled; Cs = cesium; HAW = high-activity waste; HIP = Hot Isostatic Press; NGLW = newly generated liquid waste; NGR = national geologic repository; RH = remote-handled; TRU = transuranic waste; SBW = mixed transuranic waste/SBW; WIPP = Waste Isolation Pilot Plant.

The total distances between all required origins and destinations is presented in Table C.5-2.

C.5.2.2 Rail Route Selection

Rail routes were determined by the INTERLINE 5.0 computer model (Johnson et al. 1993b). The INTERLINE computer model is designed to simulate routing on the U.S. rail system. The INTERLINE database was originally based on data from the Federal Railroad Administration and reflected the U.S. railroad system in 1974. The database has been expanded and modified over the past two decades. The code is updated periodically to reflect current track conditions and has been compared with reported mileages and observations of commercial rail firms.

The INTERLINE model uses the shortest route algorithm that finds the path of minimum impedance within an individual subnetwork. A separate method is used to find paths along the subnetworks. The routes chosen for this study used the standard assumptions in the INTERLINE model to simulate the process of selection that railroads would use to direct shipments of radioactive waste. For sites that do not have direct rail access, the rail site nearest the waste shipment endpoint was used for routing. Population densities along the route are determined using 1990 census data. Table C.5-3 presents the total mileage between INTEC and all waste shipment endpoints.

Table C.5-2. Truck route distances (miles).

	Barnwell	Envirocare	Hanford	INTEC	NGR	WIPP
Barnwell	0	NR	NR	2,400	NR	NR
Envirocare	NR	0	NR	300	NR	NR
Hanford	NR	NR	0	630	NR	NR
INTEC	2,400	300	630	0	750	1,400
NGR	NR	NR	NR	750	0	NR
WIPP	NR	NR	NR	1,400	NR	0

NR = Not required; NGR = national geologic repository; WIPP = Waste Isolation Pilot Plant.

Table C.5-3. Rail route distances (miles).

	Barnwell	Envirocare	Hanford	INTEC	NGR	WIPP
Barnwell	0	NR	NR	2,300	NR	NR
Envirocare	NR	0	NR	300	NR	NR
Hanford	NR	NR	0	690	NR	NR
INTEC	2,300	300	690	0	660	1,500
NGR	NR	NR	NR	660	0	NR
WIPP	NR	NR	NR	1,500	NR	0

NR = Not required; NGR = national geologic repository; WIPP = Waste Isolation Pilot Plant.

C.5.3 VEHICLE-RELATED IMPACTS

This section addresses the impacts of traffic accidents and vehicle emissions associated with transporting each waste type to its destination. These impacts are not related to the radioactive material or hazardous chemicals being transported and would be the same as the impacts from the transportation of nonhazardous material. DOE calculated accident impacts as the number of fatalities that would be expected due to additional vehicle traffic along the proposed routes. Fatalities were calculated on a per shipment basis and were then totaled for all shipments over the transportation period. Calculations were based on the accident statistics and data presented in *State-Level Accident Rates of Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Impacts from vehicle emissions were calculated as the expected number of excess latent fatalities.

Accident rates used in this assessment were computed for all shipments regardless of cargo. Saricks and Tompkins (1999) point out that shippers and carriers of radioactive material have a higher-than-average awareness of transportation impacts and prepare for such shipments accordingly. These effects were not considered, and accident rates were assumed to be identical to those for normal cargo transport. The accident impacts depend on the total distance traveled in each state and do not rely on national average accident statistics.

In addition to risks from accidents, DOE estimated health risks from vehicle emissions. The distance traveled in an urban population zone and the impact factor for particulate and sulfur dioxide truck exhaust emissions (Rao et al. 1982) were used to estimate urban-area pollution effects due to waste shipments. The impact factor, 1.0×10^{-7}, estimates the number of latent fatalities per kilometer traveled. This impact factor is only valid for urban population zones; therefore, latent fatalities expected from exhaust emissions are only estimated for the total distance that is traveled through urban zones. It should be noted that impacts due to exhaust gases are small relative to impacts from accident fatalities.

C.5.3.1 Truck Impacts

Table C.5-4 presents vehicle-related impacts such as number of accidents for a single round trip between selected points. These values were multiplied by the appropriate number of route shipments (Table C.5-1) to obtain the total impacts reported in ***Table 5.2-13***. All shipments were assumed to be round trip to account for the return of the empty shipping casks. Therefore, the data in Table C.5-4 were created assuming twice the one way mileage shown in Table C.5-2. The expected vehicle pollution latent fatalities were calculated only for distance traveled in urban population zones.

C.5.3.2 Rail Impacts

Table C.5-5 presents vehicle-related impacts for selected rail routes. These values were multiplied by the appropriate number of route shipments (Table C.5.1) to obtain the total impacts reported in Table 5.2-***14***. The expected number of accidents and fatalities per shipment are based on route-specific data and state-specific rail statistics presented in Saricks and Tompkins (1999). Impact factors for latent fatalities due to exhaust emissions from rail transport are not available. For this reason vehicle pollution latent fatalities are omitted from Table C.5-5. All shipments were assumed to be round trip to account for the return of the empty shipping casks. Therefore, the data in Table C.5-5 was calculated assuming twice the one-way mileage shown in Table C.5-3.

C.5.4 CARGO-RELATED INCIDENT-FREE IMPACTS

This section estimates the radiological impacts of incident-free transportation (i.e., no occurrence of accidents) to occupational and public receptors. DOE used the RADTRAN 4 model (Neuhauser and Kanipe 1992) to estimate these impacts. Required route-specific inputs such as the number of miles traveled, population densities adjacent to shipping routes, and the number of miles traveled in each of the population zones (urban, suburban, and rural) were determined using the HIGHWAY and INTERLINE models described in Section C.5.2.

Four radiation exposure scenarios were analyzed using the RADTRAN 4 code as follows:

- Along Route: Exposure to members of the public who reside adjacent to routes of travel

Table C.5-4. Vehicle-related impacts per round-trip shipment for trucks.

Originating site	Destination	Impact category	Total
INTEC	Barnwell	Accidents	3.5×10^{-3}
		Fatalities	1.4×10^{-4}
		Vehicle pollution LFs	1.3×10^{-5}
	Envirocare	Accidents	3.5×10^{-4}
		Fatalities	1.8×10^{-5}
		Vehicle pollution LFs	1.8×10^{-6}
	Hanford	Accidents	6.3×10^{-4}
		Fatalities	4.3×10^{-5}
		Vehicle pollution LFs	1.1×10^{-6}
	NGR	Accidents	7.7×10^{-4}
		Fatalities	3.5×10^{-5}
		Vehicle pollution LFs	5.5×10^{-6}
	WIPP	Accidents	1.7×10^{-3}
		Fatalities	6.5×10^{-5}
		Vehicle pollution LFs	5.0×10^{-6}

LF = latent fatality; NGR = national geologic repository; WIPP = Waste Isolation Pilot Plant.

Table C.5-5. Vehicle-related impacts per round-trip shipment for rail.

Originating site	Destination	Impact category	Total per shipment
INTEC	Barnwell	Accidents	3.2×10^{-4}
		Fatalities	6.1×10^{-5}
	Envirocare	Accidents	5.9×10^{-5}
		Fatalities	1.7×10^{-5}
	Hanford	Accidents	1.7×10^{-4}
		Fatalities	2.3×10^{-5}
	NGR	Accidents	1.0×10^{-4}
		Fatalities	3.1×10^{-5}
	WIPP	Accidents	1.6×10^{-4}
		Fatalities	3.1×10^{-5}

NGR = national geologic repository ; WIPP = Waste Isolation Pilot Plant.

- Sharing Route: Exposure to members of the public sharing the right of way

- Stops: Exposure to members of the public while shipments are at rest stops

- Occupational: Exposure to vehicle crews

Among the more sensitive RADTRAN input parameters is the Transport Index. The Transport Index represents the radiation dose at one meter away from the surface of the shipping package. The maximum radiation dose permissible is 10 millirems per hour at 2 meters for exclusive-use shipments. For this analysis, the 2-meter regulatory limit was used to calculate the maximum allowable dose at 1 meter (Transport Index). Since the Transport Index is dependent on the number of packages per shipment and the package dimension, a value for Transport Index was calculated for each of the various packages associated with the different waste forms that would be shipped. The Transport Index ranged from a high of 16.9 for truck transport of solidified high-activity waste to a low of 0.31 for rail transport of contact-handled transuranic waste. Many of the other inputs are dependent on the mode of transportation and are discussed in the following sections.

The incident-free impacts estimated from RADTRAN are in units of person-rem. These can be converted into latent cancer fatalities using conversion factors. For nonoccupational doses, 1 person-rem is expected to cause 5×10^{-4} latent cancer fatalities, and for occupational doses 1 person-rem is expected to cause 4×10^{-4} latent cancer fatalities (ICRP 1991).

C.5.4.1 Truck Impacts

In addition to the RADTRAN inputs described in Section C.5.4, other unique parameters can affect truck shipments. The vehicle speed was assumed to be 15, 25, and 55 miles per hour in urban, suburban, and rural zones, respectively. DOE believes that these speeds actually underestimate the probable speed of the truck through each of the population zones. This assumption results in a conservative overestimation of exposure and also accounts for the possibility of speed reductions due to traffic.

With the exception of shipments between the INEEL and Envirocare, all truck shipments were assumed to have 0.011 hours of stopping time for every kilometer traveled. This accounts for overnight stopping. ***Because*** the trip from the INEEL to Envirocare is not long enough to require an overnight stop, the total stopping time assumed for shipments from the INEEL to Envirocare is 0.167 hours (10 minutes).

During transport the distance between the waste and the crew is assumed to be 10 meters. During stops, there are an assumed 50 members of the public present located 20 meters from the waste.

C.5.4.2 Rail Impacts

In addition to the RADTRAN inputs described in Section C.5.4, there are other parameters which are unique to rail shipments. The train speed was assumed to be 15, 25, and 40 miles per hour in urban, suburban, and rural zones, respectively.

With the exception of shipments between the INEEL and Envirocare, all rail shipments were assumed to have 0.033 hours of stopping time for every kilometer traveled. This accounts for overnight stopping. ***Because*** the trip from INEEL to Envirocare is not long enough to require an overnight stop, the total stopping time for shipments from the INEEL to Envirocare is 0.167 hours (10 minutes).

During transport, the distance between the waste and the crew is assumed to be 152 meters. An assumed 100 members of the public are present at the stops at 20 meters from the waste.

C.5.5 CARGO-RELATED ACCIDENT IMPACTS

This section presents the impacts due to transportation accidents in which an environmental release of radioactive material occurs. Radiological impacts were evaluated considering the probability of a given accident occurring and the consequences of that accident. The RADTRAN 4 model estimates the collective accident risk to populations by considering the spectrum of possible accidents and summing the results for each type of accident. The estimates in Section 5.2.9 do not show the risk from a given accident occurring but present the total expected impacts considering the probability and consequences of all accidents. For the maximally exposed individual, DOE used the RISKIND code to calculate the radiation dose from accidents (see Section C.5.5.5).

C.5.5.1 Accident Types

All accidents can be represented by a spectrum of severity classes ranging from those considered least severe to most severe. The severity class of an accident is dependent on the crush force or impact speed and the duration of a 1,300-degree Kelvin fire (NRC 1977). Two sets of accident severity categories and associated conditional probabilities were used in assessing cargo-related accident impacts for this analysis. All vitrified waste and waste forms similar to vitrified wastes (e.g., hot isostatic pressed waste) were analyzed using a methodology based on studies performed in support of NUREG/CR-4829 (Fisher et al. 1988) (i.e., the Modal Study) (Ross 1999). This study represents the most recently developed methodology for assessing cargo-related accident impacts and is used for the transportation analysis performed for the Yucca Mountain Repository EIS. Since the study only considers the transport of spent nuclear fuel and vitrified HLW wastes, a second methodology, that found in NUREG-0170 (NRC 1977), was used for the remaining radioactive waste forms being considered in this EIS. For both of these methods, each accident severity category has an associated conditional probability. The conditional probabilities represent the likelihood that an accident will involve the mechanical forces and the heat energy associated with each of the categories.

Table C.5-6 shows what fraction of the total accidents would be expected to be from each severity category, as based on NUREG-0170. For example, of all possible truck accidents that may occur, 55 percent would be classified as a level one severity accident. According to these fractional occurrences, a level one accident occurs more often but is the least severe while a level eight is highly unlikely but is the most severe. The table also represents the fraction of all accidents of that type that could occur in each of the population density zones. Of all expected level one severity accidents, 10 percent would occur in the rural population density zone, another 10 percent would occur in the suburban zone, and 80 percent would occur in the urban population density zone.

Table C.5-7 presents the accident conditional occurrence probabilities for truck and rail transport of vitrified HLW wastes. There are only six accident severity categories used in this methodology. Table C.5-7 shows that 99 percent of all truck and rail accidents would be a Category 1 severity event; in comparison, accidents of a Category 2 through 6 severity are very unlikely

Table C.5-6. Accident conditional probability of occurrences (NUREG-0170 methodology). [a]

Accident severity category	Fractional occurrences	Rural	Suburban	Urban
		Truck		
1	0.55	0.1	0.1	0.8
2	0.36	0.1	0.1	0.8
3	0.07	0.3	0.4	0.3
4	0.02	0.3	0.4	0.3
5	2.8×10^{-3}	0.5	0.3	0.2
6	1.1×10^{-3}	0.7	0.2	0.1
7	8.5×10^{-5}	0.8	0.1	0.1
8	1.5×10^{-5}	0.9	0.05	0.05
		Rail		
1	0.50	0.1	0.1	0.8
2	0.30	0.1	0.1	0.8
3	0.18	0.3	0.4	0.3
4	0.02	0.3	0.4	0.3
5	1.8×10^{-3}	0.5	0.3	0.2
6	1.3×10^{-4}	0.7	0.2	0.1
7	6.0×10^{-5}	0.8	0.1	0.1
8	1.0×10^{-5}	0.9	0.05	0.05

a. Source: NRC (1977).

Table C.5-7. Accident conditional probability of occurrences (Modal-related methodology). [a]

Accident severity category	Conditional Probability	
	Truck	Rail
1	0.99	0.99
2	4.1×10^{-5}	2.0×10^{-3}
3	3.8×10^{-3}	1.3×10^{-6}
4	1.8×10^{-3}	5.6×10^{-4}
5	1.6×10^{-5}	6.1×10^{-4}
6	9.8×10^{-6}	1.3×10^{-4}

a. Source: Ross (1999).

to occur. The distribution of each accident severity category by population density zones is not considered in the Modal-support study.

C.5.5.2 Accident Release

As with the accident severity categories and conditional probabilities discussed in the previous section, accident releases were calculated using two methodologies: the method derived from NUREG/CR-4829 (Fisher et al. 1988) and the method presented in NUREG-0170 (NRC 1977). For both of these approaches, three factors were used to determine the amount the material that is released into the environment and available for inhalation. These factors include the release fraction, the aerosolized fraction, and the respirable fraction.

The release fraction is the fraction of material that would be released from the shipping container in an accident of a given severity category. The release fraction is dependent on the container. For the analyses in this EIS, DOE used four sets of release fractions (Tables C.5-8 and C.5-9). For vitrified HLW and wastes with physical characteristics similar to vitrified HLW (such as HIPed HLW), DOE used the release fractions reported in NUREG/CR-4829, referred to as the Modal Study. The Modal Study release fractions are based on the assumption that the stainless steel canister would limit the quantity of waste material that would be released, even in the most severe accidents. For vitrified, remote-handled, transuranic waste (RH-TRU solids and RH-TRU fraction), DOE used release fractions from the Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement (DOE 1997). For Class A-type grout, DOE used the release fractions for a Type A container as reported in NUREG-0170. For all other wastes, DOE used the release fractions for a Type B container as reported in NUREG-0170.

The aerosolized fraction represents the fraction of the material released in an accident of a given severity that becomes aerosolized. The respirable fraction represents the fraction of aerosolized material that could be inhaled. Both of these factors are dependent on the physical and chemical characteristics of the waste form. Table C.5-10 shows the aerosolized and respirable fractions for each of the radioactive waste forms considered in this transportation analysis. The vitrified waste forms all have aerosolized and respirable fractions equal to 1.0 since these factors have already been taken into account in the release fractions developed for the Modal Study support model.

Table C.5-8. Estimated release fractions.

Accident severity category	***Class A Grout***[a]	Type B container[a]	***Vitrified*** RH-TRU[b]
1	***0***	0	0
2	***0.01***	0	0
3	***0.1***	0. 01	6×10^{-9}
4	***1***	0.1	2×10^{-7}
5	***1***	1	1×10^{-4}
6	***1***	1	1×10^{-4}
7	***1***	1	2×10^{-4}
8	***1***	1	2×10^{-4}

a. Source: NRC (1977).
b. Source: DOE (1997), ***fraction includes respirable and aerosolized fractions.***
RH = remote handled ; TRU = transuranic waste.

Table C.5-9. Estimated release fractions (Modal-related methodology).[a]

Accident severity category	Release fraction
1	0
2	0
3	7.0×10^{-9}
4	4.0×10^{-6}
5	4.0×10^{-6}
6	4.0×10^{-6}

a. Source: Ross (1999).

Table C.5-10. Aerosolized and respirable fractions.

Physical waste form	Aerosolized fractions	Respirable fractions
Vitrified ***wastes***[a]	1.0	1.0
Grouted wastes[b]	0.05	0.05
Solidified HAW[b]	***0.1***	0.05
HIP HLW[a]	1.0	1.0
Cementitious HLW[b]	0.05	0.05
Calcine and Cs ion exchange resin[b]	0.1	0.05
Steam Reformed SBW[b]	***0.1***	***0.05***
RH-TRU ***Solids and Fractions***	***0.1***	***0.05***

a. Source: Ross (1999).
b. Source: NRC (1977).
HAW = high-activity waste; HIP = hot isostatic pressed; Cs = cesium; RH = remote handled ; TRU = transuranic waste.

C.5.5.3 Radiological Waste Characterization

In order to determine the potential cargo-related impacts from accidents, DOE estimated the radiological content of each waste type (Table C.5-11). The total amount of material available to receptors was determined by multiplying the total radiological content of a shipment by the release factor that corresponds to each type of accident.

C.5.5.4 Exposure Pathways for Released Material

RADTRAN 4 assumes that the material available to the receptor in any given accident is dispersed into the environment according to standard Gaussian diffusion models. Default data for atmospheric dispersion were used, representing an instantaneous ground-level release and a small diameter source cloud. The calculation of the collective population dose after the release and dispersal of radioactive material includes the following pathways:

- External exposure to a passing radioactive cloud
- External exposure to contaminated soil
- Internal exposure from inhaling airborne contaminants

C.5.5.5 Radiological Consequence Assessment Using RISKIND

The RISKIND version 1.11 (Yuan et al. 1995) assessment was configured to provide consequences under the two most frequent atmospheric surface layer conditions existing in the contiguous United States: neutral and stable. Neutral (Pasquill stability class 'D') conditions exist nearly half the time with prevalent wind speeds ranging between 4 and 7 meters per second; stable conditions (Pasquill stability classes 'F' and 'G') about one-fifth of the time with a wind speed below 1 meter per second (TRW 1998). These joint atmospheric stability and wind speed conditions dictate how much of the radioactive material released from an assumed failed waste package ultimately reaches an affected individual. The neutral and stable atmospheric transport conditions were emulated in RISKIND by selecting the D and F Pasquill stability classes with respective wind speeds of 5.7 and 0.9 meters per second.

The receptor defined for purposes of this analysis was an adult member of the public located outdoors at the location of maximum exposure to the wind-borne plume of radioactive material (the "critical receptor" location). Using RISKIND, the distance from the truck or rail accident site to the unshielded critical receptor was calculated to be <0.1 and 0.6 kilometers under neutral and stable atmospheric stability conditions, respectively. This critical receptor or

Table C.5-11. Radioactivity of each waste type (curies per container).

	Class A ***Type*** grout[a]	***Vitrified HLW*** (at INEEL)[b]	Solidified HAW[c]	***Vitrified HLW*** (at Hanford)[d]	HIP HLW[e]	Cementitious ***HLW***[f]	Early Vitrified ***HLW***[g]	Calcine and Cs IX resin[h]	***Vitrified LLW Fraction*** (at Hanford)[d]
Am-241	0.0052	12	2.6	***2.7***	1.6	0.51	0.77	2.5	0.14
Am-243	8.1×10^{-9}	1.8×10^{-5}	3.9×10^{-6}	***7.9×10^{-6}***	4.6×10^{-6}	1.5×10^{-6}	2.2×10^{-6}	7.2×10^{-6}	4.1×10^{-7}
Ba-137m	0.29	1.8×10^{-4}	4.0×10^{-5}	-	1.6×10^{3}	510	770	2.5×10^{3}	-
Cd-113m	-	-	-	-	0.067	0.021	0.032	0.1	-
Ce-144	3.7×10^{-4}	16	3.4	-	2.3	0.72	5.3×10^{-18}	1.7×10^{-17}	-
Cm-242	1.3×10^{-8}	2.9×10^{-5}	6.3×10^{-6}	-	3.9×10^{-6}	1.2×10^{-6}	1.9×10^{-6}	6.1×10^{-6}	-
Cm-244	2.4×10^{-8}	5.4×10^{-5}	1.2×10^{-5}	***1.4×10^{-5}***	7.3×10^{-6}	2.3×10^{-6}	3.5×10^{-6}	1.1×10^{-5}	1.4×10^{-7}
Co-60	0.07	2.4×10^{-5}	5.3×10^{-6}	-	0.16	0.050	0.024	0.076	-
Cs-134	0.0029	1.3×10^{-6}	2.8×10^{-7}	-	1.9	0.61	1.2×10^{-3}	3.9×10^{-3}	-
Cs-135	4.1×10^{-6}	4.6×10^{-9}	9.9×10^{-10}	***0.052***	0.027	8.6×10^{-3}	0.013	0.043	2.1×10^{-4}
Cs-137	0.34	13,000	2,800	***3.3×10^{3}***	1.8×10^{3}	570	820	2.6×10^{3}	13
Eu-152	1.3×10^{-4}	0.35	0.077	-	0.048	0.015	0.023	0.075	-
Eu-154	0.010	28	6.2	-	3.8	1.2	1.8	5.8	-
Eu-155	9.4×10^{-5}	0.82	0.18	-	0.17	0.054	0.014	0.044	-
I-129	8.9×10^{-5}	0.020	0.0036	-	1.9×10^{-3}	5.9×10^{-4}	5.6×10^{-4}	1.8×10^{-3}	-
Nb-93m	-	-	-	-	0.093	0.029	0.045	0.14	-
Ni-63	0.0093	1.0×10^{-4}	2.2×10^{-5}	-	-	-	-	-	-
Np-237	3.1×10^{-14}	0.030	0.054	***2.1×10^{-3}***	2.5×10^{-3}	7.8×10^{-4}	7.4×10^{-4}	2.4×10^{-3}	1.6×10^{-4}
Pa-233	3.8×10^{-15}	0.010	0.0025	-	1.5×10^{-3}	4.8×10^{-4}	7.4×10^{-4}	2.4×10^{-3}	-
Pd-107	-	-	-	-	7.6×10^{-4}	2.4×10^{-4}	3.7×10^{-4}	1.2×10^{-3}	-
Pm-147	0.0017	3.7	-	-	0.51	0.16	0.25	0.79	-
Pr-144	-	-	-	-	0.51	0.16	0.25	0.8	-
Pu-238	5.1×10^{-10}	100	22	***23***	14	4.3	6.5	0.21	0.85
Pu-239	1.0×10^{-11}	2.4	0.52	***0.48***	0.31	0.097	0.13	0.41	0.017
Pu-240	7.9×10^{-12}	1.6	0.36	***0.38***	0.22	0.070	0.10	0.33	0.014
Pu-241	2.4×10^{-10}	50	10.7	***12***	6.6	2.1	3.0	9.7	0.13
Pu-242	1.6×10^{-14}	0.0032	7.0×10^{-4}	-	4.3×10^{-4}	1.4×10^{-4}	2.1×10^{-4}	6.7×10^{-4}	-
Ru-106	0.22	0.14	0.031	***9.0×10^{-14}***	0.92	0.29	3.0×10^{-14}	9.8×10^{-14}	2.5×10^{-15}
Sb-125	0.050	1.9×10^{-5}	4.2×10^{-6}	-	0.20	0.062	7.5×10^{-3}	0.024	-
Sb-126	-	-	-	-	2.5×10^{-3}	8.0×10^{-4}	1.2×10^{-3}	3.9×10^{-3}	-
Se-79	-	-	-	-	0.021	6.5×10^{-3}	0.010	0.032	-
Sm-151	0.52	250	55	***67***	36	11	17	0.56	0.40
Sn-121m	-	-	-	-	1.0×10^{-3}	3.3×10^{-4}	5.0×10^{-4}	1.6×10^{-3}	-
Sn-126	-	-	-	-	0.018	5.8×10^{-3}	8.8×10^{-3}	0.028	-
Sr-90	5.4×10^{-5}	1.4×10^{4}	3.1×10^{3}	***3.5×10^{3}***	1.9×10^{3}	600	920	2.9×10^{3}	34
Tc-99	0.090	2.8	0.60	***0.25***	0.70	0.22	0.34	1.1	0.59
Th-230	3.0×10^{-5}	3.4×10^{-5}	7.4×10^{-6}	***2.3×10^{-4}***	1.2×10^{-4}	3.8×10^{-5}	5.8×10^{-5}	1.9×10^{-4}	1.6×10^{-6}
Th-231	2.2×10^{-5}	2.5×10^{-5}	5.4×10^{-6}	-	8.9×10^{-5}	2.8×10^{-5}	4.3×10^{-5}	1.4×10^{-4}	-
U-232	6.3×10^{-20}	5.9×10^{-6}	1.3×10^{-6}	-	-	-	-	-	-
U-233	1.2×10^{-17}	9.4×10^{-4}	2.0×10^{-4}	***3.8×10^{-7}***	9.3×10^{-5}	2.9×10^{-5}	1.0×10^{-7}	3.3×10^{-7}	1.1×10^{-8}
U-234	1.4×10^{-15}	0.10	0.022	***0.025***	0.014	4.4×10^{-3}	6.7×10^{-3}	0.022	7.4×10^{-4}
U-235	1.0×10^{-17}	7.6×10^{-4}	1.6×10^{-4}	***1.6×10^{-4}***	9.9×10^{-5}	3.1×10^{-5}	4.3×10^{-5}	1.4×10^{-4}	4.7×10^{-6}
U-236	2.4×10^{-17}	0.0017	3.7×10^{-4}	-	2.3×10^{-4}	7.3×10^{-5}	1.1×10^{-4}	3.6×10^{-4}	-
U-237	2.0×10^{-17}	1.1×10^{-3}	2.4×10^{-4}	-	1.5×10^{-4}	4.8×10^{-5}	7.3×10^{-5}	2.4×10^{-4}	-
U-238	2.4×10^{-18}	1.8×10^{-4}	3.9×10^{-5}	***8.3×10^{-6}***	1.9×10^{-5}	6.1×10^{-6}	2.2×10^{-6}	7.1×10^{-6}	2.4×10^{-7}
Y-90	5.1×10^{-7}	1.4×10^{4}	3.0×10^{3}	***3.5×10^{3}***	1.9×10^{3}	600	920	2.9×10^{-3}	34
Zr-93	-	-	-	-	0.11	0.034	0.051	0.17	-

a. Source: Landman and Barnes (1998).
b. Source: Landman (1998), Fluor Daniel (1997).
c. Source: Quigley and Keller (1998), Landman (1998).
d. Source: Jacobs (1998). ***Scaled for new waste volumes.***
e. Source: Barnes (1998a), Dafoe and Losinski (1998), Fluor Daniel (1997), Russell et al. (1998a,b).
f. Source: Barnes (1998a), Fluor Daniel (1997), Russell et al. (1998a,b)
g. Source: Barnes (1998a,b), Fewell (1999), Lee (1999).
h. Source: Barnes (1998a,b), Lopez (1998).

Table C.5-11. Radioactivity of each waste type (curies per container) (continued).

	Class C *Type* grout[a]	*Early* Vitrified RH-TRU[i]	*Grouted* CH-TRU [j]	RH-TRU *Fraction* [k]	***Vitrified calcine[l] (separated)***	***Vitrified calcine[m]***	***Vitrified SBW[n]***	***NGLW grout[o]***	***Steam Reformed SBW[p]***	***RH-TRU Solids[q]***	***Calcine[h]***
Am-241	5.4×10^{-3}	0.22	0.060	18	***14***	***0.77***	***0.32***	***0.15***	***0.059***	***0.32***	***1.5***
Am-243	8.3×10^{-9}	8.7×10^{-5}	2.7×10^{-5}	2.4×10^{-5}	2.1×10^{-5}	2.2×10^{-6}	1.3×10^{-4}	5.9×10^{-5}	2.4×10^{-5}	1.1×10^{-4}	4.4×10^{-6}
Ba-137m	440	150	3.6×10^{-3}	5.2×10^{-5}	2.1×10^{-4}	***770***	***220***	***12***	***41***	***250***	1.5×10^{3}
Cd-113m	-	7.4×10^{-3}	-	-	-	***0.032***	***0.011***	-	2.0×10^{-3}	-	***0.064***
Ce-144	4.0×10^{-4}	2.5×10^{-8}	2.0×10^{-4}	21	***19***	5.3×10^{-18}	3.7×10^{-8}	2.4×10^{-7}	6.8×10^{-9}	***0.070***	1.0×10^{-17}
Cm-242	1.3×10^{-8}	5.0×10^{-5}	1.5×10^{-4}	3.9×10^{-5}	3.5×10^{-5}	1.9×10^{-6}	7.4×10^{-5}	4.8×10^{-6}	1.4×10^{-5}	6.1×10^{-5}	3.8×10^{-6}
Cm-244	2.5×10^{-8}	4.4×10^{-3}	2.7×10^{-3}	7.1×10^{-5}	6.4×10^{-5}	3.5×10^{-6}	6.5×10^{-3}	4.9×10^{-5}	1.2×10^{-3}	9.7×10^{-3}	7.0×10^{-6}
Co-60	0.072	0.027	0.021	3.5×10^{-9}	2.9×10^{-5}	***0.024***	***0.040***	***0.017***	7.4×10^{-3}	***0.18***	***0.047***
Cs-134	0.16	1.1×10^{-3}	5.6×10^{-5}	1.1×10^{-9}	1.6×10^{-6}	1.2×10^{-3}	1.6×10^{-3}	2.8×10^{-3}	3.0×10^{-4}	***3.3***	2.4×10^{-3}
Cs-135	7.6×10^{-3}	3.7×10^{-3}	5.8×10^{-8}	1.1×10^{-9}	5.5×10^{-9}	***0.013***	5.4×10^{-3}	2.5×10^{-4}	1.0×10^{-3}	4.3×10^{-3}	***0.026***
Cs-137	470	150	3.8×10^{-3}	5.5×10^{-5}	1.6×10^{4}	***820***	***220***	***13***	***41***	***260***	1.6×10^{3}
Eu-152	1.7×10^{-4}	5.4×10^{-3}	2.7×10^{-4}	0.50	***0.42***	***0.023***	8.0×10^{-3}	9.1×10^{-4}	1.5×10^{-3}	***0.014***	***0.046***
Eu-154	0.013	0.24	0.020	43	***33***	***1.8***	***0.35***	***0.054***	***0.065***	***0.60***	***3.6***
Eu-155	9.6×10^{-5}	0.11	0.019	1.1	***0.98***	***0.014***	***0.16***	***0.022***	***0.030***	***1.3***	***0.027***
I-129	4.7×10^{-4}	0.034	2.3×10^{-4}	8.3×10^{-3}	***0.024***	5.6×10^{-4}	***0.050***	4.0×10^{-5}	9.2×10^{-3}	2.6×10^{-4}	1.1×10^{-3}
Nb-93m	-	7.7×10^{-3}	-	-	-	***0.045***	***0.011***	-	2.0×10^{-3}	-	***0.089***
Ni-63	9.8×10^{-3}	0.12	5.7×10^{-3}	5.9×10^{-11}	1.2×10^{-4}	-	***0.18***	***0.016***	***0.033***	***0.16***	-
Np-237	3.8×10^{-14}	0.012	6.9×10^{-5}	0.034	***0.036***	7.4×10^{-4}	***0.018***	5.1×10^{-4}	3.3×10^{-3}	7.4×10^{-4}	1.5×10^{-3}
Pa-233	3.8×10^{-14}	0.012	-	0.034	***0.012***	7.4×10^{-4}	***0.018***	-	3.3×10^{-3}	-	1.5×10^{-3}
Pd-107	-	6.7×10^{-5}	-	-	-	3.7×10^{-4}	9.9×10^{-5}	-	1.8×10^{-5}	-	7.3×10^{-4}
Pm-147	1.7×10^{-3}	0.023	0.11	5.5	***4.4***	***0.25***	***0.034***	***0.031***	6.3×10^{-3}	***2.1***	***0.49***
Pr-144	-	2.5×10^{-8}	9.8×10^{-3}	-	-	***0.25***	3.7×10^{-8}	2.4×10^{-7}	6.8×10^{-9}	***0.070***	***0.49***
Pu-238	5.7×10^{-10}	1.4	0.092	150	***120***	***6.5***	***2.1***	***0.27***	***0.39***	***6.6***	***13***
Pu-239	1.1×10^{-11}	0.23	9.6×10^{-3}	3.5	***2.9***	***0.13***	***0.34***	***0.021***	***0.063***	***0.59***	***0.25***
Pu-240	9.1×10^{-12}	0.044	3.2×10^{-3}	2.4	***1.9***	***0.10***	***0.065***	6.1×10^{-3}	***0.012***	***0.051***	***0.20***
Pu-241	2.7×10^{-10}	0.57	0.060	69	***60***	***3.0***	***0.84***	***0.12***	***0.016***	***5.2***	***6.0***
Pu-242	1.8×10^{-14}	3.3×10^{-5}	1.8×10^{-6}	4.8×10^{-3}	3.8×10^{-3}	2.1×10^{-4}	4.9×10^{-5}	4.5×10^{-6}	9.1×10^{-6}	3.8×10^{-5}	4.1×10^{-4}
Ru-106	0.23	5.0×10^{-7}	5.3×10^{-4}	0.19	***0.17***	3.0×10^{-14}	7.4×10^{-7}	3.7×10^{-6}	1.4×10^{-7}	***0.051***	6.0×10^{-14}
Sb-125	0.051	2.1×10^{-3}	8.2×10^{-3}	1.3×10^{-9}	2.3×10^{-5}	7.5×10^{-3}	3.1×10^{-3}	2.5×10^{-3}	5.7×10^{-4}	***25***	***0.015***
Sb-126	-	2.4×10^{-4}	-	-	-	1.2×10^{-3}	3.5×10^{-4}	-	6.5×10^{-5}	-	2.4×10^{-3}
Se-79	-	1.8×10^{-3}	-	-	-	***0.010***	2.7×10^{-3}	-	5.0×10^{-4}	-	***0.020***
Sm-151	0.53	1.3	0.059	350	***300***	***17***	***1.9***	***0.16***	***0.35***	***1.7***	***34***
Sn-121m	-	2.3×10^{-4}	-	-	-	5.0×10^{-4}	3.4×10^{-4}	-	6.3×10^{-5}	-	9.9×10^{-4}
Sn-126	-	1.7×10^{-3}	-	-	-	8.8×10^{-3}	2.5×10^{-3}	-	4.6×10^{-4}	-	***0.017***
Sr-90	520	160	3.3	1.2×10^{-4}	1.7×10^{4}	***920***	***240***	***10***	***44***	***180***	1.8×10^{3}
Tc-99	0.19	0.040	1.7×10^{-3}	0.41	***3.3***	***0.34***	***0.059***	4.8×10^{-3}	***0.011***	***0.90***	***0.67***
Th-230	3.2×10^{-5}	3.7×10^{-6}	1.8×10^{-8}	4.6×10^{-5}	4.1×10^{-5}	5.8×10^{-5}	5.4×10^{-6}	1.3×10^{-7}	1.0×10^{-6}	3.8×10^{-6}	1.2×10^{-4}
Th-231	2.3×10^{-5}	8.7×10^{-5}	3.1×10^{-3}	3.6×10^{-5}	3.0×10^{-5}	4.3×10^{-5}	1.3×10^{-4}	-	2.4×10^{-5}	-	8.6×10^{-5}
U-232	1.2×10^{-19}	7.7×10^{-6}	3.6×10^{-7}	8.5×10^{-6}	7.0×10^{-6}	-	1.1×10^{-5}	6.3×10^{-7}	2.0×10^{-6}	9.3×10^{-6}	-
U-233	1.3×10^{-17}	1.0×10^{-6}	2.8×10^{-10}	1.3×10^{-3}	1.1×10^{-3}	1.0×10^{-7}	1.5×10^{-6}	2.1×10^{-9}	2.8×10^{-7}	1.6×10^{-7}	2.0×10^{-7}
U-234	2.1×10^{-15}	3.4×10^{-3}	1.6×10^{-4}	0.15	***0.12***	6.7×10^{-3}	5.0×10^{-3}	3.1×10^{-4}	9.2×10^{-4}	2.9×10^{-3}	***0.013***
U-235	1.5×10^{-17}	8.7×10^{-5}	4.1×10^{-6}	1.1×10^{-3}	9.1×10^{-4}	4.3×10^{-5}	1.3×10^{-4}	8.0×10^{-6}	2.4×10^{-5}	1.0×10^{-4}	8.6×10^{-5}
U-236	3.4×10^{-17}	1.4×10^{-4}	7.9×10^{-6}	2.5×10^{-3}	2.0×10^{-3}	1.1×10^{-4}	2.1×10^{-4}	1.5×10^{-5}	3.9×10^{-5}	1.8×10^{-4}	2.2×10^{-4}
U-237	2.3×10^{-17}	1.4×10^{-5}	-	1.6×10^{-3}	1.3×10^{-3}	7.3×10^{-5}	2.1×10^{-5}	-	3.9×10^{-6}	-	1.4×10^{-4}
U-238	2.8×10^{-18}	8.7×10^{-5}	2.9×10^{-6}	2.6×10^{-4}	2.1×10^{-4}	2.2×10^{-6}	1.3×10^{-4}	8.1×10^{-6}	2.4×10^{-5}	2.0×10^{-5}	4.4×10^{-6}
Y-90	510	0.016	2.1	1.2×10^{-4}	1.8×10^{4}	***920***	***0.024***	***10***	4.4×10^{-3}	***180***	1.8×10^{3}
Zr-93	-	9.1×10^{-3}	-	-	-	***0.051***	***0.013***	-	2.4×10^{-3}	-	***0.10***

i. Source: Wenzel (1997).

j. Source: Barnes (1998c).

k. Source: Russell et al. (1998a).

l. Source: Landman (1998), Fluor Daniel (1997).

m. Source: Barnes (1998a,b), Fewell (1999), Lee (1999).

n. Source: Wenzel (1997).

o. Source: Derived from Millet (2001).

p. Scaled from vitrified SBW.

q. Source: Kimmitt (2002).

Cs IX = cesium ion exchange; HAW = high-activity waste; HIP = Hot Isostatic Press; LLW = low-level waste ; NGLW = newly generated liquid waste; TRU = transuranic waste; CH = contact-handled; RH = remote-handled ; SBW = mixed transuranic waste/SBW.

maximally exposed individual was assumed to be exposed to the plume's radioactive contents for two hours before being evacuated or otherwise leaving the affected area. Thus, the individual's consequence (total effective dose equivalent or TEDE) was derived solely from a short-term (2-hour) scenario of direct radiation exposure from the shipment, breathing contaminated air, being submerged by contaminated air ("cloudshine"), and standing on contaminated ground ("groundshine"). Long-term exposure conditions such as eating food or water contaminated by the plume or receiving medical care to reduce the amount of radioactive material present in the body were not considered by DOE to be reasonably foreseeable and thus were not included in this analysis.

The type and amount of radioactive material released from each of the ***20*** waste package categories assumed to fail in an accident was taken or adapted from the complementary RADTRAN 4 input files. All radioactivity data used was based on the unit source terms listed in Table C.5-11. The RADTRAN 4 waste package failure data used included the smallest "moderate severity" and highest "extreme severity" nonzero release fractions and the respective respirable aerosol estimators. The range of values from which the release estimators were selected is shown in Tables C.5-8 through C.5-10, which are based on NUREG-0170 and Modal-related (NUREG/CR-4829) methodologies. These two accident severity categories were chosen to portray the complete range of consequences for accidents involving release of radioactive material. To restrict the influence of waste package design and preparation on close-in direct radiation exposures, the RISKIND assessment reflected exclusive-use shipments with a 2-meter dose rate set at the Department of Transportation limit of 10 mrem per hour. Waste package dimensions for this direct radiation exposure portion of the assessment were assumed to be the same as those used for the RADTRAN analysis.

For multiple waste package shipments, it was simply assumed that one-quarter of the waste packages would fail during an accident (in all cases, at least one package was assumed to leak some or all of it's contents). Lacking verifiable information on the failure behavior of multiple INEEL waste package shipments, DOE believes that this assumption is a reasonable compensating measure. This assumption alone accounts for the differences observed in the truck and rail consequence results for each waste form shipped. RISKIND was also configured to include the effects of a moderate fire (corresponding to diesel fuel burning at a rate of about one gallon per minute) on the transport and diffusion of radioactive material from the accident site to the critical receptor. All other RISKIND parameter values were left at their default settings.

The results of the consequence analyses are shown in Tables C.5-12 and C.5-13 for moderate and extreme severity truck and rail accidents, respectively. Under moderate accident severity conditions, the critical receptor dose ranges from ***2.1×10^{-8}*** (***NGLW Grout by rail***, stable atmosphere) to ***0.36*** rem (solidified HAW by rail, neutral atmosphere). For these same shipments under extreme severity accident conditions, the critical receptor dose ranges from ***3.8×10^{-6}*** (***NGLW Grout by rail***, stable atmosphere) to 36 rem (solidified HAW by rail, neutral atmosphere). Consequences are highest for solidified HAW shipments because the combination of source term and release characteristics for this waste form results in the greatest amount of radioactive material being released under both moderate and extreme severity accident conditions.

Since issuance of the Draft EIS, more recent estimates of the radionuclide inventory in the waste forms produced under the waste processing alternatives have become available. DOE compared the cargo-related accident impacts calculated using the more recent radionuclide inventory with those published in the Draft EIS. DOE concluded that the transportation analysis in this EIS would not be substantially different from an analysis performed with the more recent radionuclide inventory.

Table C.5-12. Moderate severity truck and rail accident critical receptor consequences for all waste forms under neutral and stable atmospheric conditions.

	Truck					Rail				
Waste form shipped	Source[a] (curies)	TEDE[b] (rem) Neutral	LCF probability	TEDE[b] (rem) Stable	LCF probability	Source[a] (curies)	TEDE[b] (rem) Neutral	LCF probability	TEDE[b] (rem) Stable	LCF probability
Class A ***Type*** grout	7.9×10^{-5}	2.4×10^{-5}	1.2×10^{-8}	3.8×10^{-7}	1.9×10^{-10}	2.0×10^{-4}	4.6×10^{-5}	2.3×10^{-8}	9.1×10^{-7}	4.6×10^{-10}
Vitrified ***HLW (at INEEL)***	2.9×10^{-4}	5.8×10^{-5}	2.9×10^{-8}	1.4×10^{-6}	7.0×10^{-10}	5.8×10^{-4}	1.2×10^{-4}	6.2×10^{-8}	2.8×10^{-6}	1.4×10^{-9}
Solidified HAW	0.89	0.18	9.0×10^{-5}	4.3×10^{-3}	2.2×10^{-6}	1.8	0.36	1.8×10^{-4}	8.7×10^{-3}	4.4×10^{-6}
Vitrified ***HLW (at Hanford)***	***7.4×10^{-5}***	***2.2×10^{-5}***	***1.1×10^{-8}***	***3.4×10^{-7}***	***1.7×10^{-10}***	***1.5×10^{-4}***	***3.5×10^{-5}***	***1.8×10^{-8}***	***6.7×10^{-7}***	***3.3×10^{-10}***
HIP HLW	5.1×10^{-5}	1.6×10^{-5}	8.0×10^{-9}	2.1×10^{-7}	1.1×10^{-10}	1.0×10^{-4}	2.4×10^{-5}	1.2×10^{-8}	4.0×10^{-7}	2.0×10^{-10}
Cementitious HLW	0.058	8.8×10^{-3}	4.4×10^{-6}	2.1×10^{-4}	1.1×10^{-7}	0.11	0.018	9.0×10^{-6}	4.3×10^{-4}	2.2×10^{-7}
Early Vitrified HLW	2.4×10^{-5}	1.3×10^{-5}	6.5×10^{-9}	1.1×10^{-7}	5.3×10^{-11}	6.1×10^{-5}	1.8×10^{-5}	***9.2×10^{-9}***	2.4×10^{-7}	1.2×10^{-10}
Calcine ***(to Hanford)***	0.55	0.085	4.3×10^{-5}	2.1×10^{-3}	1.1×10^{-6}	1.1	0.17	8.5×10^{-5}	4.1×10^{-3}	2.1×10^{-6}
CsIX Resin	1.9	9.8×10^{-3}	4.9×10^{-6}	2.4×10^{-4}	1.2×10^{-7}	1.9	9.7×10^{-3}	4.9×10^{-6}	2.3×10^{-4}	1.2×10^{-7}
Vitrified ***LLW fraction (at Hanford)***	1.8×10^{-6}	1.1×10^{-5}	5.5×10^{-9}	4.8×10^{-8}	2.4×10^{-11}	3.0×10^{-6}	1.2×10^{-5}	6.0×10^{-9}	6.7×10^{-8}	3.4×10^{-11}
Class C ***Type*** grout	0.048	2.3×10^{-3}	1.2×10^{-6}	5.4×10^{-5}	2.7×10^{-8}	0.15	6.7×10^{-3}	3.4×10^{-6}	1.6×10^{-4}	8.0×10^{-8}
Early Vitrified RH-TRU	4.4×10^{-6}	8.3×10^{-6}	4.2×10^{-9}	3.5×10^{-8}	1.8×10^{-11}	8.7×10^{-6}	9.1×10^{-6}	4.6×10^{-9}	5.6×10^{-8}	2.8×10^{-11}
Grouted CH-TRU	3.3×10^{-7}	7.7×10^{-6}	3.9×10^{-9}	2.6×10^{-8}	1.3×10^{-11}	6.7×10^{-7}	8.2×10^{-6}	4.1×10^{-9}	3.8×10^{-8}	1.9×10^{-11}
RH-TRU ***Fractions***	4.0×10^{-6}	6.1×10^{-5}	3.1×10^{-8}	1.3×10^{-6}	6.5×10^{-10}	8.0×10^{-6}	1.2×10^{-4}	6.0×10^{-8}	2.6×10^{-6}	1.3×10^{-9}
Vitrified calcine (separated)	***3.5×10^{-4}***	***7.7×10^{-5}***	***3.8×10^{-8}***	***1.7×10^{-6}***	***8.3×10^{-10}***	***7.1×10^{-4}***	***1.5×10^{-4}***	***7.3×10^{-8}***	***3.3×10^{-6}***	***1.7×10^{-9}***
Vitrified calcine	***2.4×10^{-5}***	***1.3×10^{-5}***	***6.5×10^{-9}***	***1.1×10^{-7}***	***5.3×10^{-11}***	***6.1×10^{-5}***	***1.8×10^{-5}***	***9.2×10^{-9}***	***2.4×10^{-7}***	***1.2×10^{-10}***
Vitrified SBW	***6.5×10^{-6}***	***9.5×10^{-6}***	***4.8×10^{-9}***	***4.7×10^{-8}***	***2.3×10^{-11}***	***1.3×10^{-5}***	***1.1×10^{-5}***	***5.4×10^{-9}***	***7.7×10^{-8}***	***3.9×10^{-11}***
NGLW grout	***6.5×10^{-7}***	***7.7×10^{-6}***	***3.9×10^{-9}***	***2.2×10^{-8}***	***1.1×10^{-11}***	***5.2×10^{-7}***	***7.7×10^{-6}***	***3.8×10^{-9}***	***2.1×10^{-8}***	***1.0×10^{-11}***
RH-TRU Solids	***5.5×10^{-6}***	***9.8×10^{-6}***	***4.9×10^{-9}***	***7.3×10^{-8}***	***3.7×10^{-11}***	***1.1×10^{-5}***	***1.2×10^{-5}***	***6.1×10^{-9}***	***1.3×10^{-7}***	***6.6×10^{-11}***
Calcine (to NGR)	***4.8×10^{-5}***	***1.5×10^{-5}***	***7.3×10^{-9}***	***1.9×10^{-7}***	***9.7×10^{-11}***	***9.6×10^{-5}***	***2.3×10^{-5}***	***1.1×10^{-8}***	***3.7×10^{-7}***	***1.9×10^{-10}***
Steam Reformed SBW	***1.8×10^{-6}***	***7.9×10^{-6}***	***3.9×10^{-9}***	***2.6×10^{-8}***	***1.3×10^{-11}***	***1.4×10^{-6}***	***7.7×10^{-6}***	***3.9×10^{-9}***	***2.2×10^{-8}***	***1.1×10^{-11}***

a. Amount of radioactive material dispersed during the accident.

b. Total effective dose equivalent committed to an adult located 0.1 (neutral) and 0.6 (stable) kilometers downwind from the accident site for a two-hour exposure period.

CsIX = cesium ion exchange; HAW = high-activity waste; LCF = latent cancer fatality; NGLW = newly generated liquid waste; ***NGR = national geologic repository*** .

Table C.5-13. Extreme severity truck and rail accident critical receptor consequences for all waste forms under neutral and stable atmospheric conditions.

	Truck					Rail				
Waste form shipped	Source[a] (curies)	TEDE[b] (rem) neutral	LCF probability	TEDE[b] (rem) stable	LCF probability	Source[a] (curies)	TEDE[b] (rem) neutral	LCF probability	TEDE[b] (rem) stable	LCF probability
Class A ***Type*** grout	7.9×10^{-3}	1.5×10^{-3}	7.5×10^{-7}	3.7×10^{-5}	1.9×10^{-8}	0.020	3.8×10^{-3}	1.9×10^{-6}	9.0×10^{-5}	4.5×10^{-8}
Vitrified ***HLW (at INEEL)***	0.17	0.033	1.6×10^{-5}	7.9×10^{-4}	3.9×10^{-7}	0.33	0.066	3.3×10^{-5}	1.6×10^{-3}	8.0×10^{-7}
Solidified HAW	89	1.8	9.0×10^{-3}	0.43	2.2×10^{-4}	180	***36***	1.8×10^{-2}	0.87	4.4×10^{-4}
Vitrified ***HLW (at Hanford)***	***0.042***	***7.7×10^{-3}***	***3.9×10^{-6}***	***1.9×10^{-4}***	***9.3×10^{-8}***	***0.084***	***0.015***	***7.7×10^{-6}***	***3.7×10^{-4}***	***1.9×10^{-7}***
HIP HLW	0.029	4.5×10^{-3}	2.3×10^{-6}	1.1×10^{-4}	5.5×10^{-8}	0.058	9.0×10^{-3}	4.5×10^{-6}	2.2×10^{-4}	1.1×10^{-7}
Cementitious HLW	5.8	0.88	4.4×10^{-4}	0.021	1.1×10^{-5}	11	1.8	9.0×10^{-4}	0.043	2.2×10^{-5}
Early Vitrified HLW	0.014	2.1×10^{-3}	1.1×10^{-6}	5.1×10^{-5}	2.5×10^{-8}	0.035	5.2×10^{-3}	2.6×10^{-6}	1.3×10^{-4}	6.5×10^{-8}
Calcine ***(to Hanford)***	55	8.5	4.3×10^{-3}	0.21	1.1×10^{-4}	110	17	8.5×10^{-3}	0.41	2.1×10^{-4}
CsIX Resin	190	0.98	4.9×10^{-4}	0.024	1.2×10^{-5}	380	1.9	9.5×10^{-4}	0.047	2.4×10^{-5}
Vitrified ***LLW fraction (at Hanford)***	1.0×10^{-3}	7.0×10^{-4}	3.5×10^{-7}	1.6×10^{-5}	8.0×10^{-9}	1.7×10^{-3}	1.2×10^{-3}	6.0×10^{-7}	2.7×10^{-5}	1.4×10^{-8}
Class C ***Type*** grout	4.8	0.23	1.2×10^{-4}	5.4×10^{-3}	2.7×10^{-6}	15	0.67	3.4×10^{-4}	0.016	8.0×10^{-6}
Early Vitrified RH-TRU	2.5×10^{-3}	5.1×10^{-4}	2.6×10^{-7}	1.2×10^{-5}	6.0×10^{-9}	5.0×10^{-3}	1.0×10^{-3}	5.0×10^{-7}	2.4×10^{-5}	1.2×10^{-8}
Grouted CH-TRU	8.3×10^{-3}	0.013	6.5×10^{-6}	3.1×10^{-4}	1.6×10^{-7}	0.017	0.026	1.3×10^{-5}	6.2×10^{-4}	3.1×10^{-7}
RH-TRU ***Fractions***	0.13	1.8	9.0×10^{-4}	0.043	2.2×10^{-5}	0.27	3.6	1.8×10^{-3}	0.086	4.3×10^{-5}
Vitrified calcine (separated)	***0.20***	***0.039***	***2.0×10^{-5}***	***9.4×10^{-4}***	***4.7×10^{-7}***	***0.40***	***0.078***	***3.9×10^{-5}***	***1.9×10^{-3}***	***9.4×10^{-7}***
Vitrified calcine	***0.014***	***2.1×10^{-3}***	***1.1×10^{-6}***	***5.1×10^{-5}***	***2.5×10^{-8}***	***0.035***	***5.2×10^{-3}***	***2.6×10^{-6}***	***1.3×10^{-4}***	***6.3×10^{-8}***
Vitrified SBW	***3.7×10^{-3}***	***7.4×10^{-4}***	***3.7×10^{-7}***	***1.8×10^{-5}***	***8.8×10^{-9}***	***7.4×10^{-3}***	***1.5×10^{-3}***	***7.3×10^{-7}***	***3.5×10^{-5}***	***1.8×10^{-8}***
NGLW grout	***3.7×10^{-4}***	***2.0×10^{-4}***	***1.0×10^{-7}***	***4.8×10^{-6}***	***2.4×10^{-9}***	***3.0×10^{-4}***	***1.6×10^{-4}***	***8.2×10^{-8}***	***3.8×10^{-6}***	***1.9×10^{-9}***
RH-TRU Solids	***0.18***	***0.082***	***4.1×10^{-5}***	***2.0×10^{-3}***	***9.8×10^{-7}***	***0.37***	***0.16***	***8.2×10^{-5}***	***3.9×10^{-3}***	***2.0×10^{-6}***
Calcine (to NGR)	***0.027***	***4.2×10^{-3}***	***2.1×10^{-6}***	***1.0×10^{-4}***	***5.1×10^{-8}***	***0.055***	***8.4×10^{-3}***	***4.2×10^{-6}***	***2.0×10^{-4}***	***1.0×10^{-7}***
Steam Reformed SBW	***1.0×10^{-3}***	***2.8×10^{-4}***	***1.4×10^{-7}***	***6.6×10^{-6}***	***3.3×10^{-9}***	***8.1×10^{-4}***	***2.1×10^{-4}***	***1.0×10^{-7}***	***4.8×10^{-6}***	***2.4×10^{-9}***

a. Amount of radioactive material dispersed during the accident.

b. Total effective dose equivalent committed to an adult located 0.1 (neutral) and 0.6 (stable) kilometers downwind from the accident site for a two-hour exposure period.

CsIX = cesium ion exchange; HAW = high-activity waste; LCF = latent cancer fatality; ***NGR = national geologic repository*** .

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Appendix C.6

Project Information

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Appendix C.6

Project Information

C.6.1 PROJECTS AND FACILITIES ASSOCIATED WITH THE ALTERNATIVES

DOE's ***six*** waste processing alternatives are:

1. No Action
2. Continued Current Operations
3. Separations
4. Non-Separations
5. Minimum INEEL Processing
6. ***Direct Vitrification***

For purposes of analysis, DOE has broken the actions to implement each alternative and option into discrete projects. The proposed projects associated with the waste processing alternatives are presented in Table C.6.1-1. There are multiple projects comprising an alternative or option. Some projects are used repeatedly for the various alternatives and options. Projects that are very similar between alternatives and options are generally represented by a single bounding project. Detailed information on the individual projects is provided in Section C.6.2.

C.6.1.1 No Action Alternative

Existing Idaho Nuclear Technology and Engineering Center (INTEC) facilities required for the No Action Alternative would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-2. Table C.6.1-3 lists the projects associated with the No Action Alternative.

C.6.1.2 Continued Current Operations Alternative

Existing INTEC facilities required for the Continued Current Operations Alternative would include the bin sets, Tank Farm, New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-4. Table C.6.1-5 lists the projects associated with the Continued Current Operations Alternative.

C.6.1.3 Separations Alternative

DOE has selected three options for implementation of the Separations Alternative: Full Separations, Planning Basis, and Transuranic Separations. These options have similar requirements for new INTEC facilities, such as the need for a separations facility and low activity waste grouting facility. However, the specific processes that occur in each of the proposed facilities and the waste forms that would be produced differ between the options.

Full Separations Option

Existing INTEC facilities required for the Full Separations Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Waste Separations Facility, Vitrification Plant, Class A Grout Plant, Low-Activity Waste Disposal Facility, and Interim Storage Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-6. Table C.6.1-7 lists the projects associated with the Full Separations Option.

Table C.6.1-1. Projects at the INEEL associated with the waste processing alternatives.[a]

Project number	Project	Alternative/option
P1A	Calcine SBW Including New Waste Calcining Facility Upgrades	CCO, PB, HIP, DC
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	CCO, PB, HIP, DC
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	EV, ***SR***, MIN, ***VWOCS, VWCS***
P1D	No Action Alternative	NAA
P1E	Bin Set 1 Calcine Transfer	NAA, CCO
P4	Long-Term Storage of Calcine in Bin Sets	NAA, CCO
P9A	Full Separations	FS, ***VWCS***
P9B	Vitrification Plant	FS
P9C	Class A Grout Plant	FS, ***VWCS***
P9J	HAW Denitration, Packaging and Cask Loading Facility	(b)
P13	***New Storage Tanks***	***SR, VWOCS, VWCS***
P18	New Analytical Laboratory	FS, PB, TS, HIP, DC, EV, MIN, ***VWOCS, VWCS***
P18MC	Remote Analytical Laboratory Operations	NAA, CCO, ***SR***
P23A	Full Separations	PB
P23B	Vitrification Plant	PB
P23C	Class A Grout Plant	PB
P24	Vitrified Product Interim Storage	FS, PB, MIN, ***VWCS***
P25A[c]	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	FS, PB, MIN, ***VWCS***
P25B[c]	Shipping HLW from INTEC to a Geologic Repository	FS, PB, MIN, ***VWCS***
P26	Class A Grout Disposal in Tank Farm and Bin Sets	FS
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	FS, TS, MIN
P28A[c]	Class A Grout Shipment to Offsite Disposal Site	FS, PB, ***TS, SR***, ***VWCS***
P35D	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	FS
P35E	Class A Grout Packaging and Loading for Offsite Disposal	FS, PB, ***SR,*** MIN, ***VWCS***
P39A	Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant	TS
P39B[c]	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	TS
P49A	Transuranic/Class C Separations	TS
P49C	Class C Grout Plant	TS
P49D	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	TS
P49E	Class C Grout Packaging and Loading for Offsite Disposal	TS
P51	Class C Grout Disposal in Tank Farm and Bin Sets	TS
P59A	Calcine Retrieval and Transport	FS, PB, TS, HIP, DC, EV, ***SR,*** MIN, ***VWOCS, VWCS***
P59B[c,d]	Calcine Retrieval and Transport Just-in-Time	MIN
P61	Vitrified HLW Interim Storage	EV, ***VWOCS***
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	EV, ***VWOCS***
P63A[c]	Shipping Vitrified HLW from INTEC to a Geologic Repository	EV, ***VWOCS***

Table C.6.1-1. Projects at the INEEL associated with the waste processing alternatives[a] (continued).

Project number	Project	Alternative/option
P64D[c]	Transport of Vitrified Waste to INEEL	MIN
P64E	Vitrified Low-Activity Waste Shipment to Offsite Disposal Site	MIN
P71	Mixing and Hot Isostatic Pressing	HIP
P72	Interim Storage of Hot Isostatic Pressed Waste	HIP
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	HIP
P73B[c]	Shipping Hot Isostatic Pressed Waste from INTEC to a Geologic Repository	HIP
P80	Direct Cement Process	DC
P81	Unseparated Cementitious HLW Interim Storage	DC
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	DC
P83B[c]	Shipping Cementitious Waste from INTEC to a Geologic Repository	DC
P88	Early Vitrification Facility with Maximum Achievable Control Technology	EV, ***VWOCS, VWCS***
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	EV
P90B[c]	Shipping of Vitrified SBW from INTEC to the Waste Isolation Pilot Plant	EV, ***VWOCS, VWCS***
P111	SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	MIN
P112A	Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant	MIN
P112B[c]	Shipping Contact-Handled Transuranic Waste to the Waste Isolation Pilot Plant	MIN
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	CCO, HIP, DC
P117A	Calcine Packaging and Loading to Hanford	***SR***, MIN
P117B[d]	Calcine Packaging and Loading Just-in-Time	MIN
P118	Separations Organic Incinerator	FS, PB, TS
P121A[c]	Calcine Transport to Hanford	MIN
P121B[c,d]	Calcine Transport to Hanford Just-in-Time	MIN
P133	Waste Treatment Pilot Plant	FS, PB, TS, HIP, DC, EV, MIN, ***VWOCS, VWCS***
P2001	***NGLW Grout Facility***	***SR***[e]
P2002A	***Steam Reforming***	***SR***
P2002B[c]	***Calcine Transportation to Geologic Repository***	***SR***

a. NAA = No Action Alternative; CCO = Continued Current Operations Alternative; FS = Separations Alternative/Full Separations Option; PB = Separations Alternative/Planning Basis Option; TS = Separations Alternative/Transuranic Separations Option; HIP = Non-Separations Alternative/Hot Isostatic Pressed Waste Option; DC = Non-Separations Alternative/Direct Cement Waste Option; EV = Non-Separations Alternative/Early Vitrification Option; ***SR = Non-Separations Alternative/Steam Reforming Option***; MIN = Minimum INEEL Processing Alternative; ***VWOCS = Vitrification without Calcine Separations Option; VWCS = Vitrification with Calcine Separations Option.***

b. Stand-alone project; not associated with a specific waste processing alternative or option.

c. Transportation project. No project data presented in C.6.2. ***Transportation data is presented in Appendix C.5.***

d. P59A, P117A, and P121A relate to the Interim Storage Shipping scenario; P59B, P117B, and P121B relate to the Just-in-Time Shipping scenario. Section 3.1.5 explains the relationship of these two scenarios under the Minimum INEEL Processing Alternative.

e. ***This stand-alone project could be used under any of the waste processing alternatives.***

Table C.6.1-2. Facilities associated with the No Action Alternative.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW.
Tank Farm	Stores liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Proposed Facilities	
Calcine Retrieval and Transport System (bin set 1 only)[a]	Retrieves calcine from bin set 1 and transports it to bin set 6 or 7.

a. As decided in the SNF & INEL EIS Record of Decision (60 FR 28680; June 1, 1995).

Table C.6.1-3. Projects associated with the No Action Alternative.

Project number	Project name
P1D	No Action Alternative
P1E	Bin Set 1 Calcine Transfer
P4	Long-term Storage of Calcine in Bin Sets
P18MC	Remote Analytical Laboratory Operation

Table C.6.1-4. Facilities associated with the Continued Current Operations Alternative.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW.
Tank Farm	Stores liquid SBW and newly generated liquid waste.
New Waste Calcining Facility	Calcines liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Process Equipment Waste Evaporator	Concentrates the high acid and high radioactivity newly generated liquid waste.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System (bin set 1 only)	Retrieves calcine from bin set 1 and transports it to bin set 6 or 7.
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts the newly generated liquid waste prior to disposal at a low-level waste disposal facility.

Table C.6.1-5. Projects associated with the Continued Current Operations Alternative.

Project number	Project name
P1A	Calcine SBW Including New Waste Calcining Facility Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P1E	Bin Set 1 Calcine Transfer
P4	Long-Term Storage of Calcine in Bin Sets
P18MC	Remote Analytical Laboratory Operation
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant

Table C.6.1-6. Facilities associated with the Full Separations Option.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for chemical separation and potentially serves as a destination for Class A grout.
Tank Farm	Stores liquid SBW until removed for chemical separation and potentially serves as a destination for Class A grout.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Process Equipment Waste Evaporator	Concentrates the high acid and high radioactivity newly generated liquid waste.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Waste Separations Facility.
Waste Separations Facility	Performs chemical separations producing the high-activity waste and low-activity waste streams.
Vitrification Plant	Converts the high-activity waste to a vitrified (glass) form.
Class A Grout Plant	Evaporates and denitrates the low-activity waste and produces a Class A grout.
Low-Activity Waste Disposal Facility	Receives containerized Class A grout for disposal.
Vitrified Product Interim Storage Facility	Provides interim storage for vitrified high-activity waste until shipped to a geologic repository.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes

Table C.6.1-7. Projects associated with the Full Separations Option.

Project number	Project name
P59A	Calcine Retrieval and Transport
P9A	Full Separations
P9B	Vitrification Plant
P9C	Class A Grout Plant
P24	Vitrified Product Interim Storage
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P25B	Shipping HLW from INTEC to a Geologic Repository
P18	New Analytical Laboratory
P118	Separations Organic Incinerator
P133	Waste Treatment Pilot Plant
	and
P35D *and* P27	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility *and* Class A Grout Disposal in a New Low-Activity Waste Disposal Facility
	or
P35E *and* P28A	Class A Grout Packaging and Loading for Offsite Disposal *and* Class A Grout Shipment to Offsite Disposal Site
	or
P26	Class A Grout Disposal in Tank Farm and Bin Sets

Planning Basis Option

Existing INTEC facilities required for the Planning Basis Option would include the bin sets, Tank Farm, New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Waste Separations Facility, Vitrification Plant, Class A Grout Plant, Interim Storage Facility, and Newly Generated Liquid Waste Treatment Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-8. Table C.6.1-9 lists the projects associated with the Planning Basis Option.

Transuranic Separations Option

Existing INTEC facilities required for the Transuranic Separations Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Transuranic Separations Facility, Class C Grout Plant, and Low-Activity Waste Disposal Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-10. Table C.6.1-11 lists the projects associated with the Transuranic Separations Option.

Table C.6.1-8. Facilities associated with the Planning Basis Option.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for chemical separation and potentially serves as a destination for Class A grout.
Tank Farm	Stores liquid SBW until removed for chemical separation and potentially serves as a destination for Class A grout.
New Waste Calcining Facility	Calcines liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Process Equipment Waste Evaporator	Concentrates the high acid and high radioactivity newly generated liquid waste.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Waste Separations Facility.
Waste Separations Facility	Performs chemical separations producing the high-activity waste and low-activity waste streams.
Vitrification Plant	Converts the high-activity waste to a vitrified (glass) form.
Class A Grout Plant	Evaporates and denitrates the low-activity waste and produces a Class A grout.
Vitrified Product Interim Storage Facility	Stores vitrified high-activity waste in stainless steel canisters which are either stored in a modified, existing facility or placed into new concrete and steel vaults.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts the newly generated liquid waste prior to disposal at a low-level waste disposal facility.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-9. Projects associated with the Planning Basis Option.

Project number	Project name
P1A	Calcine SBW Including New Waste Calcining Facility Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P59A	Calcine Retrieval and Transport
P23A	Full Separations
P23B	Vitrification Plant
P23C	Class A Grout Plant
P24	Vitrified Product Interim Storage
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P25B	Shipping HLW from INTEC to a Geologic Repository
P18	New Analytical Laboratory
P118	Separations Organic Incinerator
P133	Waste Treatment Pilot Plant
P35E	Class A Grout Packaging and Loading for Offsite Disposal
P28A	Class A Grout Shipment to Offsite Disposal Site

Table C.6.1-10. Facilities associated with the Transuranic Separations Option.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for chemical separation and potentially serves as a destination for Class C grout.
Tank Farm	Stores liquid SBW until removed for chemical separation and potentially serves as a destination for Class C grout.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Process Equipment Waste Evaporator	Concentrates the high acid and high radioactivity newly generated liquid waste.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports in the Transuranic Separations Facility.
Transuranic Separations Facility	Performs transuranic extraction producing the transuranic and low-activity waste streams. Dries and solidifies the transuranic waste stream.
Class C Grout Plant	Evaporates and denitrates the low-activity waste and produces a Class C grout.
Low-Activity Waste Disposal Facility	Receives containerized Class C grout for disposal.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-11. Projects associated with the Transuranic Separations Option.

Project number	Project name
P59A	Calcine Retrieval and Transport
P49A	Transuranic/Class C Separations
P49C	Class C Grout Plant
P39A	Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant
P39B	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant
P18	New Analytical Laboratory
P118	Separations Organic Incinerator
P133	Waste Treatment Pilot Plant
	and
P49D *and* P27	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility *and* Class C Grout Disposal in a New Low-Activity Waste Disposal Facility
	or
P49E *and* P28A	Class C Grout Packaging and Loading for Offsite Disposal *and* Class C Grout Shipment to Offsite Disposal Site
	or
P51	Class C grout Disposal in Tank Farm and Bin Sets

C.6.1.4 Non-Separations Alternative

Hot Isostatic Pressed Waste Option

Existing INTEC facilities required for the Hot Isostatic Pressed Waste Option would include the bin sets, Tank Farm, New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Hot Isostatic Press Facility, Interim Storage Facility, and Newly Generated Liquid Waste Treatment Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-12. Table C.6.1-13 lists the projects associated with the Hot Isostatic Pressed Waste Option.

Direct Cement Waste Option

Existing INTEC facilities required for the Direct Cement Waste Option would include the bin sets, Tank Farm, New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Cement Facility, Interim Storage Facility, and Newly Generated Liquid Waste Treatment Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-14. Table C.6.1-15 lists the projects associated with the Direct Cement Waste Option.

Early Vitrification Option

Existing INTEC facilities required for the Early Vitrification Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Early Vitrification Facility, and Interim Storage Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-16. Table C.6.1-17 lists the projects associated with the Early Vitrification Option.

Steam Reforming Option

Existing INTEC facilities required for the Steam Reforming Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would

Table C.6.1-12. Facilities associated with the Hot Isostatic Pressed Waste Option.

Facility name	Purpose
Existing Facilities	
New Waste Calcining Facility	Calcines liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Calcined Solids Storage Facilities (bin sets)	Stores calcine from the New Waste Calcining Facility until removed by the Calcine Retrieval and Transport system and sent to the Hot Isostatic Press Facility.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste before storing, calcining, or grouting.
Liquid Effluent Treatment and Disposal Facility	Processes the newly generated liquid waste overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Tank Farm	Stores liquid SBW until removed for calcination in the New Waste Calcining Facility.
Coal-Fired Steam Generating Facility	Provides steam energy for the process.
Substation	Provides electrical power for the INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Hot Isostatic Press Facility.
Hot Isostatic Press Facility	Processes the calcine to produce an impervious, non-leachable glass-ceramic form.
HLW Interim Storage Facility	Provides interim storage for Hot Isostatic Pressed Waste canisters until shipped to a geologic repository.
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts the newly generated liquid waste prior to disposal at a low-level waste disposal facility.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-13. Projects associated with the Hot Isostatic Pressed Waste Option.

Project number	Project name
P1A	Calcine SBW Including New Waste Calcining Facility Maximum Achievable Control Technology Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P18	New Analytical Laboratory
P59A	Calcine Retrieval & Transport
P71	Mixing and Hot Isostatic Pressing
P72	Interim Storage of Hot Isostatic Pressed Waste
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository
P73B	Shipping Hot Isostatic Pressed Waste from INTEC to a Geologic Repository
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant
P133	Waste Treatment Pilot Plant

Table C.6.1-14. Facilities associated with the Direct Cement Waste Option.

Facility name	Purpose
Existing Facilities	
New Waste Calcining Facility	Calcines liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Calcined Solids Storage Facilities (bin sets)	Stores the HLW calcine until transported by the Calcine Retrieval and Transport system to the Direct Grouting Facility.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Processes the newly generated liquid waste overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Perform analytical services for the process streams.
Tank Farm	Stores liquid SBW until removed for calcination in the New Waste Calcining Facility.
Coal-Fired Steam Generating Facility	Provides steam energy for the process.
Substation	Provides electrical power for the INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Direct Grouting Facility.
Cement Facility	Processes the calcined SBW and HLW to produce a hydroceramic form.
HLW Interim Storage Facility	Provides interim storage for cemented HLW canisters until shipped to a geologic repository.
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts the newly generated liquid waste prior to disposal at a low-level waste disposal facility.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-15. Projects associated with the Direct Cement Waste Option.

Project number	Project name
P1A	Calcine SBW including New Waste Calcining Facility Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P18	New Analytical Laboratory
P59A	Calcine Retrieval and Transport
P80	Direct Cement Process
P81	Unseparated Cementitious HLW Interim Storage
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository
P83B	Shipping Cementitious Waste from INTEC to a Geologic Repository
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant
P133	Waste Treatment Pilot Plant

Table C.6.1-16. Facilities associated with the Early Vitrification Option.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcine, until removed by the Calcine Retrieval and Transport system and sent to the Vitrification Facility.
High-Level Liquid Waste Evaporator	Concentrates SBW and Newly Generated Liquid Waste.
Process Equipment Waste Evaporator	Concentrates the effluents resulting from vitrification at the Vitrification Facility.
Liquid Effluent Treatment and Disposal Facility	Processes the overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Tank Farm	Stores liquid SBW until removed for vitrification.
Coal-Fired Steam Generating Facility	Provides steam energy for the process.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Vitrification Facility.
Early Vitrification Facility	Vitrifies SBW, newly generated liquid waste, and calcine.
HLW Interim Storage Facility	Provides interim storage for the vitrified HLW canisters until shipped to a geologic repository.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-17. Projects associated with the Early Vitrification Option.

Project number	Project name
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility
P18	New Analytical Laboratory
P59A	Calcine Retrieval and Transport
P61	Vitrified HLW Interim Storage
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P63A	Shipping of Vitrified HLW from INTEC to a Geologic Repository
P88	Early Vitrification with Maximum Achievable Control Technology
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant
P90B	Shipping of Vitrified SBW from INTEC to the Waste Isolation Pilot Plant
P133	Waste Treatment Pilot Plant

include a Calcine Retrieval and Transport System, Packaging Facility, Steam Reforming Facility, and Newly Generated Liquid Waste Grout Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6-18. Table C.6-19 lists the projects associated with the Steam Reforming Option.

C.6.1.5 Minimum INEEL Processing Alternative

Existing INTEC facilities required for the Minimum INEEL Processing Alternative would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Calcine Packaging Facility, Interim Storage Facility, Sodium-Bearing Waste and Newly Generated Liquid Waste Treatment Facility, and Low-Activity Waste Disposal Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-***20***.

This alternative includes two scenarios for shipping calcine from INEEL to the Hanford Site. The first scenario is to ship the calcine during the years 2012 through ***2025***, which would require the Hanford Site to build canister storage buildings for interim storage of the INEEL calcine prior to treatment. Table C.6.1-***21*** lists the projects associated with this shipping scenario for the Minimum INEEL Processing Alternative. A second scenario is to ship calcine to the Hanford Site on a just-in-time basis, over the years 2028 through 2030. The calcine would be shipped to the Hanford Site at the rate it can be introduced directly to the treatment process, so that construction of canister storage buildings would not be necessary. Table C.6.1-***21*** lists the projects associated with this shipping scenario for the Minimum INEEL Processing Alternative.

In addition, this alternative would require existing and new facilities at the Hanford Site to treat the INEEL waste. The facilities and projects that would be associated with management of the calcined HLW at the Hanford Site are described in Appendix C.8.

C.6.1.6 Direct Vitrification Alternative

Vitrification without Calcine Separations Option

Existing INTEC facilities required for the Vitrification without Calcine Separations Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a New Analytical Laboratory, Waste Treatment Pilot Plant, Calcine Retrieval and Transport System, Vitrification Facility, Newly Generated Liquid Waste Treatment Facility, New Storage Tanks, and Interim Storage Facility. The existing and proposed facilities associated with this option are listed in Table C.6.1-22. Table C.6.1-23 lists the projects associated with the Vitrification without Calcine Separations Option.

Vitrification with Calcine Separations Option

Existing INTEC facilities required for the Vitrification with Calcine Separations Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a New Analytical Laboratory, Waste Treatment Pilot Plant, Calcine Retrieval and Transport System, Waste Separation Facility, Vitrification Facility, Newly Generated Liquid Waste Treatment Facility, Interim Storage Facility, New Storage Tanks, and Grout Plant. The existing facilities and proposed facilities associated with this option are listed in Table C.6.1-24. Table C.6.1-25 lists the projects associated with the Vitrification with Calcine Separations Option.

Table C.6.1-18. Facilities Associated with the Steam Reforming Option.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for packaging and loading for shipment to a geologic repository
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste
Liquid Effluent Treatment and Disposal Facility	Processes overheads from the Process Equipment Waste Evaporator
Remote Analytical Laboratory	Performs analytical services for the process streams
Tank Farm	Stores liquid SBW until removed for processing through the treatment facility
Proposed Facilities	
New Storage Tanks	Provides RCRA-compliant storage of liquid waste after 2012
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Calcine and Steam-Reformed Product Packaging Facility
Calcine and Steam-Reformed Product Packaging Facility	Prepares calcine and steam-reformed product for shipment
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts newly generated liquid waste after steam reforming ceases
Steam Reforming Facility	Processes SBW and NGLW to solid form

Table C.6.1-19. Projects Associated with the Steam Reforming Option.

Project number	Project name
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility
P13	New Storage Tanks
P18MC	Remote Analytical Laboratory Operation
P59A	Calcine Retrieval and Transport
P117A	Calcine Packaging and Loading
P2002B	Calcine Transport to Geologic Repository
P2001	NGLW Grout Facility
P28A	Grout Shipment to Offsite Disposal Sites
P35E	Grout Packaging and Loading for Offsite Disposal
P2002A	Steam Reforming

Table C.6.1-20. Facilities associated with the Minimum INEEL Processing Alternative.[a]

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for packaging and loading for shipment to the Hanford Site.
Tank Farm	Stores liquid SBW until removed for processing through the treatment facility.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Processes overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Calcine Packaging Facility.
Calcine Packaging Facility	Prepares the calcine for shipment.
SBW and NGLW Treatment Facility	Processes the liquid wastes for shipment.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Vitrified Product Interim Storage Facility	Provides interim storage for vitrified high-activity waste until shipped to a geologic repository.
Low-Activity Waste Disposal Facility	Receives vitrified low-activity waste for disposal.
Waste Treatment Pilot Plant	Develops and tests new processes.

a. Facilities at the Hanford Site are described in Appendix C.8.

Table C.6.1-21. Projects associated with the Minimum INEEL Processing Alternative.[a]

Project number	Project name
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal
P18	New Analytical Laboratory
P24	Vitrified Product Interim Storage
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P25B	Transport of Vitrified Waste from INEEL to a Geologic Repository
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility
P64D	Transport of the Vitrified Waste to INEEL
P111	SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout
P112A	Packaging and Loading Contact-Handled Transuranic Waste for Transport to the Waste Isolation Pilot Plant
P112B	Shipping Contact-Handled Transuranic Waste to the Waste Isolation Pilot Plant
P133	Waste Treatment Pilot Plant
	and
P59A	Calcine Retrieval and Transport
P117A	Calcine Packaging and Loading to Hanford
P121A	Calcine Transport to Hanford
	or
P59B	Calcine Retrieval and Transport Just-in-Time
P117B	Calcine Packaging and Loading Just-in-Time
P121B	Calcine Transport to Hanford Just-in-Time
P35E	Class A Grout Packaging and Loading for Offsite Disposal
P64E	Vitrified Low-Activity Waste Shipment to Offsite Disposal Site

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a. Projects at the Hanford Site are described in Appendix C.8.

Table C.6.1-22. Facilities associated with Vitrification without Calcine Separations Option.

Facility Name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcine, until removed by the Calcine Retrieval and Transport System and sent to the Vitrification Facility.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste.
Calcined Solids Storage Facilities (bin sets)	Stores calcine, until removed by the Calcine Retrieval and Transport System and sent to the Vitrification Facility.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Processes the overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Tank Farm	Stores liquid SBW until removed for vitrification.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Vitrification Facility.
Vitrification Facility	Vitrifies SBW, newly generated liquid waste, and calcine.
New Storage Tanks	Provides storage capacity for liquid SBW and newly generated liquid waste after 2012.
Interim Storage Facility	Provides interim storage for vitrified HLW until shipped to a geologic repository.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-23. Projects associated with Vitrification without Calcine Separations Option.

Project Number	Project Name
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility
P13	New Storage Tanks
P18	New Analytical Laboratory
P59A	Calcine Retrieval and Transport
P61	Vitrified HLW Interim Storage
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P63A	Shipping of Vitrified HLW from INTEC to a Geologic Repository
P88	Vitrification Facility with MACT
P90B	Shipping of Vitrified SBW from INTEC to a Geologic Repository
P133	Waste Treatment Pilot Plant

Table C.6-1-24. Facilities associated with Vitrification with Calcine Separations Option.

Facility Name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcine, until removed by the Calcine Retrieval and Transport System and sent to the Vitrification Facility.
Tank Farm	Stores liquid SBW until removed for vitrification.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Processes the overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Vitrification Facility.
New Storage Tanks	Provides storage capacity for liquid SBW and newly generated liquid waste after 2012.
Waste Separations Facility	Performs chemical separations of calcine producing HLW and low-level waste streams.
Vitrification Facility	Vitrifies SBW, newly generated liquid waste, and separated HLW fraction from calcine.
Grout Plant	Evaporates and denitrates the low-level waste fraction from calcine and produces a low-level waste grout.
Interim Storage Facility	Provides interim storage for vitrified HLW until shipped to a geologic repository.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-25. Projects associated with Vitrification with Calcine Separations Option.

Project Number	Project Name
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility
P9A	Full Separations
P9C	Grout Plant
P13	New Storage Tanks
P18	New Analytical Laboratory
P24	Vitrified Product Interim Storage
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P25B	Shipping of HLW from INTEC to a Geologic Repository
P28A	Grout Shipment to Offsite Disposal Sites
P35E	Grout Packaging and Loading for Offsite Disposal
P59A	Calcine Retrieval and Transport
P88	Vitrification Facility with MACT
P90B	Shipping of Vitrified SBW from INTEC to a Geologic Repository
P133	Waste Treatment Pilot Plant

C.6.1.7 Facility Disposition Alternatives

DOE used a systematic process to identify which existing INTEC facilities would be analyzed in detail under the facility disposition alternatives in this EIS. Detailed information regarding this process and facility disposition alternatives is provided in Section 3.2, Facility Disposition Alternatives. Existing HLW facilities would be dispositioned under all waste processing alternatives. The facility disposition alternatives are modular in nature and can be integrated with any waste processing alternative or option. Table C.6.1-2***6*** identifies the facility disposition alternatives and the specific project associated with the dispositioning of each facility. Detailed information for the proposed projects associated with each facility closure are presented in C.6.2.

For the Tank Farm and bin sets, which together constitute the majority of the total inventory of residual radioactivity, DOE analyzed all five facility disposition alternatives. Since the residual amount of radioactive and/or chemical contaminants associated with other INTEC facilities is much less than that of the Tank Farm and bin sets, the overall residual risk at INTEC would not change significantly due to the contribution from these other facilities. For purposes of analysis, DOE assumed a single facility disposition alternative for the other INTEC HLW facilities, except for the New Waste Calcining Facility and the Fuel Processing Building and related facilities for which two facility disposition alternatives were evaluated.

Table C.6.1-26. Facility disposition alternatives.

Facility Description	Facility Disposition Alternative				
	Clean Closure	Performance-Based Closure	Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal
Tank Farm and Related Facilities					
Tank Farm[a]	P59G	P3B	P3C	P26	P51
CPP-619 – Tank Farm Area – CPP (Waste Storage Control House)			P156B		
CPP-628 - Tank Farm Area – CPP (Waste Storage Control House)			P156C		
CPP-638 – Waste Station (WM-180) Tank Transfer Building			P156E		
CPP-712 – Instrument House (VES-WM-180, 181)			P156F		
CPP-717 – STR/SIR Waste Storage Tank Pads (A, B, C, and D) and Vessels			P156G		
Bin Sets and Related Facilities					
Bin sets[b]	P59F	P59C	P59D	P26	P51
CPP-639 – Blower Building/Bin Sets 1, 2, 3			P157A		
CPP-646 – Instrument Building for 2nd Set Calcined Solids			P157B		
CPP-647 – Instrument Building for 3rd Set Calcined Solids			P157C		
CPP-658 – Instrument Building for 4th Set Calcined Solids			P157D		
CPP-671 – Instrument Building for 5th Set Calcined Solids			P157E		
CPP-673 – Instrument Building for 6th Set Calcined Solids			P157F		
Process Equipment Waste Evaporator and Related Facilities					
CPP-604 – Process Equipment Waste Evaporator			P158H		
CPP-605 – Blower Building			P158A		
CPP-641 – West Side Waste Holdup	P156L				
CPP-649 – Atmospheric Protection Building			P158B		
CPP-708 – Exhaust Stack/Main Stack[c]			P158C		

Table C.6.1-26. Facility disposition alternatives (continued).

Facility Description	Facility Disposition Alternative Clean Closure	Performance-Based Closure	Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal
Process Equipment Waste Evaporator and Related Facilities (continued)					
CPP-756 – Pre-Filter Vault			P158D		
CPP-1618 – Liquid Effluent Treatment and Disposal Facility	P158E				
NA – PEWE Condensate Lines			P154B		
NA – PEWE Condensate Lines and Cell Floor Drain Lines			P154A		
Fuel Processing Building and Related Facilities					
CPP-601 – Fuel Processing Building		P160E	P160A		
CPP-627 – Remote Analytical Facility Building		P160F	P160C		
CPP-640 – Head End Process Plant		P160G	P160D		
FAST and Related Facilities					
CPP-666 – Fluorinel Dissolution Process and Fuel Storage Facility		P161A			
CPP-767 – Fluorinel Dissolution Process and Fuel Storage Facility Stack	P161B				
Transport Lines Group					
NA – Process Offgas Lines		P162C			
NA – High-Level Liquid Waste (Raffinate) Lines			P162A		
NA – Process (Dissolver) Transport Lines		P162D			
NA – Calcine Solids Transport Lines			P162B		
Other HLW Facilities					
CPP-659 – New Waste Calcining Facility[d]		P165A	P165B		
CPP-684 – Remote Analytical Laboratory		P159			

a. The INTEC Tank Farm consists of underground storage tanks, concrete tank vaults, waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings containing instrumentation and valves for the waste tanks. Includes waste storage tanks (VES-WM-180 through 190), Tank Vaults for Tanks VES-WM-180 through 186 (CPP-780 through 786), Tank Enclosure for Tanks VES-WM-187 through 190 (CPP-713), and facilities CPP-721 through 723, CPP-737 through 743, and CPP-634 through 636, and CPP-622, 623, and 632.

b. The bin sets consist of ancillary structures, instrument rooms, filter rooms, cyclone vaults, and stacks, including CSSF-1 through 7, CPP-729, CPP-732, CPP-741 through 742, CPP-744, CPP-746 through 747, CPP-760 through 761, CPP-765, CPP-791, CPP-795, and CPP-1615.

c. Includes the instrument building for Main Stack CPP-692 and waste transfer line valve boxes.

d. Includes Organic Solvent Disposal Building CPP-694.

STR = Submarine Thermal Reactor; SIR = Submarine Intermediate Reactor;
PEWE = Process Equipment Waste Evaporator.

C.6.2 PROJECT SUMMARIES

Although the projects for the Direct Vitrification Alternative had identically numbered counterparts in the Draft Environmental Impact Statement (EIS), the project data have been updated since the Draft EIS. The differences in data are not large.

WASTE PROCESSING PROJECTS

C.6.2.1 Calcine SBW Including New Waste Calcining Facility Upgrades (P1A)

Project Description: Four waste processing alternatives/options (Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option) require that liquid sodium-bearing waste (SBW) be calcined prior to further processing, storage, or disposal. To accomplish that objective, modifications and additions to the New Waste Calcining Facility (NWCF) and a new storage tank would be required. The modified calcining facility would process all SBW by the end of 2014, but would remain operational through 2016 in preparation for closure.

PROJECT DETAILS

NWCF Upgrades

In order to obtain an operating permit from the State of Idaho, the NWCF would have to undergo certain modifications to comply with the expected maximally achievable control technology (MACT) requirements for air emissions. Also, to calcine the liquid waste more efficiently the calciner must operate at a higher temperature than used in previous campaigns. The project data sheet reflects construction and decontamination and decommissioning, but not NWCF operations.

Baseline Information

- The calciner would operate at 600°C and would convert SBW to calcine. Startup and operational testing of the upgraded calciner would occur in 2009-2010.

- Nearly all SBW would be calcined by the end of 2014; however, the calciner may continue operations until 2016, at which time the calciner may have completed calcination of its own Type-I beds, for decontamination purposes.

- The MACT and high-temperature upgrades would be operational by 2009, when the calciner would undergo startup and operational testing.

Table C.6.2-1. Construction project data for the new liquid waste storage tank for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A).[a]

Generic Information	
Description/function and EIS Project number: EIS alternatives/options:	Storage facility for SBW & newly generated liquid waste (P1A) Continued Current Operations, Separations/Planning Basis Option, Non-Separations/HIP Waste & Direct Cement Options
Project type or waste stream:	Radioactive liquid waste
Action type:	New
Structure type:	Tank & vault
Size: (m^2)	344
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New underground tank
Construction Information	
Schedule start/end	
Pre-construction[b]:	July 2000 – December 2006
Construction:	January 2006 – December 2009
SO test and start-up:	January 2009 – December 2010
Number of workers:	48 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	490
Hours of operation: (hrs)	3,499 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.3/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	5
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	152
Contaminants[c]: (tons/yr):	7
Effluents	
Sanitary wastewater (construction): (L)	2,057,000
Sanitary wastewater (SO testing): (L)	328,000
Solid wastes	
Construction trash: (m^3)	1,150
Sanitary/indust. trash (SO test.): (m^3/yr)	50
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage	
Dust control: (L)	68,000
Domestic (construction): (L)	2,057,000
Domestic (SO testing): (L)	328,000
Energy requirements	
Electrical (construction): (MWh/yr)	3,000
Electrical (SO testing): (MWh/yr)	100
Fossil fuel:	
Heavy equipment (construction): (L)	79,000
Other use (construction): (L)	19,000

a. Sources: EDF-PDS-C-020; EDF-PDS-L-002.

b. Preconstruction schedule for Direct Cement Option: January 2001 – December 2006.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-2. Construction project data for the New Waste Calcining Facility MACT Compliance Facility for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A).[a]

General Information	
Description/function and EIS Project number:	Modifications and additions to NWCF (P1A)
EIS alternatives/options:	Continued Current Operations, Seps. Alt./Planning Basis, Non-Seps./HIP Waste & Direct Cement Options
Project type or waste stream:	Radioactive liquid waste
Action type:	Modifications/additions
Structure type	
Size: (m^2)	7,154
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Construction Information	
Schedule start/end	
Pre-construction[b]:	July 2000 – December 2006
Construction:	January 2006 – December 2009
SO test and start-up:	January 2009 – December 2010
Number of workers:	48 per yr
Number of radiation workers per year:	48
Avg. annual worker rad. dose: (rem/yr)	0.19
Heavy equipment	
Equipment used:	Dump trucks/flat beds
Trips:	104
Hours of operation: (hrs)	5,986 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.34/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	5
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	120
Contaminants[c]: (tons/yr)	6
Air emissions:	
SO testing and start-up:	
Process chemical emissions[d]: (lbs/yr)	14
Fossil fuel (steam use): (tons/yr)	5,007
Effluents	
Sanitary wastewater (construction): (L)	3,832,313
Sanitary wastewater (SO testing): (L)	241,767
Solid wastes	
Construction trash: (m^3)	2,134
SO test & start-up:	
Sanitary/industrial trash: (m^3/yr)	39
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	8
Used lube oil: (L)	1,133

Table C.6.2-2. Construction project data for the New Waste Calcining Facility MACT Compliance Facility for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A)[a] (continued).

Construction Information (continued)	
Radioactive wastes:	None
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	16
Water usage	
Dust control (construction): (L)	230,000
Domestic water (construction): (L)	3,832,313
Domestic water (SO testing): (L)	241,767
Process (SO testing): (L)	21,895,347
Energy requirements	
Electrical:	
Construction: (MWh/yr)	1.3
SO testing & start-up: (MWh/yr)	1,146
Fossil fuel:	
Heavy equipment: (L)	145,632.9
Steam generation (SO testing): (L/yr)	1,754,864

a. Sources: EDF-PDS-C-020; EDF-PDS-L-002.

b. Preconstruction schedule for Direct Cement Option: January 2001 – December 2006.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

d. Source: EDF-PDS-C-043.

Table C.6.2-3. Operations project data for combined operations of facilities for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A).[a]

Generic Information	
Description/function and EIS project number:	Combined operations for liquid retrieval, PEW evaporator & LET&D, & NWCF which covers the calciner, MACT-related items, HLW evaporator, & filter leach (P1A)
EIS alternatives/options:	Continued Current Operations
Operational Information	
Schedule start/end:	January 2011 – December 2016
Number of workers	
Operations:	58
Maintenance:	20
Support:	70
Number of radiation workers:	96 (included in above totals)
Avg. annual worker rad dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile crane, trucks, flat bed
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	2.90E-07
Process radioactive emissions[b]: (Ci/yr)	0.0608
Process tritium emissions[c]: (Ci)	126
Process chemical emissions[d]: (lbs/yr)	14
Fossil fuel emissions: (tons/yr)	5,006.84
Effluents	
Sanitary wastewater: (L/yr)	5,111,643
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	821
Radioactive wastes	
Solid radioactive wastes (LLW): (m^3)	2,250
HEPA filters (LLW): (m^3)	26
Hazardous/toxic chemicals & wastes:	None
Mixed wastes (LLW)	
PPEs & misc. mixed rad. waste: (m^3)	864
Mixed liquid rad. wastes: (L)	277,200
Water usage	
Process water: (L/yr)	149,000,000
Domestic water: (L/yr)	5,111,643
Energy requirements	
Electrical: (MWh/yr)	5,300
Fossil fuel:	
Steam generation: (L/yr)	1,754,864
Kerosene (process use): (L/yr)	3,500,000
Vehicle fuel: (L/yr)	75,000

a. Includes operation of new liquid waste storage tank. Sources: EDF-PDS-C-020; EDF-PDS-L-002.

b. Source: EDF-PDS-C-046.

c. 9.0 Ci/yr for 4 years via evaporator and 22.5 Ci/yr for 4 years via calciner. Source: EDF-PDS-C-046.

d. Source: EDF-PDS-C-043.

Table C.6.2-4. Decontamination and decommissioning project data for the new liquid waste storage tank for the Calcine SBW Including New Waste Calcining Facility with Upgrades (P1A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2017 – December 2019
Number of D&D workers each year:	42 per yr
Number of radiation workers (D&D):	31 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	2 per day
Total hours of operation: (hrs)	29,250
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.3/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
Effluents	
Sanitary wastewater: (L)	2,448,000
Radioactive wastes	
Solid LLW: (m^3)	625
Solid wastes	
Building rubble: (m^3)	470
Metals: (m^3)	2
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	5,500
Solids (paint, solvent, etc.): (m^3)	197
Water usage	
Domestic water: (L)	2,448,000
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	664,000

a. Sources: EDF-PDS-C-020; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-5. Decontamination and decommissioning project data for the New Waste Calcining Facility MACT Compliance Facility for the Calcine SBW Including New Waste Calcining Facility with Upgrades (P1A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2017 – December 2019
Number of D&D workers:	58 per yr
Number of radiation workers (D&D):	37 new workers/yr
Avg. annual worker radiation dose:	0.25 rem/yr per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	10 per day
Total hours of operation:	17,775 hours
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.34/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	1,243
Contaminants[b]: (tons/yr)	61 (total)
Effluents	
Sanitary wastewater: (L)	1,232,684
Radioactive wastes:	None
Solid wastes	
Industrial: (m^3)	625
Hazardous/toxic chemicals & wastes:	None
Mixed wastes (LLW)	
Decon solution: (L)	379
Water usage	
Domestic water: (L)	1,232,684
Process water: (L)	2,284,875
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	403,670

a. Sources: EDF-PDS-C-020; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.2 Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B)

General Project Objective: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a new facility to treat and stabilize newly generated liquid waste and Tank Farm heel waste. The project would be conducted in support of the four waste processing alternatives/options: Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option.

Project Description: The treatment facility would begin processing liquid waste in 2015. Until that time, newly generated liquid waste would be stored in the existing Tank Farm tank WM-190. The project addresses three treatment processes:

- Treatment and stabilization of the newly generated liquid waste would occur over the time period of 2015 through 2035. The proposed project would result in the design, construction, and operation of a new facility to treat and stabilize newly generated liquid waste that has been concentrated by evaporation in the Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facilities. After cesium and undissolved solids are removed from the waste, the remaining waste would be concentrated further in an evaporator, neutralized, stabilized in a grout mixture, and placed in 55-gallon drums for disposal at INEEL as Class-A, low-level waste.

- In-situ removal of cesium from the tank heels would occur over the time period of 2015 through 2016. The proposed project, which relies on the solubility of cesium in water, would utilize equipment within the new Newly Generated Liquid Waste Facility. Process water would be pumped into the tanks from CPP-603, the waste heel would be agitated via a jet pump, and undissolved solids would be allowed to settle. Subsequently, clarified water containing cesium would be decanted from the tanks and processed in an ion-exchange column. The processed water would be piped into a second tank for further cesium removal. After the small amount of cesium-saturated resin has been dried, it would be stored in the bin sets with calcine.

- The remaining tank heel waste would be stabilized over the time period of 2016 through 2020. Processing would occur within the new Newly Generated Liquid Waste Facility. Process water would be pumped into the tanks from CPP-603; the waste heel would be agitated via a jet pump, and drained from the tank into the evaporator. After concentration, the waste would be dried, packaged, and readied for shipment to WIPP.

Additional evaluation would be required during design to establish the requirements and design of the filtration device for the removal of undissolved solids. Different filtration systems may be required for the three processes.

New Facility Description: The new facility would be located in the northwest corner of the INTEC. The 2-story building is above grade with the exception of below grade canyon areas for process lines. The areas of the building requiring the most radiological shielding (5-feet thick concrete walls) are the ion exchange rooms and the packaging and loading high bay. These areas are centrally located in the facility. Except for the raw grouting and neutralization material rooms, the processing rooms are considered radiation areas with remote operations. The newly generated liquid waste is brought to the facility through a new underground pumping/piping system. No previously undisturbed land would be affected by the project.

The packaging and loading area is a shielded high bay which accommodates the remote handling of the undissolved solids and spent sorbant containers. The dried, RH-transuranic waste would be packaged in WIPP half-canisters (0.4 m^3 capacity) for disposal at WIPP, the cesium resin would be placed in the bin sets with calcine, and the remaining grouted low-level waste would be disposed of at INEEL.

Table C.6.2-6. Construction and operations project data for Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B).[a]

Generic Information	
Description/function and EIS project number:	Treatment and stabilization of NGLW & tank heel waste (P1B)
EIS alternatives/options:	Continued Current Operations, Planning Basis, Hot Isostatic Pressed Waste, & Direct Cement options
Project type or waste stream:	NGLW and tank heels
Action type:	New
Structure type:	New facility
Size: (m^2)	2,638
Other features (pits, ponds, power/water/sewer lines):	None
Location	Inside INTEC fence
Inside/outside of fence/building:	Inside new building
Construction Information	
Schedule start/end	
Continued Current Operations:[b]	
Pre-construction:	January ***2002*** – December ***2007***
Construction:	January ***2008*** – December ***2011***
SO test and start-up:	January 2012 – December 2014
Number of workers:	20 per yr
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips/Hours of operations: (hrs)	569/758 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.9/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Dust: (tons/yr)	14
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	66
Contaminants[c]: (tons/yr)	3
SO testing & start-up:	
Fossil fuel (steam use): (tons/yr)	4,123.8
Effluents	
Sanitary wastewater (construction): (L)	1,277,438
Sanitary wastewater (SO testing): (L/yr)	2,624,898
Solid wastes	
Construction trash: (m^3)	711
SO testing & start-up	
Sanitary/industrial trash: (m^3/yr)	421
Radioactive wastes	
Contaminated soils (LLW): (m^3)	20
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	100
Solid hazardous wastes: (m^3)	22
Water usage	
Dust control (construction): (L)	454,200
Domestic (construction): (L)	1,277,438
Domestic (SO testing): (L)	7,874,693
Process (SO testing): (L)	69,038
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Heavy equipment (construction): (L)	64,590
Steam generation (SO testing): (L/yr)	1,445,182
Process use (SO testing): (L)	1,998

Table C.6.2-6. Construction and operations project data for Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B)[a] (continued).

Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers:	
Operations:	43 per yr
Maintenance:	17 per yr
Support:	16 per yr
Number of radiation workers (included in above totals):	60 per yr
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	Mobile cranes, forklifts, trucks
Trips:	8
Air emissions: (None/Reference)	See Appendix C.2 for details
Building ventilation: (Ci/yr)	1.77E-07
Process radioactive emissions[d]: (Ci/yr)	3.08E-02
Process chemical emissions: (tons/yr)	4.76E-02
Fossil fuel emissions: (tons/yr)	4,123.8
Effluents	
Sanitary wastewater: (L/yr)	2,624,898
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	421
Radioactive wastes	
RH (Dry) TRU: (m^3)/(Ci)	110/54,500
LLW (GTCC-Resin) (m^3)/(Ci)	3/131,000
LLW grout: (m^3)/(Ci)	7,000/350,000
HEPA filters (LLW): (m^3)	34
Misc. solid rad. waste (LLW): (m^3)	82
Hazardous/toxic chemicals & wastes	None
Mixed wastes (LLW)	
PPEs & misc. rad. wastes: (m^3)	1,890
Mixed radioactive liquids: (L)	357,840
Water usage	
Domestic: (L/yr)	2,624,898
Process: (L/yr)	86,600,000
Energy requirements	
Electrical: (MWh/yr)	4,500
Fossil fuel	
Steam generation: (L/yr)	1,445,182
Equipment/vehicle fuel: (L/yr)	666

a. Sources: EDF-PDS-D-019; EDF-PDS-L-002.

b. Schedule for other options: Planning Basis Option – Preconstruction: January 2004 – December 2009, Construction: January 2010 – December 2013, SO testing: January 2012 – December 2014; Hot Isostatic Press Waste & Direct Cement Options – Preconstruction: January 2006 – December 2010, Construction: January 2011 – December 2013, SO testing: January 2013 – December 2014

c. CO, particulates, NO_x, SO_2, hydrocarbons.

d. Source: EDF-PDS-C-046.

Table C.6.2-7. Decontamination and decommissioning project data for Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2036
Number of D&D workers each year:	48 new workers per yr
Number of radiation workers (D&D):	36 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	9 per day
Hours of operations (all heavy equipment): (hrs)	11,925
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.9/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	834
Contaminants[b]: (tons/yr)	41 (total)
Effluents	
Sanitary wastewater: (L)	2,224,291
Solid wastes	
Non-radioactive (industrial): (m^3)	3,742
Radioactive waste	
Solid rad. Wastes (LLW): (m^3)/(Ci)	4,977/50
Mixed wastes (LLW)	
Decon solution: (L)	10,749
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	60
Lube oil: (L)	2,257
Water usage	
Domestic water: (L)	2,224,291
Process water: (L)	761,625
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel: (L)	270,817

a. Sources: EDF-PDS-D-019; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.3 Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility (P1C)

General Description: Two of the high-level-waste-treatment options require a separate project to concentrate the dilute, newly generated-liquid wastes prior to their treatment for disposal or transport. This project runs from 2000 through 2035, except for the Tank Farm portion, which only runs through 2014. The waste treatment would utilize existing facilities: the Process Equipment Waste Evaporator and the Liquid Effluent Treatment and Disposal Facility; thus, no construction activities are necessary for this project.

The Process Equipment Waste Evaporator (PEWE) uses steam from the steam plant to concentrate liquid wastes to a particular specific gravity. Vapors from the evaporator are condensed and sent to the Liquid Effluent Treatment and Disposal Facility, a fractionator for recycling acids. The feed rate into the Process Equipment Waste Evaporator limits the emissions from the Liquid Effluent Treatment and Disposal (LET&D) Facility to comply with the RCRA limits. For Type-II liquid waste (see P111 for definitions of Type-I and Type-II Newly Generated Liquid Wastes), the feed rate is 400 gal/hr. The concentrated liquid from the evaporator is returned to storage while awaiting further processing. The PEW evaporator would concentrate an average of 105,000 gallons per year of Type-II liquid waste to 5,000 gallons at a rate of 400 gal/hr.

Since the calciner is not used in the treatment options requiring this project, no new Type-I waste would be generated, except for incidental amounts from the Filter Leach Facility. Therefore, the evaporator would concentrate only small amounts of Type-I waste that could be diluted with Type-II waste.

The Direct Vitrification Alternative would require a separate project to concentrate the dilute, newly generated liquid wastes prior to their treatment for disposal or transport. This project runs from 2000 through 2035, except for the Tank Farm portion, which only runs through 2014. The waste treatment would utilize existing facilities: the Process Equipment Waste Evaporator and the Liquid Effluent Treatment and Disposal Facility; thus, no construction activities are necessary for this project.

The Process Equipment Waste Evaporator uses steam from the steam plant to concentrate liquid wastes to a particular specific gravity. Vapors from the evaporator are condensed and sent to the Liquid Effluent Treatment and Disposal Facility, a fractionator for recycling acids. The feed rate into the Process Equipment Waste Evaporator limits the emissions from the Liquid Effluent Treatment and Disposal Facility to comply with the Resource Conservation and Recovery Act (RCRA) limits. The concentrated liquid from the evaporator is returned to storage while awaiting further processing.

Table C.6.2-8. Construction and operations project data for the PEW Evaporator and LET&D Facility (P1C).[a]

Generic Information	
Description/ffunction and EIS project number:	Concentrates dilute newly generated liquid wastes (P1C)
EIS alternatives/options:	Early Vitrification ***and Steam Reforming Options***; Minimum INEEL Processing ***Alt.; Direct Vitrification Alt.***
Project type or waste stream:	Concentrated NGLW
Action type:	Existing
Structure type:	Existing building
Size: (m^2)	NA
Other features:	NA
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside existing building
Construction Information	
Schedule start/end:	No construction data is required because the facilities already exist and could continue to operate after this project has been completed.
Number of workers:	
Heavy equipment:	
Acres disturbed: New/Previous/Revegetated: (acres)	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes: Hazardous/toxic chemicals & waste	
Energy requirements:	
Operational Information	
Schedule start/end	
Early Vit. ***and Steam Reforming Options; Direct Vit. Alt.***:	January 2000 – December 2035
Minimum INEEL Processing Alt.:	January 2000 – December 2025
Number of workers	
Operations/Maintenance/Support:	22/6/28 per yr
Number of radiation workers per year:	28 (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile crane, pickup truck
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	1.45E-07
Process radioactive emissions[b]: (Ci/yr)	3.08E-02
Process tritium emissions[c]: (Ci/yr)	9.0
Process chemical emissions: (tons/yr)	4.76E-02
Fossil fuel emissions: (tons/yr)	1,030.7
Effluents	
Sanitary wastewater: (L/yr)	967,068
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	155
Radioactive wastes	
HEPA filters (LLW): (m^3)	
Early Vitrif./Min. INEEL processing:	77/56
Hazardous/toxic chemicals & wastes	None
Mixed wastes (LLW)	
(Early vitrification/Min. INEEL):	
PPEs & misc. rad. waste: (m^3)	1,512/1,092
Mixed rad. liquid waste: (m^3)	816,480/589,680

Table C.6.2-8. Construction and operations project data for the PEW Evaporator and LET&D Facility (P1C)[a] (continued).

Operational Information (continued)	
Water usage	
Process water: (L/yr)	23,000,000
Domestic water: (L/yr)	967,068
Energy requirements	
Electrical: (MWh/yr)	3,000
Fossil fuel: (L/yr)	
Steam generation: (L/yr)	361,185
Equipment/vehicle fuel: (L/yr)	757

a. Sources: EDF-PDS-D-017; EDF-PDS-L-002.
b. Source: EDF-PDS-C-046.
c. Released for 4 years via evaporator. Source: EDF-PDS-C-046.

C.6.2.4 No Action Alternative (P1D)

General Description: This No Action Alternative starts in the year 2000 and continues through 2035, which is the end for the 1995 Settlement Agreement. Because there is no construction needed in this option, there would be no decontamination, decommissioning, and demolition; only operations are included.

The calciner at the New Waste Calcining Facility (NWCF) would not operate after June 2000, and would not be upgraded during the period of interest. Rather, it would not be operating, requiring minimum maintenance by a small crew, and its buildings would be heated during the winters.

The bin sets at the Calcined Solids Storage Facility would be prepared for long-term monitoring by isolating their vaults from the atmosphere and adding a pair of small HEPA filters to accommodate bin sets 1-3. Personnel would be shared from NWCF's small crew to monitor the bin sets through 2035. The filter leach facility, also located at NWCF, would continue to operate until 2009, when tanks WM-100-102 (54,000-gal total capacity) would be full of Type I liquid wastes (see C.6.2.37 - P111 for definitions of Type I and Type II newly generated liquid wastes).

Certain INEEL facilities would continue to generate or process liquid waste that would be stored in "permitable" tanks, such as WM-190 (300,000-gal capacity for Type II liquid wastes), and WM-100-102 (54,000-gal total capacity for Type I liquid wastes). When those tanks are full (2009 for WM-100-102 and 2017 for WM-190), all liquid waste generation must cease, or other processing and disposal arrangements would be necessary.

The Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility would be used to concentrate liquid wastes prior to storage. Additionally, the High-Level Liquid Waste Evaporator would also operate until June 2001. The pH of the wastes to be stored in WM-190 after evaporation must be neutral so that WM-190's vault may be approved as secondary containment. The Process Equipment Waste Evaporator, Liquid Effluent Treatment and Disposal Facility, service waste system, off-gassystems, and Tank Farm operations would continue to operate through 2017; thereafter, only a small crew would be needed to monitor and maintain them. The Remote Analytical Laboratory would operate through 2017 to characterize the liquid wastes pertaining to the HLW program.

It is assumed that the State of Idaho would issue a RCRA, Part B permit every five years to cover all waste treatment facilities.

Table C.6.2-9. Construction and operations project data for the No Action Alternative (P1D).[a]

Generic Information	
Description/function and EIS project number:	Activities associated with taking no action (P1D)
EIS alternatives/options:	No Action Alternative
Project type or waste stream:	Liquid SBW and HLW calcine
Action type: Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Existing Existing structures 7,153 None
Location Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside existing storage facilities
Construction Information	
Schedule start/end:	No construction data is required because the facilities already exist and could continue to operate after this project has been completed.
Number of workers:	
Heavy equipment:	
Acres disturbed:	
New/Previous/Revegetated:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes	
Water usage:	
Energy requirements:	
Operational Information	
Schedule start/end:	2000 – 2035
Number of workers Operations/Maintenance: Support Radiation: (included in above totals)	 42 20 42
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference) Fossil fuel emissions: (tons/yr) Process rad. emissions[b]: (Ci/yr) Process tritium emissions[c]: (Ci/yr)	See Appendix C.2 for details 5,204 3.08E-02 9.0
Effluents: Years: Quantity: (L/yr)	Sanitary wastewater 2000 – 2017 2,141,364
Solid wastes: Years: Quantity: (m^3/yr)	Sanitary/industrial trash 2000 – 2017 356
Radioactive wastes HEPA filters (LLW): (m^3)	 74
Mixed wastes (LLW) PPEs & misc. radioactive waste: (m^3) Mixed rad. liquid waste: (L)	 1,071 785,400 (processed as NGLW)
Hazardous/toxic chemicals & wastes	None
Water usage Cooling water: (L/yr) Domestic water: (L/yr)	2000 – 2017 52,000,000 2,141,364

Table C.6.2-9. Construction and operations project data for the No Action Alternative (P1D)[a] (continued).

Operational Information (continued)	
Energy requirements:	2000 – 2017
Electrical: (MWh/yr)	4,300
Fossil fuel (steam use): (L/yr)	1,823,682

a. Sources: EDF-PDS-C-025; EDF-PDS-L-002

b. Source: EDF-PDS-C-046.

c. Released for 4 years via evaporator. Source: EDF-PDS-C-046.

C.6.2.5 Bin Set 1 Calcine Transfer (P1E)

Project Description: The No Action Alternative and the Continued Current Operations Alternative require that the calcine contained in bin set 1 be moved to a seismically-compliant bin set with sufficient available space, because bin set 1 does not meet the seismic requirements. Bin sets 6 and 7 meet these requirements and, since they are virtually identical, the cost to transfer calcine from bin set 1 to either bin set 6 or 7 would be the same.

A potential problem with this project is that the soil around the bin sets may be contaminated. Soil samples would be needed to determine if the soil is contaminated and to what degree. Should the soil be heavily contaminated, it becomes much more costly to remove, treat, and dispose of. Determining such increased treatment and disposal costs are beyond the scope of this project.

Schedule: This project would start in the year 2000, after the Record of Decision. Activities such as design, environmental permitting, mock-up, and safety documentation would run from 2000 through 2004. Construction, SO tests, and the operational readiness review would occur between 2005 and ***2011***, with the actual calcine transfer requiring one year, during 2012.

Specifics: To access the top of the concrete vault surrounding bin set 1, several feet of soil would be excavated and the original superstructure removed. A new concrete slab would then be installed on top of the vault's roof for stability. Retaining walls would also be installed between bin sets 1-2 and 1-3, to support the shielding earth berms flanking bin set 1. At least two risers (pipes) would be welded remotely to the top of each annular bin within bin set 1 by drilling and removing the cores from the thick concrete-vault's roof and then piercing the tops of the bins. Similarly, at least one riser would be installed in each of the center cylindrical bins. Flexible suction and blower tubes would be installed along with the transport piping between the annular bins in bin set 1 and a new cyclone that would be installed above bin set 7 to ensure that the transferred calcine is separated from the transport air. A new blower/HEPA filter system having a capacity of 500 lbs/hr would be installed.

It would take approximately 1,100 hours to transfer the bulk calcine from bin set 1 to bin set 7 and another 1,500 to 3,000 hours to transfer the fines, not including the time it would take to move equipment from bin to bin within bin set 1. This schedule requires two, 10-hour shifts, 4-days per week, with an additional shift working 12-hours per day for the other three days. Each shift would consist of four people: one supervisor-operator, two additional operators, and a radiation-control technician. Six additional support people (engineer, technician, administrator, and three maintenance workers) would be required, bringing the total to 18.

Baseline Information

The following information may include certain assumptions that pertain to this project:

- As part of the INEEL's infrastructure, a low-level waste landfill would be available to dispose of contaminated soil and concrete removed from the bin set 1 superstructure and for other miscellaneous low-level and incidental wastes generated during this project.

- One year is sufficient for three full-time crews to transfer the calcine from bin set 1 to bin set 7, and to remove enough of the fines so bin set 1 would be prepared for closure.

- Low-level and incidental radioactive wastes that include small amounts of calcine (the HEPA filters, for example) are listed under mixed hazardous wastes. The filters would be leached and the remnants disposed of at INEEL. This project assumes that an INEEL facility would be available (through the INEEL's infrastructure) for such purpose.

Table C.6.2-10. Construction and operations project data for the Bin Set 1 Calcine Transfer (P1E).[a]

Generic Information	
Description/function and EIS project number:	Move calcine from Bin Set 1 to seismically-compliant bin set (P1E)
EIS alternatives/options:	No Action & Continued Current Operations Alternatives
Project type or waste stream:	Waste management program
Action type:	Prepare bin sets 1 & 7 and transfer calcine
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Storage for HLW calcine 93 Pneumatic transfer lines
Location Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Outside existing structures
Construction Information	
Schedule start/end Preconstruction: Construction: SO testing and start-up:	 2000 – 2004 2005 – 2009 2010 – 2011
Number of workers:	21 per yr
Number of radiation workers per year:	21 (included in above total)
Avg. annual worker rad dose: (rem/yr)	0.69 per worker
Heavy equipment Equipment used: Trips: Hours of operation: (hrs)	 Excavator, grader, crane, trucks 73 5,259 (total)
Acres disturbed New/Previous/Revegetated: (acres)	 None/1.5/None
Air emissions: (None/Reference) Dust: (tons/yr) Fuel combustion (diesel exhaust): Major gas (CO_2): (tons/yr) Contaminants[b]: (tons/yr) SO testing and start-up: Fossil fuel (steam use): (tons/yr)	See Appendix C.2 for details. 22 77 4 1,301
Radioactive wastes Contaminated soil (LLW): (m^3)	 1,160
Mixed wastes (LLW) Solids (PPEs, HEPA, misc. trash): (m^3) Decon solution: (L)	 224 7,570
Hazardous/toxic chemicals & wastes Lube oil: (L)	 996
Water usage Dust control (construction): (L) Domestic (construction): (L) Domestic (SO testing): (L) Process (SO testing): (L)	 771,000 2,236,000 511,000 308,000
Energy requirements Electrical Construction: (MWh/yr) SO testing: (MWh/yr) Fossil fuel: Heavy equipment fuel (construct.): (L) Steam generation (SO testing): (L/yr)	 180 4,300 125,511 455,920

Table C.6.2-10. Construction and operations project data for the Bin Set 1 Calcine Transfer (P1E)[a] (continued).

Operational Information	
Schedule start/end:	January 2012 – December 2012
Number of workers Operations/Maintenance/Support:	11/6/1 per yr
Number of radiation workers per year:	17 (included in above total)
Avg. annual worker rad dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Process radioactive emissions: (Ci/yr)	2.1E-07
Fossil fuel emissions: (tons/yr)	1,301
Effluents	
Sanitary wastewater: (L/yr)	622,000
Process wastewater: (L/yr)	231,000
Solid wastes Sanitary/industrial trash: (m^3/yr)	100
Radioactive wastes HEPA filters (LLW): (m^3)	11
Mixed wastes (LLW)	
PPEs & misc. rad. Waste : (m^3)	33
Liquid waste: (L)	116,325
Hazardous/toxic chemicals & wastes	None
Water usage	
Process: (L/yr)	231,000
Domestic: (L/yr)	622,000
Energy requirements	
Electrical: (MWh/yr)	4,300
Fossil fuel: (L/yr)	455,920

a. Sources: EDF-PDS-C-026; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.6 Long-Term Storage of Calcine in Bin Sets (P4)

Project Description: This project consists of long-term storage of calcine, and monitoring and performing occasional maintenance on the calcined-solids storage facility (CSSF, commonly called bin sets) from 1999 indefinitely. There are seven bin sets and each bin set contains several individual storage units that contain a radioactive, granular-solid waste form called calcine. Each bin set is surrounded by a concrete vault. All of the sodium-bearing waste would have been converted to calcine by 2014, and all of the calcine would have been stored in the bin sets by the end of 2014; no new waste would be added to the bin sets after that.

Prior to long-term storage, a few modifications must be made to the bin sets. A pair (in series) of small (6-inch) HEPA filters must be added to the bin set groups 1, 2, and 3. Furthermore, each bin set's vault must be isolated from the atmosphere, except for bin set 1, which is already isolated.

Long-term storage would consist of the following items:

- Having a health-physicist monitor each of the continuous air monitors daily to check for potential leaks, which may take 1-2 hours to do,

- Every six months, a technician would monitor the temperatures in the bin sets via thermocouple readings,

- Once a year, a technician would calibrate the thermocouple instrumentation, and

- Approximately every 20 years, the 10 HEPA filters may need to be replaced. It is not known how frequently these filters would have to be replaced; they are not expected to be heavily contaminated, but their integrity may degrade in the radiation field over a long time.

Table C.6.2-11. Construction and operations project data for the Long-Term Storage of Calcine in Bin Sets (P4).[a]

Generic Information	
Description/function and EIS Project number:	Long-term monitoring after the last HLW calcine has been placed in the bin sets (P4)
EIS alternatives/options:	No Action & Continued Current Operations
Project type or waste stream:	HLW
Action type:	Existing
Structure type:	Existing building
Size: (m^2)	NA
Other features: (pits, ponds, power/water/sewer lines)	NA
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside existing bin sets
Construction Information	
Schedule start/end:	No construction data is required because the facilities already exist and no modifications are required for this project.
Preconstruction:	
Construction:	
SO test and start-up:	
Number of workers:	
Heavy equipment:	
Acres disturbed:	
New/previous/revegetated: (acres)	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements	
Electrical:	
Fossil fuel:	
Operational Information	
Schedule start/end:	***2000-2035***
Number of workers	
Operations/Maintenance:	3
Support:	0
Number of radiation workers:	0
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	103,614
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	17
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Mixed waste (LLW):	None
Water usage	
Domestic water: (L/yr)	103,614
Energy requirements	
Electrical: (MWh/yr)	10
Fossil fuel: (L)	0

a. Sources: EDF-PDS-C-018; EDF-PDS-L-002.

C.6.2.7 Full Separations (P9A & P23A)

General Project Objective: The general objective of this project is to provide for a Waste Separations Facility and smaller, related facilities, including the Bulk Chemical Storage Facility, the Condensate Collection Facility, the Calcine Dissolution Facility, and the Low Activity Waste Collection Facility.

Process Description: The Waste Separations Facility receives solid calcine from the Calcined Solids Storage Facility (bin sets). After some initial treatment of the calcine feed stream, the radionuclides are chemically separated into two streams: a high-activity waste stream containing the transuranic nuclides, cesium and strontium, and a low activity waste stream containing the rest of the waste constituents. After the separation process, the high-activity waste and low-activity waste streams are routed to other facilities (addressed as separate projects) for further treatment.

Calcine retrieval from the bin sets is addressed as a separate project. After the calcine is received at the Calcine Dissolution Facility (an addition to the Waste Separations Facility), it is dissolved in nitric acid, filtered, and then fed to the Waste Separations Facility for further processing.

After filtration of dissolved calcine, the waste is sent through ion exchange columns to remove cesium. After cesium removal, actinides are removed from the waste by the transuranic extraction process.

Transuranic Extraction is a solvent extraction process that removes dissolved actinides from a liquid. The organic solvent extracts a high percentage of actinides from the aqueous feed and also extracts a portion of other radioactive and nonradioactive ions. To minimize the partitioning of these non-actinide species into the solvent, the solvent is "scrubbed" with a weak nitric acid solution that back-extracts most of the non-actinide species into the scrub effluent, which is combined with the feed. The solvent is then "stripped" of actinides by contacting it with a weak nitric acid solution containing 1-hydroxyethane 1,1 diphosphonic acid. The strip solution removes the actinides and a few other metal ions such as molybdenum and zirconium. The solvent is then contacted with an aqueous sodium carbonate solution to remove additional ions, primarily mercury. Contact with the carbonate solution also neutralizes acid present in the solvent and removes organic degradation products. Finally the solvent is contacted with weak nitric acid to re-acidify the solution, which is then recycled back to the front end of the transuranic extraction process.

Mixing and separation of the various solutions in the transuranic extraction process takes place in a series of centrifugal contactors. The centrifugal contactors provide high aqueous organic interface to promote mixing and then accomplish quick separation between the organic and aqueous phases to minimize degradation of the organic solvent.

A portion of the carbonate wash solution is sent to a mercury removal system, in which dissolved mercury in the waste is reduced to elemental mercury using formic acid. The metallic mercury is then amalgamated and packaged for storage and disposal.

Strontium is removed in a strontium extraction process, which like the transuranic extraction process uses a series of centrifugal contactors to mix and separate an organic solvent and an aqueous stream. Following extraction of strontium into the solvent, the solvent is scrubbed with 2 molar nitric acid, the strontium removed (or "stripped") using 0.01 molar ammonium citrate, washed with sodium carbonate and rinsed with nitric acid to reacidify the solvent. The carbonate wash effluent is sent to a mercury removal system, similar to that described for the transuranic extraction wash. The strontium extraction strip effluent is concentrated by evaporation and sent to the Vitrification Facility. The strontium extraction rinse effluent and raffinate are sent to the Grout Plant.

Facility Descriptions: The smaller, related facilities associated with the Waste Separations Facility are the:

- Bulk Chemical Storage Facility, a steel-framed structure that is used for storage of nonradioactive bulk chemicals needed for processing.

- Low Activity Waste Collection Facility, a concrete shielded structure containing tanks that collect low activity waste from various locations at the INTEC. This facility houses three collection tanks. Each low-activity waste collection tank has a 303 cubic meters capacity (80,000 gal). The three tanks are located on one side of the facility behind a shield wall. The pumps used to transfer the low-activity waste liquids to the Waste Separations Facility are located on the other side of the wall.

- Condensate Collection Facility, a steel-framed structure housing tanks that collect condensed steam (nonradioactive) from various process and building users before transfer back to the steam plant.

- Calcine Dissolution Facility, an addition to the Waste Separations Facility in which the retrieved calcine is dissolved in nitric acid before passing it on, as a liquid, to the separations processes.

The Waste Separations Facility is designed to house the equipment and systems for separating the calcine into high-activity waste and low-activity waste streams. It is based on a concept of centrally located, below grade, process cells with thick concrete walls surrounded by areas that contain progressively less radioactive hazards. Equipment that is in highly radioactive service and not expected to require maintenance (e.g., tanks) is located in the 10 central cells. Equipment in radioactive service that would require maintenance is located in corridors (pump and valve corridors) that are adjacent to the process cells. Finally, personnel access corridors are located outside the pump and valve corridors and allow visual access to the pump and valve corridors via shielded windows. Stainless steel liners are provided in areas in where equipment and valves create a need for spill protection and decontamination.

In addition to the cells housing the process equipment, there would be three additional cells located at the north end of the facility. These cells are the manipulator repair cell, for repair of manipulators and other equipment, a decontamination cell, for decontamination of equipment prior to maintenance activities, and a filter leach cell, in which process filters are treated (by leaching in nitric acid) to remove much of the contamination before they are disposed of.

Table C.6.2-12. Construction and operations project data for Full Separations (P9A).[a]

Generic Information	
Description/function and EIS project number:	Separations and storage facilities (P9A)
EIS alternatives/options:	Full Separations ***and Vitrification with Calcine Separations Options***
Project type or waste stream:	LAW and HAW
Action type:	New
Structure type:	Concrete and metal structures
Size: (m^2)	17,466
Other features: (pits, ponds, power/water/sewer lines)	Storage tanks
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new buildings
Construction Information	
Schedule start/end: ***(Full Separations Option)***[b]	
Pre-construction:	July 2000 – December 2007
Construction:	January 2008 – December 2012
SO test and start-up:	January 2012 – December 2014
Number of workers:	301
Number of radiation workers:	None
Heavy equipment	Excavator, grader, crane, trucks
Trips:	4,864 (total)
Hours of operation: (hrs)	55,305 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.5/None
Air emissions: (none/reference)	See Appendix C.2 for details
Dust: (tons/yr)	64
Fuel combustion (diesel exhasut):	
Major gas (CO_2): (tons/yr)	1,317
Contaminants[c]: (tons/yr)	64
SO testing and start-up:	
Process air emissions: (tons/yr)	0.156
Fossil fuel (steam use): (tons/yr)	37,189
Effluents	
Sanitary wastewater (construction): (L)	25,633,913
Sanitary wastewater (SO testing): (L/yr)	4,144,575
Process wastewater (SO testing): (L/yr)	507,744
Solid wastes	
Construction trash: (m^3)	14,274
Sanitary/industrial trash (SO test.) (m^3/yr)	665
Radioactive wastes	
Contaminated soil (LLW): (m^3)	133
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	10,466 (total)
Solid hazardous waste: (m^3)	217
Water usage	
Dust control (construction): (L)	605,600
Domestic (construction): (L)	25,633,913
Domestic (SO testing): (L)	8,289,150
Process water (SO testing): (L)	846,029
Energy requirements	
Electrical (construction): (MWh/yr)	2,160
Fossil fuel:	
Heavy equipment (construction): (L)	1,710,085
Steam generation (SO testing): (L/yr)	13,034,054

Table C.6.2-12. Construction and operations project data for Full Separations (P9A)[a] (continued).

Operational Information	
Schedule start/end:	January 2015 – December 2035
Treatment of SBW:	January 2015 – December 2016
Number of workers	
Operations/Maintenance/Support:	60/10/50 per yr
Number of radiation workers:	30/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	Mobile cranes, forklifts, trucks
Trips:	1,100 (total)
Air emissions: (None/Reference)	See Appendix C.2 for details
Building ventilation: (Ci/yr)	4.83E-07
Process radioactive emissions: (Ci/yr)	4.83E-05
Process chemical emissions: (tons/yr)	0.156
Fossil fuel emissions: (tons/yr)	37,189
Effluents	
Sanitary wastewater: (L/yr)	4,144,575
Solid wastes:	
Sanitary/Industrial trash: (m^3/yr)	665
Radioactive wastes	
HEPA filters (LLW): (m^3)	245
Hazardous/toxic chemicals & wastes	
Solvents, rags, etc: (m^3)	231
Mixed wastes (LLW)	
PPEs & misc. rad. wastes (m^3)	945
Amalgamated Hg: (m^3)	
Mixed rad. liquid waste: (L)	2,590,875
Water usage	
Process water: (L/yr)	705,024
Domestic: (L/yr)	4,144,575
Energy requirements	
Electrical: (MWh/yr)	10,834
Fossil fuel	
Vehicle fuel: (L/yr)	91,597
Steam generation: (L/yr)	13,034,054

a. Sources: EDF-PDS-E-001; EDF-PDS-L-002***; Casper (2000).***

b. For Vitrification with Calcine Separations Option: Preconstruction: April 2008-September 2015; Construction: October 2015-September 2020; SO testing and startup: October 2020-September 2022; Operations: October 2022-December 2035.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-13. Decontamination and decommissioning project data for Full Separations (P9A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2038
Number of D&D workers:	224 per yr
Number of radiation workers (D&D):	102 workers/yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Trips (roll-off trucks):	30 per day
Hours of operation (all heavy equipment): (hrs)	112,590
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.5/None
Air emissions	
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	2,625
Contaminants[b]: (tons/yr)	127 (total)
Effluents	
Sanitary wastewater: (L)	14,334,956
Solid wastes: (m^3)	281
Non-radioactive (industrial) (m^3)	23,615
Radioactive wastes	
Misc. solid rad. waste (LLW): (m^3)	31,407
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	11
Lube oil (used): (L)	21,308
Mixed wastes (LLW)	
Decon solution: (L)	71,158
Solid wastes: (m^3)	281
Water usage	
Process water: (L)	6,854,625
Domestic water: (L)	14,334,956
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	2,556,919

a. Sources: EDF-PDS-E-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-14. Construction and operations project data for Full Separations (P23A).[a]

Generic Information	
Description/function and EIS project number:	Separations and storage facilities (P23A)
EIS alternatives/options:	Planning Basis Option
Project type or waste stream:	LAW and HAW
Action type:	New
Structure type:	Concrete and metal structures
Size: (m^2)	17,466
Other features: (pits, ponds, power/water/sewer lines)	Storage tanks
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new buildings
Construction Information	
Schedule start/end	
Pre-construction:	January 2005 – December 2012
Construction:	January 2013 – December 2017
SO test and start-up:	January 2017 – December 2019
Number of workers:	301
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	4,760 (total)
Hours of operation: (hrs)	53,907 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	64
Fuel combustion (diesel exhasut):	
Major gas (CO_2): (tons/yr)	1,285
Contaminants[b]: (tons/yr)	63
SO testing and start-up:	
Process air emissions: (tons/yr)	0.156
Fossil fuel (steam use): (tons/yr)	37,188.6
Effluents	
Construction:	
Sanitary wastewater: (L)	25,633,913
SO testing and start-up:	
Sanitary wastewater: (L/yr)	4,040,961
Process wastewater: (L/yr)	507,744
Solid wastes	
Construction trash: (m^3)	14,274
Sanitary/indus. trash (SO test): (m^3/yr)	649
Radioactive waste	
Contaminated soil (LLW): (m^3)	64
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	10,466
Solid hazardous waste: (m^3)	288
Water usage	
Dust control (construction): (L)	605,600
Domestic (construction): (L)	25,633,913
Domestic (SO testing): (L)	8,081,921
Process (SO testing): (L)	846,029

Table C.6.2-14. Construction and operations project data for Full Separations (P23A)[a] (continued).

Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	2,160
Fossil fuel:	
Heavy equipment (construction): (L)	1,668,627
Steam generation (SO testing): (L/yr)	13,750,054
Operational Information	
Schedule start/end:	January 2020 – December 2035
Number of workers:	
Operations/Maintenance/Support:	57/10/50 per yr
Number of radiation workers:	30 per yr (incl. in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	1,100 (total)
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	6.44E-07
Process radioactive emissions: (Ci/yr)	6.44E-05
Process chemical emissions: (tons/yr)	0.156
Fossil fuel emissions: (tons/yr)	37,188.6
Effluents	
Sanitary wastewater: (L/yr)	4,040,961
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	649
Radioactive wastes	
HEPA filters (LLW): (m^3)	98
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	176
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	16
PPEs & misc. mixed rad. waste: (m^3)	720
Mixed rad. liquid waste: (L)	1,033,200
Water usage	
Process: (L/yr)	940,032
Domestic: (L/yr)	4,040,961
Energy requirements	
Electrical: (MWh/yr)	10,589
Fossil fuel:	
Steam generation: (L/yr)	13,750,054
Equipment/vehicle fuel: (L/yr)	91,597

a. Sources: EDF-PDS-E-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-15. Decontamination and decommissioning project data for Full Separations (P23A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2035 – December 2037
Number of D&D workers:	224 per yr
Number of radiation workers (D&D):	102 new workers/yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	30 per day
Hours of operation (all heavy equipment): (hrs)	112,590
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Non-radioactive:	
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	2,625
Contaminants[b]: (tons/yr)	127 (total)
HEPA filtered offgas: (Ci/yr)	5.81×10^{-8}
Effluents	
Sanitary wastewater: (L)	14,334,956
Solid wastes	
Non-radioactive (industrial) (m^3)	23,176
Radioactive wastes	
Solid LLW: (m^3)	30,824
Mixed waste (LLW)	
Solid mixed waste: (m^3)	281
Decon solution: (L)	34,065
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	15
Lube oil: (used) (L)	21,308
Water usage	
Process water: (L)	6,854,625
Domestic water: (L)	14,334,956
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	2,556,919

a. Sources: EDF-PDS-E-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.8 Vitrification Plant (P9B & P23B)

General Project Objective: The proposed project provides for the design, construction, startup, operation, and decommissioning of the Vitrification Plant, designated the High Activity Waste Treatment Facility, for the Early Separations option. The Vitrification Plant receives liquid high-activity waste from a chemical separation process and converts it to a glassy solid form by mixing the waste with glass frit and processing it through a crucible melter. The finished product would meet the requirements for disposal at a national geologic repository.

Project Description: The Vitrification Plant receives concentrated high-activity waste from the Waste Separations Facility. This high-activity waste is the product of a process that chemically separates various radionuclides from the liquid sodium-bearing waste (SBW) and granular solid calcined material that is currently stored at INTEC. After the transuranic nuclides, cesium and strontium, would be removed from the SBW and dissolved calcine, they would be concentrated in an evaporator and transferred to the Vitrification Plant. The concentrated liquid stream would be combined with spent resin from the cesium ion exchange columns, undissolved solids from the SBW and calcine treatment, and glass frit. The resulting slurry would then be introduced into a melter, where it is melted into a homogeneous, molten glass. The glass would then be poured into canisters. After allowing the canisters to cool for about 24 hours, the canister lid is welded to the canister body and the assembly would be decontaminated before being transferred to another facility for interim storage.

Facility Descriptions: The Vitrification Plant would be divided into four main processing cells, the feed preparation cell, the pouring, vitrification, and breakdown cell, the offgas treatment cell, and the transfer welding cell. The feed preparation cell would contain the feed staging tank, solids storage tank, undissolved SBW solids tank, and the melter feed tanks. These tanks would be used to sample and blend the feed for glass formulation and waste form qualification purposes. The pouring vitrification and breakdown cell would contain the melter, canister pouring equipment, and dust scrubber. It also would contain the mechanical dismantling (breakdown equipment) used to reduce the size of equipment that is to be disposed of. The offgas cell would contain the equipment to treat the offgas from the melter. The transfer welding cell would contain equipment for welding of the canister lids, decontamination of the canisters, and radiological survey of the cleaned canisters. Rooms housing support equipment, clean chemical storage and supply, etc. would be located around and above these process cells.

Table C.6.2-16. Construction and operations project data for the Vitrification Plant (P9B).[a]

Generic Information	
Description/function and EIS project number:	Houses equipment/operations for vitrifying HAW (P9B)
EIS alternatives/options:	Separations/Full Separations
Project type or waste stream:	Vitrify the HAW
Action type:	New
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Reinforced concrete 10,205 None
Location Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence New building
Construction Information	
Schedule start/end Preconstruction: Construction: SO test and start-up:	 January 2003 – December 2008 January 2009 – December 2013 January 2013 – December 2015
Number of workers:	278 per yr
Number of radiation workers:	None
Heavy equipment Equipment used: Hours of operation: (hrs) Trips:	 Excavator, grader, crane, trucks 15,641 (total) 578
Acres disturbed New/Previous/Revegetated: (acres)	 None/1.1/None
Air emissions: (None/Reference) Dust: (tons/yr) Fuel combustion (diesel exhaust): Major gas (CO_2): (tons/yr) Contaminants[b]: (tons/yr) SO testing and start-up: Process air emissions: (tons/yr) Fossil fuel (steam use): (tons/yr)	See Appendix C.2 for details. 15 420 20 0.15 2,411
Hazardous/toxic chemicals & wastes Solid hazardous waste: (m^3) Lube oil: (L)	 162 2,960
Radioactive wastes Contaminated soil: (m^3)	 78
Solid wastes Construction trash: (m^3) SO testing: Sanitary/industrial trash: (m^3/yr)	 9,888 499
Effluents Sanitary ww (construction): (L) SO testing and start-up Sanitary wastewater: (L/yr) Process wastewater: (L/yr)	 17,756,381 3,108,431 1,136
Water usage Dust control (construction): (L) Domestic (construction): (L) Process (SO testing): (L) Domestic (SO testing): (L)	 454,200 17,756,381 869 9,325,294

Table C.6.2-16. Construction and operations project data for the Vitrification Plant (P9B)[a] (continued).

Construction Information (continued)	
Energy requirements Electrical: (MWh/yr)	180
Fossil fuel Heavy equipment: (L) Steam generation (SO testing): (L/yr)	 409,134 845,142
Operational Information	
Schedule start/end:	January 2016 – December 2035
Number of workers Operations/Maintenance/Support:	 40/4/46 per yr
Number of radiation workers:	40 per yr (incl. in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment Equipment used: Trips:	 Mobile cranes, forklifts, trucks 220 trips per yr
Air emissions: (None/Reference) Building ventilation: (Ci/yr) Process radioactive emissions[c]: (Ci/yr) Process tritium emissions: (Ci/yr) Process chemical emissions: Fossil fuel emissions: (tons/yr) Diesel exhaust: (tons/yr)	See Appendix C.2 for details. 1.52E-07 1.31E-07 None See Fluor Daniel, 1997 (DOE/ID 13206) 2,411 59
Effluents Sanitary wastewater: (L/yr)	 3,108,431
Solid wastes Sanitary/Industrial trash: (m^3/yr)	 499
Radioactive wastes Process output: HLW glass: (m^3)/(Ci) HEPA filters (LLW): (m^3)	 470/41,200,000 209
Mixed wastes (LLW) PPEs & misc. rad. wastes: (m^3) Liquid mixed waste: (L)	 1,200 2,211,997
Hazardous/toxic chemicals & wastes Solid hazardous wastes: (m^3)	 585
Water usage Process water: (L/yr) Domestic water: (L/yr)	 6,227 3,108,431
Energy requirements Electrical: (MWh/yr) Fossil fuel: Steam generation: (L/yr) Equipment/vehicle fuel: (L/yr)	 7,962 845,142 18,319

a. Sources: EDF-PDS-F-003; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.
c. Source: EDF-PDS-C-046.

Table C.6.2-17. Decontamination and decommissioning project data for the Vitrification Plant (P9B).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2038
Number of D&D workers:	72 per yr
Number of radiation workers (D&D):	45 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-of trucks, dozers, loaders
Trips (roll-off trucks):	10 per day
Hours of operation (all heavy equipment): (hrs)	60,345
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,407
Contaminants[b]: (tons/yr)	69 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	4,599,781
Solid wastes	
Non-radioactive (industrial): (m^3)	13,817
Radioactive wastes	
Building debris (LLW): (m^3)/(Ci)	18,376/184
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	11,420
Solid hazardous waste: (m^3)	6
Mixed wastes (LLW)	
Decon solution: (L)	41,578
Water usage	
Process water: (L)	2,284,875
Domestic water: (L)	4,599,781
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel (equipment/vehicles): (L)	1,370,435

a. Sources: EDF-PDS-F-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-18. Construction and operations project data for the Vitrification Plant (P23B).[a]

Generic Information	
Description/function and EIS project number:	Houses equipment and operations for vitrifying the HAW (P23B)
EIS alternatives/options:	Planning Basis Option
Project type or waste stream:	Vitrify the HAW
Action type:	New
Structure type:	Reinforced concrete
Size: (m^2)	10,205
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end:	
Preconstruction:	January 2008 – December 2013
Construction:	January 2014 – December 2018
SO testing and start-up:	January 2018 – December 2020
Number of workers:	278 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	578
Hours of operation: (hrs)	15,641 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	15
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	341
Contaminants[b]: (tons/yr)	17
SO testing and start-up:	
Process air emissions: (tons/yr)	0.15
Fossil fuel (steam use): (tons/yr)	2,411
Effluents	
Construction	
Sanitary wastewater: (L)	21,899,537
SO Testing & start-up	
Sanitary wastewater: (L/yr)	3,108,481
Process wastewater: (L/yr)	921
Solid wastes	
Construction trash: (m^3)	12,195
Sanitary/ind. trash (SO test.): (m^3/yr)	499
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	128
Lube oil: (L)	2,960
Radioactive wastes	
Contaminated soil: (m^3)	16
Water usage	
Dust control (construction): (L)	560,180
Domestic water (construction): (L)	21,899,537
Process water (SO testing): (L)	1,672
Domestic water (SO testing): (L/yr)	3,108,431

Table C.6.2-18. Construction and operations project data for the Vitrification Plant (P23B)[a] (continued).

Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Heavy equipment (construction): (L)	409,134
Steam generation (SO testing): (L/yr)	845,142
Operational Information	
Schedule start/end:	January 2021 – December 2035
Number of workers	
Operations:	40 per yr
Maintenance:	4 per yr
Support:	46 per yr
Number of radiation workers:	40/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	220 trips per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	1.52E-07
Process radioactive emissions[c]: (Ci/yr)	1.31E-07
Process chemical emissions:	See Fluor Daniel, 1997 (DOE/ID 13206)
Fossil fuel emissions: (tons/yr)	2,411
Diesel exhaust: (tons/yr)	59
Effluents	
Sanitary wastewater: (L/yr)	3,108,431
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	499
Radioactive wastes	
Process output:	
HLW glass: (m^3)	470
HEPA filters (LLW): (m^3)	86
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	504
Mixed wastes (LLW)	
PPEs & misc. rad. wastes: (m^3)	900
Mixed rad. liquid wastes: (L)	910,647
Water usage	
Process water: (L/yr)	8,637
Domestic water: (L/yr)	3,108,431
Energy requirements	
Electrical: (MWh/yr)	7,962
Fossil fuel	
Steam generation: (L/yr)	845,142
Equipment/vehicle fuel: (L/yr)	18,319

a. Sources: EDF-PDS-F-003; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.
c. Source: EDF-PDS-C-046.

Table C.6.2-19. Decontamination and decommissioning project data for the Vitrification Plant (P23B).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2037
Number of D&D workers:	78 per yr
Number of radiation workers (D&D):	49 new workers per yr
Avg. annual worker radiation dose:	0.25 rem/yr per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-of trucks, dozers, loaders
Trips (roll-off trucks):	10 per day
Hours of operation (all heavy equipment): (hrs)	55,517
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhasut):	
Gases (CO_2): (tons/yr)	1,407
Contaminants[b]: (tons/yr)	69 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	4,599,781
Solid wastes	
Non-radioactive (industrial): (m^3)	13,817
Radioactive wastes:	
Building debris (LLW): (m^3)/(Ci)	18,376/184
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	10,507
Solid hazardous waste: (m^3)	6
Mixed wastes (LLW)	
Decon solution: (L)	8,327
Water usage	
Process water: (L)	6,306,255
Domestic water: (L)	4,599,781
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,260,800

a. Sources: EDF-PDS-F-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.9 Grout Plant (P9C & P23C)

General Project Objective: This project describes the costs and impacts of the Grout Plant, designated the Low Activity Waste Treatment Facility.

Process Description: The Grout Plant receives concentrated low-activity waste from another facility, the Waste Separations Facility. This low-activity waste is the product of a process that chemically separates various radionuclides from the granular solid calcined material that is currently stored at INTEC. After the transuranic nuclides, cesium, and strontium are removed from the dissolved calcine, the solution containing the remaining radionuclides would be concentrated in an evaporator and transferred to the Grout Plant. The concentrated stream would be subjected to a high temperature denitration process. The denitration would be accomplished in a fluidized bed that uses air as the fluidization gas and burns kerosene with oxygen to provide the reaction temperature. The nitrates in the concentrated liquid stream are evolved as nitrogen oxides. Offgas from the denitrator would be treated to reduce emissions of unburned hydrocarbons and nitrogen oxides to acceptable levels. Solids from the denitrator are pneumatically conveyed to a storage bin. At intervals (currently assumed to be about once per month) the solids would be combined with Portland cement, blast furnace slag and flyash to form a low-level waste (LLW) grout. This project ends with the grout ready to be pumped (pump included with this project) to disposal facilities or LLW containers. The packaging for disposal and disposal facilities are addressed in other projects.

Facility Descriptions: The Grout Plant is about 57 meters (187 feet) long (north-south) and about 43 meters (144 feet) wide (east-west). It would extend about 22 meters (72 feet) above grade and about 12 meters (40 feet) below grade. The areas that contain radioactive material are generally located below grade, in a central concrete core. Hatches in the tops of the cells would be provided for initial installation of this equipment and non-routine access later. The cell floors and walls would be lined with stainless steel to allow easy decontamination. The process areas would be located on the lower level, and consist of a number of cells that contain the waste feed storage tanks, the denitrator, offgas treatment equipment, solids separation and storage equipment, and grout mixing and pumping equipment. A decontamination cell would also be located on the lower level and provides an area where equipment can be decontaminated before hands-on maintenance is performed.

As in any nuclear facility, the Grout Plant would be divided into ventilation zones depending on the potential for contamination. Pressure differentials would be maintained so that air flows from areas of lowest contamination potential to areas of highest contamination potential. The areas of highest potential for contamination would be maintained at the lowest pressure (typically -0.75 inches of water). Administrative areas with no contamination potential (designated clean areas) would be ventilated using separate systems designed to commercial standards.

Table C.6.2-20. Construction and operations project data for the Class A Grout Plant (P9C).[a]

Generic Information	
Description/function and EIS project number:	Denitrate the LAW and mix it with grout materials (P9C)
EIS alternatives/options:	***Vitrification with Calcine*** Separations/Full Separations
Project type or waste stream:	Denitrated LAW
Action type:	New
Structure type:	Reinforced concrete
Size: (m^2)	4,413
Other features: (pits, ponds, lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end ***(Full Separations Option)***[b]	
Preconstruction:	January 2006 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	155 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,946
Hours of operation: (hrs)	17,756
Acres disturbed	
New/Previous/Revegetated (acres)	None/1.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	15
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	901
Contaminants[c]: (tons/yr)	44
SO testing and start-up:	
Process air emissions: (tons/yr)	0.15
Fossil fuel (steam use): (tons/yr)	2,304.51
Effluents	
Sanitary wastewater (constr.): (L)	6,600,094
SO testing:	
Sanitary wastewater: (L/yr)	1,312,449
Solid wastes	
Construction trash: (m^3)	3,675
SO testing:	
Sanitary/industrial trash: (m^3/yr)	211
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	97
Lube oil: (L)	3,380
Radioactive wastes	
Contaminated soil (LLW): (m^3)	34
Water usage	
Dust control (construction): (L)	302,800
Domestic (construction): (L)	6,600,094
Domestic (SO testing): (L/yr)	1,312,449
Process (SO testing): (L)	35,618,551

Table C.6.2-20. Construction and operations project data for the Class A Grout Plant (P9C)[a] (continued).

Construction Information (continued)	
Energy requirements Electrical: (MWh/yr) Fossil fuel: Heavy equipment (construction): (L) Steam generation (SO testing): (L/yr)	 180 584,922.5 807,650
Operational Information	
Schedule start/end[b]:	January 2015 – December 2035
Number of workers Operations: Maintenance: Support:	 20 4 14
Number of radiation workers per year:	16 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment Equipment used: Trips:	 Mobile cranes, forklifts, trucks 220 per yr
Air emissions: (None/Reference) Building ventilation: (Ci/yr) Process radioactive emissions[d]: (Ci/yr) Process tritium emissions[e]: (Ci/yr) Process chemical emissions[f]: (lb/hr) Fossil fuel emissions: (tons/yr)	See Appendix C.2 for details. 1.44E-07 1.49E-03 45 11.0 2,304.51
Effluents Sanitary wastewater: (L/yr)	 1,312,449
Solid wastes Sanitary/industrial trash: (m^3/yr)	 211
Radioactive wastes LLW grout: (m^3)/(Ci) HEPA filters (LLW): (m^3)	 27,000/35,500 313
Mixed wastes (LLW) PPEs & misc. rad. wastes: (m^3) Liquid mixed wastes: (L)	 504 3,313,586
Hazardous/toxic chemicals & wastes Solid hazardous wastes: (m^3)	 682
Water usage Process: (L/yr) Domestic: (L/yr)	 17,809,275 1,312,449
Energy requirements Electrical: (MWh/yr) Fossil fuel: Steam generation: (L/yr) Equipment/vehicle fuel: (L/yr)	 6,158 807,650 18,319

a. Sources: EDF-PDS-G-001; EDF-PDS-L-002***; Casper (2000)***.

b. For Vitrification with Calcine Separations Option: Preconstruction: October 2013-September 2018; Construction: October 2018-September 2020; SO testing and startup: October 2020-September 2022; Operations: October 2022-December 2035.

c. CO, particulates, NO_x, SO_2, hydrocarbons

d. Source: EDF-PDS-C-046.

e. Released for 2 years via denitrations process. Source: EDF-PDS-C-046.

f. Source: EDF-PDS-C-043.

Table C.6.2-21. Decontamination and decommissioning project data for the Class A Grout Plant (P9C).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – June 2038
Number of D&D workers:	119 per yr
Number of radiation workers (D&D):	74 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	10 per day
Hours of operation (all heavy equipment): (hrs)	50,288
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Major gases (CO_2): (tons/yr)	1,407
Contaminants[b]: (tons/yr)	69 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	6,315,245 (total)
Solid wastes	
Non-radioactive (industrial): (m^3)	5,974
Radioactive wastes	
Building debris (LLW): (m^3)/(Ci)	7,945/79
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	9,517
Solid hazardous waste: (m^3)	3
Mixed wastes (LLW)	
Decon solution: (L)	17,979
Water usage	
Process water: (L)	5,712,188
Domestic water: (L)	6,315,245
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,142,029

a. Sources: EDF-PDS-G-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-22. Construction and operations project data for the Class A Grout Plant (P23C).[a]

Generic Information	
Description/function and EIS project number:	Denitrate the LAW and mix with grout materials (P23C)
EIS alternatives/options:	***Planning Basis*** Option
Project type or waste stream:	Denitrated LAW
Action type:	New
Structure type: Size: (m^2) Other features: (pits, ponds, lines)	Reinforced concrete 4,413 None
Location Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside new building
Construction Information	
Schedule start/end Preconstruction: Construction: SO testing and start-up:	 January 2009 – March 2014 April 2014 – December 2017 January 2018 – December 2019
Number of workers:	155 per yr
Number of radiation workers:	None
Heavy equipment: Equipment used: Trips: Hours of operation: (hrs)	 Excavator, grader, crane, trucks 1,946 17,756 (total)
Acres disturbed New/Previous/Revegetated: (acres)	 None/1.0/None
Air emissions: (None/Reference) Dust: (tons/yr) Fuel combustion (diesel exhaust): Major gas (CO_2): (tons/yr) Contaminants[b]: (tons/yr) SO testing and start-up: Process air emissions: (tons/yr) Fossil fuel (steam use): (tons/yr)	See Appendix C.2 for details. 15 487 24 0.15 2,304.51
Effluents Sanitary wastewater (construct.): (L) SO testing & start-up: Sanitary wastewater: (L/yr) Process wastewater: (L/yr)	 12,210,173 1,312,449 2,406,659
Solid wastes Construction trash: (m^3)	 6,799
SO testing: Sanitary/industrial trash: (m^3/yr)	 211
Hazardous/toxic chemicals & wastes Solid hazardous wastes: (m^3) Lube oil: (L)	 120 3,360
Radioactive wastes Contaminated soil: (m^3)	 22
Water usage Dust control (construction): (L) Domestic (construction): (L) Process (SO testing): (L) Domestic (SO testing): (L)	 560,180 12,210,173 12,851,403 2,296,785

Table C.6.2-22. Construction and operations project data for the Class A Grout Plant (P23C)[a] (continued).

Construction Information (continued)	
Energy requirements Electrical: (MWh/yr) Fossil fuel:	 180
Heavy equipment: (L) Steam generation (SO testing): (L/yr)	584,923 807,650
Operational Information	
Schedule start/end:	January 2020 – December 2035
Number of workers Operations: Maintenance: Support:	 20 4 14
Number of radiation workers:	16 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment Equipment used: Trips:	 Mobile cranes, forklifts, trucks 220
Air emissions: (None/Reference) Building ventilation: (Ci/yr) Process radioactive emissions[c]: (Ci/yr) Process tritium emissions[d]: (Ci/yr) Process chemical emissions[e]: (lb/hr) Fossil fuel emissions: (tons/yr)	See Appendix C.2 for details. 1.44E-07 1.49E-03 45 11.0 2,304.51
Effluents Sanitary wastewater: (L/yr)	 1,312,449
Solid wastes Sanitary/industrial trash: (m^3/yr)	 211
Radioactive wastes LLW grout: (m^3)/(Ci) HEPA filters (LLW): (m^3)	 30,000/35,500 224
Hazardous/toxic chemicals & wastes Solid hazardous wastes: (m^3)	 504
Mixed wastes (LLW)	
PPEs & misc. mixed rad. wastes: (m^3) Mixed rad. liquid wastes: (L)	384 2,366,237
Water usage Process: (L/yr) Domestic: (L/yr)	 25,702,806 1,312,449
Energy requirements Electrical: (MWh/yr) Fossil fuel: Steam generation: (L/yr) Equipment/vehicle fuel: (L/yr)	 6,158 807,650 18,319.4

a. Sources: EDF-PDS-G-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.
c. Source: EDF-PDS-C-046.
d. Released for 2 years via denitrations process. Source: EDF-PDS-C-046.
e. Source: EDF-PDS-C-043

Table C.6.2-23. Decontamination and decommissioning project data for the Class A Grout Plant (P23C).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	***January*** 2036 – ***December*** 2037
Number of D&D workers:	107 per yr
Number of radiation workers (D&D):	67 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	10 per day
Hours of operation (all heavy equipment): (hrs)	55,517
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.0/none
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Major gases (CO_2): (tons/yr)	1,407
Contaminants[b]: (tons/yr)	69 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	6,315,245
Solid wastes	
Non-radioactive (industrial): (m^3)	5,974
Radioactive wastes	
Building debris (LLW): (m^3)	7,945
Hazardous/toxic chemicals & wastes	
Non-radioactive lube oil: (L)	10,507
Solid hazardous wastes: (m^3)	3
Mixed wastes	
Decon solution: (L)	11,734
Water usage	
Process water: (L)	6,306,255
Domestic water: (L)	6,315,245
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,260,800

a. Sources: EDF-PDS-G-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.10 HAW Denitration, Packaging and Cask Loading Facility (P9J)

General Project Objectives: The project included activities that would be associated with the construction and operation of a facility that would use evaporation and denitration technology to process the high-activity waste (HAW), load the waste into drums, and load the drums into a shipping cask. This facility would be called the HAW Denitration, Packaging and Cask Loading Facility.

Process Description: The process would solidify the transuranic, strontium, and cesium ion exchange effluent streams for packaging and shipment to another facility for further treatment (vitrification). The objective would be to produce a dry material meeting shipping requirements that would minimize handling costs and impacts to the vitrification facility.

The waste solutions from the TRUEX and strontium extraction processes and the effluent from the cesium ion exchange would be mixed in a tank. The waste solution would be sent to an evaporator to concentrate the waste. The volume of the waste solution would be reduced by a factor of 66. The water vapor from the evaporation would be condensed and processes as low-level waste. The evaporator bottoms would be sent to the denitration process to be transformed into a solid waste suitable for shipping.

The denitrator would be a fluidized bed reactor. The evaporator bottoms, mixed with a 2.2M aluminum nitrate solution would be fed into the bed. Kerosene and oxygen would also be fed into the reactor to maintain the reactor temperature of about 600° C. The aluminum nitrate reacts with the waste to form solid pellets (calcine). The solid pellets would be separated from the fluidizing air by cyclones. The solids would be stored for packaging and shipment. The offgas would be cleaned by the MACT facility to remove environmental hazards such as organic vapors and mercury. The dried waste would be loaded into a shipping canister and sent to the vitrification facility.

Facility Descriptions: The HAW Denitration, Packaging and Cask Loading Facility would consist of two buildings, one containing the process equipment and the other would be used to receive the drums from the process building and load them into a shipping cask. The process building would be 210 feet long and 142 feet wide. The drum handling building would be 160 feet long and 42 feet wide.

The process building would be designed to house the equipment and systems for evaporation, denitration, and packaging of the high-activity waste into drums. The process cells would be centrally located with thick concrete walls surrounded by areas that contain progressively less radioactive hazards. The equipment in radioactive service that would require maintenance would be located in corridors (pump and valve corridors) that are adjacent to the process cells. Finally, an operating corridor would be located outside of the radioactive process cells. Stainless steel liners would be provided in areas where equipment and valves create a need for spill protection and decontamination.

The drum handling building would receive a high-activity waste filled drum from the process building on a transfer cart. A transfer tunnel would connect the process building to the drum handling building. The drum would be pulled from the cart up into a drum-handling machine. The drum would be then lowered from the drum handling machine into the cask.

Table C.6.2-24. Construction and operations project data for the HAW Denitration, Packaging and Cask Loading Facility (P9J).[a]

Generic Information	
Description/function and EIS project number:	Proposed new facilities for processing HAW for shipment to a permanent repository (P9J)
EIS alternatives/options:	Stand-alone project
Project type or waste stream:	TRUEX strip effluent, SREX, Cs Ion Exchange Effluent
Action type:	New
Structure type:	New facility
Size: (m^2)	3,395
Other features: (pits, ponds, power/water/sewer lines)	Power, water, and sewer
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end	
Preconstruction:	January 2002 – December 2007
Construction:	January 2008 – December 2011
SO test and start-up:	January 2012 – December 2014
Number of workers:	121 per yr
Number of radiation workers:	None
Heavy equipment:	
Equipment used:	Excavator, crane, material delivery Trucks
Trips (construction/SO testing):	6,501/189
Hours of operation: (hrs)	35,886 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/3.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	43
Diesel exhaust:	
Major gas (CO_2): (tons/yr)	836
Contaminants[b]: (tons/yr)	38.1
SO testing & start-up:	
Steam generation: (tons/yr)	6,532
Diesel/Kerosine exhaust: (tons/yr)	312.6
Effluents	
Construction:	
Sanitary wastewater: (L)	10,305,000
SO Testing & start-up:	
Sanitary wastewater: (L)	1,533,000
Service wastewater: (L)	97,950,000
Solid wastes	
Sanitary/industrial trash	
Construction: (m^3)	5,736
SO Testing: (m^3)	0.12 (ash after cubing/combustion)
Hazardous/toxic chemicals & wastes	
Used lube oil: (m^3)	Incinerated at WERF
Other hazardous waste: (m^3)	10.8
Hazardous waste (SO testing): (m^3)	2.8

Table C.6.2-24. Construction and operations project data for the HAW Denitration, Packaging and Cask Loading Facility (P9J)[a] (continued).

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	1,234,000
Domestic (construction): (L)	10,305,000
Domestic (SO testing): (L)	1,533,000
Process (SO testing): (L)	68,550,000
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel	
Heavy equipment/trips (const.): (L)	1,086,000
Steam generation (SO testing): (L)	6,867,000
Equip./vehicle fuel (SO testing): (L)	15,000
Kerosene (SO testing): (L)	276,000
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/Support:	8/5/35 per year
Number of radiation workers:	41 (inc. in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Trips:	189
Air emissions: (None/Reference)	See Appendix C.2 for details
Diesel exhaust:	
Major gas (CO_2): (tons/yr)	589
Contaminants[b]: (tons/yr)	26.8
Steam generation: (tons/yr)	8,835.5
Offgas from MACT: (tons/yr)	1.22
Building ventilation: (Ci/yr)	4.4E-08
Effluents:	
Sanitary wastewater: (L/yr)	1,022,000
Service wastewater: (L/yr)	65,300,000
Solid wastes:	
Sanitary/industrial trash: (m^3/yr)	0.08 (ash)
Radioactive wastes	
Process output: (m^3/yr)/(Ci/yr)	12/1,530,680
PPE (MLLW): (m^3/yr)/(Ci/yr)	0.041/0.030
Mixed hazardous wastes (LLW)	
Hazardous/toxic chemicals & wastes	
Activated carbon: (m^3/yr)/(Ci/yr)	1.048/1.05E-06
Kiln brick replacement: (m^3/yr)/(Ci/yr)	0.476/0.216
Paint, solvents, etc: (m^3/yr)	2.8
Water usage	
Process water: (L/yr)	45,700,000
Domestic water: (L/yr)	1,022,000
Energy requirements:	
Electrical: (MWh/yr)	4,520
Fossil fuel: (L/yr)	
Steam generation:	3,100,000
Kerosine for denitrator & MACT:	184,000
Equipment/vehicle fuel:	7,218

a. Sources: EDF-PDS-I-025; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-25. Decontamination and decommissioning project data for the HAW Denitration, Packaging and Cask Loading Facility (P9J).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2038
Number of D&D workers:	83 per yr
Number of radiation workers (D&D):	40 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Trips:	3 per day
Total hours of operation: (hrs)	56,970
Acres disturbed	
New: (acres)	None
Previous: (acres)	3.0
Revegetated: (acres)	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	43
Fuel combustion:	
Major gas (CO_2): (tons/yr)	3,986
Contaminants[b]: (tons/yr)	60.4 (total)
Effluents	
Sanitary wastewater: (L)	5,290,000
Solid wastes	
Metal recycle: (m^3)	45.5
Building debris: (m^3)	9,192
Radioactive wastes	
LLW building debris: (m^3)/(Ci)	11,879/118.79
PPEs: (m^3)/(Ci)	2.8/1.99
Hazardous/toxic chemicals and wastes	
Misc. for building demolition: (m^3)	4.1
Used lube oil:	Incinerated at WERF
Water usage	
Domestic water: (L)	5,290,000
Process water: (L)	511,000
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,294,000

a. Sources: EDF-PDS-I-025; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.11 New Storage Tanks (P13)

General Project Objective: Under the Direct Vitrification Alternative, the mixed transuranic waste/SBW would be vitrified directly from its liquid state. If the vitrification facility cannot be ready for operations in time to treat all of the liquid mixed transuranic waste/SBW by 2012, this project would provide RCRA-compliant storage for the remaining liquid mixed transuranic waste/SBW inventory beyond 2012.

Process Description: Approximately 1.2 million gallons of liquid mixed transuranic waste/SBW is being stored in existing tanks at the INTEC Tank Farm. Three new RCRA-compliant stainless steel storage tanks having a total capacity of 1.5 million gallons will be built to accommodate the current mixed transuranic waste/SBW inventory and newly generated liquid wastes.

Facility Descriptions: Three 500,000-gallon, stainless steel tanks will be built that are surrounded by reinforced concrete vaults. The vaults will be lined with stainless steel to contain any liquids that might escape from the principal storage tanks. The tanks will be built at INTEC, where the first five feet (depth) of soil is assumed to be contaminated with LLW. Operational impacts for this project are included under Project P1C.

Table C.6.2-26. Construction and operations project data for the New Storage Tanks (P13).[a]

Generic Information	
Description/function and EIS project number:	New liquid waste storage tanks (P13)
EIS alternatives/options:	Steam Reforming and Direct Vitrification Alternative
Project type or waste stream:	Waste management program
Action type:	New
Structure type:	Tank & vault
Size: (m^2)	1,070
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside
Construction Information	
Schedule start/end:	
Pre-construction[b]:	October 2000 – March 2006
Construction:	April 2006 – March 2008
SO test and start-up:	April 2008 – September 2008
Number of workers:	49 per yr
Number of radiation workers:	None
Heavy equipment:	
Equipment Used:	Excavator, grader, crane, trucks
Trips:	486
Hours of operation:	3,803
Acres disturbed: New/Previous/Revegetated: (acres)	None/1.2/None
Air emissions:	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	35
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons):	406
Contaminants[b]: (tons):	18
SO testing and startup:	
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons):	31
Contaminants[b]: (tons):	0.1
Effluents:	
Sanitary wastewater (construction): (L)	2,086,480
Sanitary wastewater (SO testing): (m^3)	63,870
Solid wastes:	
Construction trash: (m^3)	1,160
Sanitary/Industrial trash: (SO testing): (m^3)	35
Radioactive wastes:	
Contaminated soil (LLW): (m^3)	37
Hazardous/toxic chemicals & wastes:	
Lube oil: (L)	720
Water usage:	
Dust control: (L)	302,800
Domestic (construction): (L)	2,086,480
Domestic (SO testing): (L)	63,870

Table C.6.2-26. Construction and operations project data for the New Storage Tanks (P13) [a] (continued).

Construction Information (continued)	
Energy requirements:	
Electrical (construction): (MWh/yr)	180
Electrical (SO testing): (MWh/yr)	62
Fossil fuel:	
Heavy equipment (construction): (L)	131,760
Steam (SO testing and startup): (L)	10,840
Operational Information	
Operational impacts included under Project P1C.	

a. Source: EDF-1659.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-27. Decontamination and decommissioning project data for the New Storage Tanks (P13).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	October 2035 – September 2037
Number of workers:	19 per yr
Number of radiation workers:	15 per yr
Avg. annual worker radiation dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Grout delivery trucks, pumps, equipment
Trips:	660
Acres disturbed: New/Previous/Revegetated: (acres)	None/None/None
Air emissions:	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons)	169
Contaminants[b]: (tons)	8
Fuel combustion (steam generation):	
Major gas (CO_2): (tons)	7
HEPA filtered offgas: (Ci/yr)	4.0×10^{-8}
Effluents:	
Sanitary wastewater: (L)	809,000
Radioactive wastes:	
Solid LLW: (m^3)	0.2
Solid wastes:	
Sanitary/ industrial trash (m^3)	450
Hazardous/toxic chemicals & wastes:	None
Mixed wastes (LLW):	
PPEs & misc. rad. wastes: (m^3)	45
Decon solutions: (L)	2,400
Water usage:	
Domestic: (L)	851,600
Process: (L)	809,000
Energy requirements:	
Electrical: (MWh/yr)	142
Fossil fuel: (L)	
Heavy equipment: (L)	54,900
Steam generation: (L)	2,420

a. Source: EDF-1659.
b. CO, particulates, NO_x, SO_2, hydrocarbons.
HEPA = high efficiency particulate air; PPE = personal protective equipment.

C.6.2.12 New Analytical Laboratory (P18)

General Project Objective: The analytical laboratory project provides environmental and regulatory required sample analysis for the waste processing alternatives. The laboratory work would include analyses of samples required for process and criticality control, start-up tests, environmental permits, and for other project specific, environmental and regulatory required purposes. The typical types of analysis would be for metals and other inorganic species, organic chemicals, radiological samples, pH, Cl, F, SO_4, NO_3 TOC, gross alpha, beta and gamma, percent solids, etc.

Process Description: The information contained in this project summary is based on the laboratory needs for the Full Separations Option which would represent the bounding case for impacts. The analytical work would be handled by the existing Remote Analytical Laboratory and a new Environmental Analytical Laboratory. The existing Remote Analytical Laboratory would be used for analyses of samples required for process and criticality control studies and for environmental and regulatory required tests. The normal daily load for the Remote Analytical Laboratory is anticipated to be in the range of 48 samples requiring 153 analyses. The Environmental Analytical Laboratory is needed to handle the samples required for the environmental and regulatory compliance purposes because of the large number of samples and sample volumes required for such studies. The Environmental Analytical Laboratory is designed to accommodate the larger size samples taken for the environmental permits.

The Environmental Analytical Laboratory would be in operations from 2015 through 2040. The existing Remote Analytical Laboratory is reportedly scheduled for shutdown in 2020. There would be a heavy sampling and analytical workload during the initial trial-burn testing and the initial operations. However, the environmental and regulatory required sampling and analyses would be substantially reduced by the year 2020. This would allow the new laboratory to accommodate all the analytical work required without further need for the existing Remote Analytical Laboratory after 2020.

The Remote Analytical Laboratory receives samples via a pneumatic transfer system for analysis. It contains a large hot cell where analyses can be performed on radiological samples. The new Environmental Analytical Laboratory would have capability similar to the Remote Analytical Laboratory for remote analyses of the samples. Process analytical samples from the facilities would be delivered to the laboratories in new pneumatic transfer system lines similar to the one used to transfer samples from the New Waste Calcining Facility to the Remote Analytical Laboratory.

The existing pneumatic transfer system is capable of transporting up to 50-milliliter sample bottles between the New Waste Calcining Facility and the Remote Analytical Laboratory. The sample size may need to be increased to as much as 1-liter to perform more analytical work for compliance verification. Currently, studies are underway at the INTEC to evaluate the conditions that allow transportation of large sample volumes (approximately 500-milliliters) via the existing pneumatic transfer system.

The pneumatic transfer system consists of two runs of metallic tubing that connect the New Waste Calcining Facility hot cell to the Remote Analytical Laboratory hot cell. Between the two buildings, the tubing is held above ground level (approximately 20-30 feet) by a series of metal supports. Small plastic transfer canisters containing sample bottles are pneumatically propelled through the tubes. The plastic canister, commonly called a rabbit, is shaped like a dumbbell and contains padding to protect the sample bottle while in transit. The rabbits are routinely used to transport 15-milliliter bottles. The padding can be removed to allow the transport of up to 50-milliliter sample bottles.

Facility Description: The existing Remote Analytical Laboratory is located in CPP-684, about 200 yards from the New Waste Calcining Facility. The Remote Analytical Laboratory is a prefabricated/modular building with the total area of approximately 1,115 square meters (12,000 square feet). The new Environmental Analytical Laboratory would be located in the north corner of the INTEC (inside the INTEC fence). The building floor plan of the Environmental Analytical Laboratory would occupy an area of 25 meters (82 feet) by 34.1 meters (112 feet), consisting of two levels with the total area of 1,705 square meters (18,343 square feet). Its design and features are based on the Remote Analytical Laboratory. The lower level would consist of three analytical cells and two gloveboxes, both warm and cold laboratory facilities, a shift office, a health physics office, personnel decontamination area, maintenance and other support facilities. The upper level would provide separate heating and air conditioning supply and exhaust area and electrical rooms.

The Environmental Analytical Laboratory would be a structural steel building with metal walls and roof panels. The building would have a rigid frame structure with horizontal bracing in the plane of the roof and vertical bracing in the side and end walls. The foundation would primarily consist of grade beams with spread footings at column locations. The analytical cells would have 1-meter-thick (3.3-feet) concrete walls for shielding and they would be supported on an equally thick mat foundation. Other floor slabs would have a top elevation of 200 millimeters (8-inch) above grade elevation with footings down to the frostline. Reinforced concrete floor slabs would be sized to withstand the maximum loading, based on the design conditions.

The heating, ventilation, and air conditioning system would consist of multiple air-handling units that supply conditioned air to independent ventilation zones. The system would provide air for the clean areas, including cold laboratory, offices, and restrooms. Each ventilation zone in the clean area would be supplied by a single package heat pump unit. The areas of the facility having the potential for airborne contamination would be supplied by a once-through ventilation system. Those areas with high airborne contamination potential may receive ventilation air supply from other confinement zones, if this arrangement is beneficial. Airflow from these zones would be filtered and discharged.

Table C.6.2-28 Construction and operations project data for the New Analytical Laboratory (P18).[a]

Generic Information	
Description/function and EIS project number:	Provide the capability to perform analyses on samples from facilities processing high level waste (P18)
EIS alternatives/options:	Full & TRU Seps. & PB Options, HIP, DC, EV Options, Minimum INEEL Processing Alt., ***and Direct Vitrification Alternative***
Project type or waste stream:	Waste management program
Action type:	New and existing
Structure type:	Concrete and steel laboratory
Size: (m^2)	1,709
Other features: (pits, ponds, lines)	Pneumatic transfer lines
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new and existing buildings
Construction Information (Environmental Analytical Laboratory only)	
Schedule start/end:	
Preconstruction:	July 2006 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Planning Basis Option only:	
Preconstruction:	October 2011 – December 2015
Construction:	January 2016 – December 2017
SO test and start-up:	January 2018 – December 2019
Number of workers:	59 per yr
Number of radiation workers:	None
Heavy equipment	Excavator, grader, crane, trucks
Trips	147
Hours of operation: (hrs)	11,913 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.6/none
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	9
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	439
Contaminants[b]: (tons/yr)	21
SO testing and start-up:	
Process air emissions: (tons/yr)	1
Fossil fuel (steam use): (tons/yr)	472.15
Effluents	
Sanitary wastewater:	
Construction: (L)	2,512,294
SO testing & start-up: (L/yr)	3,626,503
Solid wastes	
Construction trash: (m^3)	1,399
Sanitary/industrial trash: (m^3/yr)	582
Radioactive wastes	
Contaminated soil (LLW): (m^3)	13
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	1,991
Acid/caustic liquid waste: (m^3)	65
Water usage	
Dust control (construction): (L)	302,800
Domestic (construction): (L)	2,512,294
Domestic (SO testing): (L)	14,506,013

Table C.6.2-28 Construction and operations project data for the New Analytical Laboratory (P18)[a] (continued).

Construction Information (Environmental Analytical Laboratory only) (continued)	
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil:	
Heavy equipment: (L)	285,031
Steam generation (SO testing): (L/yr)	165,508
Process use (SO testing): (L)	8,660
Operational Information (Environmental Analytical Laboratory)	
Schedule start/end:	January 2015 – December 2040
Planning Basis Option only:	January 2020 – December 2040
Number of workers	
Operations/Maintenance/Support:	80/10/15 per yr
Number of radiation workers per year:	30 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Delivery truck
Trips:	26
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.99E-07
Process chemical emissions: (tons/yr)	0.5
Fossil fuel emissions: (tons/yr)	472.15
Effluents	
Sanitary wastewater: (L/yr)	3,626,503
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	582
Radioactive wastes	
HEPA filters (LLW): (m^3)	27
Hazardous/toxic chemicals & wastes	None
Mixed wastes (LLW)	
Liquid mixed waste: (L)	599,040
PPEs: (m^3)	1,170
Water usage	
Domestic: (L/yr)	3,626,503
Energy requirements	
Electrical: (MWh/yr)	7,541
Fossil fuel	
Equipment/vehicle fuel: (L/yr)	2,165
Steam generation: (L/yr)	165,508

a. Sources: EDF-PDS-C-008; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-29. Decontamination and decommissioning project data for the New Analytical Laboratory (P18).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2041 – December 2042
Number of D&D workers:	88 per yr
Number of radiation workers (D&D):	30 new workers per yr (included in total above)
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Trips (roll-off trucks):	6 per day
Hours of operation (all heavy equipment): (hrs)	52,200
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.6 acres for each of the 2 D&D exercises/ None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	913
Contaminants[b]: (tons/yr)	44 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	7,487,169
Radioactive wastes	
Demolition material (LLW)[c]: (m^3)	3,050
Solid wastes	
Non-radioactive (industrial): (m^3)	4,621 (EAL+RAL)
Non-radioactive waste description:	Material from demolition[c]
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	4,940
Mixed solid waste	
Mixed solid waste: (m^3)	90
Decon solution: (L)	6,964
Water usage	
Process water: (L)	1,703,250
Domestic water: (L)	7,487,169
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,185,462

a. Sources: EDF-PDS-C-008; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. The total for both labs (as shown above) is assumed to be twice that for environmental lab alone.

C.6.2.13 Remote Analytical Laboratory Operations (P18MC)

General Project Objectives: This project is needed in conjunction with the other projects for the treatment and storage of high-level waste at INEEL. The project differs from another analytical laboratory project, P18, in that a new facility is not required. The existing analytical laboratory used in this project would continue to operation from 2007 through 2035, followed by decontamination, decommissioning, and demolition (covered in P159). No construction data is included, since the facility already exists.

Project Description: Liquid waste samples from the Tank Farm and calcine samples from the NWCF processing facility would be taken and analyzed to determine the calcining process parameters, and to characterize the waste form for further treatment and disposal. The existing Remote Analytical Laboratory would continue to operate from 2007 through 2035.

Table C.6.2-30. Construction and operations project data for the Remote Analytical Laboratory Operations (P18MC).[a]

Generic Information	
Description/function and EIS project number:	Provide the capability to perform analyses on samples from facilities processing high level waste (P18MC)
EIS alternatives/options:	No Action, Continued Current Operations, & ***Steam Reforming***
Project type or waste stream:	Waste management program
Action type:	D&D of existing facility, LLW Disposal
Structure type: Size: (m^2) Other features: (pits, ponds, lines)	Laboratory 1,115 Pneumatic transfer lines
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside new and existing buildings
Construction Information	
	No construction activities associated with this project.
Operational Information	
Schedule start/end: (for RAL)	January 2007 – December 2035
Number of workers Operations: Maintenance: Support:	 40 per yr 5 per yr 7 per yr
Number of radiation workers No Action: Continued Current Operations:	 5/yr (included in above totals) 10/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment Equipment used: Trips:	 Delivery truck 13 per yr
Air emissions: (None/Reference) Building ventilation: (Ci/yr) Process chemical emissions: (tons/yr) Fossil fuel emissions[b]: (tons/yr)	See Appendix C.2 for details. 2.50E-07 0.3 392.8
Effluents Sanitary wastewater: (L/yr)	 1,795,983
Solid wastes Sanitary/Industrial trash: (m^3/yr)	 172
Radioactive wastes HEPA filters (LLW): (m^3) Misc. solid wastes (LLW): (m^3)	 20 87
Mixed wastes (LLW) PPEs (No action/Cont. current ops): (m^3) Rad. liquids (HEPA wash, lab pack): (L)	 218/435 382,800
Hazardous/toxic chemicals & wastes:	None
Water usage (domestic): (L/yr)	1,795,983
Energy requirements Electrical: (MWh/yr) Fossil fuel Steam generation: (L/yr) Equipment/vehicle fuel: (L/yr)	 3,770 137,638 1,083

a. Sources: EDF-PDS-C-023; EDF-PDS-L-002.

b. CO_2, CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.14 Vitrified Product Interim Storage (P24)

General Project Objective: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a facility to receive and store the waste filled glass canisters produced under the Full Separations, Planning Basis, ***and Vitrification with Calcine Separations Options***. The storage would be for an interim period of time until a repository is ready to receive the waste.

Project Description: The scope of included work for this project is the effort to construct, operate, and decommission a facility to receive and store the waste-filled canisters. The vitrified waste would be placed in glass storage canisters that are qualified and approved for shipment to a repository. The canisters would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. The canisters would be loaded at the Vitrification Plant and sent directly to the Interim Storage Facility on a transfer cart through an underground transfer cart tunnel.

Three Interim Storage Facility concepts have been evaluated for the storage of the vitrified waste; the concepts include a new facility, a modified existing facility, or storage in NUHOMS™ storage casks.

New Facility Description: If a new Interim Storage Facility is built, it would be newly designed and constructed and sited adjacent to the Vitrification Facility. The Interim Storage Facility would consist of two equally sized, below-grade concrete vaults covered by a concrete operating deck. Each vault would contain 220 vertically oriented storage tubes with each tube holding two glass canisters. The storage tubes are closed and sealed by means of a shielding plug installed at the operating deck level. The storage vaults would have natural convective cooling with intake and exhaust plenums to maintain glass canister and structural materials within the allowable temperature limits. The glass canister handling machine would be used to handle the glass canisters. The handling machine would be designed to receive the glass canisters through the canister transfer tunnel and transport and place them in the storage tubes in the vaults.

Modified Existing Facility: If it is decided to modify an existing building rather than build a new one, the modified Interim Storage Facility would be located in the building originally built to contain the Fuel Processing Restoration process. The Fuel Processing Restoration project was cancelled with the building mostly finished, but before most of the process equipment was installed. Internal specific areas of the building would have to be modified and/or finished to provide the modified Interim Storage Facility. These specific areas include electrical, heating, ventilation, and air conditioning, life safety systems, and the areas specific to the modified Interim Storage Facility. The major reason that the Fuel Processing Restoration building was evaluated for the modified Interim Storage Facility are the existing concrete vaults that would have held the radioactive process equipment. If the modified Interim Storage Facility is selected, its current location would be an additional factor in the decision process to locate the process facility.

The modified Interim Storage Facility is designed to hold waste canisters in vertical sealed storage tubes. The storage tubes would be located in a concrete storage vault just as described for a new facility but would hold four canisters.

The concrete walls between the existing process vaults would be removed to form one storage vault. A steel grid arrangement would be installed on the existing concrete floor of the vault to level and position the storage tubes, and a steel lining would be installed on the east vault wall to provide the additional necessary personnel shielding. The bottoms of the storage tubes would be sealed with steel plate and the tops would be closed with steel shield plugs. Spacers would be used at the top of the pipes to position them and provide radiation shielding. The spacers and the pipes would be welded together to provide adequate air sealing so the fans can force the flow of cooling air from east to west. The combinations of spacers and pipe plugs would form a relatively flat floor.

A large open area called the charge hall is located above the top of the storage tube/shield plug/shield spacer surface and is formed by the walls and roof of the upper portion of the building. Two canister-handling machines used to move and handle the canisters are located in the charge hall.

NUHOMS™: If the NUHOMS™ system is used, the canisters would be placed into Dual Purpose Canisters and stored in NUHOMS™ storage casks on the existing Interim Storage Facility/NUHOMS™ pad. Additional pad space would have to be constructed adjacent to the existing pad.

Table C.6.2-31. Construction and operations project data for the Vitrified Product Interim Storage (P24).[a]

Generic Information	
Description/function and EIS project number:	Interim storage of vitrified product (P24)
EIS alternatives/options:	Full Separations, Planning Basis, Minimum INEEL Processing, & ***Vitrification with Calcine Separations***
Project type or waste stream:	Vitrified high-activity waste
Action type:	New building – Interim Storage Facility
Structure type	
Size: (m^2)	2,973
Other features: (pits, ponds, lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end[b]	
Full Separations Option:	
Preconstruction:	October 2005 – September 2010
Construction:	October 2010 – June 2014
SO test and start-up:	July 2014 – December 2015
Number of workers:	111 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, trucks, grader, cranes
Trips:	1,349
Hours of operation: (hrs)	12,058 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/3.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	43
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	333
Contaminants[c]: (tons/yr)	16
Effluents	
Sanitary wastewater (constr.): (L)	8,744,060
Sanitary wastewater (SO testing): (L)	381,646
Radioactive wastes	
Contaminated soil (LLW): (m^3)	23
Solid wastes	
Construction trash: (m^3)	4,869
Sanitary/Industrial trash (SO test.): (m^3/yr)	61
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	2,282
Solid hazardous wastes: (m^3)	221
Water usage	
Dust control (construction): (L)	950,906
Domestic (construction): (L)	8,744,060
Domestic (SO testing): (L)	381,646
Energy requirements	
Electrical (constr./SO testing): (MWh/yr)	180/290
Fossil fuel	
Heavy equipment (construction): (L)	273,828
Other use (construction): (L)	125,945

Table C.6.2-31. Construction and operations project data for the Vitrified Product Interim Storage (P24)[a] (continued).

Operational Information	
Schedule start/end[b]: Full Separations Option: Planning Basis Option: Minimum INEEL Processing:	 January 2016 – indefinite January 2021 – indefinite Unknown
Number of workers Operations/Maintenance/Support:	 1.5/1/4 per yr
Number of radiation workers:	5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents Sanitary wastewater: (L/yr)	 224,498
Solid wastes Sanitary/industrial trash: (m^3/yr)	 36
Hazardous/toxic chemicals and wastes Solid hazardous waste: (m^3)	 36
Radioactive wastes:	None
Water usage (domestic): (L/yr)	224,498
Energy requirements Electrical: (MWh /yr) Fossil fuel: (L)	 290 None

a. Sources: EDF-PDS-H-001; EDF-PDS-L-002***; Casper (2000)***.

b. Planning Basis Option: Preconstruction - October 2010 – September 2015; Construction – October 2015 – June 2019; SO testing and start-up – July 2019 – December 2020. Minimum INEEL Processing Alternative: Unknown. ***Vitrification with Calcine Separations Option: Preconstruction - October 2003 – September 2008; Construction – October 2008 – March 2012; SO testing and start-up – April 2012 – September 2013; Operations – October 2013 – indefinite.***

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-32. Decontamination and decommissioning project data for the Vitrified Product Interim Storage (P24).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	Unknown
Number of D&D workers :	31 per yr
Number of radiation workers: (D&D)	3 per year
Avg. annual worker rad. dose: (rem/yr)	None expected (0.25 per worker if found)
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Trips (roll-off trucks):	2 per day
Hours of operation: (all heavy equipment): (hrs)	15,120 hours
Acres disturbed	
New/Previous/Revegetated: (acres)	None/3.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Gases (CO_2): (tons/yr)	378
Contaminants[b]: (tons/yr)	18
Effluents	
Sanitary wastewater: (L)	1,831,745
Solid wastes	
Building rubble: (m^3)	9,405
Metals: (m^3)	20
Hazardous/toxic chemicals & wastes	
Haz. waste from demolition: (m^3)	2
Lube oil: (L)	2,861
Water usage	
Domestic water: (L)	1,831,745
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	343,375

a. Sources: EDF-PDS-H-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.15 Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository (P25A)

General Project Objective: The proposed project provides the support for the packaging and loading of vitrified high-activity waste that is stored in the Interim Storage Facility making it ready for shipment to a national geological repository. The sealed glass canisters would be loaded into a certified transport cask for shipment to the repository.

Project Description: The packaging and loading project would remove all vitrified glass canisters produced under the Full Separations, Planning Basis, ***and Vitrification with Calcine Separations Options***. The canisters would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. With the radiation levels estimated to be 2,500 rem per hour at contact, all movements of the canisters from the storage tubes to the transport cask would be performed remotely by the same glass canister handling machine used for originally placing the canisters in the storage tubes. The transport would be a multi-purpose cask design modified and certified for this specific payload. The cask would accept four canisters in a specially designed basket with spacers. Once loaded the cask is prepared for transport (sealed with its bolted cover, inspected, and leak tested). The assembly would be moved out of the loading area into a staging area and made ready for shipment to the repository on its dedicated railcar.

Facility Description: The canister load out and railcar/transport cask assembly staging area is an integral part of the Interim Storage Facility located at the east side of the facility. It includes all the equipment, utilities and controls necessary to load canisters into a transport cask and make the cask ready for shipment.

An overhead bridge crane capable of handling the transport cask would run the length of the cells. A rail spur line, branching off from a line that services the steam plant, would slope down to the south end of the staging area where it enters the building through an overhead door. In the staging area the assembly would be cleaned and inspected and the impact limiters and the cask lid removed.

The railcar loaded with the transport cask would be moved into the load out area and positioned directly below an access port in the operating vault floor. The transport cask would be raised to an upright position for loading and back to the horizontal position while on the railcar. A platform capable of lifting the shipping cask and railcar assembly to receive the canisters from the handling machine would be provided. It would be equipped with restraints to prevent movement in the event of a seismic disturbance. The shielded cover of the access port would be opened directly over the transport cask basket allowing a canister to be loaded. Only one canister at a time can be loaded.

Table C.6.2-33. Construction and operations project data for the Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository (P25A).[a]

Generic Information	
Description/function and EIS project number:	Load & ship glass canisters for shipment to a NGR (P25A)
EIS alternatives/options:	Full Separations, Planning Basis, Minimum INEEL Processing, & ***Vitrification with Calcine Separations***
Project type or waste stream:	Glass canisters of HAW
Action type:	New
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Existing HAW Interim Storage Facil. 0 None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside Interim Storage Facility
Construction Information (procurement only)	
Schedule start/end Procurement:	 Unknown
Number of workers:	No construction data is required because the facilities exist as part of P24 and could continue to operate after this project has been completed.
Heavy equipment:	
Acres disturbed: New/Previous/Revegetated: (acres)	
Air emissions: (None/Ref.)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes	
Water usage:	
Energy requirements:	
Operational Information	
Schedule start/end:	Unknown
Number of workers Operations: Maintenance: Support:	 3 1 3
Number of radiation workers:	6 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents Sanitary wastewater: (L/yr)	 241,767
Solid wastes Sanitary/industrial trash: (m^3/yr)	 39
Radioactive wastes:	
Hazardous/toxic chemicals & wastes:	None
Water usage Domestic: (L/yr) Process: (L/yr)	 241,767 18,925
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L/yr)	 2,535 None

[a] Sources: EDF-PDS-I-001; EDF-PDS-L-002.

Table C.6.2-34. Decontamination and decommissioning project data for the Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository (P25A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	Unknown
Number of D&D workers	2.1 per yr
Number of radiation workers (D&D):	None
Avg. annual worker rad. dose: (rem/yr)	None expected (0.25 per worker if found)
Heavy equipment:	None
Acres disturbed:	None
Air emissions:	None
Effluents	
Sanitary wastewater: (L)	11,359
Solid wastes	
Non-radioactive:	
Neutron shielding: (m^3)	2.8
Foam: (m^3)	3.6
Metal: (m^3)	5.4
Hazardous/toxic chemicals & wastes	
Non-radioactive lead: (m^3)	3
Water usage	
Domestic water: (L)	11,359
Energy requirements	
Electrical: (MWh)	39
Fossil fuel: (L)	None

a. Sources: EDF-PDS-I-001; EDF-PDS-L-002.

C.6.2.16 Class A Grout Disposal in Tank Farm and Bin Sets (P26)

General Project Objective: The general objective of this project is to provide for the Resource Conservation Recovery Act (RCRA) performance-based clean closure of the Tank Farm Facility and the Calcined Solids Storage Facility (bin sets) and subsequent disposal of Class A grout in these facilities. The Tank Farm currently stores sodium-bearing liquid waste. The bin sets store calcined solids resulting from the calcination of liquid waste. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities.

Process Descriptions: During the closure phase, the facilities would be decontaminated to the maximum extent that is technically and economically practical. For the Tank Farm, the tanks and vaults would be washed and the resulting liquid pumped out to remove the majority of the heel waste residues. The remaining liquid heel would be solidified using clean grout. The ancillary piping, such as waste transfer lines, would be flushed and grouted with clean grout. Afterwards, the vaults would be completely filled with clean grout to prevent the intrusion of liquid and to act as a temporary cover or cap over the tank. When pouring is complete, the 11 tanks and the sand under nine of the 11 tanks, would be encapsulated between the newly poured grout and the vault floor.

A similar closure approach would be used for the bin sets. The interior surfaces of the bins, piping, and ancillary equipment would be decontaminated, again to the maximum extent that is technically and economically practical. It is assumed, for this project, that the bins would be sufficiently decontaminated such that performance criteria would be met. The vault void (the space between the bins and the surrounding concrete structure) would be filled with clean grout to provide added structural rigidity to the bins and minimize the chance of subsidence within the bin sets over time.

After the Tank Farm and the bin sets have been closed, they would be used as low-activity waste disposal facilities. The tank and bin voids would be filled with Class A grout that would be produced at the Class A Grout Plant and delivered to the Tank Farm and bin sets in shielded piping.

Facility Descriptions: The Tank Farm consists of underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings that contain instrumentation and valving for the waste tanks. The eleven 300,000 to 318,000-gallon stainless steel tanks are contained in underground, unlined concrete vaults and are used to store mixed liquid wastes. The tanks have a 50-foot diameter and an overall height of approximately 30 feet (including the dome height). A thin sand layer was placed between the vault floor and tank on nine of the eleven tanks.

Liquid waste is transferred throughout the Tank Farm in underground stainless steel lines. The liquid waste that remains after the tanks have been emptied as low as possible with the steam jets and airlifts is referred to as a "heel." The heels are expected to range in volume from 5,000 to 15,000 gallons when cease use occurs. During high-level waste processing, grout would be pumped, at intervals, from the Class A Grout Plant to the Tank Farm in shielded lines.

The Calcined Solids Storage Facility contains seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. The Class A grout would be pumped to the bin sets using the same systems as in the Tank Farm.

Table C.6.2-35. Decontamination and decommissioning project data for Performance-Based Clean Closure of Bin Sets for the Class A Grout Disposal in Tank Farm and Bin Sets (P26 & P51).[a]

Generic Information	
Description/function and EIS project number:	Performance-Based Closure of Bin sets (P26 & P51)
EIS alternatives/options:	Separations/Full Separations, ***TRU Separations*** & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	Calcine solids storage units, weather enclosure
Size: (m^2)	1,347
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside & around the calciner Bins
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Pre – D&D:	March 2014 – June 2019
D&D:	January 2019 – January 2034
Number of D&D workers	49 per yr
Number of radiation workers (D&D):	49 per yr (included in above total)
Avg. annual worker rad. dose: (rem/hr)	0.87 per worker
Heavy equipment	
Equipment used:	Cement trucks
Trips :	2,147
Hours of operation (all heavy equipment): (hrs)	4,295
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	24.6
Contaminants[b]: (tons/yr)	1.2
Radioactive	
Calcine (cleaning): (Ci/yr)	6.08E-09
Effluents	
Sanitary wastewater: (L)	20,865,000
Grout truck wash: (L)	406,000
Solid wastes	
Construction/D&D trash: (m^3)	11,618
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage	
Domestic water: (L)	20,865,000
Process water: (L)	481,700
Energy requirements	
Electrical: (MWh/yr)	1,146
Fossil fuel: (L)	159,700

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-36. Decontamination and decommissioning project data for Performance-Based Clean Closure of Tank Farm for the Class A Grout Disposal in Tank Farm and Bin Sets (P26 & P51).[a]

Generic Information	
Description/function and EIS project number:	Performance-Based Closure of Tank Farm Facility (P26 & P51)
EIS alternatives/options:	Separations/Full Separations and ***TRU Separations*** & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	D&D of existing facility, LLW Disposal
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside buildings
Decontamination and Decommissioning (D&D) Information	
Schedule start/end D&D:	January 2000 – December 2021
Number of D&D workers:	11 per yr
Number of radiation workers (D&D):	11 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	1.1 per worker
Heavy equipment	
Equipment used:	Earthmoving equipment, cement trucks, crane
Trips (roll-off trucks):	2,188
Hours of operation (all heavy equipment): (hrs)	4,375
Acres disturbed New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Non-radioactive	
Excavation dust: (tons/yr)	0.1
Fuel combustion	
Gases (CO$_2$): (tons/yr)	89.9
Contaminants[b]: (tons/yr)	4.4
Radioactive	
Enclosure emissions: (Ci/yr)	1.1E-07
Effluents	
Sanitary wastewater: (L)	5,148,000
Service waste: (L)	716,000
Solid wastes	
Sanitary/industrial trash: (m^3)	1,342
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None

Table C.6.2-36. Decontamination and decommissioning project data for Performance-Based Clean Closure of Tank Farm for the Class A Grout Disposal in Tank Farm and Bin Sets (P26 & P51)[a] (continued).

Decontamination and Decommissioning (D&D) Information (continued)	
Water usage	
Domestic water: (L)	5,148,000
Process water: (L)	3,089,865
Energy requirements	
Electrical: (MWh/yr)	4,372
Fossil fuel: (L)	641,844

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-37. Construction and operations project data for Bin Set Closure for the Class A Grout Disposal in Tank Farm and Bin Sets (P26).[a]

Generic Information	
Description/function and EIS project number:	Fill Bin Sets with Class A Grout (P26)
EIS alternatives/options:	Separations/Full Separations & Facility Disposition
Project type or waste stream:	Waste Management Program
Action type:	New
Structure type:	Calcine storage units, enclosure
Size: (m^2)	1,347
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, and water will be required
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around calciner bins
Construction Information	
	No construction activities
Operational Information	
Schedule start/end	
Grouting operations:	January 2027 – December 2035
Number of workers:	
Operations:	4 per yr
Maintenance:	1 per yr
Support:	2 per yr
Number of radiation workers:	7 per yr
Avg. annual worker rad. dose: (rem/yr)	1.0 per worker
Heavy equipment	
Equipment used:	Cement trucks
Trips:	None
Hours of operation (all heavy equipment): (hrs/yr)	127
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Radioactive emiss. from grouting: (Ci/yr)	1.21E-10
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	9.0
Contaminants[b]: (tons/yr)	0.4
Effluents	
Sanitary wastewater: (L/yr)	12,400
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	39
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes	
Lube oil (L)	18
Mixed wastes (LLW)	
PPEs & misc. mixed rad. wastes: (m^3)	95
Mixed rad. liquid wastes: (L)	94,500
Water usage	
Domestic water: (L/yr)	12,400
Process water: (L/yr)	10,500
Energy requirements	
Electrical: (MWh/yr)	244
Equipment/vehicle fuel: (L/yr)	2,917

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-38. Decontamination and decommissioning project data for Bin Sets Closure with Class A Fill for the Class A Grout Disposal in Tank Farm and Bin Sets (P26).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule Start/end:	January 2036 – December 2037
Number of D&D workers:	36 per yr
Number of radiation workers (D&D):	36 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Flatbed trucks
Trips:	194
Hours of operation (all heavy equipment): (hrs)	583
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	54.9
Contaminants[b]: (tons/yr)	2.7 (total)
Effluents	
Sanitary wastewater: (L)	1,533,000 (total)
Solid wastes	
Building rubble: (m^3)	3,569
Metals: (m^3)	20
Radioactive wastes	None
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	11
Use lube oil: (L)	3,370
Mixed wastes	
Solid mixed wastes: (m^3)	177
Decon solution: (L)	170,000
Water usage	
Domestic water: (L)	1,533,000
Process water: (L)	170,000
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	17,809

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-39. Construction and operations project data for Tank Farm Closure with Class A Fill for the Class A Grout Disposal in Tank Farm and Bin Sets (P26).[a]

Generic Information	
Description/function and EIS project number:	Tank Farm Fill with Class A Grout (P26)
EIS alternatives/options:	Separations/Full Separations & Facility Disposition
Project type or waste stream:	Waste Management Pgm. - HLW
Action type:	New
Structure type:	Tank Farm Vaults and Tanks
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, and water will be required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Around the Tank Farm
Construction Information	
	No construction activities
Operational Information	
Schedule start/end	
Grouting operations:	January 2015 – December 2026
Number of workers:	
Operations:	2 per yr
Maintenance:	0.5 per yr
Support:	0.5 per yr
Number of radiation workers:	3 per yr
Avg. annual worker rad. dose: (rem/yr)	0.7 per worker
Heavy equipment	
Equipment used:	Crane
Trips:	None
Hours of operation (all heavy equipment): (hrs/yr)	257
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	17.9
Contaminants[b]: (tons/yr)	0.9
Effluents:	
Sanitary wastewater: (L/yr)	4,000
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	17
Radioactive wastes:	None
Hazardous/toxic chemicals and wastes	
Used lube oil: (L)	36
Mixed wastes (LLW)	
PPEs & misc. mixed rad. wastes: (m^3)	54
Liquid mixed rad. wastes: (L)	85,200
Water usage	
Domestic water: (L/yr)	4,000
Process water: (L/yr)	7,100
Energy requirements	
Electrical: (MWh/yr)	108
Fossil fuel:	
Equipment/vehicle fuel: (L/yr)	5,813

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-40. Decontamination and decommissioning project data for Tank Farm Closure with Class A Fill for the Class A Grout Disposal in Tank Farm and Bin Sets (P26).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2026 – December 2027
Number of D&D workers:	8 per yr
Number of radiation workers (D&D):	8 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Flatbed trucks
Trips:	22 trips
Hours of operation (all heavy equipment): (hrs)	66
Acres disturbed	
New/Previous/Revegetated: (acres)	None/2.6/ None
Air emissions: (None/Reference)	See Appendix C.2 for details
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	3.1
Contaminants[b]: (tons/yr)	0.2 (total)
Effluents	
Sanitary wastewater: (L)	338,000 (total)
Solid wastes	
Building rubble: (m^3)	115
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	9
Used lube oil: (L)	382
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	7
Decon solution: (L)	17,033
Water usage	
Process water: (L)	17,033
Domestic water: (L)	338,000
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	2,017

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.17 Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27)

General Project Objective: This project presents a proposed design for the Idaho National Engineering and Environmental Laboratory (INEEL) Low-activity Waste Class A/C Near Surface Land Disposal Facility. The INEEL low-activity waste disposal facility project provides an "assured storage management system" for the near surface disposal of Class A or C waste.

Project Description: The primary design criterion is to prevent leaching of contaminants from the waste into the surrounding soil or into the Snake River Aquifer. The project provides a modular design in which reasonably sized durable containers can be stored. The containers in which the grouted waste would be placed are of a size that could be retrieved and moved or repaired in the event of an unforeseen problem. The containers were also designed such that they would neither corrode nor decompose in a manner that structural integrity is lost. This provides a design that is termed "Assured Storage." The INEEL Disposal Facility would be an engineered watertight structure with a load bearing cap and internal structure.

Facility Description: This structure is designed for the long-term disposal of a maximum of 34,830 m^3 (45,556 yd^3) of Class A/C radioactive grouted LLW. The disposal unit would be constructed of reinforced concrete with liquid-tight coated interior walls and floors providing primary containment. The unit would be partitioned into nine separate cells by 45.72-cm (18-in.) reinforced concrete load-bearing walls. The drainage system design is provided by sloping the floors in the disposal unit to trench drains in the center of each cell. A secondary containment is included in the design consisting of a reinforced, heat-welded thermoplastic geo-liner set on a compacted sub-base. The geo-liner would extend under the foundation and around the walls of the disposal facility.

The most cost-effective site for the low-activity waste disposal facility and support facilities would be generally located outside the southeast corner of and as near as possible to the INTEC security perimeter fence. This location is desirable since it has already been disturbed by activities at the INTEC and many personnel facilities are already in place at the INTEC. Additionally, the roads leading from the INTEC to the disposal site are private INEEL roads.

The facility design has both an internal and an external monitoring capability for the duration of institutional control of the facility. The facility is also designed so that if radioactive material is discovered to have leached from within the facility, then the site can be remediated and repaired quickly and in a cost-effective manner.

A soil cap would be placed over the disposal unit roof after a concrete protective wear surface has been cast. The cap would include both backfilled soil and topsoil and would be at least 2.13 m (7 feet) deep to support growth of selected indigenous plant materials. The cap would be seeded with indigenous plant materials that would best transpire moisture from the soil to the atmosphere in the semi-arid alpine desert area of the INEEL.

The effective life of the disposal facility disposal unit as an intruder barrier and hazard protection would not be less than 500 years or until the maximum remaining radioactivity from all wastes would not pose an unacceptable hazard to an intruder or public health and safety. Institutional control of the site would be maintained at least through the year 2095.

Table C.6.2-41. Construction and operations project data for the Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27).[a]

Generic Information	
Description/function and EIS Project number:	INEEL Class A/C near surface Land disposal facility (P27)
EIS alternatives/options:	Separations/Full & TRU Seps.; Minimum INEEL Processing
Project type or waste stream:	LAW disposal
Action type:	New
Structure type	Near Surface Land Disposal Unit
Size: (m^2)	93
Other features: (pits, ponds, power/water/sewer lines)	Revegetated cap, secondary Containment
Location:	
Inside/outside of fence:	Outside INTEC fence
Inside/outside of building:	Outside
Construction Information	
Schedule start/end:[b]	
Preconstruction:	October 2004 – September 2009
Construction:	October 2009 – June 2034
Number of workers:	7 per yr
Number of radiation workers:	6 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/hr)	<0.19 per worker
Heavy equipment:	
Equipment used:	Excavator, grader, crane,trucks
Trips:	5,919
Hours of operation: (hrs)	34,203 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/21.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	311
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	585
Contaminants[c]: (tons/yr)	28
Effluents	
Sanitary wastewater: (L)	11,624,681
Solid wastes	
Construction trash: (m^3)	6,473
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	5,973
Solid hazardous wastes: (m^3)	6
Water usage	
Dust control (construction): (L)	1,059,800
Domestic (construction): (L)	11,624,681
Energy requirements	
Electrical: (MWh/yr)	1
Fossil fuel (heavy equipment): (L)	1,329,338
Operational Information	
Schedule start/end:[b]	
Disposal operations:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/Support:	7/2/8 per yr
Number of radiation workers:	2.5 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/hr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, trucks
Trips:	6,800

Table C.6.2-41. Construction and operations project data for the Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27)[a] (continued).

Operational Information (continued)	
Air emissions: (None/Reference) Fossil fuel emissions: (tons/yr)	See Appendix C.2 for details. 180
Effluents Sanitary wastewater: (L/yr)	 587,148
Solid wastes Sanitary/Industrial trash: (m^3/yr)	 94
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage Domestic water: (L/yr)	 587,148
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L/yr)	 1 33,308

a. Sources: EDF-PDS-J-001; EDF-PDS-L-002.

b. For Minimum INEEL Processing Alternative schedule unknown, however, durations are as follows: Preconstruction - 6.0 years, Construction – 10.5 years, and Operations – 21.0 years.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-42. Decontamination and decommissioning project data for the Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:[b]	January 2036 – December 2037
Number of D&D workers:	136 per yr
Number of radiation workers (D&D):	88 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Excavator, grader, crane, material delivery trucks
Hours of operation (all heavy equipment): (hrs)	19,980
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/21.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	699
Contaminants[c]: (tons/yr)	34 (total)
Effluents	
Sanitary wastewater: (L)	5,790,104
Solid wastes	
Non-radioactive (industrial): (m^3)	126
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	3,781
Water usage	
Domestic: (L)	5,790,104
Energy requirements	
Electrical: (MWh/yr)	1
Fossil fuel: (L)	453,746

a. Sources: EDF-PDS-J-001; EDF-PDS-L-002.

b. For Minimum INEEL Processing Alternative schedule unknown, however, D&D duration of 21 years anticipated.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.18 Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D)

General Project Objective: The project objective is to provide for the design, construction, operation, and decommissioning of a facility to fill and seal landfill-disposable hollow concrete cylinders with Class A low-level waste (LLW) grout, load the containers onto a lowboy trailer and ship to an INEEL disposal facility.

Process Description: This process consists of pumping the Class A LLW grout into hollow concrete cylinders, sealing the cylinders and transporting them to a disposal facility southeast of the INTEC. The grout would be pumped from the Class A Grout Plant as it is produced. A total of 22,339 cylinders would be filled, sealed and transported to the disposal facility. A lowboy trailer with tractor, carrying 6 cylinders per load is proposed to accomplish the transfer. The grouted concrete cylinders would be 20 mR/hr or less at contact. The cylinders could therefore be contact handled.

The steps involved in performing the operations necessary to transport the grouted cylinder to the disposal facility would be: filling, sealing the cylinders, performing a contamination and radiation survey of the cylinders, moving the cylinders from the fill area to the load area, load the cylinders and transport the cylinders to the disposal facility, unload the cylinders and return. A portable crane would be provided at the disposal facility to unload the cylinders.

Facility Description: The Grout Packaging Facility would be located in the south end of the Class A Grout Plant. The Grout Plant would be located approximately 130 feet to the west and slightly to the north of the Waste Separations Facility, which would be located near the northeast corner of the INTEC. This would include a station where the hollow concrete cylinders would be filled, sealed, and stored awaiting transportation. A hatchway in the main floor, with a 40-ton overhead bridge crane would allow for removal and installation of equipment as well as handling the empty and filled concrete waste cylinders.

The filling, sealing, handling and removal equipment would be located on the basement level. The container filling station and the container sealing station would be located on the east side of the enclosure. A grout supply line from the Class A Grout Plant with necessary grout flow controls would enter the container fill station on the east side. The sealing station would be located to the north of the fill station and also on the east side of the filling, sealing and handling enclosure. There would also be available floor space near the filling and sealing stations to store several empty cylinders and several cylinders that have been filled but not sealed. Storage space for filled and sealed cylinders would be provided on the west side of the enclosure with storage space for 36 cylinders.

An overhead rollup door located at the south end of the facility would provide access into the main floor level. This would allow lowboy access into the main floor area for loading the grouted concrete cylinders.

Table C.6.2-43. Construction and operations project data for the Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D).[a]

Generic Information	
Description/function and EIS project number:	Pack and ship Class A grout to INEEL landfill (P35D)
EIS alternatives/options:	Full Separations Option
Project type or waste stream:	LAW
Action type:	New
Structure type:	Contact handled LLW handling Facility
Size: (m^2)	491
Other features: (pits, ponds, power/water/sewer lines)	Power/water/sewer/LLW decon Collection tank
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside building
Construction Information	
Schedule start/end	
Pre-construction:	January 2007 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	21.7 per yr
Heavy equipment:	Excavator, grader, crane, trucks
Trips/Hours of operation: (hrs)	564/9,869 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	2
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	426
Contaminants[b]: (tons/yr)	21
SO testing and start-up:	
Process air emissions: (tons/yr)	8
Effluents	
Sanitary ww (constr./SO testing): (L)	923,332/656,224
Process wastewater (SO testing): (L)	9,841
Solid wastes	
Construction trash: (m^3)	514
Sanitary/industrial (SO testing): (m^3)	105
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	1,868
Solid hazardous wastes: (m^3)	4
Radioactive wastes	
Contaminated soil (LLW): (m^3)	4
Water usage	
Dust control (construction): (L)	302,800
Domestic (construction): (L)	923,332
Domestic (SO testing): (L)	656,224
Process (SO testing): (L)	9,841
Energy requirements	
Electrical (Construction): (MWh/yr)	55
Electrical (SO testing): (MWh/yr)	2,000
Fossil fuel:	
Heavy equipment fuel: (L)	224,133
Other (construction): (L)	52,644

Table C.6.2-43. Construction and operations project data for the Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D)[a] (continued).

Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers : Operations/Maintenance/Support:	7.5/1/1 per yr
Number of radiation workers:	8/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment: Trips:	Mobile cranes, forklifts, trucks 260 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.36E-08
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	2.43
Contaminants[b]: (tons/yr)	0.12
Effluents Sanitary wastewater: (L/yr)	328,112
Solid wastes Sanitary/industrial trash: (m^3/yr)	53
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes Lube oil: (L)	525
Water usage	
Process (L/yr)	19,682
Domestic (L/yr):	328,112
Energy requirements	
Electrical: (MWh/yr)	2,000
Fuel oil: (L/yr)	787

a. Sources: EDF-PDS-J-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-44. Decontamination and decommissioning project data for the Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2037
Number of D&D workers:	30 per yr
Number of radiation workers (D&D):	20 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	0.5 per day
Hours of operation (all heavy equipment): (hrs)	7,110
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	249
Contaminants[b]: (tons/yr)	12
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	1,292,360
Solid wastes	
Building rubble: (m^3)	664
Metals: (m^3)	3
Radioactive wastes:	None
Hazardous/toxic chemicals and wastes	
Used lube oil: (L)	1,346
Mixed wastes:	None
Water usage	
Process water: (L)	380,813
Domestic water: (L)	1,292,360
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	161,468

a. Sources: EDF-PDS-J-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.19 Grout Packaging and Loading for Offsite Disposal (P35E)

General Project Objective: The project objective is to provide for the design, construction, operation, and decommissioning of a facility to fill and seal landfill-disposable hollow concrete cylinders with LLW grout and load them onto rail cars for offsite disposal.

Process Description: This process consists of pumping the LLW grout into hollow concrete cylinders, sealing the cylinders and loading them onto rail cars for offsite disposal. The grout would be pumped from the Grout Plant as it is produced. A total of 22,100 cylinders are to be filled, sealed and loaded for offsite disposal. The grouted concrete cylinders would read 20 millirem per hour or less at contact and therefore can be contact handled.

The steps involved in performing the operations necessary to package and load the grouted cylinders for offsite disposal are: filling and sealing the cylinders, performing a contamination and radiation survey of the cylinders, moving the cylinders from the fill area to the load area, and loading the cylinders onto rail cars for offsite disposal.

Facility Description: The Grout Packaging Facility would be located in the south end of the Grout Plant. The Grout Plant would be located approximately 130 feet to the west and slightly to the north of the Waste Separations Facility, which would be located near the northeast corner of the INTEC. This would include a station where the hollow concrete cylinders would be filled, sealed, and stored near term prior to loading for offsite disposal. A hatchway in the main floor, with a 40-ton overhead bridge crane, would allow for removal and installation of equipment as well as handling the empty and filled concrete waste cylinders.

The filling, sealing, handling and removal equipment would be located on the basement level. The container filling station and the container sealing station would be located on the east side of the enclosure. A grout supply line from the Grout Plant with necessary grout flow controls would enter the container fill station on the east side. The sealing station would be located to the north of the fill station and also on the east side of the filling, sealing and handling enclosure. There would also be available floor space near the filling and sealing stations to store several empty cylinders and several cylinders that have been filled but not sealed. Storage space for filled and sealed cylinders would be provided on the west side of the enclosure with storage space for approximately 36 cylinders. Space would also be provided for transporting the cylinders from the basement area to the main floor (i.e., the floor area directly beneath the overhead hatch would be clear).

An overhead rollup door located at the south end of the Grout Packaging Facility would provide access into the main floor level. This would allow transporter access into the main floor area for loading the grouted concrete cylinders. Due to its low specific activity and low radiation field, the grouted concrete disposal cylinders would also serve as the shipping containers.

Table C.6.2-45. Construction and operations project data for the Class A Grout Packaging and Loading for Offsite Disposal (P35E).[a]

Generic Information	
Description/function and EIS project number:	Package Class A grout for offsite shipment and disposal (P35E)
EIS alternatives/options:	Full Separations, Planning Basis, ***Steam Reforming, Minimum INEEL Processing & Vitrification with Calcine Separations***
Project type or waste stream:	LAW grout
Action type:	New
Structure type:	Contact handled LLW handling Facility
Size: (m^2)	491
Other features: (pits, ponds,power/water/sewer lines)	Power/water/sewer/LLW decon Collection tank
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside LAWTF
Construction Information	
Schedule start/end	
Full Separations Option:[b]	
Pre-construction:	January 2007 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	21.7 per yr
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	564
Hours of operation: (hrs)	9,869 (total)
Acres disturbed & duration	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	2
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	426
Contaminants[c]: (tons/yr)	21
SO testing and start-up	
Process air emissions: (tons/yr)	8
Effluents	
Sanitary wastewater (constr.): (L)	923,332
Sanitary wastewater (SO testing): (L)	587,148
Process wastewater: (L)	9,841
Solid wastes	
Construction trash: (m^3)	514
Sanitary/industrial trash (SO test.): (m^3)	94
Hazardous/toxic chemicals and wastes	
Lube oil: (L)	1,868
Misc. (solvents, etc.): (m^3)	3
Radioactive wastes	
Contaminated soil (LLW): (m^3)	4
Water usage	
Dust control (construction): (L)	302,800
Domestic (construction)/(SO testing): (L)	(923,332)/(587,148)
Process (SO testing): (L)	9,841
Energy requirements	
Electrical (constr.)/(SO Test): (MWh/yr)	(55)/(2,000)
Fossil fuel:	
Heavy equipment (construction): (L)	224,133
Other fossil fuel (construction): (L)	52,644

Table C.6.2-45. Construction and operations project data for the Class A Grout Packaging and Loading for Offsite Disposal (P35E)[a] (continued).

Operational Information	
Schedule start/end: Full Separations Option[b]	January 2015 – December 2035
Number of workers : Operations/Maintenance/Support:	6.5/1/1 per yr
Number of radiation workers:	8/yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	Mobile cranes, forklifts, trucks
Trips:	260 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.36E-08
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	2.43
Contaminants[b]: (tons/yr)	0.12
Effluents Sanitary wastewater: (L/yr)	293,574
Solid wastes Sanitary/Industrial trash: (m^3/yr)	47
Radioactive wastes:	None
Hazardous/toxic chemicals and wastes Lube oil: (L)	525
Water usage	
Process: (L/yr)	19,682
Domestic: (L/yr)	293,574
Energy requirements	
Electrical: (MWh/yr)	2,000
Fossil fuel: (L/yr)	787

a. Sources: EDF-PDS-J-003; EDF-PDS-L-002; ***Casper (2000)***.

b. Schedule for Planning Basis Option: Preconstruction: January 2012 – December 2015; Construction: January 2016 – December 2017; SO testing & start-up: January 2018 – December 2019; Operations – January 2020 – December 2035.
Schedule for Steam Reforming Option: Preconstruction: October 2004 – September 2009; Construction: October 2009 – September 2011; SO testing & start-up: October 2011 – September 2013; Operations: October 2013 – December 2035.
Schedule for Vitrification with Calcine Separations Option: Preconstruction: October 2014 – September 2018; Construction: October 2018 – September 2020; SO testing & start-up: October 2020 – September 2022; Operations: October 2022 – December 2035.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-46. Decontamination and decommissioning project data for the Class A Grout Packaging and Loading for Offsite Disposal (P35E).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2037
Number of D&D workers:	30 per yr
Number of radiation workers (D&D):	20 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	0.5 per day
Hours of operation (all heavy equipment): (hrs)	7,110
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	249
Contaminants[b]: (tons/yr)	12
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	1,289,555
Solid wastes	
Building rubble: (m^3)	664
Metals: (m^3)	3
Radioactive wastes	None
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	1,346
Mixed wastes:	None
Water usage	
Process water: (L)	380,813
Domestic water: (L)	1,289,555
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	161,468

a. Sources: EDF-PDS-J-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.20 Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant (P39A)

General Project Objectives: The proposed project encompasses the handling and loading of transport casks with remote-handled Waste Isolation Pilot Plant (RH-WIPP) type half-canisters containing transuranic waste before immediate transport to WIPP for disposal. Truck transport is assumed with transport casks modeled after an existing spent fuel transport cask. The handling and loading of casks and canisters would occur in the Waste Separations Facility. The RH-WIPP half-canisters would be ready for shipment; therefore, there would be no waste packaging issues relative to this project. Handling and loading of casks would occur over a 21-year period but would not start before WIPP was opened to accept TRU waste. Loaded cask transport from the INEEL to WIPP, subsequent handling at WIPP, and empty cask return to the INEEL are not part of this project.

Project Description: Approximately 550 RH-WIPP half-canisters would be produced over a 22-year timeframe and shipped directly to WIPP for disposal.

All shipments to WIPP would require the use of a Type-B (M), Fissile Class 1, shielded ground shipping package (cask). The shipping cask designated for use by this project would be the RH-TRU 72-B, developed for RH-WIPP half-canister transport. One cask would be carried on a trailer for truck transport to WIPP. The cask has been tested and licensed by the NRC for TRU waste ground shipment. Each shipping cask would be capable of transporting one RH-WIPP half-canister; however, the containerized waste would require NRC approval as an authorized cask content prior to any shipment.

Table C.6.2-47. Construction and operations project data for the Packaging and Loading of Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant (P39A).[a]

Generic Information	
Description/function and EIS project number:	Pack and load TRU canisters into trailer mounted casks via the Waste Separations Facility (P39A)
EIS alternatives/options:	Transuranic Separations Option
Project type or waste stream:	TRU disposal
Action type:	New
Structure type Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	None 0 None
Location Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside Waste Separations Facility
Construction Information (procurement only)	
Schedule start/end: Design and procurement: Cask construction:	 January 2010 – December 2011 January 2012 – December 2014
Number of workers:	No construction data is required because the facilities for this project have been completed.
Acres disturbed: New/Previous/Revegetated: (acres)	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes	
Water usage:	
Energy requirements:	
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers Operations: Maintenance: Support:	 3 per yr 0.5 per yr 3 per yr
Number of radiation workers:	2.5/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents Sanitary wastewater: (L/yr)	 224,498
Solid wastes Sanitary/Industrial trash: (m^3/yr)	 37
Radioactive waste:	None
Hazardous/toxic chemicals & wastes:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 86 None

[a] Sources: EDF-PDS-E-004; EDF-PDS-L-002.

Table C.6.2-48. Decontamination and decommissioning project data for the Packaging and Loading of Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant (P39A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – June 2037
Number of D&D workers:	7 per yr
Number of radiation workers (D&D):	None
Avg. annual worker rad. dose: (rem/yr)	None expected (if found 0.25 per worker)
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks,
Trips (roll-off trucks):	9 per day
Hours of operation (all heavy equipment): (hrs)	13,500
Acres disturbed:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2) (tons/yr)	630
Contaminants[b]: (tons/yr)	31 (total)
Effluents	
Sanitary wastewater: (L)	223,552
Solid wastes	
Non-radioactive:	
Foam: (m^3)	69
Metals: (m^3)	27
Industrial: (m^3)	76
Hazardous/toxic chemicals & wastes	
Lead: (m^3)	15
Used lube oil: (L)	2,555
Water usage	
Process water: (L)	228,488
Domestic water: (L)	223,552
Energy requirements	
Electrical: (MWh/yr)	135
Fossil fuel: (L)	306,585

a. Sources: EDF-PDS-E-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.21 Transuranic/Class C Separations (P49A)

Overview: This project describes the costs and impacts of the Transuranic Separations Facility and some smaller, related facilities. These related facilities include the Bulk Chemical Storage Facility, Condensate Collection Facility, and the Low Activity Waste Collection Facility. The Transuranic Separations Facility receives liquid sodium-bearing waste from the Tank Farm Facility and solid calcine from the Calcined Solids Storage Facility. After some initial treatment of these feed streams, the radionuclides are chemically separated into two streams, one containing the transuranic nuclides and a second waste stream containing the rest of the nuclides (including cesium and strontium). The transuranic stream is dried to a solid form that would be shipped to the Waste Isolation Pilot Plant. The other stream is routed to other facilities (addressed as separate projects) for further treatment.

General Project Objectives: The project described in this Project Summary is part of the Transuranic Separations Option. The Transuranic Separations Option involves the processing of the liquid sodium-bearing waste and solid calcine that is currently stored at the INTEC. This project addresses the Transuranic Separations Facility and related facilities.

Process Description: The Transuranic Separations Facility receives liquid sodium-bearing waste from the Tank Farm and solid calcine from the Calcined Solids Storage Facility (CSSF or bin sets). After some initial treatment of these feed streams, the radionuclides would be chemically separated into two streams, one containing the transuranic nuclides and another low activity waste stream containing the rest of the nuclides. The transuranic stream would be dried to a solid form to be shipped to the Waste Isolation Pilot Plant. The low-activity waste stream is routed to another facility (addressed as a separate project) for further treatment.

Sodium-bearing waste (SBW) is transferred from the Tank Farm to a day storage tank in the Transuranic Separations Facility. The equipment for retrieval of this stream is included in this project. The SBW would then be filtered to remove undissolved solid particles before further processing. Calcine retrieval from the bin sets is addressed as a separate project. This project starts with receipt of the calcine at the Transuranic Separations Facility and includes the equipment (filters, storage bins, etc.) necessary. After the calcine is received at the Transuranic Separations Facility, it would be dissolved in nitric acid and filtered, in preparation for further processing.

After filtration of either SBW or dissolved calcine, the waste would be sent to the transuranic extraction process.

Transuranic Extraction is a solvent extraction process that removes dissolved actinides from a liquid. The organic solvent extracts a high percentage of actinides from the aqueous feed and also extracts a portion of other radioactive and nonradioactive ions. To minimize the partitioning of these non-actinide species into the solvent, the solvent would be "scrubbed" with a weak nitric acid solution that back-extracts most of the non-actinide species into the scrub effluent, which is combined with the feed. The solvent would then be "stripped" of actinides by contacting it with a weak nitric acid solution containing 1-hydroxyethane 1,1 diphosphonic acid. The strip solution would remove the actinides and a few other metal ions such as molybdenum and zirconium. The solvent would then be contacted with an aqueous sodium carbonate solution to remove additional ions, primarily mercury. Contact with the carbonate solution also neutralizes acid present in the solvent and removes organic degradation products. Finally the solvent would be contacted with weak nitric acid to re-acidify the solution, which is then recycled back to the front end of the transuranic extraction process.

Mixing and separation of the various solutions in the transuranic extraction process would take place in a series of centrifugal contactors. The centrifugal contactors would provide high aqueous organic interface to promote mixing and then accomplish quick separation between the organic and aqueous phases to minimize degradation of the organic solvent.

A portion of the carbonate wash solution would be sent to a mercury removal system, in which dissolved mercury in the waste would be reduced to elemental mercury using formic acid.

The metallic mercury would then be amalgamated and packaged for storage and disposal.

The transuranic bearing stream would be concentrated in an evaporator and transferred to a drier where it would be dried to a powder-like form. This remote-handled transuranic powder would be packaged and sealed in WIPP half-canisters for disposal at the Waste Isolation Pilot Plant.

The non-transuranic bearing stream would be transferred to another facility for additional processing.

Facility Descriptions: This project addresses the Transuranic Separation Facility and related facilities. The other facilities associated with this project are the:

- Bulk Chemical Storage Facility, a steel-framed structure that would be used for storage of non-radioactive bulk chemicals needed for processing.
- Low Activity Waste Collection Facility, a concrete shielded structure containing tanks that would collect low activity waste from various locations on the INTEC. This facility would be a 21.1-meters (69-feet) by 12.9-meters (42-feet) long concrete structure that houses the three collection tanks. Each collection tank has a 303-cubic meter capacity (80,000 gallons). The three tanks are located on one side of the facility behind a shield wall. The pumps used to transfer the liquids to the Transuranic Separations Facility would be located on the other side of the wall. This would reduce radiation exposures when maintenance of the pumps is required.
- Condensate Collection Facility, a steel-framed structure housing tanks that would collect condensed steam (non-radioactive) from various process and building users before transfer back to the steam plant. This facility would be a 21.1-meters (69-feet) by 12.9-meters (42-feet) structural steel building with a reinforced concrete slab floor. It houses the two 150-cubic meter (40,000 gallons) tanks that would be used to collect condensed steam from the various process heaters before transferring it back to the steam plant.

The overall dimensions of the Transuranic Separation Facility would be 101 meters (332 feet) by 55.8 meters (183 feet). It would extend 15.5 meters (51 feet) below grade and 13.5 meters (44 feet) above grade. The Transuranic Separation Facility is designed to house the equipment and systems for receiving both the SBW and calcine feed materials and separating them into the transuranic and low-activity waste streams. It would be based on a concept of centrally located, below grade, process cells with thick concrete walls surrounded by areas that contain progressively less radioactive hazards. Equipment that would be in highly radioactive service and not expected to require maintenance (e.g., tanks) would be located in the central cells. Equipment in radioactive service that would require maintenance would be located in corridors (pump and valve corridors) that are adjacent to the process cells. Finally, personnel access corridors would be located outside the pump and valve corridors and allow visual access to the pump and valve corridors via shielded windows. Stainless steel liners would be provided in areas where equipment and valves create a need for spill protection and decontamination.

In addition to the cells housing the process equipment, there would be three additional cells located at the north end of the facility. These cells would be the manipulator repair cell, for repair of manipulators and other equipment, a decontamination cell, for decontamination of equipment prior to maintenance activities, and a filter leach cell, in which process filters are treated (by leaching in nitric acid) to remove much of the contamination before they are disposed of. Administrative areas, the control room, and cold chemical make up areas would be located on the main floor (elevation 1.5 meters).

As in any nuclear facility, the Transuranic Separation Facility would be divided into ventilation zones depending on the potential for contamination. Pressure differentials would be maintained so that air flows from areas of lowest contamination potential to areas of highest contamination potential. The areas of highest potential for contamination would be maintained at the lowest pressure (typically -0.75 inch of water). Administrative areas with no contamination potential (designated clean areas) would be ventilated using separate systems designed to commercial standards.

Table C.6.2-49. Construction and operations project data for the Transuranic/Class C Separations (P49A).[a]

Generic Information	
Description/function and EIS project number:	Waste Separations Facility (P49A)
EIS alternatives/options:	Transuranic Separations Option
Project type or waste stream:	Transuranic and Class C waste
Action type:	New
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Concrete and metal structures 14,864 Existing utilities will be extended
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside new buildings
Construction Information	
Schedule start/end: Pre-construction: Construction: SO test and start-up:	 June 2000 – December 2007 January 2008 – December 2012 January 2013 – December 2014
Number of workers:	298 per yr
Heavy equipment: Equipment used: Trips: Hours of operation: (hrs)	 Excavator, grader, crane, trucks 3,669 (total) 64,110 (total)
Acres disturbed: New/Previous/Revegetated: (acres)	 None/4.5/None
Air emissions: (None/Reference) Dust: (tons/yr) Fuel combustion (diesel exhaust): Major gas (CO_2): (tons/yr) Contaminants[b]: (tons/yr) SO testing and start-up Process air emissions: (tons/yr) Fossil fuel (steam use): (tons/yr)	See Appendix C.2 for details. 64 1,385 67 0.156 17,396.34
Effluents Sanitary wastewater (constr.): (L) SO testing: Sanitary wastewater: (L/yr) Process wastewater: (L/yr)	 25,378,425 2,901,203 1,015,489
Solid wastes: Construction trash: (m^3) Sanitary/industrial trash: (m^3/yr)	 14,132 677
Radioactive waste Contaminated soil (LLW): (m^3)	 113
Hazardous/toxic chemicals & wastes Solid hazardous waste: (m^3) Used lube oil: (L)	 25 12,133
Water usage Dust control (construction): (L) Domestic water (construction): (L) Process (SO testing): (L) Domestic (SO testing): (L)	 605,600 25,378,425 846,029 11,604,810

Table C.6.2-49. Construction and operations project data for the Transuranic/Class C Separations (P49A)[a] (continued)

Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	2,160
Fossil fuel	
Heavy equipment (construction): (L)	1,798,460
Steam generation (SO testing): (L/yr)	6,097,291
Operational Information	
Schedule start/end:	January 2015 – December 2035
Treatment of sodium bearing waste:	January 2015 – December 2016
Number of workers	
Operations/Maintenance/Support:	(38)/(12)/(34) per yr
Number of radiation workers:	50/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	780
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.83E-07
Process rad. emissions: (Ci/yr)	4.83E-05
Process chemical emissions: (tons/yr)	1.56E-01
Fossil fuel emissions: (tons/yr)	17,396.34
Effluents	
Sanitary wastewater: (L/yr)	2,901,203
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	677
Radioactive wastes	
Process output:	
RH-TRU waste (HLW): (m^3)/(Ci)	220/330,000
HEPA filters (LLW): (m^3)	212
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	231
Mixed waste (LLW)	
PPEs & misc. mixed rad. waste: (m^3)	1,575
Mixed rad. liquid waste: (L)	2,238,075
Water usage	
Domestic: (L/yr)	2,901,203
Process: (L/yr)	183,168,000
Energy requirements	
Electrical: (MWh/yr)	10,600[c]
Fossil fuel	
Steam generation: (L/yr)	6,097,291
Equipment/vehicle fuel: (L/yr)	64,951

a. Sources: EDF-PDS-E-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-051.

Table C.6.2-50. Decontamination and decommissioning project data for the Transuranic/Class C Separations (P49A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2038
Number of D&D workers:	147 per yr
Number of radiation workers (D&D):	81 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-of trucks, dozers, loaders
Trips (roll-off trucks):	21 per day
Hours of operation (all heavy equipment): (hrs)	88,830
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/4.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Gases (CO_2): (tons/yr)	2,071
Contaminants[b]: (tons/yr)	100 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	9,412,767
Solid wastes	
Non-radioactive (industrial): (m^3)	20,079
Metal: (m^3)	99
Radioactive wastes	
Contaminated equipment, piping, bldg. material, & trash (LLW): (m^3)	26,704
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	9
Lube oil: (L)	16,811
Mixed waste	
Solid mixed waste: (m^3)	141
Decon solution: (L)	60,560
Water usage	
Process water: (L)	6,854,625
Domestic water: (L)	9,412,767
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	2,017,329

a. Sources: EDF-PDS-E-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.22 Class C Grout Plant (P49C)

General Project Objectives: This project is related to the Separations Alternative and describes the costs and impacts of one of the facilities supporting that alternative, the Class C Grout Plant, designated the Low Activity Waste Treatment Facility.

Process Description: The Class C Grout Plant would receive concentrated low-activity waste from another facility, the Transuranic Separations Facility. This low-activity waste would be the product of a process that chemically separates various radionuclides from the liquid sodium-bearing waste and granular solid calcined material that is currently stored at INTEC. After the transuranic nuclides have been removed from the SBW and dissolved calcine, the solution containing the remaining radionuclides would be concentrated in an evaporator and transferred to the Class C Grout Plant. The concentrated stream is subjected to a high temperature denitration process. The denitration would be accomplished in a fluidized bed that uses air as the fluidization gas and burns kerosene with oxygen to provide the reaction temperature. The nitrates in the concentrated liquid stream are evolved as nitrogen oxides. Offgas from the denitrator would be treated to reduce emissions of unburned hydrocarbons and nitrogen oxides to acceptable levels. Solids from the denitrator would be pneumatically conveyed to a storage bin. At intervals (currently assumed to be about once per month) the solids would be combined with Portland cement, blast furnace slag and flyash to form a grout. Based on the concentrations of nuclides in this mixture, the grout is expected to meet the definition of Class C LLW, as given in 10 CFR 61. These projects end with the grout ready to be pumped (pump included with this project) to disposal facilities or LLW containers. The packaging for disposal and disposal facilities are addressed in other projects.

Facility Descriptions: The Class C Grout Plant is about 57-m (187-ft) long (north-south) and about 43-m (144-ft) wide (east-west). It would extend about 22-m (72-ft) above grade and about 12-m (40-ft) below grade. The areas that contain radioactive material would be generally located below grade, in a central concrete core. Hatches in the tops of the cells would be provided for initial installation of this equipment and non-routine access later. The cell floors and walls would be lined with stainless steel to allow easy decontamination. The process areas would be located on the lower level, and consist of a number of cells that contain the waste feed storage tanks, the denitrator, offgas treatment equipment, solids separation and storage equipment, and grout mixing and pumping equipment. A decontamination cell would also be located on the lower level and provides an area where equipment can be decontaminated before hands-on maintenance is performed.

As in any nuclear facility, the Class C Grout Plant would be divided into ventilation zones depending on the potential for contamination. Pressure differentials would be maintained so that air flows from areas of lowest contamination potential to areas of highest contamination potential. The areas of highest potential for contamination would be maintained at the lowest pressure (typically -0.75 in. of water). Administrative areas with no contamination potential (designated clean areas) would be ventilated using separate systems designed to commercial standards.

Table C.6.2-51. Construction and operations project data for the Class C Grout Plant (P49C).[a]

Generic Information	
Description/function and EIS project number:	Denitrate the LAW and mix it with grout materials (P49C)
EIS alternatives/options:	Transuranic Separations Option
Project type or waste stream:	Denitrate the LAW
Action type:	New
Structure type:	Reinforced concrete
Size: (m^2)	4,413
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside the INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end	
Preconstruction:	January 2007 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	200 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,997
Hours of operations: (hrs)	24,649 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/1.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	15
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	1,149
Contaminants[b]: (tons/yr)	56
SO testing and start-up:	
Process air emissions: (tons/yr)	0.15
Fossil fuel (steam use): (tons/yr)	2,304.51
Effluents	
Sanitary wastewater (constr.): (L)	8,516,250
SO testing:	
Process wastewater: (L/yr)	18,108,795
Sanitary wastewater: (L/yr)	1,381,525
Solid wastes	
Construction trash: (m^3)	4,742
Sanitary/industrial trash: (m^3/yr)	222
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	163
Lube oil: (L)	4,665
Radioactive waste	
Contaminated soil (LLW): (m^3)	34
Water usage	
Dust control (construction): (L)	302,800
Domestic water (construction): (L)	8,516,250
Process (SO testing): (L)	36,217,590
Domestic (SO testing): (L)	2,763,050
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil	
Heavy equipment (construction): (L)	746,180.9
Steam generation (SO test.): (L/yr)	807,650.9

Table C.6.2-51. Construction and operations project data for the Class C Grout Plant (P49C)[a] (continued).

Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/ Support:	25/4/11 per yr
Number of radiation workers:	16/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	220 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation:	Included in values below
Process rad. emissions[c]: (Ci/yr)	4.44E-04
Process tritium emissions[d]: (Ci/yr)	45
Process chemical emissions[e]: (lb/hr)	11.0
Fossil fuel emissions: (tons/yr)	2,304.51
Effluents	
Sanitary wastewater: (L/yr)	1,381,525
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	222
Radioactive wastes	
Process output:	
LLW grout: (m^3)/(Ci)	22,700/40,900,000
HEPA filters (LLW): (m^3)	313
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	683
Mixed waste (LLW)	
PPEs & misc. rad waste: (m^3)	504
Mixed liquid rad. waste: (L)	3,313,586
Water usage	
Process: (L/yr)	18,108,795
Domestic: (L/yr)	1,381,525
Energy requirements	
Electrical: (MWh/yr)	6,158
Fuel oil:	
Steam generation: (L/yr)	807,650.9
Equipment/vehicle fuel: (L/yr)	18,319.4

a. Sources: EDF-PDS-G-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-046.

d. Released for 2 years via denitration process. Source: EDF-PDS-C-046.

e. Source: EDF-PDS-C-043.

Table C.6.2-52. Decontamination and decommissioning project data for the Class C Grout Plant (P49C).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2037
Number of D&D workers:	93 per yr
Number of radiation workers (D&D):	64 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	10 per day
Hours of operation (all heavy equipment): (hrs)	40,230 (total)
Acres disturbed: New/Previous/Revegetated: (acres)	None/1.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,407
Contaminants[b]: (tons/yr)	69 (total)
Effluents Sanitary wastewater: (L)	3,942,574
Solid wastes Non-radioactive (industrial): (m^3)	5,974
Radioactive wastes Building debris (LLW): (m^3)/(Ci)	7,945/79
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	7,614
Solid hazardous waste: (m^3)	3
Mixed waste (LLW) Decon solution: (L)	17,979
Water usage	
Process water: (L)	4,569,750
Domestic water: (L)	3,942,574
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	913,623

a. Sources: EDF-PDS-G-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.23 Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D)

General Project Objectives: This project would provide a facility and process for packaging, loading, and shipping to INEEL disposal facility the Class C low-level radioactive waste (LLW) grout resulting from the Transuranic (TRU) Separations process.

Project Description: Low activity waste, from the transuranic separation process, would be denitrated and combined with cement and other additives in the Class C Grout Plant, resulting in a Class C grout. The Class C grout would be pumped to the Container Filling, Storage and Shipping Area of the project. Because of the presence of the cesium and strontium in this stream, this grout would be much more radioactive than the Class A grout produced under the Full Separations Option and requires additional shielding and remote handling. Concrete landfill containers would be remotely filled with the grout and the grout is allowed to solidify. The containers would be capped, loaded into a shielded cask, transported to an INEEL landfill disposal facility and placed into the disposal facility.

New Facility Description: The Class C grout Container Filling, Storage and Shipping Area would be a new design and construction project and would be sited contiguous to or adjacent to the Class C Grout Plant. Concrete landfill containers, with a capacity of about 1 m^3 would be filled with the grout within the facility and allowed to set. Then a cap would be placed on the container and it would be surveyed and decontaminated, or covered with a coating to fix the contamination. The finished containers would be loaded into a shielded cask, transported to an INEEL landfill disposal facility and placed into the disposal facility.

The Container Filling, Storage and Shipping Area would be designed with enough space to hold 72 concrete waste containers in temporary (surge) storage. The container loading area would be located in a cell below grade. A hatch in the top of the cell would be provided for initial installation of equipment and routine access for transfer of empty and loaded waste containers and transport casks. One-meter thick concrete walls would separate the process cell and corridors to shield personnel from radiation. The Class C grout could have radiation fields as high as 123 R/hr. The cell floor and walls would be lined with stainless steel to allow easy decontamination.

The Container Filling, Storage and Shipping Area would handle 21,100 landfill disposal containers over the 22-year operating period. Type B shielded casks would be used to transport the containers to an INEEL disposal area. It is estimated that 16 of the casks would be required.

Table C.6.2-53. Construction and operations project data for the Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D).[a]

Generic Information	
Description/function and EIS project number:	Package and ship Class C grout to INEEL LLW landfill (P49D)
EIS alternatives/options:	Transuranic Separations Option
Project type or waste stream:	LAW
Action type:	New
Structure type:	Remote handled LLW handling fac.
Size: (m^2)	491
Other features: (pits, ponds, power/water/sewer lines)	Power/water/sewer/LLW decontamination collection tank
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside LAWTF
Construction Information	
Schedule start/end	
Preconstruction:	January 2007 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	21.7 per yr
Heavy equipment	Excavator, grader, crane, trucks
Trips:	745
Hours of operation: (hrs)	10,515 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	2
Fuel combustion (diesel exhaust)	
Major gas (CO_2): (tons/yr)	475
Contaminants[b]: (tons/yr)	23
Effluents	
Sanitary wastewater (constr.): (L)	923,332
Process wastewater (SO test.): (L)	587,148
Sanitary wastewater (SO test): (L)	13,777
Solid wastes	
Construction trash: (m^3)	514
Sanitary/Industrial trash: (m^3)	94
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	1,990
Solid hazardous waste: (m^3)	3
Radioactive waste	
Contaminated soil (LLW): (m^3)	4
Water usage	
Dust control (construction): (L)	1,990
Domestic water (construction): (L)	923,332
Process (SO testing): (L)	13,777
Domestic (SO testing): (L)	587,148
Energy requirements	
Electrical (Const./SO Test): (MWh/yr)	55/2,000
Fuel oil:	
Heavy equipment (construction): (L)	238,791
Other use (construction): (L)	69,513

Table C.6.2-53. Construction and operations project data for the Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D)[a] (continued).

Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers Operations/Maintenance/Support:	(7)/(0.5)/(1) per yr
Number of radiation workers:	8.5/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment Equipment used: Trips:	 Mobile cranes, forklifts, trucks 260 per yr
Air emissions: (None/Reference) Building ventilation: (Ci/yr) Fuel combustion (diesel exhaust): Major gas (CO_2): (tons/yr) Contaminants[b]: (tons/yr)	See Appendix C.2 for details. 4.36E-08 2.43 0.12
Effluents - Sanitary wastewater: (L/yr)	293,574
Solid wastes Sanitary/Industrial trash: (m^3/yr)	 47
Radioactive wastes	None
Hazardous/toxic chemicals & wastes Solid hazardous waste: (m^3) Used lube oil: (L)	 21 525
Water usage Process: (L/yr) Domestic: (L/yr)	 27,555 293,574
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L/yr)	 2,000 787

a. Sources: EDF-PDS-J-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-54. Decontamination and decommissioning project data for the Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2037
Number of D&D workers:	57 per yr
Number of radiation workers (D&D):	41 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	0.5 per day
Hours of operation (all heavy equipment): (hrs)	7,110
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	249
Contaminants[b]: (tons/yr)	12
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	2,427,036
Radioactive waste	
Building rubble (LLW): (m^3)/(Ci)	883/9
Solid wastes	
Non-radioactive:	
Building rubble: (m^3)	664
Metals: (m^3)	3
Cask disposal: (m^3)	33
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	1,346
Building demolition[c]: (m^3)	0.3
Water usage	
Process water: (L)	418,894
Domestic water: (L)	2,427,036
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	161,468

a. Sources: EDF-PDS-J-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Hg, PCBs, etc.

C.6.2.24 Class C Grout Disposal in Tank Farm and Bin Sets (P51)

General Project Objective: The Tank Farm currently stores sodium-bearing liquid waste (SBW). The Calcined Solids Storage Facility (CSSF or bin sets) stores high-level waste (HLW) calcined solids resulting from the calcination of liquid waste. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities. This project would provide for the Resource Conservation Recovery Act (RCRA) Performance-Based Clean Closure of the Tank Farm and bin sets and subsequent disposal of Class C Low-Level Waste (LLW) grout in these facilities. RCRA would no longer regulate either facility once the performance-based closure has been achieved. This would allow other uses for the remaining void spaces.

This project assumes that the facilities would be decontaminated to the maximum extent that is technically and economically practical. It is further assumed that the residual levels of contamination would meet the performance requirements for performance-based closure under RCRA. Meeting the performance criteria means:

- The waste has been removed from the tank system, and
- The contamination remaining in a tank or bin is within an acceptable risk level to the public or environment and is consistent with the remediation goals for the INTEC.

After the facilities are closed, they would then be used as LLW disposal facilities to receive the LLW grout generated by the Separations process.

Facility Descriptions: The Tank Farm consists of underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings that contain instrumentation and valving for the waste tanks. The eleven stainless steel 300,000- to 318,000-gallon tanks (hereafter referred to as 300,000-gallon tanks) are contained in underground, unlined concrete vaults. The tanks have a 50-foot diameter and an overall height of approximately 30 feet (includes the dome height). The vault floors are approximately 45 feet below grade level and are patterned after three basic designs: cast-in-place octagonal vaults, pillar-and-panel style octagonal vaults, or cast-in-place square 4-pack configuration. A thin sand layer was placed between the vault floor and tank on nine of the eleven tanks. To protect personnel from radiation, the concrete vault roofs are covered with approximately 10 feet of soil.

The 300,000-gallon tanks are used to store mixed liquid wastes. Eight of the eleven 300,000-gallon tanks contain stainless steel cooling coils, which are located on the tank walls and floors. These cooling coils were used, as required, to maintain the liquid waste below predetermined temperatures in order to minimize corrosion of the stainless steel tanks.

Liquid waste is transferred throughout the Tank Farm in underground, stainless steel lines. The stainless steel lines are housed in stainless steel-lined concrete troughs or double-walled stainless steel pipe. The waste is transferred using steam jets or airlifts. Generally, the intakes are located 4 to 12 inches above the tank floor, which limits the amount of liquid waste that can be removed from the tanks. The liquid waste that remains after the tanks have been emptied as low as possible with the steam jets and airlifts is referred to as a "heel." The heels are expected to range in volume from 5,000 to 15,000 gallons when cease use occurs.

The systems used for closure would involve remotely operated equipment to wash down the tanks, remove the heel to the extent possible, solidify the remaining heel, and fill the vault with clean grout. During the processing of the HLW in the Class C Grout Plant, grout would be pumped, at intervals, from the Grout Plant to the Tank Farm in shielded lines.

The Calcined Solids Storage Facilities contain seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. Bin set 1, the first constructed, is much smaller than the other six. In bin set 1, the bins vary in diameter from 3 feet to 12 feet, and in length from 20 feet to 24 feet. The bins in the rest of the bin sets are 12 feet to 13.5 feet in diameter and from 40 feet to almost 70 feet in length. The bins (with the exception of those in bin set 1) are equipped with retrieval risers or pipes that connect to the surface. These risers would be used during calcine retrieval operations. New risers would be installed on the bins in bin set 1 during the calcine retrieval activities. The vaults for bin sets 2 through 7 are hollow cylinders, with inside diameters of 40 feet to 60 feet, and a wall thickness of 2 feet to 4 feet. The vault for bin set 1 is a square design, with walls about 2.5 feet thick.

The systems used for closure of the bin sets would include remotely operated drilling and cutting equipment, remotely operated carbon dioxide pellet blasting systems, remotely operated robots for cleaning the interior surfaces of the bins, and equipment for filling the lines and vaults with clean grout.

The Class C grout would be pumped to the bin sets using the same systems as in the Tank Farm.

Process Description: The processes considered in this project are best described in two phases: (1) closure of the facilities as required for a RCRA interim status facility, and (2) subsequent use of the remaining tank and bin voids as a grout landfill.

RCRA Performance-Based Closure: During the closure phase, the facilities would be decontaminated to the maximum extent that is technically and economically practical. For the Tank Farm, the tanks and vaults would be washed and the resulting liquid pumped out to remove the majority of the heel waste residues. The remaining liquid heel would be solidified using clean grout. The ancillary piping, such as waste transfer lines, would be flushed and grouted with clean grout. Tank leak monitoring lances would then be installed in four equally spaced locations inside the vaults. Afterwards, the vaults would be completely filled with clean grout to prevent the intrusion of liquid and to act as a temporary cover or cap over the tank. When pouring is complete, the 11 tanks, and the sand under nine of the 11 tanks, would be encapsulated between the newly poured grout and the vault floor.

A similar closure approach is proposed for the bin sets. The interior surfaces of the bins, piping, and ancillary equipment would be decontaminated, again to the maximum extent that is technically and economically practical. It is proposed that decontamination be accomplished by blasting the contaminated surfaces with carbon dioxide pellets to minimize the generation of any secondary waste and maintain the structural integrity of the bins. This blasting process would dislodge the residual calcine remaining on the bin walls and floors. This dislodged calcine would then be removed from the bins using robots and the calcine removal equipment previously installed to remove the calcine.

It is assumed, for this project, that the bins would be sufficiently decontaminated such that performance criteria would be met. The vault void (the space between the bins and the surrounding concrete structure) would be filled with clean grout to provide added structural rigidity to the bins and minimize the chance of subsidence within the bin sets over time.

Subsequent Use: After the Tank Farm and the bin sets have been closed, they would be used as LLW grout landfills. The tank and bin voids would be filled with Class C grout that would be produced at the Grout Plant and delivered to the Tank Farm and bin sets in shielded piping.

Table C.6.2-55. Decontamination and decommissioning project data for Performance-Based Clean Closure of the Bin Sets for the Class C Grout Disposal in Tank Farm and Bin Sets (P51 & P26).[a]

Generic Information	
Description/function and EIS project number:	Performance-Based Closure of Bin sets (P51&26)
EIS alternatives/options:	Separations/TRU Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Calcine solids storage units, weather enclosure 1,347 Electrical, firewater, sewer, & water required
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside & around the calciner bins
Decontamination and Decommissioning (D&D) Information	
Schedule start/end Pre–D&D: D&D:	 March 2014 – June 2019 January 2019 – January 2034
Number of D&D workers:	49 per yr
Number of radiation workers (D&D):	49 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	1.0 per worker
Heavy equipment Equipment used: Trips : Hours of operation (all heavy equipment): (hrs)	 Cement trucks 2,147 trips 4,295
Acres disturbed: New Previous Revegetated: (acres)	 None/4.6/None
Air emissions: (None/Reference) Fuel combustion (diesel exhaust) Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) Radioactive: Calcine (cleaning): (Ci/yr)	See Appendix C.2 for details. 24.6 1.2 6.08E-09
Effluents Sanitary wastewater: (L) Grout truck wash: (L)	 20,865,000 406,000
Solid wastes Construction/D&D trash: (m^3)	 11,618
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Mixed wastes:	None
Water usage Domestic water: (L) Process water: (L)	 20,865,000 481,700
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 1,146 159,700

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-56. Decontamination and decommissioning project data for the Performance-Based Clean Closure of the Tank Farm for the Class C Grout Disposal in Tank Farm and Bin Sets (P51& P26).[a]

Generic Information	
Description/function and EIS project number:	Performance-Based Closure of Tank Farm Facility (P51&26)
EIS alternatives:	Separations/TRU Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	D&D of existing facility, LLW disposal
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside buildings
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2000 – December 2021
Number of D&D workers:	11 per yr
Number of radiation workers (D&D):	11 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	1.1 per worker
Heavy equipment	
Equipment used:	Earthmoving equipment, cement trucks, crane
Trips (roll-off trucks):	2,188 trips
Hours of operation (all heavy equipment): (hrs)	4,375
Acres disturbed	
New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Excavation dust: (tons/yr)	0.1
Fuel combustion	
Gases (CO_2): (tons/yr)	89.9
Contaminants[b]: (tons/yr)	4.4
Radioactive	
Enclosure emissions: (Ci/yr)	1.1E-07
Effluents	
Sanitary wastewater: (L)	5,148,000
Service waste: (L)	716,000
Solid wastes	
Sanitary/industrial trash: (m^3)	1,342
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes :	None
Mixed wastes:	None
Water usage	
Domestic water: (L)	5,148,000
Process water: (L)	3,089,865
Energy requirements	
Electrical: (MWh/yr)	4,372
Fossil fuel: (L)	641,844

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-57. Construction and operations project data for Bin Set Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).[a]

Generic Information	
Description/function and EIS project number:	Fill bin sets with Class C grout (P51)
EIS alternatives/options:	Separations/TRU Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	Calcine soild storage units, Weather enclosure
Size: (m^2)	1,347
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & Water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around the Calciner bins
Construction Information	
	No construction activities
Operational Information	
Schedule start/end	
Grouting operations:	January 2027 – December 2035
Number of workers:	
Operations/Maintenance/Support:	8/2/3 per yr
Number of radiation workers:	7 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	1.8 per worker
Heavy equipment	
Equipment used:	Cement trucks
Trips:	None
Hours of operation (all heavy equipment): (hrs/yr)	136
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhasut):	
Gases (CO_2): (tons/yr)	9.5
Contaminants[b]: (tons/yr)	0.5 (total)
Radioactive:	
Emissions from grouting: (Ci/yr)	1.21E-10
Effluents:	
Sanitary wastewater: (L/yr)	23,100
Solid wastes	
Sanitary industrial trash: (m^3/yr)	44
Radioactive wastes	None
Hazardous/toxic chemicals and wastes	
Lube oil (L)	18
Mixed wastes (LLW)	
PPEs & misc. rad. wastes: (m^3)	95
Mixed rad. liquid wastes: (L)	94,500
Water usage	
Domestic water: (L/yr)	23,100
Process water: (L/yr)	10,500

Table C.6.2-57. Construction and operations project data for Bin Set Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51)[a] (continued).

Operational Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	244
Fossil fuel:	
Equipment/vehicle fuel: (L/yr)	3,083

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-58. Decontamination and decommissioning project data for Bin Set Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2037
Number of D&D workers:	36 workers per yr
Number of radiation workers (D&D):	36 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Flatbed trucks
Trips:	194 trips
Hours of operation (all heavy equipment): (hrs)	583
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	54.9
Contaminants[b]: (tons/yr)	2.7 (total)
Effluents	
Sanitary wastewater: (L)	1,533,000
Solid wastes	
Building rubble: (m^3)	3,569
Metals: (m^3)	20
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	11
Use lube oil: (L)	3,370
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	177
Decon solution: (L)	170,000
Water usage	
Domestic water: (L)	1,533,000
Process water: (L)	170,000
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	17,809

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-59. Construction and operations project data for for Tank Farm Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).[a]

Generic Information	
Description/function and EIS project number:	Tank Farm fill with Class C grout (P51)
EIS alternatives/options:	Separations/TRU Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Tank Farm vaults and tanks 10,400 Electrical, firewater, sewer, & Water required
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Around the Tank Farm
Construction Information	
	No construction activities
Operational Information	
Schedule start/end Grouting operations:	 January 2015 – December 2026
Number of workers: Operations/Maintenance/Support:	 2/0.5/0.5 per yr
Number of radiation workers:	3 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	4.5 per worker
Heavy equipment Equipment used: Trips: Hours of operation (all heavy equipment): (hrs/yr)	 Crane None 257
Acres disturbed: New/Previous/Revegetated: (acres)	 None/2.6/None
Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr)	See Appendix C.2 for details. 17.9 0.9
Effluents Sanitary wastewater: (L/yr)	 4,000
Solid wastes Sanitary industrial trash: (m^3/yr)	 17
Radioactive wastes:	None
Hazardous/toxic chemicals and wastes Lube oil: (L)	 36
Mixed wasstes (LLW) PPEs & misc. mixed rad. wastes: (m^3) Decon solution: (L)	 54 85,200
Water usage Domestic water: (L/yr) Process water: (L/yr)	 4,000 7,100
Energy requirements Electrical: (MWh/yr) Fossil fuel: Equipment/vehicle fuel: (L/yr)	 108 5,813

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-60. Decontamination and decommissioning project data for Tank Farm Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2026 – December 2027
Number of D&D workers:	***8*** per yr
Number of radiation workers (D&D):	***8*** per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Flatbed trucks
Trips:	22 trips
Hours of operation (all heavy equipment): (hrs)	66
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Non-radioactive	
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	3.1
Contaminants[b]: (tons/yr)	0.2 (total)
Effluents	
Sanitary wastewater: (L)	402,000
Solid wastes	
Building rubble: (m^3)	115
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes (m^3)	9
Lube oil: (L)	382
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	7
Decon solution: (L)	17,033
Water usage	
Domestic water: (L)	402,000
Process water: (L)	17,033
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	2,017

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.25 Calcine Retrieval and Transport (P59A)

General Project Objective: The general objectives of the proposed calcine retrieval and transportation project at the INTEC are to prepare the bin sets for retrieval of the calcine, retrieve the calcine from the bin sets, and transport the retrieved calcine to the waste processing facility for processing. Each of these objectives are necessary for all waste processing alternatives except for the No Action and Continued Current Operations Alternatives.

Project Description: The complete calcine retrieval and transportation system will be discussed in three sections: bin set access, calcine retrieval, and calcine transportation.

Bin Set Access: Bin set access activities prepare the bin sets for retrieval of the calcine. A confinement enclosure and Ventilation Instrumentation and Control Building would be constructed for each bin set. A confinement enclosure, located on top of each bin set, would provide secondary confinement for bin set access and calcine retrieval activities. These enclosures would be prefabricated metal buildings with the surfaces of the enclosure coated with a strippable coating. A Ventilation Instrumentation and Control Building would be located adjacent to each bin set, housing ventilation equipment for one bin set and its associated confinement enclosure. Additionally, the instrumentation for the bin set and retrieval system would be located inside the Ventilation Instrumentation and Control Building. The retrieval and transportation system would be operated from the Ventilation Instrumentation and Control Building.

Once the confinement enclosure and Ventilation Instrumentation and Control Building are constructed, decontamination of the vaults, cells, and rooms located above the bin storage vault (also known as the superstructure of the bin set) will proceed. The ventilation, instrumentation, and operational (including the cyclone) equipment housed inside these vaults would be removed. Piping that enters the superstructure through the walls, roof, or floor would be cut at the point of entry and capped. These lines would be decontaminated during bin set closure activities after the retrievable calcine has been removed from a bin set. Piping that leads away from the bin set (such as calcine transport lines used to deliver the calcine to the bin sets) would be decontaminated at the time they are cut.

The superstructures of bin sets 1, 2, 3, and 4 would be demolished after the equipment and piping has been removed in order to provide a flat surface for retrieval activities. A thick concrete pad would be poured on top of the bin storage vaults for bin sets 1 through 4. The pad would provide additional shielding during retrieval activities. Access to the capped piping would be provided. Bin sets 5, 6, and 7 would not require the demolition of the superstructure or installation of a concrete pad. The design of these bin sets allows a confinement enclosure to be built on the roof. The superstructure would provide the necessary shielding.

Existing retrieval risers would be accessed where available. However, retrieval risers must be remotely installed in bin sets 1, 2, and 3. A remote drilling platform would be used to drill through the concrete floor of the confinement enclosure on those bin sets and a resistance type welder would be used to install a stem to the top of each bin. Each bin in bin set 1 and the center bin in bin set 2 require two retrieval risers to be installed. One retrieval riser must be installed for the remaining bins in bin set 2 and all the bins in bin set 3. The bins would be entered by remotely cutting a hole through the top of the bins but inside the newly installed retrieval risers. The retrieval risers would be capped with removable, stepped, concrete plugs.

At the end of these activities, the bin sets are ready for retrieval of the calcine.

Calcine Retrieval: The calcine retrieval and transportation occur simultaneously as a result of an integrated system. Two calcine retrieval and transportation systems would be installed. This would allow calcine from two bins within two separate bin sets to be retrieved at any given time. The various calcines can be blended to optimize the waste process, which results in minimizing the waste product volume. Each system would deliver 2,700 kilograms per hour of calcine to the waste processing facility.

Calcine would be remotely retrieved from the storage bin by two retrieval lines. The retrieval lines are sized to fit inside the retrieval risers that extend from the top of the bins to the floor of the confinement enclosure. An air jet would fluidize the calcine and a suction nozzle would remove it from the bin and place it in the transport system. It is assumed (based upon testing of bin set stored calcine and pilot plant produced calcine) that the calcine would not be significantly agglomerated, thus allowing the air jet to fluidize it.

In pilot plant studies, this retrieval method could efficiently remove 95 percent of the simulated calcine from a bin. The retrieval lines are disconnected from the system and remain in the bin after 95 percent of the calcine has been retrieved. The retrieval lines are thus available for later retrieval of the final 5 percent of the calcine.

Calcine Transportation: Currently, calcine is transported from the New Waste Calcining Facility to bin set 6 in a vacuum transport system. This method of calcine transport has proven to be reliable and safe. In industry, this type of transport system is generally accepted to have a limited transport distance of 250 to 300 feet. The optimum location for the waste processing facility is within this boundary.

The transport air blower would provide the suction to retrieve calcine from the bin sets and transport it to the waste processing facility. The exhaust air from the blower would be returned to the bin set and acts as the air jet to fluidize the calcine. Each transport system would have a back up transport pipe in case the transport line becomes plugged. The air lines would be heat traced to prevent water vapor from condensing and freezing inside. A concrete pipe chase would encase the transport lines, air lines, and heat tracing and would be covered by an earthen berm. The transport line pipe chase would run above grade.

The transportation system equipment would be housed in the waste processing facility. Each of the two transport systems would have a transport air blower, cyclone, sintered metal filter (or equivalent), high-efficiency particulate air (HEPA) filter bank, and a balancing air blower. The transport air blower would provide motive force for calcine retrieval and transport. The cyclone and sintered metal filter would separate the calcine from the transport air. The HEPA filter bank would remove 99.97 percent of the calcine remaining in the transport air before it enters the transport air blower. The balancing air blower would exhaust 10 percent of the transport air to the waste processing facility offgas system. The remaining 90 percent of the transport air would be recycled to the bin set to be used as the air jet.

If the waste processing facility were located outside the accepted range of a vacuum transport system, an intermediate transport station located midway between the bin sets and the waste processing facility would be required. The calcine would be delivered to the intermediate transport station as if it were at the waste processing facility. The calcine would be separated from the transport air and placed in a receiving bin. The transport air from the first leg of the system is filtered and recycled back to the bin set. A rotary valve would fluidize the calcine as it enters the second leg of the transport system. The calcine would be transported to the waste processing facility by the second leg of the transport system. Again the calcine would be separated from the transport air. The transport air would be recycled back to the intermediate transport system. The calcine would be gravity fed to the waste treatment process.

Table C.6.2-61. Construction and operations project data for the Calcine Retrieval and Transport (P59A).[a]

Generic Information	
Description/function and EIS project number:	Retrieve calcine from bin sets and transport to WTF (P59A)
EIS alternatives/options:	Separations/(Full Sep. & TRU Sep. Options); Non-Separations/(HIP, Direct Cement, Early Vit., ***Steam Reforming*** Options), Minimum INEEL Processing, & ***Direct Vitrification***
Project type or waste stream:	HLW calcine
Action type:	New
Structure type:	New and modified existing facilities
Size: (m^2)	2,657
Other features: (pits, ponds, lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside of building
Construction Information	
Schedule start/end	
Full Separations ***and Planning Basis Options***:[b]	
Preconstruction:	January 2004 – December 2009
Construction:	January 2010 – December 2014
SO testing and start-up:	January 2015 – December 2015
Number of workers:	100 per yr
Number of radiation workers:	90 per yr
Avg. annual rad. dose: (rem/yr)	0.25
Heavy equipment:	
Equipment used:	Excavator, grader, cranes, trucks
Trips/Hours of operations (hrs):	250/33,807 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	7
Fuel combustion (diesel gas):	
Major gas (CO_2): (tons/yr)	609
Contaminants[c]: (tons/yr)	30
Effluents	
Sanitary wastewater:	
Construction: (L):	8,516,250
SO testing: (L/yr)	388,554
Solid wastes	
Construction trash: (m^3)	4,742
SO testing:	
Sanitary/Industrial trash: (m^3/yr)	62
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	6
Lube oil: (L)	5,973
Radioactive wastes	
Contaminated soil (LLW): (m^3)	1,300
Mixed wastes (LLW)	
Misc. solid wastes (PPEs, debris): (m^3)	1,070
Decon solution: (L)	30,000
Water usage	
Dust control (Construction): (L)	605,600
Domestic (Construction): (L)	8,516,250
Domestic (SO testing): (L)	388,554

Table C.6.2-61. Construction and operations project data for the Calcine Retrieval and Transport (P59A)[a] (continued).

Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil:	
Heavy equipment & trips: (L)	791,056
Operational Information	
Schedule start/end:	
Full Separations Option[d]	January 2016 – December 2035
Number of workers	
Operations/Maintenance/Support:	6/1/4.25 per yr
Number of radiation workers:	10 (included in above totals)
Avg. annual rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fossil fuel emission: (tons/yr)	1,300.93
Building ventilation: (Ci/yr)	5.65E-08
Process radioactive emissions: (Ci/yr)	8.06E-03
Effluents	
Sanitary wastewater: (L/yr)	388,554
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	62
Radioactive wastes	
HEPA filters (LLW): (m^3)	231
Mixed wastes (LLW)	
Mixed solids: (m^3)	21
PPEs & misc. rad. waste: (m^3)	315
Mixed radioactive liquid wastes: (L)	2,442,825
Water usage - Domestic: (L/yr)	388,554
Energy requirements	
Electrical: (MWh/yr)	89
Fossil fuel (steam generation): (L/yr)	455,920

a. Sources: EDF-PDS-C-007; EDF-PDS-L-002***; Casper (2000)***.

b. Schedule for other alternatives/options:

Planning Basis Option: Preconstruction: January 2009 – December 2013/Construction: January 2014 – December 2018/SO test and start-up: January 2019 – December 2019.

TRU Separations Option & Non-Separations Alternative (HIP Waste, Direct Cement, & Early Vitrification Options): Preconstruction: January 2004 – December 2008; Construction: January 2009 – December 2013; SO test and start-up: January 2014 – December 2014.

Minimum INEEL Processing Alternative: Preconstruction: January 2002 – December 2006; Construction: January 2007 – December 2010; SO test and start-up: January 2010 – December 2010.

Direct Vitrification Alternative: Preconstruction: October 2010 – September 2016; Construction: October 2016 – September 2021; SO test and start-up: October 2021 – September 2022.

c. CO, particulates, NO$_x$, SO$_2$, hydrocarbons.

d. Operations schedule for other alternatives/options:

Planning Basis Option: January 2020 – December 2035.

TRU Separations Option & Non-Separations Alternative (HIP Waste, Direct Cement, & Early Vitrification Options): January 2015 – December 2035.

Steam Reforming Option: January 2016 – December 2035.

Minimum INEEL Processing: January 2011 – December 2025.

Direct Vitrification Alternative: October 2022 – December 2035.

Table C.6.2-62. Decontamination and decommissioning project data for the Calcine Retrieval and Transport (P59A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end[b]:	***January 2036 - December 2036***
Number of D&D workers:	160 per yr
Number of radiation workers (D&D):	102 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment Equipment used: Trips (roll-off trucks): Hours of operation (all heavy equipment): (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 9 per day 17,865
Acres disturbed New/Previous/Revegetated: (acres)	 None/0.5/None
Air emissions: (None/Reference) Fuel combustion (diesel exhaust) Gases (CO_2): (tons/yr) Contaminants[c]: (tons/yr)	See Appendix C.2 for details. 1,250 61 (total)
Effluents Sanitary wastewater: (L)	 3,412,304
Solid wastes Non-radioactive (industrial): (m^3)	 3,597
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage Process water: (L) Domestic water: (L)	 761,625 3,412,304
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 156 405,714

a. Sources: EDF-PDS-C-007; EDF-PDS-L-002.

b. Minimum INEEL Processing Alternative: January 2026-December 2026.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.26 Calcine Retrieval and Transport Just-in-Time (P59B)

General Project Objective: The general objectives of the proposed calcine retrieval and transportation project at INTEC are to prepare the bin sets for retrieval of the calcine, retrieve the calcine from the bin sets, and transport the retrieved calcine to a treatment facility for processing.

Process Description: The calcined solids currently stored in the Calcined Solids Storage Facilities (CSSF), also referred to as the bin sets, would be retrieved so that additional treatment can be performed to convert this waste to an acceptable final form. This project includes the modifications necessary to access the bin sets, the calcine retrieval systems that would be deployed in the bins, and the calcine transportation systems that would transfer the calcine to the treatment facilities.

Calcine would be remotely retrieved from the storage bin by two retrieval lines. The retrieval lines would be sized to fit inside the retrieval risers that extend from the top of the bins to the floor of the confinement enclosure. An air jet would fluidize the calcine and a suction nozzle would remove it from the bin and place it in the transport system. It is assumed (based upon testing of bin set stored calcine and pilot plant produced calcine) that the calcine would not be significantly agglomerated thus allowing the air jet to fluidize it. The transport system would then pneumatically convey the calcine to the treatment facility. The start of retrieval and the retrieval durations would support "just-in-time" delivery of the calcine to a waste treatment facility.

Facility Description: The bin sets are, simply, arrangements of large cylindrical vessels installed underground (to take advantage of the natural shielding) that are used to store the granular sand-like solids that resulted from the processing of high-level liquid waste in fluidized bed calciners. Confinement enclosures and Ventilation Instrumentation and Control buildings would be constructed for each bin set. The confinement enclosure, located on top of each bin set, would provide secondary confinement for bin set access and calcine retrieval activities. These enclosures would be prefabricated metal buildings. A negative pressure would be maintained inside the enclosures. The equipment necessary for retrieval would be housed inside the enclosure. It would be used to place retrieval equipment and remote drilling equipment. The surfaces of the enclosure would be coated with a strippable coating. The enclosure would be decontaminated several times; therefore workers can enter it, if necessary. A Ventilation Instrumentation and Control building would be located adjacent to each bin set. Each Ventilation Instrumentation and Control building would contain ventilation equipment for one bin set and its associated confinement enclosure. The instrumentation for the bin set and retrieval system would be located inside the Ventilation Instrumentation and Control building. The retrieval and transportation system would be located inside the Ventilation Instrumentation and Control building. The retrieval and transportation system would be operated from the Ventilation Instrumentation and Control building.

Existing retrieval risers would be accessed where available. However, retrieval risers would have to be remotely installed in bin sets 1, 2, and 3. A remote drilling platform would be used to drill through the concrete floor of the confinement enclosure on those bin sets and a resistance type welder would be used to install a stem to the top of each bin.

Table C.6.2-63. Construction and operations project data for the Calcine Retrieval and Transport Just-in-Time (P59B).[a]

Generic Information	
Description/function and EIS Project number:	Retrieve calcine from bin sets and transport to Waste Treatment Facility for transport to Hanford JIT (P59B)
EIS alternatives/options:	Minimum INEEL Processing Alt.
Project type or waste stream:	HLW calcine
Action type:	New
Structure type:	New facility
Size: (m^2)	2,657
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end	
Preconstruction:	January 1, 2019 – December 1, 2022
Construction:	January 1, 2023 – December 1, 2026
SO test and start-up:	January 1, 2027 – December 1, 2027
Number of workers:	224 per yr
Number of radiation workers:	202
Avg. annual worker rad. dose: (rem/yr)	0.25
Heavy equipment:	
Equipment used:	Excavator, grader, cranes, trucks
Trips:	250
Hours of operation: (hrs)	23,830 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	7
Fuel combustion (diesel gas)	
Contaminants[b]: (tons/yr)	22
Effluents	
Sanitary wastewater (constr.): (L)	18,690,774
Sanitary wastewater (SO test.): (L/yr)	293,574
Process wastewater (SO test.): (L/yr)	2,068
Solid wastes:	
Construction trash: (m^3)	10,408
Sanitary/ind. trash (SO test.): (m^3/yr)	47
Radioactive wastes: (m^3)	85
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	9.8
Water usage	
Dust control (construction): (L)	593,156
Domestic (construction): (L)	18,690,774
Domestic (SO testing): (L)	268,640

Table C.6.2-63. Construction and operations project data for the Calcine Retrieval and Transport Just-in-Time (P59B)[a] (continued)

Construction Information (continued)	
Energy requirements Electrical: (MWh/yr) Fossil fuel: Equipment/vehicle fuel: (L)	 180 564,482
Operational Information	
Schedule start/end:	January 2028 – March 2030
Number of workers Operations/Maintenance/Support:	 4/1/3.5
Number of radiation workers:	5 (included in above totals)
Avg. annual worker rad. dose:	0.19 rem/yr
Heavy equipment:	None
Air emissions: (None/Reference) Building ventilation: (Ci/yr) Process rad. emissions: (Ci/yr)	See Appendix C.2 for details. 1.19E-07 1.52E-05
Effluents Sanitary wastewater: (L/yr)	 293,574
Solid wastes Sanitary/industrial trash: (m^3/yr)	 47
Radioactive wastes HEPA filters: (m^3/yr) Misc. rad. wastes (mixed): (m^3/yr)/(Ci/yr)	 6 0.07/7
Hazardous/toxic chemicals & wastes Paints, solvents, etc. (LLW): (m^3/yr)/(Ci/yr)	 1/<1
Water usage Process: (L/yr) Domestic: (L/yr)	 1,935,210 293,574
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 187 None

a. Sources: EDF-PDS-C-044; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-64. Decontamination and decommissioning project data for the Calcine Retrieval and Transport Just-in-Time (P59B).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	March 15, 2030 – March 14, 2032
Number of D&D workers:	78 per yr
Number of radiation workers (D&D):	53 new workers/yr
Avg. annual worker radiation dose:	0.25 rem/yr per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	9 per day
Hours of operation (all heavy equipment): (hrs)	30,130
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion contaminants[b]:	
(tons/yr)	51 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	3,310,883
Solid wastes	
Non-radioactive (industrial): (m^3)	3,597
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	2
Radioactive wastes	
Rad. waste (LLW): (m^3)/(Ci)	4,442/47.8
Radioactive (mixed waste): (m^3)/(Ci)	94/1
Water usage	
Process water: (L)	1,523,250
Domestic water: (L)	3,310,883
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	684,252

a. Sources: EDF-PDS-C-044; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.27 Vitrified HLW Interim Storage (P61)

General Project Objective: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a facility to receive and store the vitrified non-separated waste. The storage would be for an interim period of time until a repository is ready to receive the waste.

Project Description: The scope of included work for this project is the effort to construct, operate, and decommission a facility to receive and store the vitrified non-separated waste canisters. The vitrified treated waste would be placed in storage canisters that are qualified and approved for shipment to a repository. The canisters would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. The canisters would be loaded at the vitrification facility and sent directly to the Interim Storage Facility on a transfer cart through an underground transfer cart tunnel.

Facility Description: The Interim Storage Facility would be located at the INTEC and would be capable of receiving, handling, and storing the waste canisters. The Interim Storage Facility would be newly designed and constructed and sited adjacent to the process building.

The new Interim Storage Facility would be designed to hold waste canisters in vertical sealed storage tubes located in a concrete storage vault. The storage tube would provide structural support for the stacked canisters with each storage tube holding three canisters. The storage vault would have a concrete floor and walls with inlet and outlet air cooling ducts. The roof of the storage vault would be a composite steel and concrete structure called the charge face structure. The storage tubes would be located in holes in the charge face structure extending down to the floor of the storage vault. Removable shield plugs in the charge face structure would be removed and replaced as the canisters are placed in the storage tubes. Two canister-handling machines would be located above the charge face structure. The canister handling machines are designed to move and handle the canisters.

After each canister is prepared for storage at the process facility, it would be placed in a transfer cart. The transfer cart would then move to the new Interim Storage Facility through a below ground transfer cart tunnel to a transfer cart reception bay at the new Interim Storage Facility. The canister-handling machine would have overhead access to the canisters in the transfer carts and would remove the canisters from the handling cart through the charge hall floor up into a shielded storage cask. The waste-handling machine would then be positioned over the designated storage tube, where it would remove the shielded plug, place the canister in the tube, and replace the plug.

Supplementary lag storage locations would be provided at the end of the transfer cart tunnel to provide more immediate storage in the event of equipment maintenance or failure. This would help prevent a bottleneck in shipments from the production line. The work associated with the loading of the canister at the process facility and with the removal and shipping of the canisters to the disposal facility is not within the scope of this project.

Table C.6.2-65. Construction and operations project data for Vitrified HLW Interim Storage (P61).[a]

Generic Information	
Description/function and EIS project number:	Long-term storage for contain awaiting shipment to NGR (P61)
EIS alternatives/options:	Early Vitrification & ***Vitrification without Calcine Separations Options***
Project type or waste stream:	Treated HLW calcine
Action type:	New
Structure type:	
Size: (m^2)	13,493
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end: ***(Early Vitrification Option)***[b]	
Preconstruction:	July 2005 – December 2009
Construction:	January 2010 – December 2013
SO test and start-up:	January 2014 – December 2014
Number of workers:	114 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	2,191 trips
Hours of operations: (hrs)	50,548 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/5.0/None
Air emissions (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	
Fuel combustion (diesel exhaust):	72
Major gas (CO_2): (tons/yr)	1,042
Contaminants[c]: (tons/yr)	51
Effluents	
Sanitary wastewater (constr.): (L)	9,708,525
Sanitary wastewater (SO test.): (L)	224,498
Solid wastes	
Construction trash: (m^3)	5,406
Sanitary/ind. trash (SO test.): (m^3/yr)	36
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	220
Used lube oil: (L)	31,888
Radioactive wastes	
Contaminated soil (LLW): (m^3)	103
Water usage	
Dust control (construction): (L)	2,056,032
Domestic (construction): (L)	9,708,525
Domestic (SO testing): (L)	224,498
Energy requirements	
Electrical	
Construction: (MWh/yr)	156
SO testing: (MWh/yr)	4,368
Fossil fuel	
Heavy equipment (construction): (L)	1,147,953
Other use (construction): (L)	204,561

Table C.6.2-65. Construction and operations project data for Vitrified HLW Interim Storage (P61)[a] (continued)

Operational Information	
Schedule start/end:	January 2015 – indefinite
Number of workers Operations: Maintenance: Support:	 4 1 1.5
Number of radiation workers:	4.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents Sanitary wastewater: (L/yr)	 224,498
Solid wastes: Sanitary/industrial trash: (m^3/yr)	 36
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 4,368 None

a. Sources: EDF-PDS-H-004; EDF-PDS-L-002***; Casper (2000)***.

b. ***Vitrification without Calcine Separations Option: Preconstruction: March 2004-September 2008; Construction: October 2008-September 2012; SO testing and startup: October 2012-September 2013; Operations: October 2013-indefinite.***

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-66. Decontamination and decommissioning project data for Vitrified HLW Interim Storage (P61).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	Unknown
Number of D&D workers:	249 per yr
Number of radiation workers (D&D):	25.3 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	None expected (0.25 per worker if found)
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	9 per day
Total hours of operation: (hrs)	50,220
Acres disturbed:	
New/Previous/ Revegetated: (acres)	None/5.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	1,171
Contaminants[b]: (tons/yr)	57
Effluents	
Sanitary wastewater: (L)	15,901,630
Solid wastes	
Non-radioactive:	
Building rubble: (m^3)	42,946
Metals: (m^3)	91
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	9,504
Solid hazardous wastes: (m^3)	22
Water usage	
Domestic water: (L)	15,901,630
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,140,496

a. Sources: EDF-PDS-H-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.28 Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository (P62A)

General Project Objective: The proposed project encompasses the handling and loading of transport casks with vitrified non-separated HLW canisters before immediate transport to a national geological repository. Rail transport is assumed with the rail cask modeled after an existing spent fuel transport cask. The handling and loading of casks would occur in the Interim Storage Facility after all canisters had been produced and transferred into the Interim Storage Facility from the vitrification facility. Handling and loading of casks would occur over a 20-year time period but would not start before the repository was opened to accept HLW. Loaded cask transport from the Idaho National Engineering and Environmental Laboratory (INEEL) to the repository, subsequent handling at the repository, and empty cask return to the INEEL are beyond the scope of this study.

Process Description: Approximately 12,000 canisters would be produced by the vitrification facility over a 20-year timeframe and stored in the Interim Storage Facility. Since the Interim Storage Facility is not designed to handle incoming canisters for storage and cask loading simultaneously, it is assumed that cask handling and loading of canisters would not start until all canisters had been produced and placed into interim storage. It is also assumed that cask loading would occur over a 20-year period.

Each canister would contain 0.72 cubic meters (nominal) of vitrified HLW and be based on the Savannah River Site-type stainless steel canister. All canisters would be remote handled and would be clean and without outer surface contamination prior to cask loading.

All shipments to the repository would require the use of a Type-B shielded shipping packaging (cask). The shipping cask chosen as the model for canister transport is the MP-187, a commercial, spent-fuel type, rail cask currently being processed for certification by the U.S. Nuclear Regulatory Commission (NRC). Each shipping cask would be capable of transporting four HLW canisters; however, to transport the HLW canisters in this cask, the application for NRC approval would need to be amended and approved by NRC. In addition, the cask configuration would have to be modified to NRC requirements because the total plutonium content of four HLW canisters exceeds 20 curies. This modification would also require NRC's approval.

An estimated 32 casks with internals and railcars (including standby units) would be required to continuously transport canisters to the repository. The round trip time duration of casks and railcars for an uninterrupted disposal operation is estimated to be four weeks and would require 16 casks to be in operation throughout the duration. The standby of eight empty casks with railcars at INEEL and eight at the repository would allow two extra weeks of time duration to accommodate loading, unloading, cask maintenance, weather, and railroad logistics problems. The Interim Storage Facility would load four canisters per day into a cask, thereby producing four casks per week for immediate transport to the repository. With 4 railcars loaded with casks shipped per week, 26 rail carrier trips to the repository would be made per year.

The packaging, loading, and transport process is as follows:

- Load four casks and railcars (duration one-week).
- Transport four casks and railcars by commercial train to a railhead near the repository (duration one-week).
- Transport four loaded casks from the railhead to the repository by truck and return with four empty casks (duration one-week).
- Return four empty casks with railcars via commercial train to the INEEL (duration one-week).

Table C.6.2-67. Construction and operations project data for the Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository (P62A).[a]

Generic Information	
Description/function and EIS project number:	Package and load vitrified HLW canister into RMC via ISF (P62A)
EIS alternatives/options:	Early Vitrification & ***Vitrification without Calcine Separations Options***
Project type or waste stream:	Waste mgt. pgm., HAW disposal
Action type:	New
Structure type	None
Size: (m^2)	0
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Interim Storage Facility (ISF)
Construction Information (procurement only)	
Schedule start/end:	
Design & procurement spec.:	Unknown
Cask construction:	Unknown
Number of workers:	No construction data is required - procurement only (fabricate 32 casks with internal support and railcars).
Number of radiation workers:	
Avg. annual worker rad. dose: (rem/yr)	
Heavy equipment:	
Equipment used:	
Acres disturbed:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	
Operational Information	
Schedule start/end:	Unknown
Number of workers	
Operations:	3 per yr
Maintenance:	0.5 per yr
Support:	3 per yr
Number of radiation workers:	2.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	224,498
Solid wastes	
Sanitary/industrial trash (m^3/yr):	36
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements	
Electrical: (MWh/yr)	4,368
Fossil fuel: (L)	None

a. Sources: EDF-PDS-I-003; EDF-PDS-L-002.

Table C.6.2-68. Decontamination and decommissioning project data for the Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository (P62A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	Unknown
Number of D&D workers:	10 per yr
Number of radiation workers (D&D):	0 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	None expected, if found 0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, Loaders
Trips:	9 per day
Total hours of operation: (hrs)	27,000
Acres disturbed:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	630
Contaminants[b]: (tons/yr)	31 (total)
Effluents	
Sanitary wastewater: (L)	586,141
Solid wastes	
Non-radioactive:	
Neutron shielding: (m^3)	91
Metals: (m^3)	172
Industrial: (m^3)	165
Hazardous/toxic chemicals & wastes	
Lead: (m^3)	109
Lube oil: (L)	5,110
Radioactive wastes:	None
Water usage	
Domestic water: (L)	586,141
Process water: (L)	913,950
Energy requirements	
Electrical: (MWh/yr)	135
Fossil fuel: (L)	613,170

a. Sources: EDF-PDS-I-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.29 Mixing and Hot Isostatic Pressing (P71)

General Project Objectives: The project described in this project summary is part of the Hot Isostatic Press (HIP) Waste Option for treating calcined waste at the INTEC. All of the sodium-bearing waste at the INTEC would be calcined through the existing New Waste Calcining Facility under a separate project. The HIPing process would involve mixing the calcine with amorphous silica and titanium powder in special cans, then applying a HIP technology to produce a glass-ceramic. The resulting product would then be packed into Savannah River Site (SRS) canisters for ultimate disposal in a national geological repository. The information presented here describes plans for the design, construction, and operation of HIP facilities.

Process Description: This project directly interfaces with calcine retrieval at the front end and with HIP product interim storage at the back end (both are separate projects). The HIP facility would be set up in four separate process lines or trains, each of which is the same. Each of the four process lines would be designed to operate simultaneously with the other lines, but independent of them. This process description follows one line through from beginning to end.

Calcine treatment by mixing and HIPing begins by taking calcine from the retrieved-calcine storage hoppers (calcine retrieval is covered under another project) and transporting it to a temporary storage cell in the HIP facility. In the temporary storage cell, the calcine would be sized in a ball mill and fed into a storage/blending vessel (a ribbon blender). Pre-sized amorphous silica and titanium (or aluminum) powder would be added with the calcine in the blender in portions specified by the selected recipe. The mixture containing around 70% calcine is blended and about 1600 lbs. of the homogenous feed would be fed to a stainless steel HIP can (approximately 2 feet in diameter by 3 feet high). A lid with a venting tube would be welded to the can, and the filled can would be devolatilized for approximately 24 hours at about 650°C. The offgas would be vented to the offgastreatment system. The can would be evacuated to 0.5 torr, the vent/evacuation port is welded shut, and the can placed into one of 3 HIPing vessels. The HIPing vessel (filled with one can) would be pressurized with argon and heated to 1050°C. The final pressure inside the HIPing vessel after it is heated would be about 20,000 psi. The HIPing step (including overpacking, placement in the HIP vessel, pressurization, heatup, and time at temperature or soaking) would take about 24 hours.

After the HIPing step is complete the argon gas would be evacuated and analyzed for radioactivity to determine whether the HIP can was breached. (If it was breached that material would be recycled through the process). If the analysis indicates that the can was not breached, the can would be unloaded from the HIPing machine and allowed to cool. Once an SRS disposal canister is filled with 3 HIP cans, the canister would be welded closed and transported to interim storage. (The interim storage facility, canister-transport tunnel, and cars are covered under another project.)

The HIPing facility would be designed for a production rate of 9 cans per day with an operating schedule consisting of 10 hour days, 4 days per week. A down time of 50% is allowed for maintenance. About 5,700 canisters of HIP HLW would be produced by the HIP facility.

Facility Description: The HIP facility would be located in close proximity to the bin sets. The HIP facility would be designed to house the equipment and operations for processing waste and provide essential features for safe and efficient operation and maintenance of the facility. Its layout is based on centrally located process cells with heavy concrete walls for shielding. Limited personnel access is provided. The cells are intended to house equipment that presents a high radiation hazard but requires minimal maintenance. The HIP facility would be set up on two levels: a below grade level and an above grade level. The cells on each level would be set up in four rows where each row houses a process train. An heating, ventilation, and air conditioning canyon would run between the first and second row and the third and fourth rows for a total of two heating, ventilation, and air conditioning canyons per level. On each level operating corridors would run around the outer perimeter of the four rows of cells and between the second and third rows of cells. This would cause each row to have an operating corridor next to one wall and on each end. The perimeter of the facility would contain office space, support facilities and non-radioactive operation areas. The building would occupy an area measuring 302 × 320 feet.

The HIP facility below-grade level would contain six cells in each of the four rows. These cells would provide storage for pallets of empty HIP cans and contain equipment for filling, welding and decontaminating the HIP cans. A cell for sizing/grinding off spec HIP cans would also be provided. Also, on the below grade level are the bottom of the HIP cell, which contains the HIPing furnace and the bottom of a cell for leading the final product canisters for transport to interim storage.

Each of the four rows in the above grade level would contain eleven process cells with 3-ft-thick reinforced concrete walls for shielding. Each set of eleven cells would contain blending equipment, decontamination chemical tank storage, a fill tank, and weld equipment. Also included would be decontamination, devolatilization/heat/weld, HIP, QA/assay, canister loading, load-out, remote maintenance, and crane maintenance cells. The HIPing and final loading cells would be continued from below grade.

Table C.6.2-69. Construction and operations project data for the Mixing and Hot Isostatic Pressing (P71).[a]

Generic Information	
Description/function and EIS project number:	Hot isostatically press HLW calcine for storage awaiting shipment (P71)
EIS alternatives/options:	***Non-Separations/***HIP Waste Option
Project type or waste stream:	HIPed HLW calcine
Action type:	New
Structure type:	New Hot Isostatic Press Facility Bldg.
Size: (m^2)	16,722
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside HIPing Facility
Construction Information	
Schedule start/end	
Preconstruction:	July 2000 – December 2007
Construction:	January 2008 – December 2011
SO test and start-up:	January 2012 – December 2014
Number of workers:	100 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,156 trips
Hours of operation: (hrs)	71,200 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/6.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	89
Fuel combustion (diesel exhaust)	
Major gas (CO_2): (tons/yr)	276
Contaminants[b]: (tons/yr)	13
SO testing and start-up:	
Process air emissions: tons/yr	6
Fossil fuel (steam use): (tons/yr)	7,917.09
Effluents	
Sanitary wastewater (constr.): (L)	8,516,250
Sanitary wastewater (SO test.): (L/yr)	1,535,196
Process wastewater (SO test.): (L/yr)	1,142,425
Solid wastes	
Construction trash: (m^3)	4,742
Sanitary/Industrial trash: (m^3/yr)	433
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	12,941
Solid hazardous waste: (m^3)	456
Radioactive waste	
Contaminated soil (LLW): (m^3)	128
Water usage	
Dust control (construction): (L)	605,600
Domestic (construction): (L)	8,516,250
Process (SO testing): (L)	308,000,000
Domestic (SO testing): (L)	4,605,588

Table C.6.2-69. Construction and operations project data for the Mixing and Hot Isostatic Pressing (P71)[a] (continued).

Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	156
Fuel oil:	
Heavy equipment & trips: (L)	1,719,894
Steam generation (SO testing): (L/yr)	2,774,749
Process use (SO testing): (L)	2,498
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations:	29 per yr
Maintenance:	15 per yr
Support:	34 per yr
Number of radiation workers:	22 (included in above totals)
Avg. annual rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.99E-07
Process rad. emissions: (Ci/yr)	9.10E-02
Fossil fuel emissions: (tons/yr)	7,917.09
Process chem. emissions[c]: (lb/hr)	12
Effluents	
Sanitary wastewater: (L/yr)	1,535,196
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	433
Radioactive wastes	
Process output:	
HLW (Hot Isostatic Press): (m^3)/(Ci)	3,400/40,700,000
HEPA filters (LLW): (m^3)	243
Hazardous/toxic chemicals & wastes:	None
Mixed waste (LLW)	
Solid mixed waste: (m^3)	63
PPEs & misc. rad. waste: (m^3)	693
Mixed rad. liquid waste: (L)	2,569,119
Water usage	
Process: (L/yr)	102,649,200
Domestic: (L/yr)	1,535,196
Energy requirements	
Electrical: (MWh/yr)	8,472
Fuel oil:	
Steam generation: (L/yr)	2,774,749
Equipment/vehicle fuel: (L/yr)	833

a. Sources: EDF-PDS-C-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-043.

Table C.6.2-70. Decontamination and decommissioning project data for the Mixing and Hot Isostatic Pressing (P71).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2040
Number of D&D workers:	198 per yr
Number of radiation workers (D&D):	146 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Trips (roll-off trucks):	15 per day
Total hours of operation:	76,950 hours
Acres disturbed	
New/Previous/ Revegetated: (acres)	None/6.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Fuel combustion	
Gases (CO_2): (tons/yr)	1,794
Contaminants[b]: (tons/yr)	87 (total)
Effluents	
Sanitary wastewater: (L)	12,619,592
Solid wastes	
Non-radioactive (industrial): (m^3)	26,193
Radioactive waste	
Sand & frit (LLW): (m^3)	34,836
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	12
Used lube oil: (L)	24,272
Mixed waste (LLW)	
Solid mixed waste: (m^3)	141
Decon solution: (L)	68,130
Water usage	
Process water: (L)	6,854,625
Domestic water: (L)	12,619,592
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,747,535

a. Sources: EDF-PDS-C-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.30 Interim Storage of Hot Isostatic Pressed Waste (P72)

General Project Objective: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a facility to receive and store the waste-filled canisters produced in the Hot Isostatic Press (HIP) option. The storage would be for an interim period of time until a repository is ready to receive the waste.

Project Description: This project provides for a facility for the interim storage of the waste-filled canisters produced by the HIPed Waste option. The HIP treated waste would be placed in storage canisters that are qualified and approved for shipment to a repository. It is estimated that the HIP process option would generate 5,700 canisters. The Savannah River Site-type canisters would be loaded at the HIP Facility and sent directly to the Interim Storage Facility on a transfer cart through an underground transfer cart tunnel. The canisters would be delivered at a rate of 3 per day.

Two Interim Storage Facility concepts (a new or modified existing facility) have been evaluated for the storage of the HIP waste. Either facility would be located at the INTEC and would be capable of receiving, handling, storing, retrieving, and loading the waste canisters.

New Facility Description: If a new Interim Storage Facility is built, it would be all new design and construction and would be sited adjacent to the HIP Facility. Storage tubes in the new Interim Storage Facility would hold waste canisters in vertical sealed storage tubes located in a concrete storage vault with each storage tube holding three canisters.

After each canister is prepared for storage at the process facility, it would be moved on a transfer cart through a below ground transfer cart tunnel to a reception bay at the new Interim Storage Facility. The canister-handling machine would have overhead access to the canisters in the transfer carts and would remove the canisters from the handling car. The canister-handling machine would then be positioned over the designated storage tube, where it would remove the shielded plug, place the canister in the tube, and replace the plug.

Supplementary lag storage locations would be provided at the end of the transfer cart tunnel to provide more immediate storage in the event of equipment maintenance or failure. This would help prevent a bottleneck in shipments from the production line.

When the waste canisters are removed for shipment to disposal, the process would be reversed. The canisters would be moved from the storage tube by the canister-handling machine to a location directly above the shipping cask bay and placed in the shipping cask. A rail car load-out bay called the shipping cask bay would be incorporated into the facility. A specialized cask maneuvering hydraulic platform would be provided to upright and recline the shipping cask for loading while on the rail car.

Modified Existing Facility: If an existing building is to be modified rather than building a new one, the modified Interim Storage Facility would be located in the building originally built to contain the Fuel Processing Restoration process. That project was cancelled with the building mostly finished, but before most of the process equipment was installed. Internal specific areas of the building would have to be modified and/or finished to provide the modified Interim Storage Facility. The major reason that the Fuel Processing Restoration building was evaluated for the modified Interim Storage Facility are the existing concrete vaults that would have held the radioactive process equipment.

The modified Interim Storage Facility was designed to hold waste canisters in vertical sealed storage tubes. The storage tubes would be located in a concrete storage vault just as described for a new facility but would hold four canisters.

The concrete walls between the existing process vaults would be removed to form one storage vault. A steel grid arrangement would be installed on the existing concrete floor of the vault to level and position the storage tubes, and a steel lining would be installed on the east vault wall to provide the additional necessary personnel shielding. The bottoms of the storage tubes would be sealed with steel plate and the tops would be closed with steel shield plugs. Spacers would be used at the top of the pipes to position them and provide radiation shielding. The spacers and the pipes would be welded together to provide adequate air sealing so the fans can force the flow of cooling air from east to west. The combinations of spacers and pipe plugs would form a relatively flat floor.

After each canister is prepared for storage at the process facility, it would moved in a transfer cart into a shielded storage cask just as described above for a new Interim Storage Facility. Likewise, a shipping cask bay is incorporated into the facility and would be equipped with specialized cask maneuvering hydraulic platform.

Table C.6.2-71. Construction and operations project data for Interim Storage of Hot Isostatic Pressed Waste (P72).[a]

Generic Information	
Description/function and EIS project number:	Long-term storage for containers awaiting shipment to NGR (P72)
EIS alternatives/options:	Non-Separations/HIP Waste Option
Project type or waste stream:	Treated HLW calcine
Action type:	New
Structure type	
Size: (m^2)	7,283
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Interim Storage Facility
Construction Information	
Schedule start/end:	
Preconstruction:	July 2006 – December 2010
Construction:	January 2011 – December 2013
SO test and start-up:	January 2014 – December 2014
Number of workers:	92 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, trucks, grader, cranes
Trips:	1,349 trips
Hours of operation: (hrs)	33,332 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/3.0/ None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	43
Fuel combustion (diesel exhaust)	
Major gas (CO_2): (tons/yr)	907
Contaminants[b]: (tons/yr)	44
Effluents:	
Sanitary wastewater (constr.): (L)	5,876,213
Sanitary wastewater (SO test.): (L)	224,498
Solid wastes:	
Construction trash: (m^3)	3,272
Sanit./ind. trash (SO test): (m^3/yr)	36
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	218
Lube oil: (L)	6,308
Radioactive waste	
Contaminated soil (LLW): (m^3)	56
Water usage	
Dust control (construction): (L)	771,005
Domestic (construction): (L)	5,876,213
Domestic (SO testing): (L)	224,498
Energy requirements	
Electical (MWh/yr)	156
Fossil fuel	
Heavy equipment: (L)	756,964
Other fuel use: (L)	125,945

Table C.6.2-71. Construction and operations project data for Interim Storage of Hot Isostatic Pressed Waste (P72)[a] (continued).

Operational Information	
Schedule start/end:	January 2015 – indefinite
Number of workers Operations/Maintenance/Support:	3/0.5/3
Number of radiation workers:	2.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents Sanitary wastewater: (L/yr)	224,498
Solid wastes: Sanitary/Industrial trash: (m^3/yr)	36
Hazardous/toxic chemicals & wastes:	None
Radioactive waste:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements	
Electrical: (MWh/yr)	4,368
Fossil fuel: (L)	0

a. Sources: EDF-PDS-H-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-72. Decontamination and decommissioning project data for the Interim Storage of Hot Isostatic Pressed Waste (P72).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	Unknown
Number of D&D workers:	154 per yr
Number of radiation workers (D&D):	16 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	9 per day
Total hours of operation:	35,640 hours
Acres disturbed:	
New/ Previous/Revegetated: (acres)	None/3.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	831
Contaminants[b]: (tons/yr)	40 (total)
Effluents	
Sanitary wastewater: (L)	9,818,799
Solid wastes	
Non-radioactive (industrial): (m^3)	22,985
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	4
Lube oil: (L)	6,745
Water usage	
Domestic water: (L)	9,818,799
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	809,384

a. Sources: EDF-PDS-H-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.31 Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository (P73A)

General Project Objectives: The proposed project encompasses the handling and loading of transport casks with Hot Isostatic Pressed (HIPed) high-level waste (HLW) canisters preparatory to immediate transport to the National Geological Repository. Rail transport is assumed with the rail cask modeled after an existing spent fuel transport cask. The handling and loading of casks would occur in the Interim Storage Facility after all HIPed canisters have been produced and transferred into the Interim Storage Facility from the HIP Facility. The HIP would produce about 5,700 canisters. Handling and loading of casks would occur over a 20-year time period but would not start before the repository was opened to accept HLW.

Loaded cask transport from the INEEL to the repository, subsequent handling at the repository, and empty cask return to the INEEL are not part of this project.

Project Description: Approximately 5,700 HIPed canisters would be produced by the HIP Facility over a 20-year timeframe and stored in the Interim Storage Facility. Canister production as proposed would start in January 2015 and end in December of 2035. It is assumed that cask handling and loading of canisters would not start until all canisters had been produced and placed into interim storage because the Interim Storage Facility is not designed to handle incoming canisters for storage and cask loading simultaneously. Operations for this project would begin with cask loading, which is assumed to occur over a 20-year period.

Each canister would contain 0.72 cubic meters (nominal) of HIPed HLW (three HIP cans containing a glass-ceramic waste material) and be based on the Savannah River Site Defense Waste Processing Facility stainless steel canister design. All canisters would be remote handled and would be clean and without outer surface contamination prior to cask loading.

All shipments to the repository would require the use of a Type-B shielded shipping packaging (cask). The shipping cask chosen as the model for canister transport is the MP-187, a commercial, spent-fuel type, rail cask currently being processed for certification by the NRC. Each shipping cask would be capable of transporting four HLW canisters; however, to transport the HIPed HLW in this cask, the application for NRC approval would need to be amended and approved by the NRC. In addition, the cask configuration would have to be modified to NRC requirements because the total plutonium content of four HLW canisters exceeds 20 Curies. This modification would also require NRC's approval.

The Interim Storage Facility would load two canisters per day into a cask, thereby producing two casks per week. Two weeks of cask loading would provide four casks/railcars ready for immediate transport to the repository. An estimated 24 casks with internals and railcars (including standby units) would be required to continuously transport the HIPed canisters to the repository. The round trip time duration of casks and railcars for an uninterrupted disposal operation is estimated to be five weeks requiring 16 casks to be in operation throughout the duration. The standby of four empty casks with railcars at INEEL awaiting loading and four at the repository unloaded, or waiting to be unloaded, would allow two extra weeks of time duration to accommodate loading, unloading, cask maintenance, weather, railroad logistics, and other problems. With four railcars with loaded casks shipped every other week, approximately 9 rail carrier round trips from the INEEL to the repository and back could be made per year.

The loading, and transport logic is presented as-follows:

- Load four casks and railcars (duration two-weeks).
- Transport four casks and railcars by commercial train to a railhead near the repository (duration one-week).
- Transport four loaded casks from the railhead to repository by truck and return with four empty casks (duration one-week).
- Return four empty casks with railcars via commercial train to the INEEL (duration one-week).

Table C.6.2-73. Construction and operations project data for Packaging and Loading of Hot Isostatic Pressed Waste for Shipment to a Geologic Repository for Waste Processing (P73A).[a]

Generic Information	
Description/function and EIS Project number:	Package and load HIPed waste canisisters into RMC via ISF (P73A)
EIS alternatives/options:	Non-Separations/HIPed Waste Option
Project type or waste stream:	Waste mgt program, HAW disposal
Action type:	New
Structure type Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	None NA None
Location Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside Interim Storage Facility (ISF)
Construction Information	
Schedule start/end:	Unknown
Number of workers:	No construction data is required - procurement only (fabricate 24 casks with internal support and railcars).
Heavy equipment:	
Acres disturbed:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	
Operational Information	
Schedule start/end:	Unknown
Number of workers Operations: Maintenance: Support:	 3 0.5 3
Number of radiation workers:	2.5 (included in above totals)
Avg. annual worker rad. dose (rem/yr):	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents Sanitary wastewater: (L/yr)	 224,498
Solid wastes Sanitary/Industrial trash: (m^3)	 98
Hazardous/toxic chemicals & wastes:	None
Radioactive waste:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements Electrical: (MWh/yr) Fuel oil: (L/yr)	 135 None

[a] Sources: EDF-PDS-I-004; EDF-PDS-L-002.

Table C.6.2-74. Decontamination and decommissioning project data for Packaging and Loading of Hot Isostatic Pressed Waste for Shipment to a Geologic Repository for Waste Processing (P73A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	Unknown
Number of D&D workers	7 per yr
Number of radiation workers (D&D):	0 new workers per yr
Avg. annual worker radiation dose:	None expected, if found 0.25 rem/yr/worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, loaders
Trips:	9 per day
Hours of operation: (hrs)	22,500
Acres disturbed:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	630
Contaminants[b]: (tons/yr)	31 (total)
Effluents	
Sanitary wastewater: (L)	372,586
Solid wastes	
Non-radioactive:	
Neutron shielding: (m^3)	48
Foam: (m^3)	313
Metals: (m^3)	122
Industrial: (m^3)	39
Hazardous/toxic chemicals & wastes	
Lead from casks: (m^3)	68
Used lube oil: (L)	4,258
Water usage	
Domestic water: (L)	372,586
Process water: (L)	761,625
Energy requirements	
Electrical: (MWh/yr)	135
Fossil fuel: (L)	510,975

a. Sources: EDF-PDS-I-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.32 Direct Cement Process (P80)

General Project Objective: The general objective of this project is to provide information for the design, construction, startup, operation, and decommissioning of a new Direct Grouting Facility under the Direct Cement Option. The facility would be used to directly grout the INTEC calcine, including calcined SBW waste, into a cementitious waste form for disposal as high level waste (HLW). Under a separate project, the waste filled canisters would be put in interim storage until final repository space is available for their disposal.

Project Description: In the hydroceramic grouting process, calcined HLW and calcined sodium-bearing waste (SBW) would be combined with clay, blast furnace slag, and caustic soda to generate a hydroceramic form of naturally occurring feldspathoids/zeolites. The grouting process is used, which generally involves the following steps:

- Mixing a thick paste of calcine and hydroceramic additives.
- Casting the paste into a waste canister.
- Curing the hydroceramic under temperature and pressure.
- Removing the free water from the hydroceramic by baking.
- Sealing the canister.

The process is described in more detail below.

Calcine would be received at the grouting facility on demand for batch processing via the Calcine Retrieval and Transport System. Once the grout recipe is determined, the calcine blend and the grout ingredients consisting of clay, blast furnace slag, sodium hydroxide, and water would be delivered through a series of blenders and mixers to a kneeder extruder for final mixing. From the kneeder extruder the grout mixture would be delivered to the canister injection head through which each canister is filled with approximately 1,225 kg (2,700 lb) of grout. The waste would be grouted into Savannah River Site Defense Waste Plant Facility HLW stainless steel canisters measuring 0.6 m (24 inches) in diameter by 3 m (10 foot) in length.

Grout curing would occur in saturated steam conditions through an autoclave process operating in the range of 250° C (577 psia) to 300° C (1,246 psia). Eighteen canisters at a time would be placed in the single autoclave that would operate through a 48-hour cycle.

Following curing, the canisters would be removed from the autoclave and sent to the dewatering chambers. Dewatering serves to dry the cured grout in the canisters such that the residual moisture content of the grout is less than 2% of the grout by weight. Total time in the dewatering cycle would be approximately seven days. The chambers would be sized to accommodate 50 canisters.

From the dewatering chamber, the canisters would travel to the welding room where the canisters' caps would be remotely installed and welded in place. After welding and testing steps are complete, the canisters are once again be processed through a decontamination check station for surface surveys and cleaning, if required.

Canisters that have completed the process through the grouting facility would be sent to interim storage via an underground tunnel connecting the grouting and interim storage facilities. The interim storage facility and operations are covered in another project description.

New Facility Description: The grouting facility would be located in the northeast area of INTEC within the existing security perimeter fence. No previously undisturbed soils would be affected. The estimated size of the facility would be approximately 18,327 m^2 (197,275 $feet^2$).

The grouting facility would be designed to house all activities involving the grouting process from receipt of calcine and grout ingredients to preparation of the filled canisters for transfer to the interim storage facility. Radiological shielding would be incorporated into the facility designs and criticality is not a concern. The design would be based on a concept of centrally located process cells with thick concrete walls surrounded by areas that contain progressively less radioactive hazards. Equipment in radioactive service that requires maintenance would be located in areas with remote handling and maintenance capabilities. Radiological contamination control would be maintained throughout the process through the use of engineered building boundaries, filtration systems, and canister surface checks and cleaning. Off gassing from the various tanks and vessels would be routed through a high-efficiency particulate air (HEPA) filtration system.

All processes would be operated remotely from a control room with a number of operations requiring robotic handling. Processes involving calcine and the grouted waste form would be performed remotely and under computer control. Robotic handling would include remotely controlled canister movement through the facility and canister manipulation at the filling station, monitoring and decontamination stations.

Table C.6.2-75. Construction and operations project data for the Direct Cement Process (P80).[a]

Generic Information	
Description/function and EIS project number:	Directly grout HLW calcine (P80).
EIS alternatives/options:	Non-Separations/Direct Cement Option
Project type or waste stream:	Grouted HLW calcine
Action type:	New
Structure type	
Size: (m^2)	18,581
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Grouting Facility
Construction Information	
Schedule start/end	
Preconstruction:	July 2000 – December 2007
Construction:	January 2008 – December 2011
SO testing and start-up:	January 2012 – December 2014
Number of workers:	100 per yr
Number of radiation workers:	None
Heavy equipment	
Equip used:	Excavator, grader, crane, trucks
Trips:	3,567
Hours of operation: (hrs)	14,695 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/3.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	51
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	1,498
Contaminants[b]: (tons/yr)	73
SO testing and start-up:	
Fossil fuel (steam use): (tons/yr)	4,877.25
Effluents	
Sanitary wastewater (constr.): (L)	8,516,250
Sanitary wastewater (SO test): (L/yr)	4,835,338
Solid wastes:	
Construction trash: (m^3)	4,742
Sanit./Ind. trash (SO testing): (m^3/yr)	776
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	12,941
Solid hazardous waste: (m^3)	222
Radioactive wastes	
Contaminated soil: (m^3)	142
Water usage	
Dust control: (L)	605,600
Domestic (construction): (L)	8,516,250
Process water (SO testing): (L)	583,831
Domestic (SO testing): (L)	9,670,675
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel:	
Heavy equip./trips (const.): (L)	1,944,737
Steam generation (SO test.): (L/yr)	1,709,444

Table C.6.2-75. Construction and operations project data for the Direct Cement Process (P80)[a] (continued).

Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/Support:	59/34/47 per yr
Number of radiation workers per yr:	93 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	
Equipment used:	Trucks for deliver only
Trips:	10 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	7.61E-07
Process chem. emissions[c]: (lb/hr)	0.0013
Fossil fuel emissions: (tons/yr)	4,877.25
Effluents	
Sanitary wastewater: (L/yr)	4,835,338
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	776
Radioactive wastes	
Process output:	
HLW cement: (m^3)/(Ci)	13,000/40,700,000
HEPA filters (LLW): (m^3)	267
Hazardous/toxic chemicals & wastes:	None
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	63
PPEs & misc. mixed wastes: (m^3)	2,930
Mixed rad. liquid wastes: (L)	2,819,801
Water usage	
Process: (L/yr)	291,915
Domestic: (L/yr)	4,835,338
Energy requirements	
Electrical: (MWh/yr)	3,767
Fuel oil:	
Steam generation: (L/yr)	1,709,444
Equipment/vehicle fuel: (L/yr)	833

a. Sources: EDF-PDS-C-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-043.

Table C.6.2-76. Decontamination and decommissioning project data for the Direct Cement Process (P80).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2038
Number of workers each year of D&D:	164 per yr
Number of radiation workers (D&D):	121 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	15 per day
Hours of operation: (hrs)	68,175
Acres disturbed	
New/Previous/Revegetated: (acres)	None/3.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion	
Gases (CO_2): (tons/yr)	1,590
Contaminants[b]: (tons/yr)	77 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	10,478,337
Solid wastes	
Non-radioactive (industrial): (m^3)	25,156
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	12,902
Solid hazardous waste: (m^3)	11
Radioactive wastes	
Solid waste (LLW): (m^3)/(Ci)	33,456/330
Mixed wastes (LLW)	
Solid mixed rad. wastes: (m^3)	141
Decon solution: (L)	75,700
Water usage	
Process water: (L)	6,854,625
Domestic water: (L)	10,478,337
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,548,254

a. Sources: EDF-PDS-C-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.33 Unseparated Cementitious HLW Interim Storage (P81)

General Project Objective: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a facility to receive and store the waste-filled canisters produced in the Direct Cement option. The storage would be for an interim period of time until a repository is ready to receive the waste.

This project does not include the transfer cart loading area in the process facility and associated equipment, the rail car and cask, or the railroad tracks. Additionally, the loading of the canister at the process facility as well as the removal and shipping of the canister to the disposal facility are not included in this project.

Project Description: The scope of this project includes construction, operation, and decommissioning the facility where the treated waste would be placed in storage canisters that are qualified and approved for shipment to a repository. The canisters would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. After each canister is prepared for storage at the process facility, it would be placed in a transfer cart. The transfer cart would then move to the new Interim Storage Facility through a below ground transfer cart tunnel to a transfer cart reception bay at the new Interim Storage Facility. The canister-handling machine would have overhead access to the canisters in the transfer carts. The canister-handling machine would remove the canisters from the handling cart through the charge hall floor up into a shielded storage cask. The waste-handling machine would then be positioned over the designated storage tube, where it would remove the shielded plug, place the canister in the tube, and replace the plug.

Facility Description: The Interim Storage Facility would be a new facility located at the INTEC, adjacent to the process building, and would be capable of receiving, handling, and storing the waste canisters.

The new Interim Storage Facility would be designed to hold waste canisters in vertical sealed storage tubes. The storage tubes would be located in a concrete storage vault. The storage tube would provide structural support for the stacked canisters. Three canisters would be placed in each storage tube. A cushion block would be placed between each of the canisters and between the bottom canister and the bottom of the storage tube.

The storage vault would have a concrete floor and walls with inlet and outlet air cooling ducts. The roof of the storage vault would be a composite steel and concrete structure called the charge face structure. The storage tubes would be located in holes in the charge face structure extending down to the floor of the storage vault. Removable shield plugs in the charge face structure would be removed and replaced as the canisters are placed in the storage tubes.

Supplementary lag storage locations would be provided at the end of the transfer cart tunnel to provide more immediate storage in the event of equipment maintenance or failure. This would help prevent a bottleneck in shipments from the production line.

Table C.6.2-77. Construction and operations project data for Unseparated Cementitious HLW Interim Storage (P81).[a]

Generic Information	
Description/function and EIS project number:	Provide long-term storage for road-ready HLW containers (P81)
EIS alternatives/options:	Non-Separations/Direct Cement
Project type or waste stream:	Treated HLW calcine
Action type:	New
Structure type:	
Size: (m^2)	15,967
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end	
Preconstruction:	January 2005 – December 2009
Construction:	January 2010 – December 2013
SO test and start-up:	January 2014 – December 2014
Number of workers:	134 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	2,482
Hours of operation: (hrs)	55,360 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/9.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	130
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	1,147
Contaminants[b]: (tons/yr)	56
Effluents	
Sanitary wastewater (constr.): (L)	11,411,775
Sanitary wastewater (SO test.): (L)	224,498
Solid wastes	
Construction trash: (m^3)	6,355
Sanitary/ind. trash (SO test.): (m^3/yr)	36
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	34,923
Solid hazardous waste: (m^3)	220
Radioactive wastes	
Contaminated soil: (m^3)	122
Water usage	
Dust control (construction): (L)	3,700,858
Domestic (construction): (L)	11,411,775
Domestic (SO testing): (L)	224,498
Energy requirements	
Electrical:	
Construction: (MWh/yr)	156
SO testing: (MWh/yr)	4,586
Fossil fuel:	
Heavy equipment (construction): (L)	1,257,231
Other use (construction): (L)	231,743

Table C.6.2-77. Construction and operations project data for Unseparated Cementitious HLW Interim Storage (P81)[a] (continued).

Operational Information	
Schedule start/end:	January 2015 – indefinite
Number of workers Operations/Maintenance/Support:	4/1/1.5 per yr
Number of radiation workers:	4.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents Sanitary wastewater: (L/yr)	224,498
Solid wastes Sanitary/Industrial trash: (m^3/yr)	36
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	4,586 None

a. Sources: EDF-PDS-H-005; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-78. Decontamination and decommissioning project data for Unseparated Cementitious HLW Interim Storage (P81).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	Unknown
Number of D&D workers :	287.2 new workers per yr
Number of radiation workers (D&D):	87.6 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	None expected (0.25 per worker if found)
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	12 per day
Hours of operation: (all heavy equipment) (hrs)	62,100
Acres disturbed	
New/Previous/Revegetated: (acres)	None/9.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Fuel combustion:	
Gases (CO_2): (tons/yr)	1,448
Contaminants[b]: (tons/yr)	70 (total)
Effluents	
Sanitary wastewater: (L)	18,346,756
Solid wastes	
Building rubble: (m^3)	50,817
Metals: (m^3)	108
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	24
Used lube oil: (L)	11,752
Water usage	
Domestic water: (L)	18,346,756
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,410,291

a. Sources: EDF-PDS-H-005; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.34 Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository (P83A)

General Project Objectives: The proposed project encompasses the handling and loading of transport casks with Cement canisters before immediate transport to a Geologic Repository. The handling and loading of casks would occur in the Interim Storage Facility after all waste canisters had been produced and transferred into the Interim Storage Facility from the cement facility. Handling and loading of casks would occur over a 20-year time period but would not start before the repository was opened to accept high-level waste (HLW).

Loaded cask transport via rail from the INEEL to the repository, subsequent handling at the repository, and empty cask return to the INEEL are not part of this project.

Project Description: Approximately 18,000 canisters would be produced by the grouting facility and stored in the Interim Storage Facility. Canister production as proposed would start in January 2015 and end in December of 2035. It is assumed that cask handling and loading of canisters would not start until all canisters had been produced and placed into interim storage because the Interim Storage Facility (as currently proposed) would not be designed to handle incoming canisters for storage and cask loading simultaneously. Operations for this project would begin with cask loading which would occur over a 20-year period.

Each canister would contain 0.72 cubic meters (nominal) of HLW and be based on the Savannah River Site Defense Waste Processing Facility stainless steel canister design. All canisters would be remote handled and would be clean and without outer surface contamination prior to cask loading.

All shipments to the repository would require the use of a Type-B shielded shipping packaging (cask). The shipping cask chosen as the model for canister transport is the MP-187, a commercial, spent-fuel type, rail cask currently being processed for certification by the NRC. Each shipping cask would be capable of transporting four HLW canisters; however, to transport the Cement HLW in this cask, the application for NRC approval would need to be amended and approved by the NRC. In addition, the cask configuration would have to be modified to NRC requirements because the total plutonium content of four HLW canisters exceeds 20 Curies. This modification would also require NRC's approval.

The Interim Storage Facility would load five (5) canisters per day into several casks, thereby producing five (5) casks per week for immediate transport to the repository. With five (5) railcars with loaded casks being shipped every week, then approximately 12 rail carrier round trips from the INEEL to the repository and back could be made per year.

An estimated 40 casks with internals and railcars (including standby units) would be required to continuously transport the canisters to the repository. The round trip time duration of casks and railcars for an uninterrupted disposal operation is estimated to range between four (4) and six (6) weeks and would require 20 casks to be in operation throughout the duration. The standby of 10 empty casks with railcars at INEEL awaiting loading and 10 at the repository unloaded or waiting to be unloaded would allow two extra weeks of time duration to accommodate loading, unloading, cask maintenance, weather, railroad logistics, and other problems.

The loading, and transport logic is presented as-follows:

- Load five (5) casks and railcars (duration one-week).

- Transport five (5) casks and railcars by commercial train to a railhead near the repository (duration one-week).

- Transport five (5) loaded casks from the railhead to the repository by truck and return with four empty casks (duration one-week).

- Return five (5) empty casks with railcars via commercial train to the INEEL (duration one-week).

Table C.6.2-79. Construction and operations project data for Packaging and Loading of Cementitious Waste at INTEC for Shipment to a Geologic Repository (P83A).[a]

Generic Information	
Description/function and EIS project number:	Package and load cementitious waste canisters into rail casks (P83A)
EIS alternatives/options:	Non-Separations/Direct Cement
Project type or waste stream:	HAW disposal
Action type:	New
Structure type	None
Size: (m^2)	NA
Other features: (pits, ponds, power/water/sewer lines)	NA
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Interim Storage Facility
Construction Information	
Schedule start/end:	
Design & procurement specs:	Unknown
Cask construction:	Unknown
Number of workers:	No construction activities - procurement only.
Heavy equipment:	
Acres disturbed:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	
Operational Information	
Schedule start/end:	Unknown
Number of workers :	
Operations:	5 per yr
Maintenance:	1 per yr
Support:	5 per yr
Number of radiation workers per yr:	2.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	379,919
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	47
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage	
Domestic: (L/yr)	379,919
Energy requirements	
Electrical: (MWh/yr)	135
Fossil fuel: (L)	None

a. Sources: EDF-PDS-I-008; EDF-PDS-L-002.

Table C.6.2-80. Decontamination and decommissioning project data for Packaging and Loading of Cementitious Waste at INTEC for Shipment to a Geologic Repository (P83A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	Unknown
Number of D&D workers:	7 per yr
Number of radiation workers (D&D):	0 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	None expected, if found 0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, loaders
Trips:	9 per day
Hours of operation (all heavy equipment): (hrs)	31,500
Acres disturbed:	None
Air emissions: (None/Reference)	See Appendix C.2 for details
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	630
Contaminants[b]: (tons/yr)	31 (total)
Effluents	
Sanitary wastewater: (L)	521,620
Solid wastes	
Non-radioactive:	
Neutron shielding: (m^3)	79
Foam: (m^3)	521
Metals: (m^3)	204
Industrial: (m^3)	51
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	5,961
Lead from casks: (m^3)	113
Water usage	
Process water: (L)	1,066,275
Domestic water: (L)	521,620
Energy requirements	
Electrical: (MWh/yr)	135
Fossil fuel: (L)	715,365

a. Sources: EDF-PDS-I-008; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.35 Vitrification Facility with Maximum Achievable Control Technology (P88)

General Project Objective: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a new Vitrification Facility to process liquid waste from the Tank Farm and solid calcine. Liquid waste would include either mixed transuranic waste/SBW or non-sodium-bearing liquid which is also known as newly generated liquid waste (NGLW). The liquid waste and the dry calcine granules would be converted into a geologically stable borosilicate glass suitable for disposal. A waste incidental to reprocessing determination would be made for the glass produced from the liquid waste. Based on that determination, the glass would be disposed of at the Waste Isolation Pilot Plant (WIPP) or stored, pending disposal at the national geologic repository. The glass produced from the calcine would be HLW that would be disposed of at the national geologic repository.

Project Description: This project includes the Vitrification Facility for vitrifying and packaging calcine and liquid waste, a mixed transuranic waste/SBW (and NGLW) retrieval and transport system for transporting liquid waste from the Tank Farm to the Vitrification Facility, and a grout plant for stabilizing Process Equipment Waste Evaporator bottoms resulting from processing of the Vitrification Facility offgas liquid. The vitrification process is designed to vitrify both calcine and liquid wastes. Liquid wastes would be mixed with glass frit and fed to the melter in the dry condition. Liquid waste and calcine would be treated in separate campaigns. The liquid waste would be collected continuously in the Vitrification Facility, and then vitrified and packaged in one or two campaigns per year.

The vitrified waste would be placed in glass storage canisters that are qualified and approved for shipment to a repository. The canisters for the glass would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. They are 2 feet in diameter and 10 feet in length. The canisters would be loaded at the Vitrification Facility and sent directly to the Interim Storage Facility on a transfer cart through an underground transfer cart tunnel.

Both the liquid waste and the dry calcine would have to be blended with additional chemicals to form glass. In the Vitrification Facility, these chemicals would be received as specially-formulated powdered glass called frit. Because of the many chemistries of liquid waste and many types of calcine generated at INTEC, the chemical compositions to be vitrified are not uniform. Based on laboratory work, up to six different frit formulations would be needed to make acceptable glass with the liquid waste calcine. The Vitrification Facility would provide equipment to store and blend liquid waste or calcine with the frit, melt those materials to form glass, cast the glass into appropriate canisters, manage full and empty canisters, and treat liquid and gaseous effluents.

New Facility Description: The Vitrification Facility would be located near the northeast corner of the INTEC. The facility would be a multistory building that would extend from elevations of 32 feet below grade, to 75 feet above grade, and would have a floor plan occupying an area measuring 433 feet by 178 feet. The Vitrification Facility layout would be based on a centrally located process-cell complex with limited personnel access and heavy concrete walls for shielding. The facility would have a separate system for processing melter offgas and reclaiming mercury waste.

The heart of the Vitrification Facility would be the vitrification system that would include the melters and the offgas treatment system with its scrubber blowdown processing systems. Liquid waste and calcine would be vitrified in separate campaigns and would not be mixed or melted together in the same campaign. The liquid waste would be pumped to the process. The pumping system would consist of a tie-in in to an existing INTEC Tank Farm valve box, a lift station to pump the liquid to a transport line, and a 1,200-ft long transport line from the lift station to the vitrification system. The vitrification system would receive liquid waste, dry calcine, and frit, from separate handling systems. Liquid waste from the Tank Farm would be received by two

24,000-gallon storage tanks in the Vitrification Facility.

Liquid waste from other sources would be transferred into one of the two storage tanks and blended before being characterized. After the liquid has been characterized, it would be transferred to one of two 8,000-gallon tanks for mixing with the appropriate frit. Additional characterization would be performed on the mixture as part of the certification process. Once the contents of a mix tank would be certified, the entire volume of the tank would be transferred to one of two feed tanks. Each mix tank and each feed tank would hold enough liquid and frit mixture for about one day of operation.

Dry calcine form the existing storage bins would be received and stored in two large blender tanks. The calcine would be fluidized and homogenized in each blender tank by air injection systems. A secondary pneumatic transfer system for each tank would deliver calcine to a weigh hopper that would measure and dispense it into a ribbon blender for mixing with a measured amount of frit. This mixture would then be dispensed into the melter.

Each type of frit would be conveyed to a separate silo outside the Vitrification Facility. Other sets of conveyors would transport the frit into six separate indoor storage tanks. The proper frit would be conveyed from these tanks to the frit weigh tank, and finally to a mix tank for mixing with liquid waste or to the ribbon blender where it would be mixed with dry calcine and dispensed into the melter.

The Vitrification Facility would include two joule-heated (i.e., electrically powered) melters. One would be installed as a spare. The feed material, called "batch", would be a mixture of liquid waste or dry calcine and dry frit. Before melting, the feed material would float on top of the molten glass, forming a "cold cap" that would reduce emissions of volatile species in the melter offgas. Large quantities of condensable, low-quality steam would be released as the liquid waste and frit mixture would contact the melter cold cap. The steam would be exhausted from the melter by the offgas ventilation system, and condensed and treated in the offgas system components. Product glass would be gravity drained through a separate port into the canisters.

A limited amount of ventilation air would be allowed to enter the melter to cool instrument and viewing ports. The ventilation air would collect steam, volatile gases, and fine particulates, that would later be removed in the offgas treatment system. The offgas treatment train would include a Noxidizer™ (a two-chambered incinerator designed to chemically reduce nitrogen oxides (NO_x) and oxidize organics), a quench column, a venture, a packed bed absorber, and a granular activated carbon column. Contaminated water form the offgas treatment system would be processed in the Vitrification Facility to collect and immobilize mercury. Elemental mercury from the activated carbon absorber system and from the wastewater would be amalgamated. Further treatment of the scrubber blowdown water would be performed at other facilities at the INTEC.

The vitrified remote handled transuranic waste glass from the liquid waste, and the vitrified HLW glass from the calcined waste would be drained from the melter into Defense Waste Processing Facility-type canisters. The canisters would then be cooled, capped, and transported through three separate cells for lid welding and leak checking, decontamination, and exterior contamination swiping. Finally, the filled canisters would be placed in a below-grade tunnel and transferred to a separate Interim Storage Facility located near the Vitrification Facility.

Table C.6.2-81. Construction and operations project data for the Early Vitrification Facility with Maximum Achievable Control Technology (P88).[a]

Generic Information	
Description/function and EIS project number:	Vitrify liquid waste, calcine, and grout evaporator bottoms (P88)
EIS alternatives/options:	Early Vitrification ***Option and Direct Vitrification Alternative***
Project type or waste stream:	HLW treatment
Action type:	New
Structure type:	Treatment facility
Size: (m^2)	20,438
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end: ***(Early Vitrification Option)***[b]	
Pre-construction:	July 2000 – December 2007
Construction:	January 2008 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	115 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	2,744
Hours of operation: (hrs)	56,402 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.8/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	40
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	986
Contaminants[c]: (tons/yr)	48
SO testing and start-up	
Fossil fuel emissions: (tons/yr)	5,879.8
Effluents	
Sanitary ww (construction): (L)	9,793,688
Sanitary ww (SO testing): (L/yr)	4,593,571
Process ww (SO testing): (L/yr)	359,870
Solid wastes	
Construction trash: (m^3)	5,454
Sanitary/ind. trash (SO test): (m^3/yr)	738
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	10,674
Solid hazardous wastes: (m^3)	336
Radioactive wastes	
Contaminated soil (LLW): (m^3)	156
Water usage	
Dust control (construction): (L)	757,000
Domestic (construction): (L)	9,793,688
Process (SO testing): (L)	2,084,631
Domestic (SO testing): (L)	13,780,712
Energy requirements	
Electrical (construction): (MWh/yr)	198
Fuel oil:	
Heavy equipment (construction): (L)	1,280,894
Steam generation (SO testing): (L/yr)	2,060,727
Process use (SO testing): (L/yr)	545,040

Table C.6.2-81. Construction and operations project data for the Early Vitrification Facility with Maximum Achievable Control Technology (P88) [a] (continued).

Operational Information	
Schedule start/end:	
Vitrify SBW & calcine:	January 2015 – December 2035
Process sodium bearing waste:	January 2015 – December 2016
Number of workers:	
Operations/Maintenance/Support:	48/46/39 per yr
Number of radiation workers:	39 (included in above totals)
Avg. annual work rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	6.48E-07
Process radioactive emissions[d]: (Ci/yr)	1.11E-03
Process tritium emissions[e]: (Ci/yr)	45
Process chemical emissions[f]: (lb/hr)	2.9
Fossil fuel emissions: (tons/yr)	5,879.8
Effluents	
Sanitary wastewater: (L/yr)	4,593,571
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	738
Radioactive wastes	
HLW glass: (m^3)/(Ci)	8,860
LLW glass: (m^3)/(Ci)	30/28,000
RH TRU (TRU): (m^3)/(Ci)	360/510,000
HEPA filters (LLW): (m^3)	290
Mixed wastes (LLW)	
Solid mixed wastes.: (m^3)	441
PPEs & misc. rad. wastes: (m^3)	1,229
Mixed liquid rad. waste: (L)	3,071,801
Hazardous/toxic chemicals & wastes:	None
Water usage	
Process: (L/yr)	694,877
Domestic: (L/yr)	4,593,571
Energy requirements	
Electrical: (MWh/yr)	16,831
Fuel oil:	
Steam generation: (L/yr)	2,060,727
Process use: (L/yr)	545,040

a. Sources: EDF-PDS-F-006; EDF-PDS-L-002***; Casper (2000)***.

b. Direct Vitrification Alternative: Preconstruction: October 1999-September 2007; Construction: October 2007-September 2012; SO testing and startup: October 2012-September 2013; Operations (SBW): October 2013-September 2015; Operations (calcine): October 2022-December 2035.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

d. Source: EDF-PDS-C-046.

e. Released for 2 years via vitrification process. Source: EDF-PDS-C-046.

f. Source: EDF-PDS-C-043.

Table C.6.2-82. Decontamination and decommissioning project data for the Early Vitrification Facility with Maximum Achievable Control Technology (P88).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2040
Number of D&D workers:	117 per yr
Number of radiation workers (D&D):	78 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	18 per day
Hours of operation: (hrs)	166,950
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.8/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	2,336
Contaminants[b]: (tons/yr)	114 (total)
HEPA filted offgas: (Ci/yr)	7.26E-08
Effluents	
Sanitary wastewater: (L)	12,467,752
Radioactive wastes	
Solid rad. waste (LLW): (m^3)	31,104
Solid wastes	
Non-radioactive (industrial): (m^3)	23,387
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	281
Decon solution: (L)	83,270
1. Hazardous/toxic chemicals & wastes	
Lube oil: (L)	31,595
Solid hazardous waste[c]: (m^3)	11
Water usage	
Process water: (L)	13,328,438
Domestic water: (L)	12,467,752
Energy requirements	
Electrical: (MWh/yr)	182
Fossil fuel: (L)	3,791,435

a. Sources: EDF-PDS-F-006; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.
c. Hg and PCB contaminated equipment (after decon); PCBs from electrical equipment taken out of service.

C.6.2.36 Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant (P90A)

General Project Objective: This project includes the handling and loading of shipping casks with containers of remote handled transuranic waste before immediate truck transport to WIPP for disposal. The interim storage, handling, and loading of casks and containers would occur in the Interim Storage Facility. The transuranic waste would be processed in the Vitrification Facility. Handling and loading of casks would occur over a 26-year period, but would not start before WIPP was opened to accept transuranic waste. Loaded cask transport from the INEEL to WIPP, subsequent handling at WIPP, and empty cask return to the INEEL are not part of this project.

Project Description: Approximately 610 remote-handled transuranic waste canisters would be produced by the Vitrification Facility and transferred to the Interim Storage Facility for interim storage and cask loading prior to shipment to WIPP for disposal. Interim storage would be provided in the Interim Storage Facility to allow for accumulation before shipment. Production would start in October 2013 and end in September 2015.

Each canister would contain about 0.72 cubic meters of vitrified transuranic waste. All remote-handled WIPP containers would be clean and without outer surface contamination prior to cask loading.

The shipping cask designated for use by this project would be the remote-handled TRU 72-B, developed for remote-handled WIPP container transport. One cask would be carried on a trailer for truck transport to WIPP. The cask has been tested and licensed by the NRC for transuranic waste ground shipment. Each shipping cask would be capable of transporting one remote-handled WIPP container; however, the containerized waste would require NRC approval as an authorized cask content prior to any shipment.

The Interim Storage Facility would load about two casks per week with each cask containing one to two remote-handled canisters. If trailers with loaded casks were shipped every week, then approximately 90 truck carrier round trips from the INEEL to WIPP could be made per year. The decision to provide shipments of two casks per week to WIPP would reduce the quantity of remote-handled WIPP containers placed into interim storage during the first three years of Grout FacilityVitrification Facility operation.

An estimated 16 cask and trailer units (including standby units) would be required to continuously transport the remote-handled WIPP containerscanisters to WIPP. The round trip time duration of casks and trailers for an uninterrupted disposal operation is estimated to be four weeks, requiring eight casks to be in operation throughout the duration. The standby of four empty casks with trailers at INEEL awaiting loading and four at WIPP, unloaded or waiting to be unloaded, would allow two extra weeks to accommodate loading, unloading, cask maintenance, weather, trucking logistics, and other problems. The loading, and transport logic is presented as-follows:

- Load two casks/trailers (duration one-week).

- Transport two casks/trailers by commercial truck transport to WIPP (duration one-week).

- Unload two casks/trailers at WIPP and pickup two empty casks/trailers (duration one-week).

- Return two empty casks/trailers via commercial truck transport to the INEEL (duration one-week).

Table C.6.2-83. Construction and operations project data for the Packaging and Loading of Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant (P90A).[a]

Generic Information	
Description/function and EIS project number:	Load vitrified TRU canisters into trailer mounted casks (P90A)
EIS alternatives/options:	Early Vitrification ***Option and Direct Vitrification Alternative***
Project type or waste stream:	TRU disposal
Action type:	New
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	None -- None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside Interim Storage Facility
Construction Information	
Schedule start/end Design & procurement specs.: Cask construction	 January 2010 - December 2011 January 2012 - December 2014
Number of workers:	No construction activities – procurement only.
Heavy equipment:	
Acres disturbed: New/Previous/Revegetated: (acres)	
Air emissions (None/Reference)	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	
Operational Information	
Schedule start/end:	January 2015 - January 2035
Number of workers Operations: Maintenance: Support:	 3 per yr 0.5 per yr 3 per yr
Number of radiation workers:	2.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents Sanitary wastewater: (L/yr)	 224,498
Solid wastes Sanitary/industrial trash: (m^3/yr)	 36
Radioactive wastes:	None
Mixed wastes (LLW):	None
Hazardous/toxic chemicals:	None
Water usage Domestic: (L/yr)	 224,498
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 86 None

a. Sources: EDF-PDS-I-010; EDF-PDS-L-002.

Table C.6.2-84. Decontamination and decommissioning project data for the Packaging and Loading of Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant (P90A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – June 2037
Number of D&D workers :	7 per yr
Number of radiation workers (D&D):	0 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	None expected, if found 0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, loaders
Trips (roll-off trucks):	9 per day
Hours of operation (all heavy equipment): (hrs)	13,500
Acres disturbed:	None
Air emissions: (None/Reference)	See Appendix C.2 for details
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	630
Contaminants[b]: (tons/yr)	31 (total)
Effluents	
Sanitary wastewater: (L)	223,552
Solid wastes	
Non-radioactive	
Foam: (m^3)	69
Metals: (m^3)	27
Industrial: (m^3)	76
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	2,555
Lead: (m^3)	15
Water usage	
Process water: (L)	228,488
Domestic water: (L)	223,552
Energy requirements	
Electrical: (MWh/yr)	135
Fossil fuel: (L)	306,585

a. Sources: EDF-PDS-I-010; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.37 SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111)

General Project Objective: The proposed project provides for design and construction of a new treatment facility for processing the existing sodium-bearing waste (SBW) by a means other than calcination and for processing Type I and Type II newly generated liquid waste at the INTEC. Type I and Type II are defined as follows:

- Type I liquid waste - Liquid radioactive waste generated at the New Waste Calcining Facility (NWCF) associated with NWCF operations and the decontamination of the NWCF.
- Type II liquid waste - Liquid radioactive waste not associated with the calciner operation or decontamination. This waste originates from other facilities at the INTEC, Test Reactor Area, and Test Area North. The quantity of Type II wastes are very small.

Process Description: This project would produce a contact-handled transuranic grout, a small quantity of ion-exchange resin saturated with cesium isotopes removed from the SBW, and a low-level grout from the newly generated liquid waste. A small amount of transuranic waste in the form of undissolved solids would also be produced, but it would be blended with the contact-handled transuranic grout. For disposal, the contact-handled transuranic grout would be sent to the Waste Isolation Pilot Plant (WIPP), the low-level waste (LLW) grout would remain at INEEL, and the resin would be sent with the high-level waste (HLW) calcine to Hanford for vitrification.

The treatment facility would begin processing activities in 2009. Until then, all newly generated liquid waste and the existing SBW would be stored in the existing Tank Farm. From 2009 through 2012, SBW and newly generated liquid waste would be processed together until the SBW processing is completed. Newly-generated liquid waste would then be processed through 2025, the time when operations would be completed. The quantity of Type II wastes would be very small and this project assumes there is no separation of Type II waste from the SBW and Type I waste. From 2013 through 2019, the generation of Type I waste would rapidly decrease and the Type II waste would increase from about 3% of the newly generated liquid waste in 2013 to about 60% in 2015. The generation of Type I and II after 2014 would be constant at approximately 2,000 gallons per year. Because of this significant change in operation demands, the operating schedule has been divided into Primary Operations dates, which are from 2011 through 2015, and Reduced Operations dates from 2016 through 2025.

The treatment of the wastes includes the following basic steps:

- remove cesium from the existing SBW liquid
- evaporate the remaining liquid to a specified solids concentration
- neutralize the waste by the addition of calcium oxide
- the waste with portland cement, blast furnace slag, and flyash to produce a grouted waste form
- place the grouted waste into 55-gal waste drums

The grouted waste in the 55-gal waste drums, from 2009 through 2012, would be contact-handled transuranic waste which would be ready for shipment to WIPP. The major waste form between 2013 and 2025 would be LLW, due to the reduction in the Type I to Type II ratio. This LLW would also be mixed into a grouted form which would be ready for disposal in a LLW landfill.

Facility Description: The new facility would be located to the west of the Non-Separations facilities near the northeast corner of the INTEC. This 2-story building would be above grade with the exception of below grade canyon areas for process lines. The areas of the building requiring the most radiological shielding (5 feet thick concrete walls) would be the ion exchange rooms and the packaging and loading high bay which are centrally located. Except for the rooms where raw grouting and neutralization materials are handled, all processing rooms would be considered radiation areas with operations being performed remotely. The SBW and newly generated liquid waste would be brought to the facility through a new underground pumping/piping system which would interface with the treatment facility in the underground canyon vault and connects to the existing Tank Farm.

Treatment process components and systems housed in the facility include:

- A system to retrieve the liquid waste and transfer it to the treatment facility
- Storage tank sized for 24-hour operations
- A system to adjust the pH of SBW feed to increase Cs removal
- Ion exchange columns filled with a crystalline silicotitanate sorbant to remove Cs from the filtered waste
- A tank to provide holding capacity for ion exchange effluent
- An evaporator to concentrate and partially crystallize the ion exchange effluent
- A tank which serves both as a neutralization tank for the concentrated waste and a feed tank for the grouting process
- A system to add CaO to the concentrated waste to neutralize it
- Storage bins for grout additives
- A grout mixing tank
- A system to clean the grout mixing tank
- A system to load grouted waste into 55-gal drums
- Assay equipment to determine radionuclide concentrations in the drums of grouted waste
- A system to back-flush, drain, and dry spent sorbant columns
- A heater, filters, and blower to superheat, remove particulate, and exhaust noncondensible gases from the process.

The packaging and loading area would be a shielded high bay to accommodate the remote handling of the spent sorbant containers. The principle product would be contact-handled transuranic waste drums which can be loaded into a container in either the shielded high bay or in the unshielded truck loading bay. Radioactively hot and cold areas are provided for use in the various radioactive and non-radioactive maintenance activities required in a facility of this nature.

Table C.6.2-85. Construction and operations project data for the SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111).[a]

Generic Information	
Description/function and EIS project number:	Process SBW & NGLW into grout to ship to WIPP and Hanford (P111)
EIS alternatives/options:	Minimum INEEL Processing Alt.
Project type or waste stream:	Grouted TRU and Grouted LLW
Action type:	New
Structure type	Processing facility
Size: (m^2)	2,787
Other features (pits, ponds, lines):	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside processing facility
Construction Information	
Schedule start/end	
Pre-construction:	January 2001 – June 2005
Construction:	July 2005 - December 2007
SO test and start-up:	January 2007 - December 2008
Number of workers:	20 per yr
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	566
Hours of operation: (hrs)	1,921 (total)
Acres disturbed	
New/Previous/Revegetated (acres)	None/0.95/None
Air emissions (None/Reference)	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	14
Fuel combust. (diesel exhaust):	
Major gas (CO_2): (tons/yr)	72
Contaminants[b]: (tons/yr)	3.5
SO testing and start-up:	
Process air emissions: (tons/yr)	0.00001
Fossil fuel (steam use): (tons/yr)	434.98
Effluents:	
Sanitary ww (const.): (L)	1,277,438
Sanitary ww (SO test.): (L/yr)	1,934,135
Solid wastes	
Construction trash: (m^3)	711
SO testing:	
Sanitary/industrial trash: (m^3/yr)	311
Radioactive wastes	
Contaminated soil (LLW): (m^3)	21
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	143
Solid haz. wastes: (m^3)	6
Water usage	
Dust control (construction): (L)	454,200
Domestic (construction): (L)	1,277,438
Process (SO testing): (L)	69,038
Domestic (construction): (L)	1,934,135

Table C.6.2-85. Construction and operations project data for the SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111)[a] (continued).

Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil:	
Heavy equipment (construction): (L)	70,046
Steam generation (SO testing): (L/yr)	152,314
Equip./vehicle fuel (SO testing) (L/yr)	666
Operational Information	
Schedule start/end:	
Cesium ion exchange:	January 2009 – December 2025
Treatment of sodium bearing waste:	January 2009 – December 2012
Number of workers	
Operations/Maintenance/Support:	23/17/16 per yr
Number of radiation workers	33 per yr (incl. in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Trucks
Trips:	8 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	3.25E-08
Process radioactive emissions: (Ci/yr)	0.600
Process tritium emissions[c]: (Ci/yr)	22.5
Process chemical emissions: (tons/yr)	2.80E-03
Fossil fuel emissions: (tons/yr)	434.98 (total)
Effluents	
Sanitary wastewater: (L/yr)	1,934,135
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	311
Radioactive wastes	
Process output:	
CH-TRU Grout: (m^3)/(Ci)	7,500/340,000
LLW Grout: (m^3)/(Ci)	230/7,200
LLW GTCC (resin): (m^3)/(Ci)	9/250,000
HEPA filters (LLW): (m^3)	41
Hazardous/toxic chemicals & wastes:	None
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	10.2
PPEs & misc. mixed wastes: (m^3)	842
Mixed rad. liquid waste: (L)	431,843
Water usage	
Process: (L/yr)	828,461
Domestic: (L/yr)	1,934,135
Energy requirements	
Electrical: (MWh/yr)	1,484
Fuel oil:	
Steam generation: (L/yr)	152,314
Equipment/vehicle fuel: (L/yr)	666

a. Sources: EDF-PDS-D-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. For 4 years via evaporation and grouting processes. Source: EDF-PDS-C-046.

Table C.6.2-86. Decontamination and decommissioning project data for the SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2026 – December 2026
Number of D&D workers	104 per yr
Number of radiation workers (D&D):	59 new workers per yr (included in number above)
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	9 per day
Hours of operation (all heavy equipment): (hrs)	11,925
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.95/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gases (CO_2): (tons/yr)	834
Contaminants[b]: (tons/yr)	41 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	2,224,291
Solid wastes	
Industrial: (m^3)	3,742
Radioactive wastes	
Solid LLW: (m^3)	4,977
Mixed waste (LLW)	
Decontamination solution: (L)	11,355
Solid mixed wastes: (m^3)	4
Hazardous/toxic chemicals & wastes	
Solid hazarsous waste: (m^3)	2
Used lube oil: (L)	2,257
Water usage	
Process water: (L)	761,625
Domestic water: (L)	2,224,291
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel: (L)	270,817

a. Sources: EDF-PDS-D-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.38 Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant (P112A)

General Project Objectives: The proposed project encompasses the handling and loading of transport casks with contact handled 55 gallon drums containing transuranic waste before immediate transport to the Waste Isolation Pilot Plant (WIPP) for disposal. Truck transport is assumed with transport casks modeled after an existing spent fuel transport cask. The handling and loading of casks and drums would occur in the Sodium-Bearing Waste (SBW)/Newly Generated Liquid Waste Facility. No interim storage would be provided. The drums would be of standard 55 U.S. Gallon configuration ready for shipment; therefore, there would be no waste packaging issues relative to this project. Handling and loading of casks would occur over a four-year period but would not start before WIPP was opened to accept Transuranic (TRU) waste.

Loaded cask transport from the INEEL to WIPP, subsequent handling at WIPP, and empty cask return to the INEEL are not part of this project.

Process Description: Approximately 37,500 TRU drums would be produced over a four-year timeframe and shipped directly to WIPP for disposal. About 20 drums would be produced in the facility and loaded into casks per day. No interim storage would be provided.

Each drum would contain about 0.2 cubic meters of powdered or granulated transuranic waste and would satisfy NRC fissile-gram equivalent requirements. All drums would be contact handled due to calculated gamma radiation levels of-less-than 200 mR/hr at contact. The calculated maximum thermal output per drum would be 0.4 Watts. All drums would be clean and without outer surface contamination prior to cask loading. The estimated maximum weight of each drum would be 777 pounds. Nine drums and five empty drums (49 pounds/drum) would be required to fill a TRUPACT-II cask (14 drums total) and achieve a total payload weight of about 7,238 pounds. The weight of all drums is less than the maximum cask payload allowable of 7,265 pounds.

All shipments to WIPP would require the use of a Type-B shipping package (cask) per the requirements of the U.S. Nuclear Regulatory Commission 10 CFR 71 and Department of Transportation Hazardous Materials Regulations. Only those packagings that have been approved by the U.S. Nuclear Regulatory Commission as meeting the applicable NRC requirements of 10 CFR 71 are suitable for these transports.

The shipping cask identified for contact handled WIPP drum transport is the TRUPACT-II; a commercial cask designed for transuranic contact-handled waste. Three casks would be carried on a trailer for truck transport to WIPP. Each shipping cask would transport a transuranic drum to WIPP; however, the contents would have to be listed within the transuranic content transport codes for the TRUPACT-II prior to any shipment. No cask shipment may exceed a 325 fissile-gram-equivalent of plutonium-239.

Each shipping cask would include the internal "payload pallet" required for the linear and radial positioning and support of the drums. Three casks would be carried on one dedicated trailer. Three casks with payload pallets plus a trailer would be purchased as a unit; however, the casks and trailer of each unit must be interchangeable with other units. The estimated weight of each loaded shipping cask would be about 9.61 tons: approximately 5.99 tons for the cask and 3.62 tons for the payload.

The 20 drums per day or 140 drums per week would be loaded for immediate transport to WIPP. Since 27 TRU drums and 15 empty drums are required to fill three casks for one trailer load, there would be about 5.2 trailer loads per week transported to WIPP. For cask/trailer quantity determination, and simplicity, six trailer loads (18 casks) would be used per week for this project. It is assumed that 18 personnel would be dedicated to cask loading.

An estimated 108 casks with payload pallets and 36 trailers (including standby units) would be required to continuously transport the drums to WIPP. The round trip time duration of casks and trailers for an uninterrupted disposal operation is estimated to be four weeks, requiring 24 casks and eight trailers to be in operation throughout the duration. The standby of 18 empty casks with six trailers at INEEL, awaiting loading, and 18 casks with six trailers at WIPP, unloaded or waiting to be unloaded, would allow one extra week to accommodate loading, unloading, cask maintenance, weather, trucking logistics, and other problems. Considering 200 operations work-days per year (about 28.5 weeks), a 24-hour-a-day seven-day workweek operation, and six trailers with 18 loaded casks shipped every week, then approximately 171 truck carrier round trips from the INEEL to WIPP and back could be made per year. The loading, and transport logic is presented as-follows:

- Load 18 casks/six trailers (duration one-week).
- Transport 18 casks/six trailers by commercial truck transport to WIPP (duration one-week).
- Unload 18 casks/six trailers at WIPP and pickup 18 casks/six trailers (duration one-week).
- Return 18 casks/six trailers via commercial truck transport to the INEEL (duration one-week).

Table C.6.2-87. Construction and operations project data for the Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant (P112A).[a]

Generic Information	
Description/function and EIS project number:	Package/load drums into casks for ground transport (P112A)
EIS alternatives/options:	Minimum INEEL Processing Alt.
Project type or waste stream:	TRU disposal
Action type:	New
Structure type	None
Size: (m^2)	0
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside NGLW Facility
Construction Information	
Schedule start/end:	
Design & procurement:	January 2002 – December 2005
Cask construction:	January 2006 – December 2008
Number of workers:	No construction – only procurement activities.
Heavy equipment:	
Acres disturbed:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	
Operational Information	
Schedule start/end:	January 2009 - December 2025
Number of workers per yr	
Operations:	8
Maintenance:	2
Support:	8
Number of radiation workers per yr:	2.5 (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	621,686
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	100
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage - Domestic: (L/yr)	621,686
Energy requirements	
Electrical: (MWh/yr)	86
Fuel oil: (L/yr)	None

[a] Sources: EDF-PDS-I-011; EDF-PDS-L-002.

Table C.6.2-88. Decontamination and decommissioning project data for the Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant (P112A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2026 – June 2030
Number of D&D workers:	7 per yr
Number of radiation workers (D&D):	None
Avg. annual worker rad. dose: (rem/yr)	None expected, if found 0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-of trucks, loaders
Trips (roll-off trucks):	9 per day
Hours of operation (all heavy equipment): (hrs)	40,500
Acres disturbed: (acres)	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Major gas (CO_2): (tons/yr)	630
Contaminant[b]: (tons/yr)	31 (total)
Effluents	
Sanitary wastewater: (L)	670,655
Solid wastes	
Non-radioactive:	
Foam: (m^3)	468
Metals: (m^3)	184
Industrial: (m^3)	228
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	7,665
Water usage	
Process water: (L)	685,463
Domestic water: (L)	670,655
Energy requirements	
Electrical: (MWh/yr)	135
Fossil fuel: (L)	919,755

a. Sources: EDF-PDS-I-011; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.39 Calcine Packaging and Loading to Hanford (P117A)

General Project Objectives: This project provides for the facility supporting the Minimum INEEL Processing Alternative, the Waste Packaging Facility (WPF). The Waste Packaging Facility would package unprocessed calcined solids and spent cesium-saturated resin into the 15-foot long "Hanford" canisters for shipment by dedicated rail to the Hanford Site for further processing.

Process Description: The Waste Packaging Facility would start packaging calcine in ***2011*** and would complete the removal in 2025. Calcine would be retrieved from the storage bins on an as needed basis and collected in a dispensing vessel in the WPF. Calcine would be metered from the vessel into re-useable canisters. The calcine processing campaign is expected to take about 14 years. Intermittently, small amounts of spent, cesium-contaminated resin from the cesium extraction process in the SBW/Newly Generated Liquid Waste Facility would be transported to the dispensing vessels in the Waste Packaging Facility for loading into containers. The spent resin would be held in the Newly Generated Liquid Waste Facility until enough is available to fill a Hanford canister. Any decontamination solution or other liquid wastes generated in the Waste Packaging Facility would be collected in the process liquid hold tank would be sent to the SBW/Newly Generated Liquid Waste Facility for treatment.

Facility Description: The Waste Packaging Facility would be designed to house the equipment and systems for packaging calcine and spent cesium contaminated resin into re-usable containers and for loading those containers into casks that are part of railcars used for transportation to the Hanford Site.

The Waste Packaging Facility process area would be a large cell housing the process equipment (i.e., the cyclone separators, dispensing vessel, sintered metal filters, pumps). Four cells would be arranged along the north wall of the basement area: a remote filter cell, a filter leaching cell, a decontamination cell, and a filter packaging cell. A cell housing the calcine transport air blowers and aftercoolers would be located along the west wall of the basement. The main operating floor and canister loadout area would be at grade level.

Table C.6.2-89. Construction and operations project data for Calcine Packaging and Loading to Hanford (P117A).[a]

Generic Information	
Description/function and EIS project number:	Fill & make ready to send containers of unprocessed calcine to Hanford (P117A)
EIS alternatives/options:	Minimum INEEL Processing Alt. & ***Steam Reforming Option***
Project type or waste stream:	Containers of unprocessed calcine
Action type:	New
Structure type	New facility
Size: (m^2)	1,932
Other features: (pits, ponds, lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end ***(Min. INEEL Proc. Alt.)***[b]	
Preconstruction:	January 2002 – December 2006
Construction:	January 2007 – December 2010
SO test and start-up:	January 2009 – December 2010
Number of workers:	78 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	817
Hours of operation: (hrs)	1,909 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/1.16/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	17
Fuel combustion:	
Major gas (CO_2): (tons/yr)	171
Contaminants[c]: (tons/yr)	8.32
SO testing and start-up:	
Fossil fuel (steam use): (tons/yr)	668.04
Effluents	
Sanitary ww (construction): (L)	3,321,000
Sanitary ww (SO testing): (L/yr)	1,022,000
Solid wastes	
Sanitary/industrial trash:	
Construction: (m^3)	1,848.94
Start-up testing: (m^3/yr)	0.27
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	2,000
Solid hazardous wastes: (m^3)	24
Radioactive wastes	
Contaminated soil (LLW): (m^3)	15
Water usage	
Dust control (construction): (L)	238,000
Domestic (construction): (L)	3,321,000
Process (SO testing): (L)	7,000
Domestic (SO testing): (L)	2,044,000
Energy requirements	
Electrical (construction): (MWh/yr)	180
Fuel oil:	
Heavy equipment/trips (const.): (L)	111,000
Steam generation (SO testing): (L/yr)	233,982
Equipment/fuel oil (SO testing): (L)	333

Table C.6.2-89. Construction and operations project data for Calcine Packaging and Loading to Hanford (P117A)[a] (continued)

Operational Information	
Schedule start/end:[b]	January 2011 – December 2025
Number of workers Operations/Maintenance/Support:	36/8/4 per yr
Number of radiation worker:	44 (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	2
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	2.35E-07
Process radioactive emissions: (Ci/yr)	3.10E-05
Fossil fuel emissions: (tons/yr)	668.04 (total)
Effluents Sanitary wastewater: (L/yr)	1,022,000
Solid wastes Sanitary/industrial trash: (m^3/yr)	0.27
Radioactive wastes	
Calcine & Cs resin (HLW): (m^3)	4,324
HEPA filters (LLW): (m^3)	18
Mixed wastes (LLW)	
PPEs & misc. waste: (m^3)	924
Mixed rad. liquid waste: (L)	187,200
Hazardous/toxic chemicals & wastes:	None
Water usage	
Process: (L/yr)	125,000
Domestic: (L/yr)	1,022,000
Energy requirements	
Electrical: (MWh/yr)	7,580
Fuel oil:	
Steam generation: (L/yr)	233,982
Equipment/vehicle oil: (L/yr)	167

a. Sources: EDF-WPF-013; EDF-PDS-L-002.

b. Steam Reforming Option: Preconstruction: October 2003-September 2008; Construction: October 2008-September 2011; Operations: October 2011-December 2035.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-90. Decontamination and decommissioning project data for Calcine Packaging and Loading to Hanford (P117A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:[b]	January 2026 – December 2028
Number of D&D workers :	52 per yr
Number of radiation workers (D&D):	33 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	15 per day
Hours of operation (all heavy equipment): (hrs)	4,662
Acres disturbed	
New: (acres)	None
Previous: (acres)	1.16
Revegetated: (acres)	None
Air emissions: (None/Reference)	See Appendix C.2 for details
Non-radioactive:	
Fuel combustion:	
Major gas (CO_2): (tons/yr)	109
Contaminants[c]: (tons/yr)	5.29 (total)
Effluents	
Sanitary wastewater: (L)	3,327,000
Solid wastes	
Neutron shielding: (m^3)	54.4
Foam: (m^3)	85.6
Radioactive wastes	
Solid wastes (LLW): (m^3)	110
Mixed wastes (LLW)	
Decon solution: (L)	7,837
Hazardous/toxic chemicals & wastes	
Lead (from shielding): (m^3)	46
Used lube oil: (L)	2,000
Water usage	
Process water: (L)	9,140,000
Domestic water: (L)	3,327,000
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	105,874

a. Sources: EDF-WPF-013; EDF-PDS-L-002.

b. Steam Reforming Option: January 2036-December 2036.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.40 Calcine Packaging and Loading to Hanford Just-in-Time (P117B)

General Project Objectives: This project provides for the Waste Packaging Facility operating on a just-in-time schedule with the Hanford vitrification campaign under the Minimum INEEL Processing Alternative. The Waste Packaging Facility would package unprocessed calcined solids and spent cesium-saturated resin into canisters that are proposed for Hanford high level waste disposal and would prepare them for shipment by dedicated rail to the Hanford Site for further processing.

Process Description: The Waste Packaging Facility would start packaging calcine in February 2028 and would complete the removal in March 2030. This just-in-time schedule would support the Hanford vitrification campaign schedule. In order to meet this schedule three identical processing lines and load-out bays would be required in the Waste Packaging Facility. Calcine would be retrieved from the INTEC bins on an as needed basis and collected in a dispensing vessel in the Waste Packaging Facility. Calcine would be metered from the vessel into the Hanford canisters. Intermittently, small amounts of spent, cesium-contaminated resin from the cesium extraction process in the SBW/Newly Generated Liquid Waste Facility would be transported to one of the Waste Packaging Facility dispensing vessels and metered into Hanford canisters. The spent resin would be generated starting in 2009 but would be held in the SBW/Newly Generated Liquid Waste Facility until enough is available to fill four canisters or one shipping cask's worth. All decontamination solution and other contaminated liquid wastes generated in the Waste Packaging Facility would be collected in the Waste Packaging Facility process liquid hold tank and sent to the SBW/Newly Generated Liquid Waste Facility for treatment.

This project includes the facilities and equipment for receiving and packaging the calcine and spent resin. Additionally, it includes the costs for the containers, casks, and railcars needed for shipment. It does not include the costs of the calcine retrieval system external to the Waste Packaging Facility, the rail spur, shipping to and unloading at Hanford, or the return of the railcar/cask assemblies to the INEEL.

Facility Description: The Waste Packaging Facility would be designed to house the equipment and systems for packaging calcine and spent cesium contaminated resin into re-usable containers and for loading those containers into casks that are part of railcars used for transportation to the Hanford Site.

The Waste Packaging Facility would consist of an upper and lower level and would house an empty canister storage area for eighty-eight canisters, an open area for the three canister loading ports leading to the below grade fill cells, and three separate but identical shielded calcine receiving/dispensing and filled canister transport cells. A separate room attached to the eastside of the upper level structure would contain the HEPA filters. Connected to the northwest side would be an open area with access to the remote HEPA filter train cells below. The administration area which would include the process control room and the electrical and mechanical areas would be located off the northwest corner of the upper level structure.

The lower level would consist of two sections. Located along the west wall would be the calcine transport air blower cell housing the calcine transport air blowers, water-cooled aftercoolers and balancing blowers. Four cells would be aligned along the north wall of this area; a remote HEPA filter train cell, a filter leach cell, a decontamination cell, and a filter packaging. Three separate fill cells with airlocks on either end for empty canister insertion and filled canister removal would occupy the rest of the area. The three cask/railcar assembly load-out bays would be located on the lower level.

Table C.6.2-91. Construction and operations project data for Calcine Packaging and Loading to Hanford Just-in-Time (P117B).[a]

Generic Information	
Description/function and EIS project number:	Fill & make ready to send containers of unprocessed calcine to Hanford on a just-in-time schedule (P117B)
EIS alternatives/options:	Minimum INEEL Processing Alt.
Project type or waste stream:	Containers of unprocessed calcine
Action type:	New
Structure type	New facility
Size: (m^2)	2,384
Other features: (pits, ponds, lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end	
Pre-construction:	June 2014 – May 2019
Construction:	September 2019 – November 2024
SO test and start-up:	December 2024 – January 2028
Number of workers:	53 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,617
Hours of operation: (hrs)	3,216 (total)
Acres disturbed	
New/Previous/Revegetated (acres)	None/1.45/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	21
Fuel combustion:	
Major gas (CO_2): (tons/yr)	123
Contaminants[b]: (tons/yr)	5.89
SO testing and start-up:	
Fossil fuel (steam use): (tons/yr)	26
Effluents	
Sanitary wastewater (constr.): (L)	5,981,000
Sanitary wastewater (SO test.): (L)	6,813,000
Solid wastes	
Construction trash: (m^3)	3,329
Start-up testing:	
Sanitary/industrial trash: (m^3/yr)	0.55
Hazardous/toxic chemicals & wastes	
Lube oil: (m^3)	Incinerated at WERF
Hazardous wastes: (m^3)	13.6 (total)
Storage/inventory: (m^3)	2.5
Water usage	
Dust control (construction): (L)	789,000
Domestic water (construction): (L)	5,981,000
Domestic water (SO testing): (L)	6,813,000
Process water (SO testing): (L)	1,100

Table C.6.2-91. Construction and operations project data for Calcine Packaging and Loading to Hanford Just-in-Time (P117B)[a] (continued).

Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Equip./vehicle fuel (constr.): (L)	208,000
Steam generation (SO testing): (L)	943,000
Equip./vehicle fuel (SO testing): (L)	7,994
Operational Information	
Schedule start/end:	February 2028 - March 2030
Number of workers	
Operations/Maintenance/Support:	64/4/32 per yr
Number of radiation worker:	99 (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	30
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	2.98E-07
Process radioactive emissions: (Ci/yr)	3.64E-05
Fossil fuel (steam use): (tons/yr)	26
Effluents	
Sanitary wastewater: (L/yr)	2,129,000
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	0.55
Radioactive wastes	
Unprocessed calcine canisters: (m^3/yr)	1,962
Cesium resin canisters: (m^3/yr)	2.5
HEPA filters (LLW): (m^3/yr)	14
Mixed wastes (LLW)	
PPE & misc. mixed waste (ash): (m^3/yr)/(Ci/yr)	0.4/0.31
Hazardous/toxic chemicals & wastes	
Paint, solvents, etc: (m^3/yr)/(Ci/yr)	2.8/<1
Water usage	
Process water: (L/yr)	3,225,000
Domestic water: (L/yr)	2,129,000
Energy requirements	
Electrical: (MWh/yr)	10,470
Total fuel oil:	
Steam generation: (L/yr)	294,800
Equipment/vehicle fuel: (L/yr)	2,498

a. Sources: EDF-WPF-015; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-92. Decontamination and decommissioning project data for Calcine Packaging and Loading to Hanford Just-in-Time (P117B).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2035 – December 2037
Number of D&D workers:	88 per yr
Number of radiation workers (D&D):	56 new workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips (roll-off trucks):	15 per day
Hours of operation (all heavy equipment): (hrs)	44,024
Acres disturbed	
New: (acres)	None
Previous: (acres)	1.45
Revegetated: (acres)	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Non-radioactive	
Fuel combustion:	
Major gas (CO_2): (tons/yr)	770
Contaminants[b]: (tons/yr)	37.51 (total)
HEPA filtered offgas: (Ci/yr)	1.74E-7
Effluents	
Sanitary wastewater: (L)	7,510,000
Solid wastes	
Neutron shielding: (m^3)	171.7
Foam: (m^3)	270.3
Radioactive wastes	
Metal (LLW): (m^3)/(Ci)	348/insignificant rad
Mixed wastes (LLW)	
LLW Combustible PPE (ash): (m^3)/(Ci)	0.099/0.071
Hazardous/toxic chemicals & wastes	
Lead (from shielding): (m^3)	146.2
Used lube oil:	Incinerated at WERF
Water usage	
Process water: (L)	17,033,000
Domestic water: (L)	7,510,000
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	1,000,000

a. Sources: EDF-WPF-015; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.41 Separations Organic Incinerator (P118)

General Project Objectives: The project addresses the treatment of spent organic solvents that would be used in conjunction with the transuranic extraction, strontium extraction, and ion-exchange separation processes. The Separations Organic Incinerator would operate in support of the INTEC Waste Separations Facility or Transuranic Separations Facility.

The design and requirements of the Separations Organic Incinerator have not been finalized. It is assumed that the incinerator would control emissions without the addition of additional offgas control systems for NOx, mercury, and dioxin.

Process Description: The primary separation processes would be ion exchange and liquid-liquid extraction. Cesium would be removed by an ion exchange process. Actinides would be removed through the transuranic extraction liquid-liquid extraction process. Finally, strontium would be removed from the stream using the strontium extraction liquid-liquid process. Although each of these processes would recycle extraction solvents, they would become spent at some point in the process. At that time, solvent disposal is necessary. This project assumes that the solvents would be incinerated in the Separations Organic Incinerator.

Facility Description: The Separations Organic Incinerator would be made up of three sections, a combustion chamber, quench chamber, and an ash collection sump. The incinerator would be designed for four nine-day incineration campaigns per year. The normal feed rate would be 147 pounds per hour.

The feed would consist of a composition of the following:

- Two thousand gallons per year of transuranic separations spent solvent.

- Two thousand gallons per year of strontium extraction spent solvent.

- Fourteen thousand gallons per year of dodecane spent solvent.

Table C.6.2-93. Construction and operations project data for the Separations Organic Incinerator (P118).[a]

Generic Information	
Description/function and EIS project number:	Treat spent organic solvents from separation process (P118)
EIS alternatives/options:	Full Separations, Planning Basis, & Transuranic Separations Options
Project type or waste stream:	Spent organic solvent
Action type:	New
Structure type	New facility
Size: (m^2)	232
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end:	
Full Separations Option[b]:	
Preconstruction:	April 2006 – September 2009
Construction:	October 2009 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	10 per yr
Number of radiation workers:	None
Heavy equipment:	Crane, material delivery trucks
Trips:	41
Hours of operation (hrs):	4,723 (total)
Acres disturbed	
New/Previous/Revegetated (acres)	None/0.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	2
Diesel exhaust:	
Major gas (CO_2): (tons/yr)	103
Contaminants[c]: (tons/yr)	5
Effluents	
Sanitary ww (construction): (L)	702,591
Sanitary ww (SO testing): (L/yr)	293,574
Solid wastes	
Construction trash: (m^3)	391
SO testing & start-up:	
Sanitary/industrial trash: (m^3/yr)	47
Radioactive wastes	
Contaminated soil (LLW): (m^3)	2
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	896
Solid hazardous waste: (m^3)	1
Water usage	
Dust control (construction): (L)	24,981
Domestic (construction): (L)	702,591
Domestic (SO testing): (L/yr)	293,574
Process (SO testing): (L)	66,238
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel	
Heavy equipment: (L)	110,671
Process use (SO testing): (L)	766

Table C.6.2-93. Construction and operations project data for the Separations Organic Incinerator (P118)[a] (continued).

Operational Information	
Schedule start/end: Full Separations Option[b]:	January 2015 – December 2035
Number of workers per year Operations/Maintenance/Support:	4/1/3.5 per yr
Number of radiation workers:	8.5 (inc. in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment Trips:	Mobile cranes, forklifts, trucks 4 per yr
Air emissions: (None/Reference) Process chemical emissions[d]: (lb/hr)	See Appendix C.2 for details. 1,149.8
Effluents Sanitary wastewater: (L/yr)	293,574
Solid wastes Sanitary/industrial trash: (m^3/yr)	47
Radioactive wastes Solid radioactive wastes (LLW): (m^3) HEPA filter (LLW): (m^3)	84 3
Hazardous/toxic chemicals & wastes Solid hazardous waste: (m^3)	21
Mixed wastes (LLW) PPEs & misc. rad. waste: (m^3) Mixed liquid rad. waste: (L)	268 31,500
Water usage Process: (L/yr) Domestic: (L/yr)	461,808 293,574
Energy requirements Electrical: (MWh/yr) Fuel oil (equipment/vehicles): (L/yr)	17 333

a. Sources: EDF-PDS-E-008; EDF-PDS-L-002.

b. Schedule for other options:
Planning Basis Option: Preconstruction: March 2011 – September 2014; Construction: October 2014 – December 2017; SO testing: January 2018 – December 2019; Operations: January 2020 – December 2035.
TRU Separations Option: Preconstruction: March 2005 – September 2009; Construction: October 2009 – December 2012; SO testing: January 2013 – December 2014; Operations: January 2015 – December 2035.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

d. Source: EDF-PDS-C-043.

Table C.6.2-94. Decontamination and decommissioning project data for the Separations Organic Incinerator (P118).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2037
Number of D&D workers:	2 per yr
Number of radiation workers (D&D):	2 new workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	30 per day
Total hours of operation: (hrs)	3,752
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Fuel combustion:	
Major gas (CO_2): (tons/yr)	131
Contaminants[b]: (tons/yr)	6 (total)
Effluents	
Sanitary wastewater: (L)	716,747
Solid wastes:	None
Hazardous/toxic chemicals and wastes	
Lube oil: (L)	710
Radioactive wastes	
Decon solution: (L)	946
Mixed waste	
Mixed solid waste: (m^3)	14
Water usage	
Domestic water: (L)	716,747
Process water: (L)	228,488
Energy requirements	
Electrical: (MWh/yr)	7.8
Fossil fuel: (L)	85,208

a. Sources: EDF-PDS-E-008; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.42 Waste Treatment Pilot Plant (P133)

General Project Objective: The proposed project would provide a pilot plant that would be used for process and equipment development testing. The facility would have both radioactive and non-radioactive testing areas for laboratory, bench, component, and integrated pilot scale tests. These tests would be required to study and identify the design parameters for the Waste Treatment Facility equipment and process. The Waste Treatment Facility would treat the HLW at INTEC.

Process Description: Waste Treatment Pilot Plant testing would include both radiologically hot and cold tests. Hot testing would be done at roughly 1/50 scale relative to the corresponding full-scale operations and would be expected to include the following:

- Bench scale testing of calcine dissolution processes.
- Bench scale integrated testing of the liquid-liquid separations process to extract fission products and actinides from dissolved radioactive calcines.
- Bench scale testing of ion-exchange extraction of cesium-137 from dissolved calcine
- Testing of filtration systems to separate undissolved solids from dissolved calcines
- Bench scale denitration and vitrification of high activity aqueous raffinates from separations
- Sample preparation and chemical/physical analysis of hot glass samples
- Sample preparation and chemical/physical analysis of glass frit/waste mixtures prior to vitrification

The sizes of the hot cells were selected by consideration of (a) the size of the hot cell currently being used for 1/50 scale testing of radioactive separations in the Radiological Analytical Laboratory at INTEC, (b) the size of the hot cell being used at Hanford for subscale vitrification testing, and (c) the size of analytical hot cells being used at the Savannah River Site to support the Defense Waste Processing Facility.

In addition to hot process testing described above, hot analytical cells would be included in the facility to allow wet chemistry, remoted analytical determinations (e.g., scanning electron microscopy, X-ray diffraction measurements, and inductively-coupled plasma/mass spectroscopy), and dilution and preparation of hot samples for glove box analytical procedures. The facility would also include ample glove box space to complement the hot analytical cells.

Cold pilot scale testing in the facility is expected to encompass the following:

- Integrated pilot scale testing of liquid-liquid separations of fission product and actinide simulants from cold calcines
- Scaleup testing of glass melters (hot melter testing is expected to be done at crucible scale, only)
- Integrated vitrification system pilot scale demonstration, including pretreatment of vitrification feeds from separations (i.e., evaporation and denitration) and offgas treatment
- Treating of offgas treatment systems for denitration, vitrification, and dissolution systems, including thermal quench, acid and/or caustic scrubbing, NO_x reduction, mercury extraction, and HEPA filtration
- Production of cold calcine simulants for all calcine stored at INTEC
- Synthesis of cold simulants for high activity liquid wastes from separations for vitrification system development testing
- Cold pilot scale testing of calcine dissolution and undissolved solids filtration systems
- Cold testing of undissolved slurry handling/transport systems

- Mockup of full scale process equipment

Nonradioactive laboratory scale tests would also be performed to complement pilot scale testing. Laboratory testing would be done in the following areas:

- Materials testing/evaluation of coupons from pilot testing

- Stability (precipitation) testing of stored, concentrated waste solutions from separations

- Treatability tests for secondary waste streams (e.g., mercury)

- Laboratory tests to optimize extraction solvent compositions for separations

- Cold analytical procedures supporting pilot plant testing (e.g., leach testing of glass made from high activity separations effluent and of grouted waste from low activity separations effluent, sample analysis from offgas system testing, etc.)

Equipment that would be utilized in hot process cells would likely include subscale centrifugal liquid-liquid contactors, ion-exchange columns, calcine dissolution vessels (breakers/flasks), crucible furnaces, sintered metal filters, small-scale denitration equipment (kilns, fluidized beds), and equipment for sizing and dissolution of glass samples. Standard analytical equipment such as stirrers, crucible ovens, titrators, etc., would also be used.

Cold pilot facilities would include pilot scale centrifugal liquid-liquid contactors and ion-exchange columns, heated calcine dissolution tanks with mixing, subscale glass melters, sub- and full-scale sintered filters, and subscale rotary kilns and/or fluidized bed calciners. The 15 centimeter pilot plant for the INTEC New Waste Calcining Facility would be moved from CPP-637 to the Waste Treatment Pilot Plant to provide cold calcine simulants for used in pilot scale development/demonstration work. Tankage equipment would be used for makeup and storage of feedstocks for pilot scale processes, and full-scale process equipment mockups would be used for training, evaluation, and development of operating/maintenance procedures. Coring equipment for sampling and testing of grouted low activity waste would be used, and typical laboratory equipment would be installed and used in the cold laboratory space. Analytical equipment such as scanning/transmission electron microscope, optical microscopes, microprobes, X-ray diffractometers, viscometers, mass spectrometers, balances, gas analysis and particulate sizing equipment might also be used. All cold laboratories would include hood space with suitable air filtering/conditioning systems.

Cold pilot plant for separations and vitrification, and analytical hot cells would continue operation beyond full-scale startup to support waste processing operations in the Waste Treatment Facility.

Facility Description: The Waste Treatment Pilot Plant would be located in the northeast corner of INTEC, north of Palm Avenue and Hemlock Street. The ground floor footprint of the building would be approximately 34,500 feet. The main areas of the facility would consist of hot cells, crane bay, cold pilot plant, receiving and storage, and general support areas with office space and laboratories. Two floors above ground level would provide low-cost space for laboratories (8,800 square feet) and mechanical/electrical equipment (5,000 square feet). The crane bay (with 20-ton bridge crane) and crane maintenance areas (5,000 square feet) above the hot cells would be arranged to provide removal of concrete hatchways allowing access to the hot cells below, and allowing maintenance and decontamination of large items exposed to the hot cell environments. The total floor space in the facility is anticipated to be not less than 58,000 square feet.

Two types of hot cells (analytical cells and process cells) would be arranged in two parallel rows. The rows would be separated by a buffer area (with a 30-ton and 5-ton crane) and a decontamination cell. Each row of hot cells would have a manipulator running the entire length and eleven shield windows for viewing inside the cells (22 shield windows in all). Twenty of the windows would each be equipped with a pair of manipulators, and the remaining two windows are to be used for operating the manipulators.

The facility would be all above grade with a minimum overall height of 58 feet plus the stack and would be divided into different building classifications by code to reduce construction costs. Construction types that would be employed would include shielded concrete, pre-cast concrete, pre-engineered metal building fabrications, and combinations thereof for cost containment.

Table C.6.2-95. Construction and operations project data for the Waste Treatment Pilot Plant (P133).[a]

Generic Information	
Description/function and EIS project number:	Pilot plant process development studies
EIS alternatives/options:	All options under Separations, Non-Separations ***(except Steam Reforming)***, Min. INEEL Processing, ***and*** ***Direct Vitrification Alternatives***
Project type or waste stream:	Solid LLW
Action type:	New
Structure type	New facility
Size: (m^2)	5,440
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end: [b]	
Preconstruction:	January 2000 – December 2004
Construction:	January 2005 – December 2007
SO test and start-up:	January 2008 – December 2008
For Planning Basis Option only:	
Preconstruction:	January 2005 – December 2009
Construction:	January 2010 – December 2012
SO test and start-up:	January 2013 – December 2013
Number of workers:	63 per yr
Number of radiation workers:	None
Heavy equipment	Excavator, grader, crane, backhoe, trucks
Trips:	895
Hours of operation (hrs):	16,370
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust (construction): (tons/yr)	17
Diesel exhaust (construction):	
Major gas (CO_2): (tons/yr)	467
Contaminants[c]: (tons/yr)	21.2
Steam generation (SO testing):	
Major gas (CO_2): (tons/yr)	4,185[d]
Contaminants[c]: (tons/yr)	19.2[e]
Effluents	
Sanitary ww (construction): (L)	4,024,000
Sanitary ww (SO testing): (L)	830,000
Solid wastes	
Sanitary/industrial trash:	
Construction: (m^3)	2,240
SO testing: (m^3)	0.22
Waste salt (SO testing): (m^3)	10
Hazardous/toxic chemicals & wastes	
Used lube oil: (m^3)	6,300
Solid hazardous waste: (m^3)	14
Radioactive wastes	
Contaminated soil (LLW): (m^3)	42
Water usage	
Dust control (construction): (L)	362,000
Domestic (construction): (L)	4,024,000
Domestic (SO testing): (L)	830,000

Table C.6.2-95. Construction and operations project data for the Waste Treatment Pilot Plant (P133)[a] (continued).

Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil:	
Heavy equipment (construction): (L)	455,000
Steam generation (SO testing): (L/yr)	1,473,516[f]
Operational Information	
Schedule start/end[b]:	January 2009 – December 2035
Min. INEEL Process. Alternative only:	January 2009 – December 2025
Planning Basis Option only:	January 2014 – December 2035
Direct Vitrification Alternative only:	***October 2011 – September 2017***
Number of workers per year	
Operations/Maintenance/Support:	23/7/9 per yr
Number of radiation workers:	33 (included in above totals)
Annual average worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Trips:	4 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Diesel exhaust:	Essentially none
Steam generation:	
Major gas (CO_2): (tons/yr)	4,185[d]
Contaminants[c]: (tons/yr)	19.2[e]
Building ventilation: (Ci/yr)	2.8E-08
Effluents	
Sanitary wastewater: (L/yr)	830,000
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	0.22 (ash)
Waste salt: (m^3/yr)	10
Radioactive wastes	
HEPA filters (LLW): (m^3)	90
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	4
Mixed wastes (LLW)	
PPEs: (m^3)	1,337
Mixed liquid waste: (L)	948,672
Water usage	
Domestic water: (L/yr)	830,000
Energy requirements	
Electrical: (MWh/yr)	2,514
Fuel oil:	
Equipment/vehicle fuel: (L/yr)	369
Steam generation: (L/yr)	1,473,516[f]

a. Sources: EDF-PDS-I-028; EDF-PDS-L-002***; Casper (2000)***.

b. ***Schedules*** for Full Separations, TRU Separations, HIPed Waste, Direct Cement, Early Vitrification Options, and Minimum INEEL Processing Altenative. ***Direct Vitrification Alternative: Preconstruction: October 2000-September 2005; Construction: October 2005-September 2010; SO testing and startup: October 2010-September 2011.***

c. CO, particulates, NO_x, SO_2, hydrocarbons.

d. Value shown is for Full Separations and Planning Basis Option only. For Transuranic Separations Option: 2,091 tons/yr and for Hot Isostatic Press Waste Option, Direct Cement, Early Vitrification Options, and Minimum INEEL Processing Alternative: 1,257 tons/yr.

e. Value shown is for Full Separations and Planning Basis Option only. For Transuranic Separations Option: 9.6 tons/yr and for Hot Isostatic Press Waste Option, Direct Cement, Early Vitrification Options, and Minimum INEEL Processing Alternative: 5.8 tons/yr.

f. Value shown is for Full Separations and Planning Basis Option only. For Transuranic Separations Option: 736,285 L/yr; and for Hot Isostatic Press Waste Option, Direct Cement, and Early Vitrification Options, and Minimum INEEL Processing Alternative: 442,801 L/yr.

Table C.6.2-96. Decontamination and decommissioning project data for the Waste Treatment Pilot Plant (P133).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:[b]	January 2036 – December 2037
Number of D&D workers:	45 per yr
Number of radiation workers (D&D):	25 workers per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	2 per day
Total hours of operation: (hrs)	19,624
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.17/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Diesel exhaust:	
Major gas (CO_2): (tons/yr)	1,374
Contaminants[c]: (tons/yr)	31.3
Effluents	
Sanitary wastewater: (L)	1,932,000
Solid wastes	
Metal recycle: (m^3)	36.9
Building recycle: (m^3)	5,397
Radioactive wastes	
Building debris (LLW): (m^3)	6,745
Hazardous/toxic chemicals and wastes	
Solid hazardous wastes: (m^3)	3
Used lube oil: (L)	5,000
Mixed wastes	
Decon solution: (L)	22,165
Water usage	
Domestic water: (L)	1,932,000
Process water: (L)	341,000
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	446,000

a. Sources: EDF-PDS-I-028; EDF-PDS-L-002.

b. Minimum INEEL Processing Alternative: January 2026-December 2027.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.43 NGLW Grout Facility (P2001)

General Project Objective: The proposed project would process all NGLW generated from 2006 through 2035. It would do so by blending the concentrated NGLW with other materials to form a grouted-waste product. Although the radioactive characteristics of such a waste form are uncertain at this time, it is believed that this grouted waste would be classified as mixed, remote-handled, transuranic waste. As such, it could only be sent to WIPP for disposal.

Process Description: The NGLW Grout Facility project includes the following elements:

1. Transferring concentrated NGLW from its holding tanks to the grouting facility
2. A three-story, remotely-operated processing plant with lag storage and cask-loading bay
3. Processing the NGLW into a grouted waste and pouring it into appropriate canisters
4. Sampling each batch of grouted waste for analysis and certification
5. A vessel offgas system tied to the HEPA-filtered, building ventilation system
6. Storing the grout canisters until the grout cures
7. Decontaminating the canisters
8. Welding the lids on the canisters
9. Canister moving and handling system
10. Cask loading area and equipment

Facility Description: The NGLW Grout Facility would use a new, three-story building to receive the concentrated NGLW, process the NGLW into grout, package the grouted waste in canisters, seal and decontaminate the canisters, and load them into casks for shipment to WIPP. This building would have a footprint roughly 100 feet by 75 feet. Each of its three floors would have an approximate area of 7,500 square feet, for a total of 22,500 square feet. Two floors would be above grade and one would be below grade. Each floor is roughly 25 feet high and the cask-loading area is a high bay. The plant would be designed for remote operations and include thick concrete walls to surround each of the processing cells and the cask loading area.

It is estimated that a total of 235,000 gallons of concentrated NGLW will be generated from 2006 through 2035. Based on this amount of NGLW, about 53 cubic meters of grout per year (or roughly 4.5 cubic meters per month) would have to be made during the plant's operating years from ***2013*** through 2035. The grout would be loaded to at least 60 weight-percent NGLW.

A quantity of concentrated NGLW would be transferred from the NGLW storage tanks via valve boxes and new piping to the grout plant's small, batch storage tank. The NGLW's pH would be adjusted, as needed, by the addition of calcium oxide. Then the NGLW would be blended with the cement, fly-ash, and other ingredients deposited via hoppers into a batch mixer. At least four canisters of grout could be produced per day of actual grout-making operations, and a month's worth of grouted waste (eight canisters) could be produced in two days of grouting. The grouting equipment includes a vessel offgas system to minimize airborne contamination. A HEPA-filtered ventilation system is connected with the vessel offgas system and the building ventilation. During the grout-mixing operation, a small quantity is removed for analysis, so that the contents of any canister can be certified.

The grout mixer must be flushed at the end of each day of grouting to prevent grout residue from hardening in the mixer. Up to 100 gallons of water and nitric acid would be used for this purpose. This secondary liquid waste would be stored in a small tank until there is enough to return to the tank farm for subsequent concentration via evaporation. Eventually the re-concentrated liquid would be added to the NGLW storage tanks for grouting. This small amount of concentrated, secondary waste has not been included in the NGLW volume mentioned earlier.

A remotely operated transfer cart system would place a canister beneath the ouput of the mixer. This canister can hold one batch of grout from the grout mixer, or 0.6 cubic meters of grouted waste. After a canister has been filled, it is fitted with a temporary, vented lid and then placed in temporary storage while the grout cures (total cure time is roughly one month). With the "just-in-time" shipping philosophy (waste shipped to WIPP according to INEEL's processing schedule), there should seldom be more than eight canisters in lag storage at any time. However, there is about 2,200 square feet of shielded storage available, should it be needed, and each canister requires about 16 square feet of floor-space for storage.

After the grout has cured in a canister, that canister is moved from storage via the cart transport system through shielded doors into a remotely-operated welding cell, where a lid is welded onto the canister and the seam is checked for leaks.

From the welding cell, the canister is moved via the cart system through shielded doors into a decontamination cell, where the canister's thin, protective coating is removed by blasting with carbon dioxide pellets. Once it has been determined that the canister has been successfully decontaminated, it is moved to the cask-loading area.

In the cask loading bay, a full-time crew of 12 people must load 2 casks per week, in order to keep up with the shipping schedule of 8 canisters per month, or 2 canisters per week. A type 72-B shipping cask weighs 45,000 pounds and can hold a maximum of one canister (2 feet in diameter by 20 feet tall).

Table C.6.2-97. Construction and operations project data for the NGLW Grout Facility (P2001).[a]

Generic Information	
Description/function and EIS project number:	New processing plant for NGLW (P2001)
EIS alternatives/options:	Steam Reforming Option
Project type or waste stream:	Waste management program
Action type:	New building – Processing plant for NGLW
Structure type:	Concrete/steel, 3-story bldg.
Size: (m^2)	700
Other features (pits, ponds, lines):	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end:	
Preconstruction:	January 2003 – December 2007
Construction:	October 2009 – September 2012
SO test and start-up:	April 2012 – September 2013
Number of workers:	50 per yr
Number of radiation workers:	None
Heavy Equipment:	Excavator, grader, crane, delivery trucks
Trips:	247
Hours of operation:	7,720
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.5/None
Air emissions:	
Dust: (tons/yr)	7.2
Fuel Combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	201
Contaminants[b]: (tons/yr)	9
SO testing (steam generation):	
Major gas (CO_2): (tons/yr)	586
Contaminants[b]: (tons/yr)	2.68
Effluents:	
Sanitary wastewater (constr.): (L)	3,190,000
Sanitary wastewater (SO testing): (L)	800,000
Radioactive wastes:	
Contaminated soil (LLW): (m^3)	None
Solid wastes:	
Sanitary/Industrial waste (constr./SO testing): (m^3)	1,780/210
Hazardous/toxic chemicals & wastes:	
Lube oil: (L)	1,460
Water usage:	
Dust control (constr.): (L)	450,000
Domestic (constr./SO testing): (L)	3,190,000/800,000

Table C.6.2-97. Construction and operations project data for the NGLW Grout Facility (P2001)[a] (continued).

Construction Information (continued)	
Energy requirements:	
Electrical (constr./SO testing): (MWh/yr)	180/540
Fossil Fuel:	
Heavy Equipment (constr.): (L)	196,000
Other use (SO testing): (L)	310,000
Operational Information	
Schedule start/end:	October 2013 – December 2035
Number of workers:	
Operations/Maintenance/Support:	25 per yr
Number of radiation workers:	22 per yr (included in above total)
Avg. annual worker radiation dose: (rem/yr)	0.19 per worker
Air emissions:	
Building ventilation: (Ci/yr)	$6.0x10^{-8}$
Steam generation:	
Major gas (CO_2): (tons/yr)	586
Contaminants[b]: (tons/yr)	2.68
Effluents:	
Sanitary wastewater: (L/yr)	473,000
Solid wastes:	
Sanitary/industrial trash: (m^3/yr)	140
Radioactive wastes:	
HEPA filters (LLW): (m^3/yr)	1.1
Mixed wastes: (MLLW)	
PPEs & misc. rad. waste: (m^3/yr)	33
Water usage:	
Domestic water: (L/yr)	473,000
Process Water (flush) (L/yr)	76,000
Energy requirements:	
Electrical: (MWh/yr)	540
Fossil fuel:	
Steam generation: (L/yr)	207,000

a. Source: P2001-TGM-02-2001

b. CO, particulates, NO_x, SO_2, hydrocarbons.

HEPA = high efficiency particulate air; PPE = personal protective equipment.

Table C.6.2-98. Decontamination and decommissioning project data for the NGLW Grout Facility (P2001).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2036 – December 2036
Number of workers:	16
Number of radiation workers:	9 (included in above total)
Avg. annual worker radiation dose: (rem/yr.)	0.25
Heavy Equipment:	
Equipment Used	Trucks and heavy equipment
Hours of operation:	6,000
Acres disturbed:	
New/Previous/Revegetated:	None/0.5/None
Air emissions:	
Radioactive contaminants: (Ci/yr)	4.0×10^{-8}
Fuel Combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	420
Contaminants[b]: (tons/yr)	19
Effluents:	
Sanitary wastewater: (L)	341,000
Solid wastes:	
Industrial: (m^3)	1,870
Radioactive wastes:	
Building debris (LLW): (m^3)	2,490
HEPA filters (LLW): (m^3)	0.2
Hazardous/toxic chemicals & wastes:	
Lube oil: (L)	1,140
Mixed wastes: (MLLW)	
PPE: (m^3)	14
Water usage:	
Process: (L)	852,000
Domestic: (L)	341,000
Energy requirements:	
Electrical: (MWh/yr)	180
Fossil fuel: (L)	136,300

a. Source: P2001-TGM-02-2001.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

HEPA = high efficiency particulate air; PPE = personal protective equipment.

C.6.2.44 Steam Reforming (P2002A)

General Project Objectives: The Steam Reforming project provides for the design, construction, startup, operation, and decommissioning of a new Steam Reforming Facility to process liquid SBW from the Tank Farm as well as other liquid waste from INTEC (newly generated liquid waste) that may be produced during the time that the Steam Reforming Facility is processing SBW. The liquid would be converted to a dry powder that would be canned and shipped to the Waste Isolation Pilot Plant as remoted-handled, mixed transuranic waste.

Process Description: The central feature of the Steam Reforming project is the Reformer, a fluidized bed reactor in which steam is used as the fluidizing gas and a refractory oxide material is used as the bed medium. An organic reductant and other additives are also fed to the bed to enhance denitration and prevent particle agglomeration. Water in the waste is vaporized to superheated steam, while organic compounds in the waste are broken down through thermal processes and reaction with hot nitrates, steam, and oxygen. A fine, solid, remote-handled waste consisting of primarily organic salts is produced. Solid product is separated from the entrained bed using a cyclone within the reactor. Bed media are returned to the reactor from the cyclone, while the product is carried out with the offgas. Filter candles are used to separate the solid product from the offgas. Periodic back pulsing of the candles with nitrogen recovers the solids, which are combined with larger particles that are occasionally withdrawn from the bottom of the bed. Together, these solids constitute the primary steam-reformed product.

The product of the steam reforming project would be collected and packaged in the Calcine and Steam-Reformed Product Packaging Facility, which is the same facility that would be used to package calcine for shipment to the geologic repository (see Project 117A, Calcine Packaging and Loading).

New Facility Description: The Steam Reforming Facility would be built in the northeast corner of INTEC. It would be a multistory building that would contain approximately 87,000 square feet of floor space and cover a footprint of approximately 45,000 square feet. In addition to the Reformer vessel, the facility would contain filters, driers, a steam generator and superheater, various tanks, ceramic filters, offgas treatment, mercury processing equipment, and other ancillary process equipment. The facility would receive liquid waste from three sources: SBW, newly generated liquid waste, and tank heel sludge.

The steam generator and superheater would provide steam at 700 pounds per hour at 500 to 600 degrees Celsius to the reformer vessel. The reformer converts the liquid waste stream to a fine powder, which leaves the vessel in the offgas. After the product is filtered from the offgas, the steam is condensed and returned to the steam generator. A quencher/scrubber subsystem cools the offgas and removes acid gases. The acid gases are neutralized by injection of sodium hydroxide to yield sodium salts. The salts are dried and combined with the steam-reformed product for shipment to WIPP. Vapors from the drying process could contain mercury, which would be condensed and amalgamated prior to disposal.

The scrubbed offgas then undergoes a thermal conversion of an trace organics, carbon monoxide, and hydrogen to carbon dioxide and water, which is then polished with granulated activated carbon to remove any remaining mercury. Finally, the offgas is HEPA-filtered and discharged through a stack with continuous emissions monitoring. The overall destruction and removal efficiency for the entire process is expected to exceed 99.9999 per cent.

Table C.6.2-99. Construction and operations project data for the Steam Reforming Plant (P2002A).[a]

Generic Information	
Description/function and EIS project number:	Houses equipment/operations for steam reforming SBW, tank heels, and NGLW
EIS alternatives/options:	Non-Separations /Steam Reforming
Project type or waste stream:	convert SBW to powder
Action type:	New
Structure type:	Reinforced concrete
Size: (m^2)	8,110
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end	
Preconstruction:	January 2003 – September 2006
Construction:	October 2006 – September 2009
SO test and start-up:	October 2009 – September 2011
Number of workers:	295 per year
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Hours of operation: (hrs)	12,430 (total)
Trips:	460
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	15
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	420
Contaminants[b]: (tons/yr)	20
SO testing and start-up:	
Process air emissions: (tons/yr)	0.17
Fuel combustion: steam use (tons/yr)	339
Fuel combustion: diesel exhaust (tons/yr)	59
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	162
Lube oil: (L)	2,960
Radioactive wastes	
Contaminated soil: (m^3)	78
Solid wastes	
Construction trash: (m^3)	10,494
SO testing:	
Sanitary/industrial trash: (m^3/yr)	1,636

Table C.6.2-99. Construction and operations project data for the Steam Reforming Plant (P2002A) [a] (continued).

Construction Information (continued)	
Effluents	
Sanitary wastewater (construction): (L/yr)	10,312,000
SO testing and start-up	
Sanitary wastewater: (L/yr)	1,706,000
Process wastewater: (L/yr)	90,000
Water usage	
Dust control (construction): (L)	454,200
Domestic (construction): (L/yr)	10,312,000
Process (SO testing): (L/yr)	90,000
Domestic (SO testing): (L/yr)	1,706,000
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel	
Heavy equipment: (L)	409,134
Steam generation (SO testing): (L/yr)	116,364
Operational Information	
Schedule start/end:	
Waste Processing	October 2011 – September 2013
Waste Shipment	October 2011 – March 2017
Number of workers	
Operations/Maintenance/Support:	32/4/10
Number of radiation workers:	40 per yr (incl. in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	220 trips per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	1.21E-07
Process radioactive emissions: (Ci/yr)	3.13E-05
Process tritium emissions: (Ci/yr)	45
Process chemical emissions: (tons/yr)	0.17
Fossil fuel emissions: (tons/yr)	339
Diesel exhaust: (tons/yr)	58
Effluents	
Sanitary wastewater: (L/yr)	1,706,000
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	255
Radioactive wastes	
Process output: Remote-handled TRU: (m^3)	1,110
Filters (LLW): (m^3)	70
Mixed wastes (LLW)	
PPEs & misc. rad. wastes: (m^3)	1,200
Liquid mixed waste: (L)	0
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	59

Table C.6.2-99. Construction and operations project data for the Steam Reforming Plant (P2002A) [a] (continued).

Operational Information (continued)	
Water usage	
Process water: (L/yr)	0
Domestic water: (L/yr)	1,600,000
Energy requirements	
Electrical: (MWh/yr)	7,250
Fossil fuel:	
Steam generation: (L/yr)	116,364
Equipment/vehicle fuel: (L/yr)	18,319

a. Sources: Wood (2002a,b); Mason (2002); scaling or adaptation from P9B project data sheet.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-100. Decontamination and decommissioning project data for the Steam Reforming Plant (P2002A).[a]

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	October 2013 – September 2014
Number of D&D workers:	72
Number of radiation workers (D&D):	45
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-of trucks, dozers, loaders
Sanitary wastewater: (L)	1,535,000
Solid wastes	
Non-radioactive (industrial): (m^3)	10,980
Radioactive wastes	
Building debris (LLW): (m^3)/(Ci)	14,520/145
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	3,800
Solid hazardous waste: (m^3)	6
Mixed wastes (LLW)	
Decon solution: (L)	41,578
Water usage	
Process water: (L)	675,000
Domestic water: (L)	1,535,000
Energy requirements	
Electrical: (MWh/yr)	96
Fossil fuel (equipment/vehicles): (L)	457,000

a. Sources: Wood (2002a,b); Mason (2002); scaling or adaptation from P9B project data sheet.

FACILITY DISPOSITION PROJECTS

C.6.2.45 Bin Set 1 Performance-Based Closure (P1F)

General Project Objectives: The proposed project defines and describes the activities that would be required for performance-based closure of the bin set 1 following the transfer of calcine from bin set 1 to bin set 7 (P1E). This includes the regulatory, compliance, and design requirements, cost estimates, and estimated schedules. Bin set 1 would then be filled with clean grout for stabilization purposes.

Physical Description: Bin set 1 consists of four sets of three concentric, stainless steel bins for a total of 12 bins. The storage capacity for bin set 1 is approximately 7,844 cubic feet. All of the bins are enclosed in a square concrete vault to provide secondary containment for the calcine. The vault for bin set 1 is buried 54.83 feet in the ground. The bins in bin set 1 are not anchored to the vault.

Closure Process Description: Performance-Based Closure of the Calcined Solids Storage Facilities would be expected upon completion of the following activities:

1. Filling the vault void to provide added structural rigidity to the bins and minimize the chance of subsidence within the Calcined Solids Storage Facilities over time. (Subsidence minimization is not a regulatory requirement but would be done as a best management practice.)
2. Decontaminating the interior surfaces of the piping, bins, vault (if necessary), and ancillary equipment.
3. Removing the residual calcine from the bins.
4. Sampling the calcine material in bin set 1.
5. Performing a risk analysis of the remaining bin contaminants.
6. Verifying that the risk to public health from the remaining bin residual contaminants, when combined with all other health risk sources at INTEC, is consistent with the cumulative risk assessment limits.
7. Filling the remaining bin voids with clean gout to solidify the remaining contaminants.

Performance-based closure would involve the use of robotics (snake-like crawler robots, tractor/vacuum robots, and light duty utility arms), existing retrieval equipment, and carbon dioxide blasting to clean the bottoms of the bins, as well as the ledges and pipe supports. Robots would be used due to the high radiation fields expected in the bins, as they could be deployed and operated remotely through the use of controllers and camera systems. Carbon dioxide blasting would be used for decontamination purposes because it is more effective than other decontamination methods, it minimizes the generation of secondary waste, and it would not adversely affect the bin surfaces.

Table C.6.2-101. Decontamination and decommissioning project data for the Performance-Based Clean Closure with Subsequent Clean Fill of Bin Set 1 in the Calcined Solids Storage Facility (P1F).[a]

Generic Information	
Description/function and EIS Project number:	Bin set closure to clean closure
EIS alternatives/options:	Continued current operations
Project type or waste stream:	Waste management program
Action type:	New
Structure type:	Calcine solids storage units, Weather enclosure
Size: (m^2)	86
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, and Water
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around calciner bin set 1
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Pre-D&D:	January 2010 – January 2014
D&D:	January 2014 – December 2019
Number of D&D workers:	110 workers/yr
Number of radiation workers (D&D):	110 workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Cement trucks
Trips:	113
Hours of operation: (hrs)	3,946
Acres disturbed	
New/Previous/Revegetation: (acres)	None/1.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Gases (CO_2): (tons/yr)	204
Contaminants[b]: (tons/yr)	9.9
Calcine (cleaning): (Ci/yr)	2.23E-08
Effluents	
Sanitary wastewater: (L)	3,513,000
Grout truck wash: (L)	18,000
Solid wastes	
Construction/D&D trash: (m^3)	1,956
Radioactive solid wastes:	All expected to be mixed haz. wastes
Hazardous/toxic chemicals & wastes	
Storage/inventory: (m^3)	32.6 (total)
Generation	
Misc. D&D: (m^3)	1.2
Lube oil: (L)	18,837
Mixed hazardous waste (generation)	
PPE: (m^3)/(Ci)	0.30/2.2
Debris from D&D: (m^3)/(Ci)	131/1.31

Table C.6.2-101. Decontamination and decommissioning project data for the Performance-Based Clean Closure with Subsequent Clean Fill of Bin Set 1 in the Calcined Solids Storage Facility (P1F) [a] (continued).

Decontamination and Decommissioning (D&D) Information (continued)	
Water usage	
Process water: (L)	23,678
Domestic water: (L)	3,513,000
Energy requirements	
Electrical: (MWh/yr)	382
Fossil fuel: (L)	99,534

a. Sources: EDF-PDS-C-041; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.46 Performance-Based Closure with Subsequent Clean Fill of the Tank Farm Facility (P3B)

General Project Objective: The general objective of this project is to provide for the Resource Conservation and Recovery Act (RCRA) performance-based closure of the 11 stainless steel tanks contained within the Tank Farm Facility. The Tank Farm Facility currently stores High-Level Liquid Waste and sodium-bearing liquid waste. Closure activities would begin once usage of a tank or tanks ceases. Each tank and vault would be filled with clean grout as part of the closure process. Existing operations would remove the liquid waste (except for the heel) from the Tank Farm Facility.

Process Description: Each individual tank system would be isolated from the rest of the Tank Farm by cutting, grouting (as applicable), and capping the ancillary piping. Tank and vault wall contamination residue would be washed into the heel using water or decon solution. The residual heel material in the tanks and vaults would then be stabilized. The stabilization process would include washing, flushing, pumping, pH adjustment, heel displacement, and free liquid elimination.

A material sampling and risk analysis of the remaining tank heel and vault contaminants would be performed. The analysis would have to verify that the risk to public health from the remaining Tank Farm residual heels meets the Closure Plan performance criteria and the total Tank Farm Facility closure risk, when combined with all other health risk sources at the INTEC, would be consistent with the cumulative risk assessment limits for the INTEC.

The vault void (the space between the tanks and the surrounding concrete structure) would be filled with clean grout. The tank and vault voids would be filled with clean grout to provide added structural rigidity to the tanks and minimize the chance of subsidence over time.

The closure method presented in the study would involve using heel characterization equipment, liquid removal, tank and vault washing systems, and grout placement systems to close each tank.

Facility Description: The Tank Farm Facility is used to temporarily store mixed waste until the waste is converted into a solid form at the New Waste Calcining Facility. The Tank Farm Facility consists of mixed waste underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pit, cooling equipment, and several small buildings containing instrumentation and valving for the waste tanks. The closure study focuses on closing the nine 300,000-gallon (1,135,624-liter) and two 318,000-gallon (1,203,761-liter) stainless steel storage tanks (WM-182 through WM-190, and WM-180 plus WM-181, respectively) and associated Tank Farm Facility item. All 11 storage tanks are cylindrical in shape with a dome on top and a flat bottom. Each tank is contained in an underground, unlined concrete vault.

Liquid waste enters the tanks via a process waste feed line. Waste is removed using a steam-jet system that uses steam to lift the waste out of the tank. The waste can be directed to a specific tank via various approved valving arrangements. The waste can be placed or removed from any tank and placed into another tank or processing facility depending on the valve configuration and the desired end location.

Table C.6.2-102. Decontamination and decommissioning project data for Closure of the Tank Farm – Performance-Based Clean Closure with Clean Fill (P3B).[a]

Generic Information	
Description/function and EIS Project number:	Performance-based closure of tank facility with clean fill (P3B)
EIS alternatives/options:	Waste Management
Project type or waste stream:	Waste management program
Action type:	New
Structure type:	D&D of existing facility, low
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside buildings
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	April 2000- September 2005[b]
Demolition:	January 2004 – November 2020[c]
Number of D&D workers:	20 per yr
Number of radiation workers (D&D):	20 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.92 per worker
Heavy equipment	
Equipment used:	Earthmoving equipment, trucks, crane
Trips:	3,987
Hours of operation: (hrs)	7,975
Acres disturbed	
New/Previous/Revegetation: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Diesel exhaust:	
Major gases[d]: (tons/yr)	1473
Contaminants[e]: (tons/yr)	8.6 (total)
Excavation dust: (tons/yr)	0.26
Enclosure emissions: (tons/yr)	1.1E-07
Effluents	
Sanitary wastewater: (L)	7,199,400
Service waste: (L)	1,147,000
Solid wastes	
Sanitary/industrial trash: (m^3)	1.9

Table C.6.2-102. Decontamination and decommissioning project data for Closure of the Tank Farm – Performance-Based Clean Closure with Clean Fill (P3B)[a] (continued).

Decontamination and Decommissioning (D&D) Information (continued)	
Hazardous/toxic chemicals & wastes	
Storage	
TAA (based on one 55-gal drum): (m^3)	0.2
Generation	
Used lube oil: (L)	Incinerated at WERF
Mixed hazardous wastes:	
PPE: (m^3)	0.9
Water usage	
Domestic water: (L)	7,199,400
Process water: (L)	3,520,865
Energy requirements	
Electrical: (MWh/yr)	4,373
Fossil fuel: (L)	972,713

a. Sources: EDF-PDS-C-010; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. This deactivation period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 deactivation would occur from 2010 - 2015. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 deactivation would occur from March 2009 - July 2014.

c. This demolition period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 demolition would occur from 2018 - 2023. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 demolition would occur from 2014 – 2034.

d. CO_2, H_2O, O_2 and N_2.

e. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.47 Tank Farm Closure to RCRA Landfill Standards (P3C)

General Project Objectives: The proposed project defines and describes the activities that would be required to close eleven 300,000-gallon tanks contained within the Tank Farm to landfill standards. This would include the major regulatory, compliance, and design requirements, cost estimates, and estimated schedules. Closure to landfill standards activities would begin once cease use of a Tank Farm tank or tanks occur. Each Tank Farm tank and vault void would be filled with clean grout as part of the closure process. Filling both tank and vault voids would prevent future ground subsidences from occurring within the Tank Farm.

Physical Description: The Tank Farm is used to store mixed waste until the waste is converted into a solid form at the New Waste Calcining Facility. The Tank Farm consists of mixed waste underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pit, cooling equipment, and several small buildings containing instrumentation and valving for the waste tanks. The closure would focus on closing the nine 300,000-gallon (1,135,624-liter) and two 318,000-gallon (1,203,761-liter) stainless steel storage tanks (WM-182 through WM-190 and WM-180 plus WM-181, respectively) and associated Tank Farm items. All 11 storage tanks are cylindrical in shape with a dome on top and a flat bottom. Each tank is contained in an underground, unlined concrete vault.

Liquid waste enters the tanks via a process waste feed line. Waste is removed using a steam-jet system that uses steam to lift the waste out of the tank. The waste can be directed to a specific tank via various approved valving arrangements. The waste can be removed from any tank and placed into another tank or processing facility depending on the valve configuration and the desired end location.

Closure Process Description: Closure to landfill standards/clean fill of the Tank Farm would be expected upon completion of the following activities:

1. Leaving the tanks, vaults, and piping in place. This would include isolating each individual tank system from the rest of the Tank Farm by cutting, grouting (as applicable), and capping the ancillary piping.

2. Washing the bulk of the tank wall contamination residue into the heel using water (once only).

3. Stabilizing the residual heel material in the tank bottoms. (Heel stabilization would include washing, flushing, pumping, pH adjustment, heel displacement, and free liquid elimination.)

4. Filling the tank and vault voids with clean grout. (Excavation would be required to create additional access risers into each vault. The excavated soils would be used to back fill against the risers. The soil displaced by the access riser (approximately 0.25 m^3 per riser) would be sent to a CERCLA soils repository.)

The closure to landfill standards method would involve using heel characterization equipment, liquid removal and agitation pumps, tank washing systems, and wet and dry grout placement systems to close each tank.

It is assumed that the closure to landfill standards cleaning efforts would be directed at removing as much residual waste from the tanks as possible without going to the level of cleanliness required by performance-based clean closure. To accomplish this, the cleaning effort would be directed at washing the tank wall once then removing as much waste residue as possible during the pH adjustment portion of heel stabilization.

Table C.6.2-103. Decontamination and decommissioning project data for Tank Farm Closure to RCRA Landfill Standards (P3C).[a]

Generic Information	
Description/function and EIS Project number:	Closure of tank farm to RCRA Landfill standards (P3C)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	Mixed low-level waste (MLLW)
Action type:	Closure to landfill standards
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	11 underground storage tanks 10,400 Electrical, firewater, sewer, Steam, & water required
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Outside buildings
Decontamination and Decommissioning (D&D) Information	
Schedule start/end: Deactivation: Demolition:	 April 2000 – September 2005[b] January 2004 – November 2020[c]
Number of D&D workers:	12 per yr
Number of radiation workers (D&D):	***12*** per yr
Avg. annual worker rad. dose: (rem/yr)	1.2 per worker
Heavy equipment Equipment used: Trips: Hours of operation: (hrs)	 Cement trucks, backhoes, cranes, front-end loaders, graders 3,992 trips 24,300
Acres disturbed: New/Previous/Revegetated: (acres)	 None/2.6/None
Air emissions: (None/Reference) Nonradioactive Dust: (tons/yr) Fuel combustion: (tons/yr) Radioactive: (Ci/yr)	See Appendix C.2 for details. 0.02 1,050 0.031
Effluents Service waste water: (L) Mixed: (L) Hazardous: (L)	 882,200 2,823,200 106,000
Solid wastes Sanitary/industrial trash: (m^3)	 1,656
Radioactive wastes: Mixed: (m^3)/(Ci)	 478/30

Table C.6.2-103. Decontamination and decommissioning project data for Tank Farm Closure to RCRA Landfill Standards (P3C) [a] (continued).

Decontamination and Decommissioning (D&D) Information (continued)	
Hazardous/toxic chemicals & wastes	
Generation:	
Lubrication oil: (L)	2,715
Storage: (L)	37,860
Pits/pond created: Yes/No (m^2)	Yes – 37
Water usage	
Domestic water: (L)	3,951,540
Process water: (L)	5,535,274
Energy requirements	
Electrical: (MWh/yr)	1,152
Fossil fuel: (L)	724,803

a. Sources: EDF-PDS-C-011; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. This deactivation period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 deactivation would occur from 2010 - 2015. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 deactivation would occur from March 2009 - July 2014.

c. This demolition period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 demolition would occur from 2018 - 2023. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 demolition would occur from 2014 – 2034.

C.6.2.48 Performance-Based Closure with Class A Grout Placement in Tank Farm Facility and Calcined Solids Storage Facility (P26)

General Project Objective: The general objective of this project is to provide for the Resource Conservation Recovery Act (RCRA) performance-based closure of the Tank Farm Facility and the Calcined Solids Storage Facility (CSSF) and subsequent disposal of Class A Low-Level Waste grout in these facilities. The Tank Farm Facility currently stores High-Level Liquid Waste and sodium-bearing liquid waste (SBW). The Calcined Solids Storage Facility stores High-Level Waste calcined solids resulting from the calcination of liquid waste. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities.

Process Descriptions: During the performance-based closure phase, the facilities would be decontaminated to the maximum extent that is technically and economically practical. For the Tank Farm, the tanks and vaults would be washed and the resulting liquid pumped out to remove the majority of the heel waste residues. The remaining liquid heel would be solidified using clean grout. The ancillary piping, such as waste transfer lines, would be flushed and grouted with clean grout. Afterwards, the vaults would be completely filled with clean grout to prevent the intrusion of liquid and to act as a temporary cover or cap over the tank. When pouring is complete the 11 tanks and the sand under 9 of the 11 tanks would be encapsulated between the newly poured grout and the vault floor.

A similar closure approach is proposed for the CSSF. The interior surfaces of the CSSF bins, piping, and ancillary equipment would be decontaminated, again to the maximum extent that is technically and economically practical. It is assumed, for this project, that the bins will be sufficiently decontaminated such that performance criteria would be met. The vault void (the space between the bins and the surrounding concrete structure) would be filled with clean grout to provide added structural rigidity to the bins and minimize the chance of subsidence within the CSSF over time.

After the Tank Farm and the CSSF have been closed, they would be used as low-level waste disposal facilities. The tank and bin voids would be filled with Class A grout that would be produced at the Class A Grout Plant and delivered to the Tank Farm and CSSF in shielded piping.

Facility Descriptions: The Tank Farm consists of underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings that contain instrumentation and valving for the waste tanks. The eleven stainless steel tanks are contained in underground, unlined concrete vaults and are used to store mixed liquid wastes. Liquid waste is transferred throughout the Tank Farm in underground, stainless steel lines. The liquid waste that remains after the tanks have been emptied as low as possible with the steam jets and airlifts is referred to as a "heel." The heels are expected to range in volume from 5,000 to 15,000 gallons when cease use occurs. During HLW processing, grout would be pumped, at intervals, from the Class A Grout Plant to the Tank Farm in shielded lines.

The CSSF contains seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. The grout would be pumped to the CSSF using the same systems as in the Tank Farm.

Please see Project 26 under "Waste Processing Projects" for project data tables.

C.6.2.49 Performance-Based Closure and Class C Grout Disposal in Tank Farm & CSSF (P51)

General Project Objectives: The Tank Farm Facility currently stores High-Level Liquid Waste and sodium-bearing liquid waste (SBW). The Calcined Solids Storage Facility (CSSF) stores HLW calcined solids resulting from the calcination of liquid waste. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities. This project provides for the Resource Conservation Recovery Act (RCRA) performance-based closure of the Tank Farm and CSSF and subsequent disposal of Class C low-level waste grout in these facilities. RCRA would no longer regulate either facility once the performance criteria have been achieved. This allows other uses for the remaining void spaces.

This project assumes that the facilities would be decontaminated to the maximum extent that is technically and economically practical. It is further assumed that the residual levels of contamination would meet the performance requirements for Performance-Based Closure under RCRA. Meeting the performance criteria means:

1. The waste has been removed from the tank system, and

2. The contamination remaining in a tank or bin is within an acceptable risk level to the public or environment and is consistent with the remediation goals for the INTEC.

After the facilities are closed, it is proposed that they then be used as low-level waste disposal facilities to receive the grout generated by the separations process.

Facility Descriptions: The Tank Farm consists of underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings that contain instrumentation and valving for the waste tanks. The eleven stainless steel 300,000 to 318,000-gallon tanks (hereafter referred to as 300,000-gallon tanks) are contained in underground, unlined concrete vaults. The tanks have a 50-foot diameter and an overall height of approximately 30 feet (includes the dome height). The vault floors are approximately 45 feet below grade level and are patterned after three basic designs: cast-in-place octagonal vaults, pillar-and-panel style octagonal vaults, or cast-in-place square 4-pack configuration. A thin sand layer was placed between the vault floor and tank on nine of the eleven tanks. To protect personnel from radiation, the concrete vault roofs are covered with approximately 10 feet of soil.

The 300,000-gallon tanks are used to store mixed liquid wastes. Eight of the eleven 300,000-gallon tanks contain stainless steel cooling coils, which are located on the tank walls and floors. These cooling coils were used, as required, to maintain the liquid waste below predetermined temperatures in order to minimize corrosion of the stainless steel tanks.

Liquid waste is transferred throughout the Tank Farm in underground, stainless steel lines. The stainless steel lines are housed in stainless steel-lined concrete troughs or double-walled stainless steel pipe. The waste is transferred using steam jets or airlifts. Generally, the intakes are located 4 to 12 inches above the tank floor, which limits the amount of liquid waste that can be removed from the tanks. The liquid waste that remains after the tanks have been emptied as low as possible with the steam jets and airlifts is referred to as a "heel." The heels are expected to range in volume from 5,000 to 15,000 gallons when cease use occurs.

The systems used for closure will involve remotely operated equipment to wash down the tanks, remove the heel to the extent possible, solidify the remaining heel, and fill the vault with clean grout. During the processing of the HLW in the Class C Grout Plant, LLW grout will be pumped, at intervals, from the Class C Grout Plant to the Tank Farm in shielded lines.

The CSSF contains seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. Bin set 1, the first constructed, is much smaller than the other six. In bin set 1, the bins vary in diameter from 3 feet to 12 feet, and in length from 20 feet to 24 feet. The bins in the rest of the bin sets are 12 feet to 13.5 feet in diameter and from 40 feet to almost 70 feet in length. The bins (with the exception of those in Bin set 1) are equipped with retrieval risers or pipes that connect to the surface. These risers will be used during calcine retrieval operations. New risers will be installed on the bins contained in bin set 1 during the calcine retrieval activities. The vaults for bin sets 2 through 7 are hollow cylinders, with inside diameters of 40 feet to 60 feet, and a wall thickness of 2 to 4 feet. The vault for bin set 1 is a square design, with walls about 2.5 feet thick.

The systems used for closure of the bin sets will include remotely operated drilling and cutting equipment, remotely operated carbon dioxide pellet blasting systems, remotely operated robots for cleaning the interior surfaces of the bins, and equipment for filling the lines and vaults with clean grout.

The grout would be pumped to the CSSF using the same systems as in the Tank Farm.

Process Description: The processes considered in this project are best described in two phases:

- Closure of the facilities as required for a RCRA interim status facility, and
- Subsequent use of the remaining tank and bin voids as a low-level landfill.

RCRA Closure: During the closure phase, the facilities would be decontaminated to the maximum extent that is technically and economically practical. For the Tank Farm, the tanks and vaults would be washed and the resulting liquid pumped out to remove the majority of the heel waste residues. The remaining liquid heel would be solidified using clean grout. The ancillary piping, such as waste transfer lines, would be flushed and grouted with clean grout. Tank leak monitoring lances would then be installed in four equally spaced locations inside the vaults. Afterwards, the vaults would be completely filled with clean grout to prevent the intrusion of liquid and to act as a temporary cover or cap over the tank. When pouring is complete, the 11 tanks, and the sand under nine of the 11 tanks, would be encapsulated between the newly poured grout and the vault floor.

A similar closure approach is proposed for the CSSF. The interior surfaces of the CSSF bins, piping, and ancillary equipment would be decontaminated, again to the maximum extent that is technically and economically practical. It is proposed that decontamination be accomplished by blasting the contaminated surfaces with carbon dioxide pellets to minimize the generation of any secondary waste and maintain the structural integrity of the bins. This blasting process would dislodge the residual calcine remaining on the bin walls and floors. This dislodged calcine would then be removed from the bins using robots and the calcine removal equipment previously installed to remove the calcine.

It is assumed, for this project, that the bins would be sufficiently decontaminated such that performance criteria would be met. The vault void (the space between the bins and the surrounding concrete structure) would be filled with clean grout to provide added structural rigidity to the bins and minimize the chance of subsidence within the CSSF over time.

Subsequent Use: After the Tank Farm and the CSSF have been closed, they would be used as low-level waste landfills. The tank and bin voids would be filled with Class C grout that is produced at the Class C Grout Plant and delivered to the Tank Farm and CSSF in shielded piping.

Please see Project 51 tables under the "Waste Processing Projects" for project data information.

C.6.2.50 Performance-Based Clean Closure of the Calcined Solids Storage Facility (P59C)

General Project Objective: The project defines and describes the activities required for performance-based closure of the Calcined Solids Storage Facility (CSSF) following the end of use of the bins within a given bin set. The bins comprising the bin set would then be filled with clean grout for stabilization purposes.

Physical Description: The Calcined Solids Storage Facility consists of seven bin sets, each bin set contains from three to twelve bins. A bin is a single, stainless steel, vertical vessel that holds, or will hold, processed calcine for long-term storage. Three different bin types have been installed in the Calcined Solids Storage Facility. Bin set 1, the pilot-scale bin set, contains four main bins, each main bin consisting of three individual, concentric shells. The storage capacity for bin set 1 is approximately 7,844 cubic feet. Bin sets 2-4 are comprised of cylindrical bins (total storage capacity of 17,895 to 40,686 cubic feet). Bins sets 5-8 are composed of annular bins resembling a donut (total storage capacity of 36,544 to 64,778 cubic feet).

All of the bins within a given bin set are enclosed in a concrete vault (cylindrical or square) to provide secondary containment for the calcine. The vaults have all been buried, the depth varying from one bin set to the next. The bins in bin sets 2-7 are anchored to the vault by means of a metal skirt welded to the bin bottom and bolted to the vault floor. The bins in bin set 1 are not anchored to the vault.

Calcine enters each bin set via a main feed line. This line then enters a distributor, which routes the calcine to the individual bins. The distributor piping does not contain any control valves, thus the flow of calcine cannot be directed into a specific bin within a bin set.

Closure Process Description: Performance-based closure/clean fill of the Calcined Solids Storage Facility would be expected upon completion of the following activities:

1. Filling the vault void to provide added structural rigidity to the bins and minimize the chance of subsidence within the Calcined Solids Storage Facility over time.

2. Decontaminating the interior surfaces of the Calcined Solids Storage Facility piping, bins, vaults (if necessary), and ancillary equipment.

3. Removing the residual calcine from the bins.

4. Performing a material sampling and risk analysis of the remaining bin contaminants.

5. Verifying that the risk to public from the remaining bin residual contaminants, when combined with all other health risk sources at the INTEC, is consistent with the cumulative risk assessment limits for the INTEC.

6. Filling the remaining bin voids with clean grout to solidify the remaining contaminants.

This method of closure would involve the use of robotics, existing retrieval equipment, and carbon dioxide blasting to clean the bottom of the bins, as well as the ledges and pipe supports. Robots would be used due to the high radiation fields expected in the bins, as they could be deployed and operated remotely through the use of controllers and camera systems.

Table C.6.2-104. Decontamination and decommissioning project data for the Performance-Based Clean Closure of the Calcined Solids Storage Facility (P59C).[a]

Generic Information	
Description/function and EIS Project number:	Performance-based closure of the bin sets (P59C)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	New
Structure type:	Calcined solids storage units, weathered enclosure
Size: (m^2)	1,350
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around calciner bins
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	March 2011 – July 2015
Demolition:	January 2015 – February 2036
Number of D&D workers:	55 per yr
Number of radiation workers (D&D):	55 per yr
Avg. annual worker rad. dose: (rem/yr)	0.88 per worker
Heavy equipment	
Equipment used:	Flatbed trucks and cement trucks
Trips:	3,340
Hours of operation: (hrs)	6,874
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Gases (CO_2): (tons/yr)	36.9
Contaminants[b]: (tons/yr)	1.8 (total)
Calcine (cleaning and grouting): (Ci/yr)	2.05E-05
Effluents	
Sanitary wastewater: (L)	24,471,949
Grout truck wash: (L)	595,251
Solid wastes	
Building rubble: (m^3)	3,569
Metals: (m^3)	20
Radioactive wastes	
Building rubble: (m^3)/(Ci)	145/1.45
PPE: (m^3)/(Ci)	85/0.49
Hazardous/toxic chemicals & wastes	
Storage	
TAA: (m^3)	1.5
Generation	
Building demolition: (m^3)	1.5
Misc. decontamination/demolition: (m^3)	98
Used lube oil: (L)	1,301

Table C.6.2-104. Decontamination and decommissioning project data for the Performance-Based Clean Closure of the Calcined Solids Storage Facility (P59C) [a] (continued).

Decontamination and Decommissioning (D&D) Information (continued)	
Water usage	
Domestic water: (L)	24,471,949
Process water: (L)	837,491
Energy requirements	
Electrical: (MWh/yr)	1,605
Fossil fuel: (L)	251,727

a. Sources: EDF-PDS-C-008; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.51 Closure to Landfill Standards with Subsequent Clean Fill of the Calcined Solids Storage Facility (P59D)

General Project Objectives: The proposed project defines and describes the activities which would be required to close the Calcined Storage Facility (CSSF) to landfill standards when use of the bins within a given bin set ceases. This includes the major regulatory, compliance, and design requirements, cost estimates, and estimated schedules. The bins comprising the bin set would then be filled with clean grout for stabilization purposes.

Physical Description: The Calcined Solids Storage Facilities consist of seven bin sets, each bin set containing from three to twelve bins. A bin is a single, stainless steel, vertical vessel that holds, or would hold, processed calcine for long-term storage. Three different bin types have been installed in the CSSF. Bin set 1, the pilot-scale bin set, contains four main bins, each main bin consisting of three individual, concentric shells. The storage capacity for bin set 1 is approximately 7,844 cubic feet. Bin sets 2-4 are comprised of cylindrical bins (total storage capacity of 17,895 to 40,686 cubic feet). Bin sets 5-8 are composed of annular bins resembling a donut (total storage capacity of 36,544 to 64,778 cubic feet).

All of the bins within a given bin set are enclosed in a concrete vault (square cylindrical or) to provide secondary containment for the calcine. The vaults have all been buried, the depth varying from one bin set to the next. The bins in bin sets 2-7 are anchored to the vault by means of a metal skirt welded to the bin bottom and bolted to the vault floor. The bins in bin set 1 are not anchored to the vault.

Calcine enters each bin set via a main feed line. This line then enters a distributor, which routes the calcine to the individual bins. The distributor piping does not contain any control valves, thus the flow of calcine cannot be directed into a specific bin within a bin set. All bins within the bin set are filled at the same time.

Closure Process Description: Closure to Landfill Standards with subsequent Clean Fill of the Calcined Solids Storage Facility would be expected upon completion of the following activities:

1. Leaving the bins, vaults, and piping in place. This would include isolating each individual bin system from the rest of the Calcined Solids Storage Facility by cutting, grouting (as applicable), and capping the ancillary piping.

2. Filling the vault void with grout to provide a cap. This temporary cap would minimize subsidence within the Calcined Solids Storage Facility. (Subsidence minimization is not a regulatory requirement, but would be done as a Best Management Practice.)

3. Managing the residual waste material in the bin bottoms. Residue management would include partial removal of the contaminants, decontamination, and residue solidification using clean grout.

4. Making provisions for a landfill monitoring system.

5. Filling the remaining bin voids with clean grout to solidify the remaining contaminants.

6. The method of closure would involve the use of robotics (tractor/vacuum robots), in conjunction with the existing retrieval equipment, to clean the floor of the bins after the vault void had been grouted. Robots would be used due to the high radiation fields expected in the bins, as they can be deployed and operated remotely through the use of controllers and camera systems.

7. The cleaning efforts during Closure to Landfill Standards would be directed at removing as much residual calcine from the bins as possible without going to the level of cleanliness required by Performance-Based Clean Closure. To accomplish this, the cleaning efforts would be directed at removing the calcine from the floors, as this is where the majority of the calcine would be expected. The ledges and interior surfaces of the walls would not be expected to be cleaned under this scenario, as they would be expected to have minimal contamination.
8. The bin voids would then be grouted with clean grout to solidify the remaining contaminants.

Table C.6.2-105. Decontamination and decommissioning project data for the Closure of the Calcined Solids Storage Facility to Landfill Standards with Subsequent Clean Fill (P59D).[a]

Generic Information	
Description/function and EIS Project number:	Calcined solids storage facility closure study (P59D)
EIS alternatives/options:	Closure to land fill standards/ Clean fill
Project type or waste stream:	Waste management program
Action type:	New
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Calcine solids storage units, weather enclosure 1,347 Electrical, firewater, sewer, and water required
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside and around calciner bins
Decontamination and Decommissioning (D&D) Information	
Schedule start/end: Deactivation: Demolition:	 March 2011 – July 2015 January 2015 – February 2036
Number of D&D workers:	27 workers/yr
Number of radiation workers (D&D):	27 workers/yr
Avg. annual worker rad. dose: (rem/yr)	698 per worker
Heavy equipment Equipment used: Trips: Hours of operation: (hrs)	 Flatbed trucks, cement trucks 3,340 6,874
Acres disturbed: New/Previous/Revegetated: (acres)	 None/4.6/None
Air emissions: (None/Reference) Fuel combustion: Major Gas (CO_2): (tons/yr) Contaminants[b]: (tons/yr) Calcine (cleaning and grouting): (Ci/yr)	See Appendix C.2 for details. 36.9 1.8 1.20E-06
Effluents Sanitary wastewater: (L) Grout truck wash: (L)	 12,174,283 595,251
Solid wastes Building rubble: (m^3) Metals: (m^3)	 3,569 20
Radioactive wastes: Building rubble: (m^3)/(Ci) PPE: (m^3)/(Ci)	 145/1.45 33/0.19
Hazardous/toxic chemicals & wastes Storage TAA (based on blding demolition): (m^3) Generation Building demolition: (m^2) Misc. D&D: (m^2) Used lube oil: (L)	 1.5 1.5 98 1,301

Table C.6.2-105. Decontamination and decommissioning project data for the Closure of the Calcined Solids Storage Facility to Landfill Standards with Subsequent Clean Fill (P59D) [a] (continued).

Decontamination and Decommissioning (D&D) Information (continued)	
Water usage	
Domestic water: (L)	12,174,283
Process water: (L)	837,491
Energy requirements	
Electrical: (MWh/yr)	990
Fossil fuel: (L)	251,727

a. Sources: EDF-PDS-C-009; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.52 Clean Closure to Detection Limits of the Calcined Solids Storage Facility (P59F)

General Project Objectives: The Calcined Solids Storage Facility (CSSF), or bin sets, stores high-level waste calcined solids resulting from the calcination of liquid waste. This project provides for the Resource Conservation Recovery Act (RCRA) clean closure of the Calcined Solids Storage Facility. This closure method removes the hazardous and radioactive wastes still contained inside each bin down to detection limits, demolishes the remaining concrete vault structures to grade level, and fills any remaining vault voids. Long-term monitoring would not be required since the facility would be clean closed and would no longer pose a threat to human health or the environment. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities.

Process Description: The project processes are best described in the following steps:

1. Cleaning the facility to the levels identified in EDF-PDS-B-002 (P51),
2. Remotely removing the vault roof,
3. Remotely removing each bin from the vault and transporting the bin to the debris treatment facility built as part of this project to handle each bin,
4. Remotely dismantling, decontaminating, and disposing of the bins, and
5. Demolishing the remaining reinforced concrete vaults to grade level and filling each vault with clean fill.

The Calcined Solids Storage Facility would be closed to clean standards once the above steps were completed. No additional regulatory oversight would be required for the closed area. Final stages of the process would include construction of a new low-level waste storage landfill as well as dismantling and removal of the new debris treatment facility.

Facility Description: The Calcined Solids Storage Facility contains seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. Bin set 1, the first constructed, is much smaller than the other six. The bins (with the exception of those in bin set 1) are equipped with retrieval risers or pipes that connect to the surface. These risers would be used during calcine retrieval operations. New risers would be installed on the bins contained in bin set 1 during the calcine retrieval activities. The vaults for bin sets 2 through 7 are hollow cylinders, with inside diameters of 40 feet to 60 feet, and a wall thickness of 2 feet to 4 feet. The vault for bin set 1 is a square design, with walls about 2.5 feet thick.

The systems used for clean closure of each bin set would include:

1. Remotely operated drilling and cutting equipment,
2. Remotely operated carbon dioxide pellet blasting systems,
3. Remotely operated robots for cleaning the interior surfaces of the bins,
4. Remotely operated equipment for removing the vault roof and disconnecting each bin from the other bins contained in the vault, and
5. Equipment for removal and transport of bins to a new Debris Treatment facility (also referred to as the Bin Cutting facility).

Table C.6.2-106. Decontamination and decommissioning project data for the Clean Closure to Detection Limits of the Calcined Solids Storage Facility (P59F).[a]

Generic Information	
Description/function and EIS Project number:	Clean closure of bin set group[b] (P59F)
EIS alternatives/options:	D&D
Project type or waste stream:	Waste management program
Action type:	New
Structure type:	Calcine solids storage units, weather enclosure, bin facility
Size: (m^2)	1,347
Remote cutting facility: (m^2)	1,691
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around calciner
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	March 2009 – July 2014
Demolition:	2014 – 2034
Number of D&D workers:	58 per yr
Number of radiation workers (D&D):	58 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.60 per worker
Heavy equipment	
Equipment used:	Trucks, excavator, crane, grader, front end loader
Trips:	1,471
Hours of operation: (hrs)	13,142
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/7.3/None
Air emissions: (None/Reference)	
Fuel combustion (diesel exhaust):	See Appendix C.2 for details.
Major gas (CO_2): (tons/yr)	43.7
Contaminants[c]: (tons/yr)	2.1
Building ventilation: (Ci/yr)	1.74E-08
Calcine bins (cleaning): (Ci/yr)	4.50E-08
Calcine bins (cutting & vacuuming): (Ci/yr)	6.80E-08
Effluents	
Sanitary wastewater: (L)	33,140,000
Solid wastes	
Construction/D&D trash: (m^3)	18,450
Building rubble: (m^3)	5,858
Metals: (m^3)	31
Radioactive wastes:	
Bins: (m^3)/(Ci)	1,208/12
Vault piping: (m^3)/(Ci)	167/1.67
Building rubble: (m^3)/(Ci)	3,189/32

Table C.6.2-106. Decontamination and decommissioning project data for the Clean Closure to Detection Limits of the Calcined Solids Storage Facility (P59F) [a] (continued).

Decontamination and Decommissioning (D&D) Information (continued)	
Hazardous/toxic chemicals & wastes	
Storage	
TAA (based on two 4x4x8 boxes): (m^3)	7.3
Generation	
Non-radioactive:	
Used lube oil: (L)	50,111
Misc. D&D: (m^3)	126
Radioactive:	
Acid Bath: (L)/(Ci)	146,923/11,336
Water Bath: (L)/(Ci)	293,847/810
PPE: (m^3)/(Ci)	176
Water usage	
Domestic water: (L)	33,140,000
Process water: (L)	396,042
Energy requirements	
Electrical: (MWh/yr)	3,086
Fossil fuel: (L)	330,187

a. Sources: EDF-PDS-B-003; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. Bin set group considered for clean closure includes: CSSF 1-7, CPP-729, CPP-741, CPP-742, CPP-744, CPP-746, CPP-747, CPP-760, CPP-761, CPP-765, CPP-791, CPP-795, CPP-1615.
c. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.53 Total Removal Clean Closure of the Tank Farm Facility (P59G)

General Project Objective: The proposed project defines and describes the activities required for the total removal clean close of the eleven 300,000-gallon tanks contained within the Tank Farm Facility. This includes the major regulatory, compliance, and design requirements, cost estimates, and estimated schedules. Clean closure activities would begin once cease use of a Tank Farm tank or tanks occurs. Total removal of the wastes, tanks, vaults, ancillary piping, and contaminated soils are part of the closure process.

Physical Description: The Tank Farm consists of mixed waste underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pit, cooling equipment, and several small buildings containing instrumentation and valving for the waste tanks. The closure study focuses on closing the nine 300,000-gallon (1,135,624-liter) and two 318,000-gallon (1,203,761-liter) stainless steel storage tanks (WM-182 through WM-190 and WM-180 plus WM-181, respectively) and associated Tank Farm items. Each tank is contained in an underground, unlined concrete vault.

A Debris Cleaning Facility would be constructed for processing the removed equipment, tanks, and vaults. The facility will be used for cleaning and sizing debris. This facility would have extensive contamination controls to reduce air emissions: A vacuum system attached to the carbon dioxide blasting system. Both the vacuum system and cell ventilation system will have a cyclone, sintered metal filter, and two HEPA filters to remove airborne contamination.

A Low Level Waste Disposal site, which meets RCRA Subtitle D landfill requirements, would be built for the Tank Farm waste.

Closure Process Description: The Clean closure method requires the removal of all waste residues and the decontamination of equipment and structures to be left in place. The waste and equipment removed must be managed properly. This process provides for the complete removal of contaminated Tank Farm components including tanks, vaults, piping, and valve boxes. Following removal, these contaminated components are treated and disposed of in accordance with Land Disposal Restrictions.

Table C.6.2-107. Decontamination and decommissioning project data for the Total Removal Clean Closure of the Tank Farm Facility (P59G). [a]

Generic Information	
Description/function and EIS Project number:	INTEC tank farm closure (total Removal clean closure) (P59G)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	Waste management program
Action type:	Total removal clean closure
Structure type:	Weather enclosure for tank farm
Size: (m^2)	14,057
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Presite work:	***October 2003 – October 2010***
Site work:	***October 2010 – October 2036***
Number of D&D workers:	280 per yr
Number of radiation workers (D&D):	280 per yr
Avg. annual worker rad. dose: (rem/yr)	1 per worker
Heavy equipment	
Equipment used:	Earthmoving equipment, crane, trucks, pulverizer, plane shear, vibratory pile extractor
Trips:	30,166
Hours of operation: (hrs)	226,608
Acres disturbed:	
New/Previous/Revegetated: (acres)	15/6/None
Air emissions: (None/Reference)	
Diesel exhaust:	See Appendix C.2 for details.
Major gas (CO_2): (tons/yr)	883
Contaminants[b]: (tons/yr)	40
Fossil fuel (steam use): (tons/yr)	641.9
Dust (landfill): (tons/yr)	262
Enclosure emissions: (Ci/yr)	6.14E-07
Tank removal tent emissions: (Ci/yr)	2.25E-07
Debris facility vacuum system: (Ci/yr)	1.35E-08
Debris facility ventilation system: (Ci/yr)	4.49E-09
Total emissions: (Ci/yr)	8.57E-07
Effluents	
Sanitary wastewater: (L)	196,584,857
Solid wastes	
Industrial landfill material: (m^3)	117,453
Sanitary/industrial trash: (m^3)	40.3 (ash)
Radioactive wastes:	
LLW for disposal from D&D: (m^3)/(Ci)	1,102/4,000
LLW for WERF from D&D: (m^3)/(Ci)	20/600
Mixed hazardous wastes:	
PPE: (m^3)/(Ci)	28/20
Mixed hazardous wastes: (m^3)/(Ci)	7,140/4,036
CERCLA waste:	
Soil from tank farm area: (m^3)/(Ci)	133,800/46,200

Table C.6.2-107. Decontamination and decommissioning project data for the Total Removal Clean Closure of the Tank Farm Facility (P59G) [a] (continued).

Decontamination and Decommissioning (D&D) Information (continued)	
Hazardous/toxic chemicals & wastes	
Storage	
TAA: (m^3)	649
Generation	
Used lube oil: (L)	Incinerated at WERF
Water usage	
Domestic water: (L)	196,584,857
Process water: (L)	4,422,000
Raw water: (L)	9,252,000
Energy requirements	
Electrical: (MWh/yr)	7,259
Fossil fuel: (L)	7,457,000

a. Sources: EDF-PDS-B-004; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, hydrocarbons.

C.6.2.54 Closure to Landfill Standards of the Process Equipment Waste Condensate Lines (P154A, B)

General Project Objective: The proposed project defines and describes the activities required for the deactivation and demolition of the Process Equipment Waste Condensate Lines.

Physical Description: This project addresses two transfer lines:

- Process Equipment Waste and Cell Floor Drain Lines (154A)

- Process Equipment Waste Condensate Lines (P154B)

The transport lines are used to transport waste and condensate from the process facility to the treatment or storage facility.

Process Equipment Waste and Cell Floor Drain Lines (P154A):

The original lines between INTEC-601 and -604 were replaced about 1982 (at the same time the high-level liquid waste lines were replaced). The lines were capped and abandoned in place and may have several places where they were cut and capped. Each 3-inch diameter stainless steel pipeline was surrounded with a 6-inch diameter tile pipe which was encased in concrete. The lines are between 6 and 12 feet below ground. The total linear footage is approximately 700 feet. The capping effort would require 6 caps per line (18 capping points).

Two 3-inch diameter stainless steel pipelines replaced the original lines. The new lines are encased in 4-inch stainless steel pipe, which is buried directly in the ground (approximately 6 to 12 feet deep). The lines are approximately 300 feet long. The lines will be capped and abandoned in place. The capping effort would require 2 caps total for both lines.

Process Equipment Waste Condensate Lines (P154B):

Above ground: The new Process Equipment Waste Condensate Discharge Line runs from CPP-601 to CPP-605. This project considers the outdoors portion of the line. A portion of the line runs over CPP-649 and CPP-604. The line is approximately 300 feet in length and consists of a 2-inch pipe contained in a 4-inch insulated pipe. Seven support stanchions support the line. The landfill closure requires the line to be capped and abandoned in place. However, since the line is above ground, the line would be completely removed. There is 50 feet of this piping run that is underground. It must be capped on each end.

Below ground: The old Process Equipment Waste Condensate Discharge Line runs from CPP-601 to CPP-605. The line is approximately 1,200 feet in length and consists of a 2-inch to 3-inch diameter that was buried directly in the ground at a depth of between 6 to 12 feet. The performance-based closure requires the line to be flushed, capped, and abandoned in place. Since the line has been cut in a number of places over the years to make way for new facility piping, the line must be capped in 8 places.

Table C.6.2-108. Decontamination and decommissioning project data for the PEW and Cell Floor Lines (P154A).[a]

Generic Information	
Description/function and EIS Project number:	PEW and cell floor lines (P154A)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Underground lines
Size: (m^2)	34.9
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	4 per yr
Number of radiation workers (D&D):	2 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Trips:	
Hours of operation: (hrs)	2,700
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.03/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9 (total)
Effluents	
Sanitary wastewater: (L)	21,938
Solid wastes (abandoned in place)	
Building material: (m^3)	180
Radioactive wastes:	
Combustibles:	1/0.01
Bldg. material (abandoned in place):	4/0.04
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	21,938
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-031; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-109. Decontamination and decommissioning project data for the PEW Condensate Lines (P154B).[a]

Generic Information	
Description/function and EIS Project number:	PEW Condensate Lines (P154B)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Lines
Size: (m^2)	19.5
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	3 per yr
Number of radiation workers (D&D):	2 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks,
Trips:	dozers, loaders
Hours of operation: (hrs)	2,700
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.02/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9 (total)
Effluents	
Radioactive:	
Mixed waste: (L)/(Ci)	3,785/1000
Non-radioactive:	
Sanitary wastewater: (L)	16,313
Solid wastes:	None
Radioactive wastes:	
Bldg. material (abandoned in place):	3/0.03
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	16,313
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-031; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.55 Tank Farm Complex Closure (P156B-F, G, L)

General Project Objectives: The project included activities that would be associated with the deactivation and demolition of the Tank Farm Complex.

Process Description: The complex is currently undergoing deactivation and is targeted for a "land-fill" closure, except for the Waste Holdup Pumphouse (CPP-641) which would be clean closed. The below ground levels of the complex would be demolished in place and covered with an earthen cap. The ridged asbestos siding and roofing would be removed and either placed in the below ground areas of the existing building prior to grouting or placed in a land-fill approved for asbestos disposal.

The Tank Farm Complex facilities scheduled for deactivation and demolition as shown below.

Complex Description: The total multi-level building area of the complex is approximately 4,699 feet2.

The Tank Farm Area-CPP (Waste Storage Control House) (CPP-619) houses the computer that receives data transmitted by radio frequency probes on the levels in the big tanks of the Tank Farm. The Waste Storage Control House is a one-story, 416 square-foot masonry-exterior building. The building is rated as a low-hazard facility.

The Tank Farm Area-CPP (Waste Storage Control House) (CPP-628) houses the pneumatic instrument readouts for the big tanks in the Tank Farm. The CPP-628 Tank Farm Area-CPP (Waste Storage Control House) is a one-story, 1,562 square-foot masonry-exterior building. It was built in 1953 as a Tank Farm control house. The building is rated as a high-hazard facility. High levels of radiation are present in the northeast corner around the jet. Low levels of hazardous chemical contamination exist due to a leaky chromate water system. Low quantities of asbestos exist in the piping insulation.

The Tank Farm Area (Waste Storage Pipe Manifold Building) (CPP-634) is one of the primary locations of the Tank Farm's cooling system valves. The CPP-634 Tank Farm Area (Waste Storage Pipe Manifold Building) is a one-story, 231 square-foot masonry-exterior building. It was built in 1958 to house the valves for the water cooling system in the Tank Farm. The building is rated as a low-hazard facility. Low quantities of asbestos contamination are present in the piping insulation.

The Waste Station (WM-180) Tank Transfer Building (CPP-638) houses the valves and controls of the offgascondenser system. The CPP-638 Waste Station (WM-180) Tank Transfer Building is a one-story, 87 square-foot masonry-exterior building. The building is rated as a medium-hazard, medium-radiation facility. Medium quantities of asbestos are located in the transite and piping insulation.

The Waste Holdup Pumphouse (CPP-641) houses the monitoring systems for the WL-103, WL-104, WL-105 tanks. These tanks receive waste from laboratories in the INTEC-637 Process Improvement Low Bay, but the laboratories do not currently generate waste; therefore, the tanks are inactive. The CPP-641 Waste Holdup Pumphouse is a 442 square-foot, one-story, masonry-exterior building. The building is rated as a medium-hazard-facility, medium-radiation facility. Medium quantities of asbestos are located in the transite insulation.

The CPP-712 Instrument House (VES-WM-180, 181) is a 216 square-foot concrete block building. It is rated as a low-hazardous, low-radiation facility.

The CPP-717 STR Waste Storage Tanks (WM-103, 104, 105, 106) are four 30,200 gallon tanks buried approximately 15 feet below grade. The tanks set on 12-inch thick concrete pads. The tanks are rated low radiation.

Table C.6.2-110. Decontamination and decommissioning project data for the Waste Storage Control House (P156B).[a]

Generic Information	
Description/function and EIS Project number:	Waste storage control house - CPP 619 (P156B)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards, masonry-exterior
Structure type:	
Size: (m^2)	38.7
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.02/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building rubble: (m^3)	53
Radioactive wastes: (m^3)/(Ci)	
Building material (abandoned in place):	67/0.67
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	3
Generation:	
Solvents, etc.: (L)	79
Used lube oil: (L)	4,200
Water usage	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-111. Decontamination and decommissioning project data for the Waste Storage Control House (P156C).[a]

Generic Information	
Description/function and EIS Project number:	Waste storage control house - CPP 628 (P156C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry-exterior
Size: (m^2)	145.3
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	2,250
Solid wastes (abandoned in place)	
Building material: (m^3)	198
Radioactive wastes: (m^3)/(Ci)	13/0
Bldg material (abandoned in place):	250/2.50
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	12
Generation:	
Solvents, etc.: (L)	296
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	2,250
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-112. Decontamination and decommissioning project data for the Waste Storage Pipe Manifold Building (P156D).[a]

Generic Information	
Description/function and EIS Project number:	Waste Storage Pipe Manifold Building – CPP 634 (P156D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry-exterior
Size: (m^2)	21.5
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.01/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	29
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	2/0
Bldg material (abandoned in place):	37/0.37
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	2
Generation:	
Solvents, etc.: (L)	44
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-113. Decontamination and decommissioning project data for the Waste Station (WM-180) Tank Transfer Building (P156E).

Generic Information	
Description/function and EIS Project number:	Waste Station VES-WM-180 Shielded Tank Transfer Building - CPP 638 (P156E)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry-exterior
Size: (m^2)	8.1
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2012
Demolition:	2014 – 2015
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	7,400
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/None/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	1,125
Solid wastes (abandoned in place)	
Building material: (m^3)	11
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	1/0
Bldg material (abandoned in place):	14/0.14
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	2
Generation:	
Solvents, etc.: (L)	16
Used lube oil: (L)	1,400
Water usage	
Domestic water: (L)	1,125
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	168,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-114. Decontamination and decommissioning project data for the Instrument House (P156F).[a]

Generic Information	
Description/function and EIS Project number:	Instrument house (VES-WM-180, 181) - CPP 712 (P156F)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete block
Size: (m^2)	20.1
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.01/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	27
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	2/0
Bldg material (abandoned in place):	35/0.35
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	2
Generation:	
Solvents, etc.: (L)	41
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-115. Decontamination and decommissioning project data for the Closure of the STR Waste Storage Tank (WM-103, 104, 105, 106) – CPP 717 to Landfill Standards (P156G).[a]

Generic Information	
Description/function and EIS Project number:	STR Waste Storage Tank - CPP 717 (P156G)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	39.1
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.02/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	6,750
Solid wastes (abandoned in place)	
Building material: (m^3)	53
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	4/0
Bldg material (abandoned in place):	67/0.67
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	3
Generation:	
Solvents, etc.: (L)	79
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	6,750
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-116. Decontamination and decommissioning project data for the West Side Waste Holdup (P156L).[a]

Generic Information	
Description/function and EIS Project number:	West side waste holdup - CPP 641 (P156L)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Clean Closure
Structure type:	Reinforced concrete
Size: (m^2)	41.1
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2012
Demolition:	2014 – 2015
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	7,400
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.02/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	3,375
Solid wastes (abandoned in place)	
Building material: (m^3)	56
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	4/0
Bldg material (abandoned in place):	71/0.71
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	10
Generation:	
Solvents, etc.: (L)	84
Used lube oil: (L)	1,400
Water usage	
Domestic water: (L)	3,375
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	168,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.56 Facility Closure of the Bin Set Group (P157A-F)

General Project Objectives: The project included activities that would be associated with the deactivation and demolition of the bin set complex.

Process Description: Deactivation of the complex would be scheduled for completion in 2037. Demolition would be scheduled to start in 2038 and would be completed in 2043.

The project addresses these facilities:

- CPP-639: Instrumentation Building for bin set 1 (P157A)
- CPP-646: Instrument Building for 2nd Set of Calcined Solids (P157B)
- CPP-647: Instrument Building for 3rd Set of Calcined Solids (P157C)
- CPP-658: Instrument Building for 4th Set of Calcined Storage (P157D)
- CPP-671: Instrument Building for 5th Set of Calcined Storage (P157E)
- CPP-673: Service Building for 6th Set Calcined Solids (P157F)

Complex Description: The INTEC bin set buildings house the instrumentation to monitor the bid sets. The total multi-level building area of the complex is approximately 1,131 ft^2. The complex is currently undergoing deactivation and would be targeted for a landfill closure. The above ground portion of the complex would be demolished in place and covered with an earthen cap.

The CPP-639 Instrumentation Building for bin set 1 is a one-story, 372 ft^2 masonry-exterior building. The building houses instrumentation to monitor bin set 1. The building is rated as a low-hazard facility. It contains low levels of radiation and medium quantities of asbestos in the roof, siding, and piping insulation.

The CPP-646 Instrument Building for 2nd Set of Calcined Solids is a one-story, 91 ft^2 masonry-exterior building. The building houses instrumentation to monitor bin set 2. The building is rated as a low-hazard facility. It contains low levels of radiation and low quantities of asbestos in the roof, siding, and piping insulation.

The CPP-647 Instrument Building for 3rd Set of Calcined Solids is a one-story, 91 ft^2 masonry-exterior building. The building houses instrumentation to monitor bin set 3. The building is rated as a low-hazard facility. It contains low levels of radiation and low quantities of asbestos in the roof, siding, and piping insulation.

The CPP-658 Instrument Building for 4th Set of Calcined Storage is a one-story, 81 ft^2 reinforced-concrete building. The building houses instrumentation to monitor bin set 4. The building is rated as a low-hazard facility. It contains low levels of radiation and low quantities of asbestos in the roof, siding, and piping insulation.

The CPP-671 bin set 5 service building is a one-story, 240 ft^2 prefabricated building The building houses instrumentation to monitor bin set 5. The building is rated as a high-hazard, high-radiation facility. Low quantities of asbestos contamination are present in the roof.

The CPP-673 Service Building for 6th Set Calcined Solids is a one-story, 256 ft^2 metal building. The building houses instrumentation to monitor bin set 6. The building is rated as a low-hazard, low-radiation facility.

Table C.6.2-117. Decontamination and decommissioning project data for the closure of the Instrumentation Building for Bin Set 1 (CPP-639) (P157A).[a]

Generic Information	
Description/function and EIS Project number:	Instrumentation Building for bin Set 1 - CPP 639 (P157A)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Masonry – exterior 34.6 None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end: Deactivation: Demolition:	 2035 – 2037 2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 22,200
Acres disturbed: New/Previous/Revegetated: (acres)	 None/0.02/None
Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 259 13 (total) 1.45E-08
Effluents Sanitary wastewater: (L)	 563
Solid wastes (abandoned in place) Building material: (m^3)	 47
Radioactive wastes: (m^3)/(Ci) Combustibles (disposal at WERF): Bldg material (abandoned in place):	 3/0 60/0.60
Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Solvents, etc.: (L) Used lube oil: (L)	 3 70 4,200
Water usage Domestic water: (L)	 563
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 None 504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-118. Decontamination and decommissioning project data for the Bin Set 2 Instrumentation Building (P157B).[a]

Generic Information	
Description/function and EIS Project number:	Bin set 2 instrumentation building- CPP 646 (P157B)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry- exterior
Size: (m^2)	8.5
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/None/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	12
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	1/0
Bldg material (abandoned in place):	15/0.15
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	1
Generation:	
Solvents, etc.: (L)	17
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-119. Decontamination and decommissioning project data for the Bin Set 3 Instrumentation Building (P157C).[a]

Generic Information	
Description/function and EIS Project number:	Bin set 3 instrumentation building-CPP 647 (P157C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry - exterior
Size: (m^2)	8.5
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/None/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	12
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	1/0
Bldg material (abandoned in place):	15/0.15
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	1
Generation:	
Solvents, etc.: (L)	17
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-120. Decontamination and decommissioning project data for the Bin Set 4 Instrumentation Building (P157D).[a]

Generic Information	
Description/function and EIS Project number:	Bin set 4 instrumentation building- CPP 658 (P157D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Reinforced concrete
Size: (m^2)	7.5
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/None/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	10
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	1/0
Bldg material (abandoned in place):	13/0.13
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	1
Generation:	
Solvents, etc.: (L)	15
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-121. Decontamination and decommissioning project data for the Bin Set 5 Service Building (P157E).[a]

Generic Information	
Description/function and EIS Project number:	Bin set 5 service building- CPP 671 (P157E)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Prefabrication/Modular
Size: (m^2)	22.3
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.01/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	563
Solid wastes (abandoned in place)	
Building material: (m^3)	30
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	2/0
Bldg material (abandoned in place):	38/0.38
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	2
Generation:	
Solvents, etc.: (L)	45
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	563
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-122. Decontamination and decommissioning project data for the Bin Set 6 Service Building (P157F).[a]

Generic Information	
Description/function and EIS Project number:	Bin set 6 service building- CPP 673 (P157F)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Metal
Size: (m^2)	23.8
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.01/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	33
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	2/0
Bldg material (abandoned in place):	41/0.41
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	2
Generation:	
Solvents, etc.: (L)	48
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

[a] Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

[b] CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.57 Closure of the Process Equipment Waste Group (P158A-E, H)

General Project Objectives: The project included activities that would be associated with the deactivation and demolition of the Process Equipment Waste Group.

Process Description: The INTEC Process Equipment Waste complex would be targeted for a landfill closure, except for the Liquid Effluent Treatment and Disposal Building (CPP-1618), which would be targeted for clean closure. The below ground levels of the complex would be grouted with concrete. Subsequently, the above ground portion of the complex would be demolished in place and covered with an earthen cap. The rigid asbestos siding and roofing would be removed and placed in a landfill approved for asbestos disposal. Complete deactivation of the complex would be completed in 2037. Demolition would start in 2038 and would be completed in 2043.

Complex Description: The INTEC Blower Building (CPP-605) houses three uninterruptible power supply blowers and the vessel offgassystems that supports the INTEC. The CPP-605 Blower Building is a 2,622 square-foot, one-story, reinforced concrete building. The building is rated as a low hazard, average radiation facility. The building is adjacent to the CPP-604. All utilities that support CPP-604 pass through CPP-605.

The INTEC Atmospheric Protection Building (CPP-649) houses blowers and ventilation for the Atmospheric Protection System. Ninety percent of the INTEC offgassystem runs through this building. (CPP-605 has its own offgassystem.) The building is a 3,572 square-foot, one-story, reinforced concrete building. The building is rated as a low hazard, average radiation facility.

The INTEC Liquid Effluent Treatment & Disposal Building (CPP-1618) is used to process the overheads from the process equipment waste system. Within the building, the acid is recaptured and transferred to the CPP-659 New Waste Calcining Facility or the Tank Farm.

The primary function of the Process Equipment Waste Evaporator, which is housed in CPP-604, is to separate liquid radioactive waste into two fractions. The high level waste is directed to the Tank Farm. The other fraction is directed to the Liquid Effluent Treatment and Disposal Facility.

The CPP-708 Exhaust Stack/Main Stack is a 250 foot high concrete stack with a stainless steel liner. The diameter of the stack ranges from 27.7 feet as the base and 14 feet at the top. The stack is rated as a high hazard, high radiation facility.

The CPP-756 Pre-Filter Vault is a 3,670 square-foot, below grade concrete vault. The building is rated as a low hazard, average radiation facility.

The CPP-1618 Liquid Effluent Treatment and Disposal Building is a 6,850 square-foot, three-story, steel frame building. The building is rated as a low hazard, low radiation facility.

The CPP-604 Process Equipment Waste Evaporator Building is a 24,275 square-foot, multi-level, steel frame and reinforced concrete building. The building has areas of medium to high asbestos, hazards, and radiation.

Table C.6.2-123. Decontamination and decommissioning project data for the Blower Building (P158A).[a]

Generic Information	
Description/function and EIS Project number:	Blower building- CPP 605 (P158A)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Concrete block/steel 243.9 None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end: Deactivation: Demolition:	 2035 – 2037 2038 – 2043
Number of D&D workers:	***2*** per yr
Number of radiation workers (D&D):	***1*** per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders, scabbler, ram 22,200
Acres disturbed: (acres)	0.24
Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 259 13 (total) 1.45E-08
Effluents Sanitary wastewater: (L)	 153,000
Solid wastes Industrial: (m^3)	 776
Abandoned in place: (m^3)	333
Radioactive wastes: (m^3)/(Ci) Combustibles (WERF disposal): Bldg material (abandoned in place):	 22/0.22 420/4.20
Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Solvents, etc.: (L) Used lube oil: (L)	 21 496 4,201
Water usage Domestic water: (L)	 153,000
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 None 504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_x, hydrocarbons.

Table C.6.2-124. Decontamination and decommissioning project data for the closure of the Atmospheric Protection Building (CPP-649) (P158B).[a]

Generic Information	
Description/function and EIS Project number:	Atmospheric Protection Building - CPP 649 (P158B)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Concrete 332.3 None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end: Deactivation: Demolition:	 2035 – 2037 2038 – 2043
Number of D&D workers:	2 per yr
Number of radiation workers (D&D):	1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 22,200
Acres disturbed: New/Previous/Revegetated: (acres)	 None/0.2/None
Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 259 13 (total) 1.45E-08
Effluents Sanitary wastewater: (L)	 9,000
Solid wastes Building material: (m^3)	 454
Radioactive wastes: (m^3)/(Ci) Combustibles (WERF disposal): Bldg material (abandoned in place):	 30/0 573/5.73
Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Solvents, etc.: (L) Used lube oil: (L)	 28 676 4,200
Water usage Domestic water: (L)	 9,000
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 None 504,000

[a] Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

[b] CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-125. Decontamination and decommissioning project data for the Exhaust Stack/Main Stack (P158C).[a]

Generic Information	
Description/function and EIS Project number:	Exhaust stack/main stack CPP-708 (P158C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	4,837.2
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	9 per yr
Number of radiation workers (D&D):	6 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.4/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	48,375
Solid wastes	
Building material: (m^3)	6,603
Radioactive wastes: (m^3)/(Ci)	
Combustibles (WERF disposal):	438/4
Bldg material (abandoned in place):	8,335/83.35
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	410
Generation:	
Solvents, etc.: (L)	9,842
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	48,375
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-126. Decontamination and decommissioning project data for the Pre-Filter Vault (P158D).[a]

Generic Information	
Description/function and EIS Project number:	Pre-Filter Vault - CPP 756 (P158D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	341.4
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	
Acres disturbed:	22,200
New/Previous/Revegetated: (acres)	None/0.3/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	6,750
Solid wastes	
Building material: (m^3)	466
Radioactive wastes: (m^3)/(Ci)	
Combustibles (WERF disposal):	31/0
Bldg material (abandoned in place):	588/5.88
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	29
Generation:	
Solvents, etc.: (L)	695
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	6,750
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-127. Decontamination and decommissioning project data for the Liquid Effluent Treatment and Disposal Building (P158E).[a]

Generic Information	
Description/function and EIS Project number:	Liquid effluent treatment and disposal building - CPP 1618 (P158E)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Clean Closure
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Steel 637.2 None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end: Deactivation: Demolition:	 2035 – 2037 2038 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 22,200
Acres disturbed: New/Previous/Revegetated: (acres)	 None/0.3/None
Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 259 13 (total) 1.45E-08
Effluents Sanitary wastewater: (L)	 7,875
Solid wastes Building material: (m^3)	 870
Radioactive wastes: (m^3)/(Ci) Combustibles: Bldg material (abandoned in place):	 58/1 1,098/10.98
Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Solvents, etc.: (L) Used lube oil: (L)	 54 1,296 4,200
Water usage Domestic water: (L)	 7,875
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 None 504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-128. Decontamination and decommissioning project data for the PEW Evaporator Facility (P158H).[a]

Generic Information	
Description/function and EIS Project number:	PEW Evaporator Facility – CPP- 604 (P158H)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Steel frame and reinforced concrete
Size: (m^2)	2,258.1
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	36 per yr
Number of radiation workers (D&D):	25 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	58,050
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/1.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	677
Contaminants[b]: (tons/yr)	33 (total)
HEPA filtered offgas: (Ci/yr)	2.90E-08
Effluents	
Mixed Waste: (L)/(Ci)	17,979/18
Sanitary wastewater: (L)	203,625
Solid wastes	
Building material: (m^3)	3,082
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	205/2
Bldg material (abandoned in place):	3,891/38.91
Mixed waste (abandoned in place):	14/0.14
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	5,994
Generation:	
Solvents, etc.: (L)	143,845
Used lube oil: (L)	11,000
Water usage	
Domestic water: (L)	203,625
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	1,318,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.58 Performance-Based Closure of the Remote Analytical Laboratory (P159)

General Project Objectives: The project included activities that would be associated with the deactivation and demolition of the Remote Analytical Laboratory.

Process Description: Deactivation of the complex would be complete in ***2037***. Demolition would begin in ***2038*** and would be completed in ***2043***.

Complex Description: The Remote Analytical Laboratory (CPP-684) was designed to receive, analyze, and dispose of radioactive samples from the entire INTEC complex in a safe and timely manner. These samples sources include fuel dissolution, first, second, and third cycle extraction raffinate and product solutions, recycled solvents, waste solutions, waste calcination feed, waste calcine and scrub solutions, and Process Equipment Waste Evaporator feed and condensate solutions. The facility houses a cold and warm laboratories, an analytical cell, a waste handling cell, a uranium storage cabinet, and equipment support areas for decontamination and maintenance.

Table C.6.2-129. Decontamination and decommissioning project data for the Remote Analytical Laboratory (P159).[a]

Generic Information	
Description/function and EIS Project number:	Remote analytical laboratory- CPP-684 (P159)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Reinforced concrete
Size: (m^2)	1,116.3
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	***2017-2019***
Demolition:	***2019 – 2021***
Number of D&D workers:	7 per yr
Number of radiation workers (D&D):	4 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	48,375
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	677
Contaminants[b]: (tons/yr)	33 (total)
HEPA filtered offgas: (Ci/yr)	2.90E-08
Effluents	
Mixed Waste: (L)/(Ci)	568/1
Sanitary wastewater: (L)	38,813
Solid wastes	
Building material: (m^3)	1,524
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	101/1
Bldg material (abandoned in place):	1,923/19.23
Mixed waste (abandoned in place):	7/0.07
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	114
Generation:	
Solvents, etc.: (L)	2,271
Used lube oil: (L)	9,200
Water usage	
Domestic water: (L)	38,813
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	1,099,000

a. Sources: EDF-PDS-C-036 ; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.59 Performance-Based Closure and Closure to Land Fill Standards of the Fuel Processing Complex (P160A, C-G)

General Project Objectives: The project included activities that would be associated with the deactivation and demolition of the Fuel Processing Complex.

The project addresses four facilities:

- CPP-601: Fuel Processing Facility (P160A & E)
- CPP-627: Remote Analytical Facility (P160C & F)
- CPP-640: Head-End Processing Facility (P160D & G)

Process Description: The complex is currently undergoing deactivation and is targeted for a "land-fill" closure. Deactivation is scheduled to be complete in 2007. The below ground levels of the complex would be clean grouted with concrete. Subsequently, the above ground portion of the complex would be demolished in place and covered with an earthen cap. The ridged asbestos siding and roofing would be removed and either placed in the below ground areas of the existing building prior to grouting or placed in a land-fill approved for asbestos disposal. Demolition would start in 2015 and would be completed in 2025.

Complex Description: The total multi-level building area of the complex is approximately 164,000 ft^2. The above ground areas are approximately 74,800 ft^2. CPP-601 is a steel frame building, while buildings 640 and 627 are constructed of concrete block. The majority of the complex is sided and roofed with a ridged asbestos material, i.e., transite.

The Process Building (CPP-601) contains 25 process cells, numerous corridors, and auxiliary cells that house equipment and controls for separating uranium from fission products. Much of the processing equipment in the building is located in heavily shielded cells and must be operated remotely. Fuel element processing consisted of a series of aqueous process steps. These included dissolution in acid, separation of the fission products from uranium by counter-current solvent extraction, concentration and interim storage of uranyl nitrate hexahydrate solution, and conversion for the uranyl nitrate hexahydrate to solid uranium trioxide before shipping. The first three process steps for aluminum and zirconium clad fuels are performed in the process cells of CPP-601. CPP-601 contains a low bay area and process/storage cells.

Minimum functions are performed in the building, including monitoring heating and ventilation systems for contamination, supporting analytical activities, and maintaining the process makeup area for the high level waste activities. The building has high radiation areas, chemical contamination (i.e., nitric acid and aluminum nitrate), and high quantities of asbestos contamination in the form of piping insulation and transite siding and roofing. The facility includes treated, potable, and demineralized water system and plant air, steam and power. CPP buildings 604, 605, 621, 640, and 641 are supplied plant services through this building.

Electrolytic dissolution, combustion and dissolution of graphite fuels take place in the Head End Processing Plant (CPP-640), and custom dissolution takes in the Multicurie Cell in CPP-627. CPP-640 contains office space, operating and treatment areas and process cells. It has high levels of radiation contamination and medium quantities of asbestos contamination in the roofing and insulation materials. CPP-627 contains office space, decontamination rooms, a glove box area, the multi-curie cell and cave. It has high levels of radiation contamination and medium quantities of asbestos contamination in the roofing and insulation materials.

Table C.6.2-130. Decontamination and decommissioning project data for the Closure of the Fuel Processing Building to Landfill Standards (P160A).[a]

Generic Information	
Description/function and EIS Project number:	Fuel Processing Building, CPP-601 (P160A)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Reinforced concrete
Size: (m^2)	6,945.5
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	16 per yr
Number of radiation workers (D&D):	10 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/3.4/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Mixed Waste: (L)/(Ci)	3,533/4
Sanitary wastewater: (L)	91,125
Solid wastes	
Building material: (m^3)	9,480
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	629/6
Bldg material (abandoned in place):	11,968/119.68
Mixed waste (abandoned in place):	43/0.43
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	353
Generation:	
Solvents, etc.: (L)	14,132
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	91,125
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-131. Decontamination and decommissioning project data for the Closure of the Remote Analytical Facility Building to Landfill Standards (P160C).[a]

Generic Information	
Description/function and EIS Project number:	Remote analytical facility building, CPP-627 (P160C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	1,469.8
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	8 per yr
Number of radiation workers (D&D):	5 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.7/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	46,688
Solid wastes	
Building material: (m^3)	2,006
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	133/1
Bldg material (abandoned in place):	2,533/25.33
Mixed waste (abandoned in place):	9/0.09
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	46,688
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-132. Decontamination and decommissioning project data for the Closure of the Head End Process Plant to Landfill Standards (P160D).[a]

Generic Information	
Description/function and EIS Project number:	Head End Process Plant CPP-640 (P160D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	1,693.0
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	8 per yr
Number of radiation workers (D&D):	5 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.8/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Mixed waste: (L)/(Ci)	3,444/3
Sanitary wastewater: (L)	44,438
Solid wastes	
Building material: (m^3)	2,311
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	153/2
Bldg material (abandoned in place):	2,917/29.17
Mixed waste (abandoned in place):	10/0.10
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	86
Generation:	
Solvents, etc.: (L)	3,445
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	44,438
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-133. Decontamination and decommissioning project data for the Performance-Based Closure of the Fuel Processing Building (P160E).[a]

Generic Information	
Description/function and EIS Project number:	Fuel Processing Building, CPP-601 (P160E)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Reinforced Concrete
Size: (m^2)	6,945.5
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	20 per yr
Number of radiation workers (D&D):	13 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/3.4/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Mixed waste: (L)/(Ci)	3,533/4
Sanitary wastewater: (L)	113,625
Solid wastes	
Building material: (m^3)	9,480
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	629/6
Bldg material (abandoned in place):	11,968/119.68
Mixed waste (abandoned in place):	43/0.43
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	353
Generation:	
Solvents, etc.: (L)	14,132
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	113,625
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-134. Decontamination and decommissioning project data for the Performance-Based Closure of the Remote Analytical Facility Building (P160F).[a]

Generic Information	
Description/function and EIS Project number:	Remote Analytical Facility Building, CPP-627 (P160F)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Concrete
Size: (m^2)	1,469.8
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	10 per yr
Number of radiation workers (D&D):	6 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.7/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	58,500
Solid wastes	
Building material: (m^3)	2,006
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	133/1
Bldg material (abandoned in place):	2,533/25.33
Mixed waste (abandoned in place):	9/0.09
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	58,500
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-135. Decontamination and decommissioning project data for the Performance-Based Closure of the Head End Process Plant (P160G).[a]

Generic Information	
Description/function and EIS Project number:	Head End Process Plant, CPP-640 (P160G)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Concrete
Size: (m^2)	1,693.0
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	10 per yr
Number of radiation workers (D&D):	6 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.8/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Mixed waste: (L)/(Ci)	3,444/3
Sanitary wastewater: (L)	55,688
Solid wastes	
Building material: (m^3)	2,311
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	153/2
Bldg material (abandoned in place):	2,917/29.17
Mixed waste (abandoned in place):	10/0.10
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	86
Generation:	
Solvents, etc.: (L)	3,445
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	55,688
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.60 Fluorinel Dissolution Process and Fuel Storage Facility Closure (P161A, B)

General Project Objectives: The project addresses the deactivation and demolition of the Fluorinel Dissolution and Fuel Storage Complex.

Process Description: The complex is scheduled to complete deactivation in 2010. Demolition would begin in 2011 and would be completed in 2017.

The project addresses three facilities:

- CPP-666: Fuel Storage Area (P161A)
- CPP-666: Dissolution Process Area (P161A)
- CPP-767: Fluorinel Dissolution Process and Fuel Storage Facility Stack (P161B)

The Fuel Storage and Dissolution Process Facility would be targeted for closure to landfill standards, except for the facility stack which would be clean closed.

Complex Function: The Fluorinel Dissolution Process and Fuel Storage building was a combination of fuel storage and fuel dissolution process area. The Fuel Storage Area provides facilities for receiving, preparing for storage, transferring, storage, and preparing for processing. The Fluorinel Dissolution Process Area consists of facilities for processing irradiated fuels. The resulting product could be characterized as a hydrofluoric-nitric acid solution containing dissolved zirconium, uranium, and other nuclides. Subsequently, this product was transferred to CPP-601 for further processing.

Complex Description: The total multilevel area of the CPP-666 complex is approximately 175,000 ft^2. The complex is a combination of reinforced concrete and structural steel exterior walls. The complex was designed to provide office space, underwater fuel storage, and fuel dissolution areas. The entire fuel basin area, fuel dissolution cell, fuel handling area, air handling system area, and water treatment system area are radiologically contaminated.

The complex has potable, raw, treated, demineralized, and fire water systems; a steam/condendate system; plant air; and 480-volt power service. Special complex equipment includes two 25-ton cranes, one 130-ton overhead crane, several manipulators, cask handling equipment, water treatment system, high-efficiency particulate air filtration system, numerous basin filled with water for the storage of spent nuclear fuel, and a heavily shielded area for fuel dissolution and dissolution. The stack (CPP-767) is a simple steel stack.

Table C.6.2-136. Decontamination and decommissioning project data for the Performance-Based Closure of the Fluorinel Storage Facility (P161A, *B*).[a]

Generic Information	
Description/function and EIS Project number:	Fuel storage facility (FAST) – CPP-666 (P161A&B)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Structural steel, reinforced concrete
Size: (m^2)	16,279.1
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2006 – 2010
Demolition:	2011 – 2017
Number of D&D workers:	54 per yr
Number of radiation workers (D&D):	34 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	87,750
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/8.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	303,188
Solid wastes	
Building material: (m^3)	22,220
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	1,475/15
Bldg material (abandoned in place):	28,050/280.50
Mixed waste (abandoned in place):	100/1.00
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	1,380
Generation:	
Solvents, etc.: (L)	33,122
Used lube oil: (L)	16,600
Water usage	
Domestic water: (L)	303,188
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	1,993,000

a. Sources: EDF-PDS-C-038; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.61 Closure of the Transport Lines Group (P162A-D)

General Project Objectives: The project will address the deactivation and demolition of the Transport Lines Group.

Process Description: Deactivation of the complex would be completed in ***2038***. Demolition would be scheduled to start in ***2043*** and would be completed in 2043.

The project addresses seven transfer lines:

- High-Level Liquid Waste (Raffinate) Lines (P162A)
- Calcine Solids Transport Lines (P162B)
- Process Off Gas Lines (and drains) (P162C)
- Vessel Off Gas Lines (P162D)

Complex Function: The transport lines are used to transport solid waste, liquid waste, and process offgas from the process facility to the treatment or storage facility.

Complex Description: High-Level Liquid Waste (Raffinate) Lines: The two original 1, 2, & 3 cycle raffinate lines between CPP-601 and CPP-604 were replaced about 1982. They were capped and abandoned in place and may have several places in the line that have been cut and capped.

Two 2-inch diameter stainless steel pipelines replaced the original raffinate lines. The new lines are encased in 4 inch stainless steel pipe, which is buried directly in the ground (approximately 6-12 feet deep). The lines are approximately 300 feet long and some portion of them would remain in service until all of the processes that create liquid waste would be shut down and closed. The sections of the lines that would no longer be needed would be capped and abandoned in place.

Calcine Solids Transport Lines: There are two calcined solids transport lines between the Waste Calcine Facility and bin sets 1, 2, 3, and 4. The stainless steel lines are 3 to 4 inches in diameter and inserted into clay tile sleeves. Each line is encased in concrete (approximately 3 feet by 3 feet) and buried at a depth of approximately four feet. These lines would be capped and abandoned in place.

There are two calcined solids transport lines between the New Waste Calcining Facility and bin sets 4, 5, 6, and 7. The stainless steel lines are 3 to 4 inches in diameter and inserted into clay tile sleeves. Each line is encased in concrete (approximately 3 feet by 3 feet) and buried at a depth of approximately four feet. These lines would be capped and abandoned in place.

Calciner Process Off-Gas Lines: The Process Off-Gas lines run from CPP-633 and CPP-659 to the Process Atmospheric Protection System filter system in CPP-649. The 10-inch diameter, stainless steel line from Waste Calcining Facility is directly buried in the ground, the 12-inch diameter stainless steel line from New Waste Calcining Facility has a secondary containment of 20-inch stainless steel pipe which is encased in concrete (approximately 3 feet by 3 feet) at a depth of approximately 8 to 10 feet. The lines are approximately 300 to 500 feet long. Clean closure would require the line to be flushed, capped, and abandoned in place.

Vessel Off-Gas Line: The Vessel Off-Gas line runs from CPP-601 to the Vessel Off-Gas filter system in CPP-604. The 8-inch diameter, stainless steel line has a secondary containment of clay tile which is encased in concrete (approximately 3 feet by 3 feet) at a depth of approximately 8 to 14 feet. The line is approximately 300 feet long. Clean closure would require the line to be flushed, capped, and abandoned in place.

Dissolver Off-Gas Lines: The "C & D" and RALA Dissolver Off-Gas lines run from CPP-601 to the CPM Dissolver Off-Gas filter system in CPP-604. The 4-inch diameter stainless lines have a secondary containment of clay tile which are encased in concrete (approximately 3 feet by 3 feet) buried in the ground at a depth of approximately 8 to 14 feet. The lines are approximately 300 feet long. The performance-based closure requires the lines to be flushed, capped, and abandoned in place.

The "E- Dissolver Off-Gas" and "CPM Dissolver Off-Gas" lines are 2-inch and 4-inch stainless steel lines are routed through the CPP-601 vent tunnel and then overhead along the vent duct to the filtering systems in CPP-604. The lines are approximately 300 feet long. Clean closure would require the lines to be flushed, capped, and abandoned in place. The overhead portion would be removed during closure.

Overhead Pneumatic Transfer Lines: The overhead pneumatic transfer lines are used to transport radioactive samples from various INTEC facilities to the Remote Analytical Laboratory.

CPP-1776 Utility Tunnel System throughout Chem Plant: The utility tunnel runs throughout the INTEC complex. The tunnel contains steam, condensate, sewer, water, and electric services. There is approximately 5000 linear feet of utility tunnel with a cross-section of 10 feet by 10 feet.

Table C.6.2-137. Decontamination and decommissioning project data for the Closure of the High-Level Waste (Raffinate) Lines (P162A).[a]

Generic Information	
Description/function and EIS Project number:	High level liquid waste (raffinate) lines (P162A)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Underground Lines 117.2 None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end: Deactivation: Demolition:	 2038 – 2038 2043 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 2,700
Acres disturbed: New/Previous/Revegetated: (acres)	 None/0.1/None
Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr)	See Appendix C.2 for details. 188 9 (total)
Effluents Sanitary wastewater: (L)	 2,813
Solid wastes Building material: (m^3)	 81
Radioactive wastes: (m^3)/(Ci) Combustibles: Bldg material (abandoned in place):	 2/0.02 1/0.01
Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Used lube oil: (L)	 None 500
Water usage Domestic water: (L)	 2,813
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 None 61,000

a. Sources: EDF-PDS-C-039; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-138. Decontamination and decommissioning project data for the Closure of the Calcine Solids Transport Lines (P162B).[a]

Generic Information	
Description/function and EIS Project number:	Calcine solids transport lines (P162B)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Underground Lines
Size: (m^2)	70.3
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	2,700
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9 (total)
Effluents	
Sanitary wastewater: (L)	1,125
Solid wastes	
Building material: (m^3)	157
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	1/0.01
Bldg material (abandoned in place):	4/0.04
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	1,125
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-039; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-139. Decontamination and decommissioning project data for the Closure of the Process Offgas Lines and Drains (P162C).[a]

Generic Information	
Description/function and EIS Project number:	Process offgas lines and drains (P162C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Underground Lines 175.8 None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end: Deactivation: Demolition:	 2038 – 2038 2043 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	1 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 2,700
Acres disturbed: New/Previous/Revegetated: (acres)	 None/0.2/None
Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO2): (tons/yr) Contaminants[b]: (tons/yr)	See Appendix C.2 for details. 188 9
Effluents Sanitary wastewater: (L) Mixed waste: (L)/(Ci)	 5,625 31,037/31
Solid wastes Building material: (m^3)	 130
Radioactive wastes: (m^3)/(Ci) Combustibles: Bldg material (abandoned in place):	 3/0.03 11/0.11
Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Used lube oil: (L)	 None 500
Water usage Domestic water: (L)	 5,625
Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 None 61,000

a. Sources: EDF-PDS-C-039; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-140. Decontamination and decommissioning project data for the Closure of the Vessel Offgas Lines (P162D).[a]

Generic Information	
Description/function and EIS Project number:	Vessel offgas lines (P162D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Underground Lines
Size: (m^2)	175.8
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	<1 per year
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	2,700
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9 (total)
Effluents	
Sanitary wastewater: (L)	12,112/12
Mixed waste: (L)/(Ci)	3,938
Solid wastes	
Building material: (m^3)	392
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	3/0.03
Bldg material (abandoned in place):	9/0.09
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	3,938
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-039; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

C.6.2.62 Performance-Based Closure and Closure to Landfill Standards of the New Waste Calcining Facility (P165A & B)

General Project Objective: These projects address the deactivation, decontamination, and demolition of the New Waste Calcining Facility. Activities supporting performance-based closure of the facility are covered by P165A while closure of the New Waste Calcining Facility to landfill standards is covered by P165B.

Complex Description: The primary function of the New Waste Calcining Facility (CPP-659) is to calcine high-level liquid waste. The CPP-659 facility, which was built in 1980, is a combination of reinforced concrete and structural steel exterior walls. As a replacement facility for the Waste Calcining Facility, the new facility houses the calciner, the high-level liquid waste evaporator, the filter leach system, associated process equipment, equipment decontamination area, and heating/ventilation and air-conditioning equipment.

Project Description:

P165A - Performance-based closure: The performance-based closure project option includes deactivating and decontaminating the New Waste Calcining Facility, cleaning tanks and vessels to lowest levels possible, filling the below-ground portion of the facility and associated tanks and vessels with clean, non-radioactive grout, and demolishing the above-ground portion of the facility.

P16B - Closure to landfill standards: The closure to landfill standards project option includes deactivating and decontaminating the New Waste Calcining Facility, flushing and eliminating free liquids in tanks and vessels, filling the below-ground portion of the facility and associated tanks and vessels with clean, non-radioactive grout, and demolishing the above-ground portion of the facility.

Table C.6.2-141. Decontamination and decommissioning project data for the Performance-Based Closure of the New Waste Calcining Facility (P165A).[a]

Generic Information	
Description/function and EIS Project number:	Deactivation of the New Waste Calcining Facility
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	Performance-Based Closure
Action type:	D&D of existing facility
Structure type:	Concrete/steel construction
Size: (m^2)	8,930.2
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Includes building
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2017 – 2019
Demolition:	2019 – 2021
Number of D&D workers:	47 per yr
Number of radiation workers (D&D):	35 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	73,125
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/4.4/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	317
Fuel combustion (diesel exhaust):	
Gases (CO2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	263,250
Solid wastes	
Building material (abandoned in place): (m^3)	18,271
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	To be incinerated at WERF
LLW disposal:	2,082/21
Bldg material (abandoned in place):	4,783/47.83
Mixed waste (abandoned in place):	23/0.023
Hazardous/toxic chemicals & wastes	
Generation:	
Used lube oil: (L)	13,839
Solvents: (L)	253,622
Storage/inventory: (L)	12,681
Water usage	
Domestic water: (L)	263,250
Energy requirements	
Electrical: (MWh/yr)	300
Fossil fuel: (L)	1,661,000

a. Sources: EDF-PDS-C-050; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-142. Decontamination and decommissioning project data for the Closure to Landfill Standards of the New Waste Calcining Facility (P165B).[a]

Generic Information	
Description/function and EIS Project number:	Deactivation of the New Waste Calcining Facility
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	Closure to landfill standards
Action type:	D&D of existing facility
Structure type:	Concrete/steel construction
Size: (m^2)	8,930.2
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Includes building
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2017 – 2019
Demolition:	2019 – 2021
Number of D&D workers:	44 per yr
Number of radiation workers (D&D):	32 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	73,125
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/4.4/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	317
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	246,938
Solid wastes	
Building material (abandoned in place): (m^3)	18,271
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	To be incinerated at WERF
LLW disposal:	2,082/21
Bldg material (abandoned in place):	4,783/47.83
Mixed waste (abandoned in place):	23/0.023
Hazardous/toxic chemicals & wastes	
Generation:	
Used lube oil: (L)	13,839
Solvents: (L)	253,622
Storage/inventory: (L)	12,681
Water usage	
Domestic water: (L)	246,938
Energy requirements	
Electrical: (MWh/yr)	300
Fossil fuel: (L)	1,661,000

a. Sources: EDF-PDS-C-050; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Appendix C.6 References

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Appendix C.7

Description of Input and Final Waste Streams

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Appendix C.7

Description of Input and Final Waste Streams

The alternatives analyzed in this EIS were designed to offer a full range of options for treating the ***mixed*** high-level waste (HLW) and ***mixed transuranic waste/***sodium-bearing waste (SBW) presently stored by DOE at the Idaho Nuclear Technology and Engineering Center (INTEC). Each option would begin with essentially the same input streams (i.e., the inventory of ***mixed*** HLW and ***mixed transuranic waste/***SBW). In addition, ongoing INTEC operations would generate new radioactive liquid wastes from decontamination activities. Ultimately, each option would result in a final waste stream suitable for disposal. For each option, the final waste stream would consist of one or more forms (i.e., borosilicate glass, grout, etc.). Each of these forms would be designed to meet the waste acceptance criteria set by the intended disposal facility (i.e., the Waste Isolation Pilot Plant, geologic repository, etc.). Table C.7-1 lists existing and projected input waste streams and quantities. ***The values in the bottom half of the table reflect the calcination of mixed transuranic waste/SBW through May 2000.*** Table C.7-2 through C.7-5 list the concentrations of chemical and radioactive constituents in the ***mixed HLW*** calcine and ***mixed transuranic waste/***SBW. The values provided in Tables C.7-2 through C.7-5 have been estimated by a variety of methods, and not all constituents have been verified by sampling and analysis. Table C.7-6 lists output waste streams for each option. The table includes the output compositions, quantities, numbers of containers, and final dispositions. Table C.7-6 only includes those wastes designated as "product waste" as defined in Section 5.2.13. Other waste generated indirectly as a result of the activities under the waste processing alternatives ("process wastes") are described in Section 5.2.13. References are provided for the data in all tables.

Table C.7-1. Waste processing alternative inputs.

Waste (type)	Quantity	Source
Draft EIS waste inputs		
Calcine – granular solid (mixed HLW)	4,155 $m^{3(a)}$ 5,435 $m^{3(b)}$	Staiger (1999) Russell et al. (1998)
SBW – acid solution (mixed transuranic waste)	~800,000 gallons	Russell et al. (1998)
Concentrated NGLW (Type 1) – acid solution (mixed transuranic waste)	~300,000 gallons[c] (1998-2016)	Russell et al. (1998) Barnes (1999) McDonald (1998)
Other NGLW (Type 2) – acid solution (mixed low-level waste)	~230,000 gallons[c] (1998-2032)	Russell et al. (1998) Barnes (1999) McDonald (1998)
Final EIS waste inputs		
Calcine – granular solid (mixed HLW)	***4,400 cubic meters***	***Beck (2000)***
SBW – acid solution	***1,300,000 gallons***	***Valentine (2000)***

a. Without SBW/NGLW calcination.
b. With SBW/NGLW calcination.
c. The volume of these wastes may be reduced or eliminated by actions taken under the INEEL liquid waste management program.
NGLW = newly generated liquid waste; m^3 = cubic meters; ~ = approximately.

Table C.7-2. Bin set total chemical inventory (fission and activation species decayed to 2016).[a]

Constituent	Total mass (kg)	Constituent	Total mass (kg)
Actinium	1.2×10^{-6}	Molybdenum	2.9×10^{4}
Aluminum	9.7×10^{5}	Neodynium	1.4×10^{3}
Americium	4.4	Neptunium	46
Antimony	10	Nickel	2.6×10^{3}
Arsenic	3.7	Niobium	2.6
Astatine	8.5×10^{-20}	Palladium	110
Barium	770	Plutonium	1.3×10^{3}
Beryllium	3.6	Polonium	2.8×10^{-9}
Bismuth	2.7×10^{-9}	Potassium	2.8×10^{4}
Boron	4.0×10^{4}	Praseodymium	380
Bromine	29	Promethium	5.7×10^{-3}
Cadmium	4.7×10^{4}	Protoactinium	2.4×10^{-3}
Calcium	1.1×10^{6}	Radium	2.7×10^{-5}
Californium	1.0×10^{-12}	Rhodium	140
Cerium	850	Rubidium	170
Cesium	740	Ruthenium	1.9×10^{3}
Chlorine	4.5×10^{3}	Samarium	280
Chromium	8.8×10^{3}	Selenium	51
Cobalt	1.6	Silver	8.3
Curium	3.6×10^{-3}	Sodium	1.3×10^{5}
Dysprosium	3.3	Strontium	2.6×10^{3}
Erbium	1.8	Technetium	280
Europium	20	Tellurium	140
Fluorine	8.4×10^{5}	Terbium	0.94
Francium	3.1×10^{-14}	Thallium	0.36
Gadolinium	15	Thorium	6.1
Gallium	14	Thulium	0.14
Germanium	1.2	Tin	43
Holmium	1.1	Uranium	1.7×10^{4}
Indium	4.0	Ytterbium	1.8
Iodine	1.4×10^{3}	Yttrium	260
Iron	2.2×10^{4}	Zinc	71
Lanthanum	440	Zirconium	5.6×10^{5}
Lead	360	NO_3	2.5×10^{5}
Lithium	18	PO_4	2.4×10^{4}
Manganese	1.2×10^{3}	SO_4	5.3×10^{4}
Mercury	1.2×10^{4}		

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a. Source : Valentine (2000).

Table C.7-3. Bin set total inventory of radionuclides (decayed to 2016).[a]

Constituent	Total activity (Ci)	Constituent	Total activity (Ci)	Constituent	Total activity (Ci)
H-3	15	Sm-148	9.0×10^{-9}	Th-227	0.085
Be-10	0.033	Sm-149	2.9×10^{-9}	Th-228	1.6
C-14	0.038	Sm-151	4.5×10^{5}	Th-229	1.4×10^{-4}
Co-60	1.5×10^{3}	Eu-150	5.3×10^{-3}	Th-230	1.4
Ni-63	6.8×10^{4}	Eu-152	430	Th-231	5.0
Se-79	9.9×10^{4}	Gd-152	5.3×10^{-10}	Th-232	2.3×10^{-7}
Rb-87	9.1×10^{-3}	Eu-154	2.9×10^{4}	Th-234	5.0
Sr-90	7.9×10^{6}	Eu-155	3.9×10^{3}	Pa-231	0.11
Y-90	7.9×10^{6}	Ho-166m	0.014	Pa-233	690
Zr-93	680	Tm-171	1.1×10^{-9}	Pa-234m	5.0
Nb-93m	630	Tl-207	0.085	Pa-234	6.3×10^{-3}
Nb-94	270	Tl-208	0.16	U-232	1.6
Tc-98	7.3×10^{-4}	Tl-209	1.9×10^{-6}	U-233	0.057
Tc-99	4.6×10^{3}	Pb-209	1.4×10^{-4}	U-234	130
Rh-102	9.1×10^{-3}	Pb-210	0.013	U-235	3.2
Ru-106	4.4×10^{-3}	Pb-211	0.085	U-236	11
Rh-106	0.029	Pb-212	1.6	U-237	1.5
Pd-107	9.1	Pb-214	0.027	U-238	3.1
Ag-108	1.1×10^{-5}	Bi-210m	5.2×10^{-17}	U-240	1.6×10^{-7}
Ag-108m	1.3×10^{-4}	Bi-210	0.013	Np-235	5.1×10^{-17}
Ag-109m	3.8×10^{-17}	Bi-211	0.085	Np-237	470
Cd-109	3.8×10^{-17}	Bi-212	1.6	Np-238	0.017
Cd-113m	1.6×10^{3}	Bi-213	1.4×10^{-4}	Np-239	50
In-115	2.7×10^{-8}	Bi-214	0.027	Np-240m	1.6×10^{-7}
Sn-121m	68	Po-210	0.013	Pu-236	0.027
Te-123	1.3×10^{-10}	Po-211	1.7×10^{-4}	Pu-238	1.1×10^{5}
Sb-125	130	Po-212	0.29	Pu-239	4.8×10^{4}
Te-125m	38	Po-213	1.4×10^{-4}	Pu-240	2.0×10^{3}
Sn-126	310	Po-214	0.027	Pu-241	4.8×10^{4}
Sb-126	43	Po-215	0.085	Pu-242	130
Sb-126m	310	Po-216	1.6	Pu-243	1.1×10^{-13}
I-129	1.6	Po-218	0.027	Pu-244	1.6×10^{-7}
Cs-134	67	At-217	1.4×10^{-4}	Am-241	1.2×10^{4}
Cs-135	360	Rn-219	0.085	Am-242m	6.1
Cs-137	8.8×10^{6}	Rn-220	1.6	Am-242	5.8
Ba-137m	8.5×10^{6}	Rn-222	0.027	Am-243	50
La-138	6.8×10^{-8}	Fr-221	1.4×10^{-4}	Cm-242	4.8
Ce-142	9.4×10^{-3}	Fr-223	0.018	Cm-243	5.0
Ce-144	8.6×10^{-5}	Ra-223	0.085	Cm-244	250
Pr-144	1.4×10^{-3}	Ra-224	1.6	Cm-245	0.071
Pr-144m	1.7×10^{-5}	Ra-225	1.4×10^{-4}	Cm-246	4.6×10^{-3}
Nd-144	4.6×10^{-7}	Ra-226	0.027	Cm-247	5.2×10^{-9}
Pm-146	2.3	Ra-228	2.3×10^{-7}	Cm-248	5.5×10^{-9}
Pm-147	5.3×10^{3}	Ac-225	1.4×10^{-4}	Cf-249	4.0×10^{-9}
Sm-146	8.6×10^{-5}	Ac-227	0.085	Cf-250	1.7×10^{-9}
Sm-147	3.0×10^{-3}	Ac-228	2.3×10^{-7}	Cf-251	6.3×10^{-11}

a. Source : Valentine (2000).

Table C.7-4. Calculated radionuclides activities for SBW (curies per liter) decayed to 2016.[a]

Radionuclide		Radionuclide		Radionuclide	
Hydrogen-3	1.2×10^{-4}	Samarium-147	2.9×10^{-11}	Thorium-227	8.1×10^{-10}
Beryllium-10	3.1×10^{-10}	Samarium-148	8.5×10^{-17}	Thorium-228	1.5×10^{-8}
Carbon-14	3.6×10^{-10}	Samarium-149	2.8×10^{-17}	Thorium-229	1.3×10^{-12}
Cobalt-60	8.1×10^{-6}	Europium-150	5.0×10^{-11}	Thorium-230	1.3×10^{-8}
Nickel-63	6.0×10^{-4}	Samarium-151	4.2×10^{-3}	Thorium-231	4.7×10^{-8}
Selenium -9	2.2×10^{-5}	Europium-152	4.0×10^{-6}	Thorium-232	1.9×10^{-15}
Rubidium-87	8.6×10^{-11}	Gadolinium-152	5.0×10^{-18}	Thorium-234	4.1×10^{-8}
Strontium-90	0.15	Gadolinium-153	3.1×10^{-31}	Protactinium-231	1.1×10^{-9}
Yttrium-90	0.15	Europium-154	5.5×10^{-5}	Protactinium-233	6.4×10^{-6}
Zirconium-93	6.5×10^{-6}	Europium-155	5.4×10^{-5}	Protactinium-234m	4.1×10^{-8}
Niobium-93m	6.0×10^{-6}	Holmium-166m	1.3×10^{-10}	Protactinium-234	5.3×10^{-11}
Niobium-94	1.2×10^{-4}	Thulium-171	1.0×10^{-17}	Uranium-232	1.5×10^{-8}
Technetium-98	6.9×10^{-12}	Thallium-207	8.1×10^{-10}	Uranium-233	5.4×10^{-10}
Technetium-99	1.7×10^{-4}	Thallium-208	1.5×10^{-9}	Uranium-234	1.8×10^{-6}
Rhodium-102	8.7×10^{-11}	Thallium-209	1.8×10^{-14}	Uranium-235	2.2×10^{-8}
Ruthenium-106	2.6×10^{-10}	Lead-209	1.3×10^{-12}	Uranium-236	7.4×10^{-8}
Rhodium-106	2.6×10^{-10}	Lead-210	1.2×10^{-10}	Uranium-237	1.4×10^{-8}
Palladium-107	8.6×10^{-8}	Lead-211	8.1×10^{-10}	Uranium-238	2.0×10^{-8}
Silver-108	1.1×10^{-13}	Lead-212	1.5×10^{-8}	Uranium-240	1.5×10^{-15}
Silver-108m	1.2×10^{-12}	Lead-214	2.5×10^{-10}	Neptunium-235	4.8×10^{-25}
Silver-109m	3.6×10^{-25}	Bismuth-210m	4.9×10^{-25}	Neptunium-237	2.0×10^{-6}
Cadmium-109	3.6×10^{-25}	Bismuth-210	1.2×10^{-10}	Neptunium-238	1.6×10^{-10}
Silver-110	6.2×10^{-31}	Bismuth-211	8.1×10^{-10}	Neptunium-239	4.8×10^{-7}
Silver-110m	4.8×10^{-29}	Bismuth-212	1.5×10^{-8}	Neptunium-240m	1.5×10^{-15}
Cadmium-113m	1.5×10^{-5}	Bismuth-213	1.3×10^{-12}	Plutonium-236	2.5×10^{-10}
Indium-115	2.5×10^{-16}	Bismuth-214	2.5×10^{-10}	Plutonium-238	7.1×10^{-4}
Tin-119m	1.9×10^{-29}	Polonium-210	1.2×10^{-10}	Plutonium-239	1.6×10^{-4}
Tin-121m	6.4×10^{-7}	Polonium-211	1.6×10^{-12}	Plutonium-240	2.3×10^{-5}
Tellurium-123	1.2×10^{-18}	Polonium-212	2.7×10^{-9}	Plutonium-241	5.8×10^{-4}
Antimony-125	6.0×10^{-6}	Polonium-213	1.3×10^{-12}	Plutonium-242	4.7×10^{-8}
Tellurium-125m	3.6×10^{-7}	Polonium-214	2.5×10^{-10}	Plutonium-243	1.0×10^{-21}
Tin-126	2.9×10^{-6}	Polonium-215	8.1×10^{-10}	Plutonium-244	1.5×10^{-15}
Antimony-126	4.0×10^{-7}	Polonium-216	1.5×10^{-8}	Americium-241	7.4×10^{-5}
Antimony-126m	2.9×10^{-6}	Polonium-218	2.5×10^{-10}	Americium-242m	5.7×10^{-8}
Iodine-129	1.3×10^{-7}	Astatine-217	1.3×10^{-12}	Americium-242	5.5×10^{-8}
Cesium-134	1.9×10^{-6}	Radon-219	8.1×10^{-10}	Americium-243	4.8×10^{-7}
Cesium-135	3.4×10^{-6}	Radon-220	1.5×10^{-8}	Curium-242	4.5×10^{-8}
Cesium-137	0.084	Radon-222	2.5×10^{-10}	Curium-243	4.7×10^{-8}
Barium-137m	0.081	Francium-221	1.3×10^{-12}	Curium-244	2.4×10^{-6}
Lanthanum-138	6.5×10^{-16}	Francium-223	1.7×10^{-10}	Curium-245	5.9×10^{-10}
Cerium-142	8.9×10^{-11}	Radium-223	8.1×10^{-10}	Curium-246	3.6×10^{-2}
Cerium-144	1.2×10^{-11}	Radium-224	1.5×10^{-8}	Curium-247	4.9×10^{-17}
Praseodymium-144	1.3×10^{-11}	Radium-225	1.3×10^{-12}	Curium-248	5.2×10^{-17}
Praseodymium-144m	1.6×10^{-13}	Radium-226	2.5×10^{-10}	Californium-249	3.8×10^{-17}
Neodymium-144	4.3×10^{-15}	Radium-228	2.1×10^{-15}	Californium-250	1.6×10^{-17}
Promethium-146	2.2×10^{-8}	Actinium-225	1.3×10^{-12}	Californium-251	5.9×10^{-19}
Samarium-146	8.1×10^{-13}	Actinium-227	8.1×10^{-10}	Californium-252	7.7×10^{-30}
Promethium-147	4.9×10^{-5}	Actinium-228	2.1×10^{-15}		

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[a] Source: Valentine (2000).

Table C.7-5. Chemical inventory (fission and activation species decayed to 2016) in SBW.[a]

Constituent	Total mass (kg)	Average concentration (kg/L)	Constituent	Total mass (kg)	Average concentration (kg/L)
Actinium	5.2×10^{-8}	1.0×10^{-14}	Neptunium	14	2.8×10^{-6}
Americium	0.11	2.3×10^{-8}	Niobium	830	1.6×10^{-4}
Antimony	0.42	8.4×10^{-8}	Neodymium	65	1.3×10^{-5}
Arsenic	54	1.1×10^{-5}	Palladium	5.0	9.9×10^{-7}
Astatine	3.7×10^{-21}	7.4×10^{-28}	Plutonium	13	2.5×10^{-6}
Barium	2.1×10^{3}	4.1×10^{-4}	Polonium	1.2×10^{-10}	2.4×10^{-17}
Beryllium	2.1×10^{-6}	4.2×10^{-13}	Praseodymium	17	3.4×10^{-6}
Bismuth	1.2×10^{-10}	2.3×10^{-17}	Promethium	2.5×10^{-4}	4.9×10^{-11}
Bromine	0.35	6.8×10^{-8}	Protoactinium	1.0×10^{-4}	2.1×10^{-11}
Cadmium	0.080	1.6×10^{-8}	Radium	1.2×10^{-6}	2.4×10^{-13}
Californium	4.5×10^{-14}	8.9×10^{-21}	Rhodium	6.4	1.3×10^{-6}
Carbon	150	3.0×10^{-5}	Rubidium	6.8	1.4×10^{-6}
Cerium	37	7.4×10^{-6}	Ruthenium	92	1.8×10^{-5}
Cesium	34	6.8×10^{-6}	Samarium	12	2.5×10^{-6}
Cobalt	1.4	2.7×10^{-7}	Selenium	2.9	5.8×10^{-7}
Curium	1.6×10^{-4}	3.1×10^{-11}	Silver	5.8	1.2×10^{-6}
Dysprosium	4.2×10^{-3}	8.4×10^{-10}	Strontium	18	3.6×10^{-6}
Erbium	1.4×10^{-4}	2.7×10^{-11}	Technetium	12	2.5×10^{-6}
Europium	0.86	1.7×10^{-7}	Tellurium	6.0	1.2×10^{-6}
Francium	1.4×10^{-15}	2.7×10^{-22}	Terbium	9.9×10^{-3}	2.0×10^{-9}
Gadolinium	0.44	8.6×10^{-8}	Thallium	1.1×10^{-13}	2.2×10^{-20}
Gallium	1.1×10^{-7}	2.2×10^{-14}	Thorium	3.0×10^{-3}	5.9×10^{-10}
Germanium	0.021	4.1×10^{-9}	Thulium	9.1×10^{-9}	1.8×10^{-15}
Holmium	1.5×10^{-4}	3.0×10^{-11}	Tin	1.7	3.4×10^{-7}
Indium	0.16	3.2×10^{-8}	Uranium	1.5×10^{3}	3.0×10^{-4}
Iodine	820	1.6×10^{-4}	Ytterbium	1.6×10^{-9}	3.1×10^{-16}
Lanthanum	18	3.6×10^{-6}	Yttrium	6.5	1.3×10^{-6}
Lead	2.3×10^{-9}	4.5×10^{-16}	Zinc	19	3.9×10^{-6}
Lithium	5.3×10^{-6}	1.1×10^{-12}	Zirconium	23	4.5×10^{-6}
Molybdenum	310	6.1×10^{-5}			

a. Source : Valentine (2000).

Table C.7-6. Waste processing alternative outputs.[a]

Option	Composition	Quantity	No. of containers	Disposition	Source
Continued Current Operation Alternative					
Transuranic Waste (remote-handled Waste Isolation Pilot Plant containers)	Dry solids	110 m^3	280	Waste Isolation Pilot Plant	Fewell (1999a,b)
Separations Alternative					
Full Separations Option					
Vitrified high-level waste (SRS canisters)	Glass	470 m^3	780	Onsite storage – NGR	Fluor Daniel (1997)
Class A low-activity waste (cylinders)	Grout	27,000 m^3	25,100	INEEL or offsite disposal	Fewell (1999b)
Planning Basis Option					
Vitrified high-level waste (SRS canisters)	Glass	470 m^3	780	Onsite storage – NGR	Fluor Daniel (1997)
Class A low-activity waste (cylinders)	Grout	30,000 m^3	27,900	Offsite disposal	Fewell (1999b)
Transuranic Waste (remote-handled Waste Isolation Pilot Plant containers)	Dry solids	110 m^3	280	Waste Isolation Pilot Plant	Fewell (1999a,b)
Transuranic Separations Option					
Transuranic solids (remote-handled Waste Isolation Pilot Plant containers)	Al_20_3, $Zr0_2$, phosphates, sulfates	220 m^3	560	Waste Isolation Pilot Plant	Kinnaman (1999)
Class C low-activity waste (cylinders)	cesium, strontium grout	22,700 m^3	21,100	INEEL or offsite disposal	Russell et al. (1998)
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option					
Glass ceramic high-level waste (SRS canister)	$Si0_2$, $Ti0_2$, calcine (70 percent)	3,400 m^3	5,700	Onsite storage – NGR	Lee (1999a) Fewell (1999b)
Transuranic Waste (remote-handled Waste Isolation Pilot Plant containers)	Dry solids	110 m^3	280	Waste Isolation Pilot Plant	Fewell (1999a,b)

Table C.7-6. Waste processing alternative outputs (continued).

Option	Composition	Quantity	No. of containers	Disposition	Source
Non-Separations Alternative (continued)					
Direct Cement Waste Option					
Hydroceramic high-level waste (SRS canisters)	Clay, Slag, Caustic soda, Calcine	13,000 m^3	18,000	Onsite storage – NGR	Dafoe and Losinski (1998); Prendergast (1999); Lee (1999b)
Transuranic Waste (remote-handled Waste Isolation Pilot Plant containers)	Dry solids	110 m^3	280	Waste Isolation Pilot Plant	Fewell (1999a,b)
Early Vitrification Option					
Vitrified SBW transuranic (remote-handled Waste Isolation Pilot Plant containers)	Glass	360 m^3	900	Waste Isolation Pilot Plant	Kimmett (1999) Lopez (1998)
Vitrified calcine high-level waste (SRS canisters)	Glass	8,500 m^3	11,700	Onsite storage – NGR	Kimmett (1999)
Steam Reforming Option					
Calcined HLW (SRS canisters)	***Dry Solids***	***4,400 m^3***	***6,100***	***NGR***	***Beck (2000)***
Steam reformed SBW (remote handled Waste Isolation Pilot Plant containers)	***Dry Solids***	***1,300 m^3***	***3,300***	***Waste Isolation Pilot Plant***	***Kimmel (2002)***
Transuranic grout (remote handled Waste Isolation Pilot Plant containers)	***Grout***	***1,300 m^3***	***3,200***	***Waste Isolation Pilot Plant***	***McDonald (2001)***
Minimum INEEL Processing Alternative					
Transuranic Grout (contact-handled Waste Isolation Pilot Plant containers)	Grout	7,500 m^3	37,500	Waste Isolation Pilot Plant	Dafoe (1999) Fewell (1999b)
Vitrified high-level waste (Hanford canisters)	Glass	***3,500*** m^3	***3,000***	INEEL onsite storage – NGR	Jacobs (1998)
Vitrified low-activity waste (Hanford low-activity waste boxes)	Glass	14,400 m^3	5,550	INEEL or offsite disposal	Jacobs (1998)

Table C.7-6. Waste processing alternative outputs (continued).

Option	Composition	Quantity	No. of containers	Disposition	Source
Direct Vitrification Alternative					
Vitrification without Calcine Separations					
Vitrified HLW (SRS canisters)	***Glass***	***8,500 m^3***	***12,000***	***Onsite storage – NGR***	***McDonald (1999)***
Vitrified SBW (SRS canisters)	***Glass***	***440 m^3***	***610***	***Onsite Storage-NGR or WIPP***	***Barnes (2000)***
Vitrification with Calcine Separations					
Vitrified HLW (SRS canisters)	***Glass***	***470 m^3 (from calcine)***	***650***	***Onsite storage – NGR***	***McDonald and Spinti (1999)***
Vitrified SBW (SRS canisters)	***Glass***	***440 m^3***	***610***	***Onsite Storage-NGR or WIPP***	***Barnes (2000)***
Low-level waste (cylinders)	***Grout***	***23,800 m^3***	***22,000***	***Offsite disposal***	***Russell et al. (1998)***

a. Product waste volumes reported here assume that post-2005 newly generated liquid waste would be treated using the same technology applied to liquid SBW. DOE could treat the post-2005 newly generated liquid waste by grouting (see project P2001 in Appendix C.6), which would result in 1,300 cubic meters of grouted waste and a small reduction in the treated SBW volume. The grout would be managed as transuranic or low-level waste depending on its characteristics.

m^3 = cubic meters; NGR = national geologic repository; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant

Appendix C.7 References

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Appendix C.8

Description of Activities and Impacts at the Hanford Site

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Appendix C.8

Description of Activities at the Hanford Site

C.8.1 INTRODUCTION

The U.S. Department of Energy (DOE) is preparing this Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (HLW & FD EIS) to analyze the environmental impacts of alternative methods of managing the Idaho National Engineering and Environmental Laboratory (INEEL) HLW. One alternative, the Minimum INEEL Processing Alternative, includes shipping INEEL HLW to the Hanford Site for immobilization in the proposed Hanford HLW vitrification plant. The Minimum INEEL Processing Alternative includes two shipping scenarios-Just-in-Time and Interim Storage-which are described in Section C.8.2. Under the Minimum INEEL Processing Alternative, INEEL HLW would be transported to the Hanford Site where it could be stored prior to waste processing. It would be processed in Hanford Site facilities (waste separations and vitrification) and shipped back to INEEL for interim storage pending disposal at a geologic repository.

The environmental impacts to the Hanford Site from managing and immobilizing Hanford Site HLW are described in the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (DOE 1996a), known as the TWRS EIS, and Record of Decision (62 FR 8693; February 26, 1997). The TWRS EIS analysis was used to support the analysis of the Minimum INEEL Processing Alternative because it analyzed alternatives that are similar to the Idaho HLW & FD EIS Minimum INEEL Processing Alternative. Consequently some, if not most, of the impact analysis for the INEEL alternative may be bounded by the TWRS EIS impact analysis and thus, the analysis can be incorporated by reference into the Idaho HLW & FD EIS (DOE 1993). For impacts that may exceed those presented in the TWRS EIS, calculations of the magnitude of the impacts can be derived from the TWRS EIS using scaling factors to determine whether the exceedances in impacts are substantial and, therefore, require additional analysis. This approach was used in the TWRS EIS analysis and in two TWRS supplement analyses (DOE 1997; 1998) and conforms to DOE NEPA guidance (DOE 1993).

For purposes of analysis under the National Environmental Policy Act, DOE assumed that the Hanford Site facilities would begin processing the INEEL HLW in 2028. This corresponds to the completion date for processing the Hanford tank wastes as presented in the TWRS EIS. Processing schedules for the Hanford tank wastes continue to evolve as the design and implementation of the Tank Waste Remediation System progresses. As more definitive information becomes available over the next 10 years, DOE will supplement this analysis as necessary.

This appendix addresses the potential environmental and human health impacts associated with the storage and treatment of INEEL HLW at the Hanford Site in conformance with NEPA requirements. The appendix does not address issues or impacts associated with the management of waste at the INEEL site or the transportation of waste to, or from, the Hanford Site. Those impacts are being considered as part of the analysis of the INEEL-related impacts. Specifically, this appendix:

- Summarizes the two scenarios for processing the waste at the Hanford Site (1) Just-in-Time Shipping and (2) Interim Storage Shipping (see Section C.8.2)

- Assesses the potential environmental impacts of the Minimum INEEL Processing Alternative at the Hanford Site. Both the Just-in-Time and Interim Storage Shipping Scenarios are evaluated. If there are no notable differences between the two scenarios in terms of potential environmental impacts, they are discussed collectively as the Minimum INEEL Processing Alternative. In cases where there are differences between the two scenarios they are discussed separately.

- Unless otherwise noted, all information in this appendix is based on the *Minimum INEEL Processing Alternative Hanford Site Environmental Impact Assessment Report* (Jacobs 1998). A comprehensive summary of the potential environmental impacts associated with the Hanford Site waste management activities is also presented in Jacobs (1998).

Following publication of the Draft EIS, DOE obtained updated information indicating that vitrification of INEEL mixed HLW at the Hanford Site would result in a larger volume of HLW glass than was analyzed in the EIS. Under the Minimum INEEL Processing Alternative, DOE had estimated that 730 cubic meters of vitrified mixed HLW (approximately 625 Hanford canisters) would be produced and transported back to INEEL. After the Draft EIS was issued, DOE Richland identified that their process for treating the INTEC HLW calcine would change. This change included dissolution of the calcine and raising the pH to 12 to be compatible with their process. This change resulted in an increase of the vitrified product. Based on this information, DOE estimates that 3,500 cubic meters of vitrified mixed HLW (approximately 3,000 Hanford canisters) would be produced under that alternative. Appendix C.5 and Section 5.2.9 present revised transportation impacts for the Minimum INEEL Processing Alternative associated with this larger mixed HLW volume.

C.8.2 DESCRIPTION OF ALTERNATIVE TREATMENT OF INEEL WASTE AT HANFORD

C.8.2.1 Introduction

This section describes alternatives for processing INEEL waste at the Hanford Site as a part of the Minimum INEEL Processing Alternative. This section also summarizes the waste to be processed. Additional information regarding the waste inventory and components of the alternatives are provided in Jacobs (1998). The description of alternatives in this section is limited to those activities associated with the potential treatment of INEEL waste that would take place on the Hanford Site. Activities associated with retrieving, handling, and packaging the waste at INEEL along with transporting the INEEL waste to and from the Hanford Site are not within the scope of this appendix. Appendix C.6 presents project descriptions for the activities at INEEL. All INEEL waste received at the Hanford Site for treatment would be returned to the INEEL for interim storage and/or disposal.

C.8.2.2 Minimum INEEL Processing Alternative

The Minimum INEEL Processing Alternative would involve processing approximately 4,000 cubic meters of calcine and approximately 160 cubic meters of cesium ion-exchange resin from the INEEL at the Hanford Site. Two transportation scenarios are evaluated from the standpoint of waste handling and interim storage requirements at the Hanford Site: (1) Just-in-Time Shipping, where the INEEL calcine would not be stored at the Hanford Site prior to processing and treatment, and (2) Interim Storage Shipping, where 308 cubic meters of calcine per year would be transported over a 14-year period and stored in new Canister Storage Buildings at the Hanford Site prior to processing and treatment. Calcine processing activities would include dissolution of the dry calcine powder, pH adjustment, lag storage in existing Hanford Site double-shell tanks, separation into HLW and low-activity waste fractions, vitrification, and packaging for shipment to INEEL. Calcine processing is summarized on Figure C.8-1. The cesium ion-exchange resin would be blended with the HLW feed, vitrified, and packaged for shipment to the INEEL.

C.8.2.3 Construction

Construction activities for this alternative would consist of building three Canister Storage Buildings and a Calcine Dissolution Facility. The Canister Storage Buildings would not be constructed if Just-in-Time Shipping were used. Each Canister Storage Building would be approximately 3,700 square meters (m^2) in plan area (footprint) and would consist of a large subsurface vault consisting of three individual bays each with a capacity of 440 Hanford Site (1.17 cubic meters) HLW canisters per bay or 1,320 canisters per Canister Storage Building. The below-surface vaults would be covered by an aboveground operating deck, within a prefabricated metal enclosure. Approximately 3,690 canisters of calcine would require storage. Preconstruction activities would take 1 year,

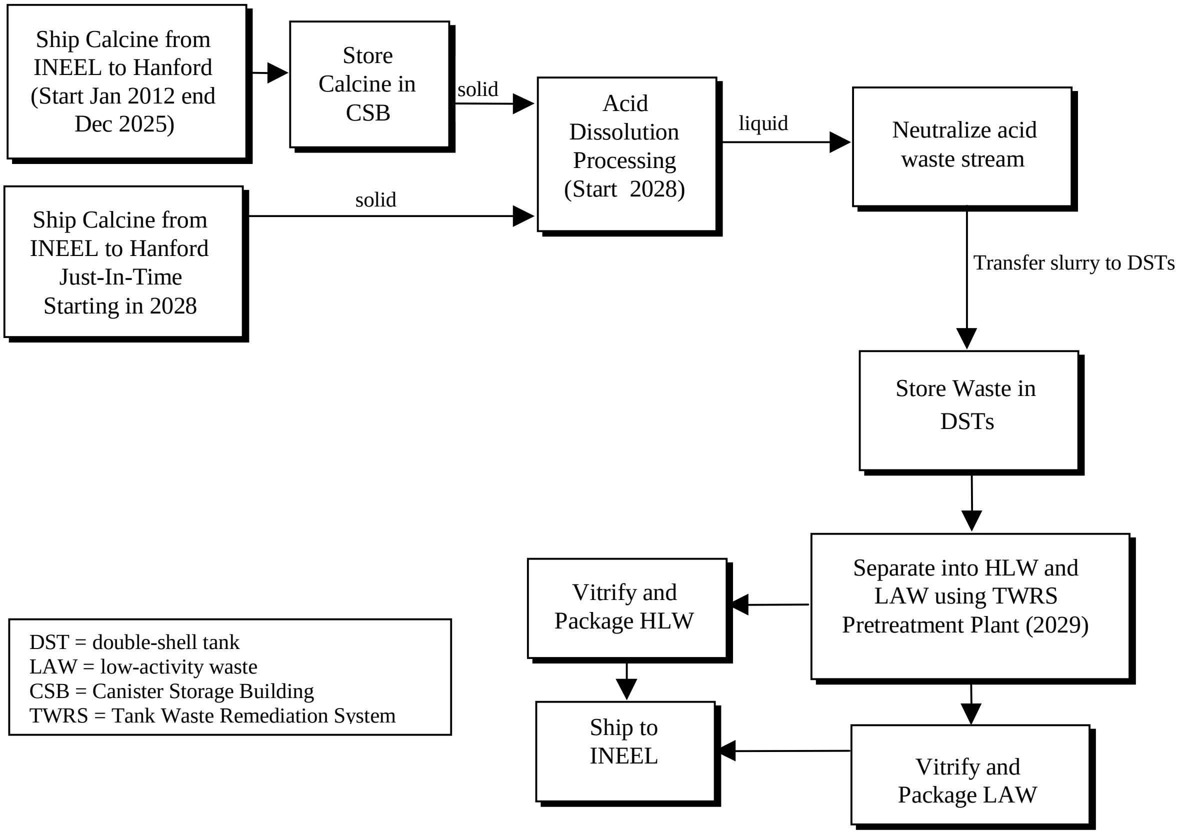


FIGURE C.8-1
Minimum INEEL Processing Alternative process flow diagram.

starting in January 2009, followed by two years of construction for the first Canister Storage Building. The two remaining Canister Storage Buildings would be constructed as needed. The first Canister Storage Building would be ready to receive INEEL calcine canisters in January 2012.

The Calcine Dissolution Facility would be approximately 3,800 m^2 in plan area and would be a hot-cell type facility. The Calcine Dissolution Facility would be constructed to provide systems to retrieve calcine from transport canisters, dissolve calcine, adjust pH, and transfer to the existing TWRS double-shell tank system. Preconstruction activities would start in 2021, while facility construction would start in 2024 with completion by December 2027.

C.8.2.4 Operations

Operations for the Canister Storage Building portion of this alternative would take place between January 2012 and April 2030. Shipment of calcine from the INEEL would begin in 2012 and vitrification operations at the Hanford Site would be complete in 2030. If Just-in-Time Shipping were used, no Canister Storage Building operations would be required. Operations of the Calcine Dissolution Facility would start in February 2028 and would end in April 2030. The existing waste separation facilities and the HLW and low-activity waste melters would operate from January 2029 through April 2030 (16 months).

Under the interim storage shipping scenario, INEEL would start shipping calcine canisters in

January 2012. Each year approximately 260 canisters (308 cubic meters) of calcine would be shipped from INEEL to the Hanford Site. Calcine shipments would be completed in December 2025.

The calcine canisters would be transferred to the calcine dissolution hot cell facility for calcine removal and dissolution. The facility would be operated to accomplish the following:

- Receive and unpackage calcine canisters.
- Rinse/decontaminate transport canisters.
- Transfer powdered calcine into stainless-steel vessels.
- Dissolve calcine in boiling nitric acid.
- Adjust calcine solution to pH of 7 using sodium hydroxide.
- Transfer liquid waste into double-shell tanks or directly into pretreatment system.

Following transfer into the double-shell tank system, the INEEL waste would be separated to create HLW and low-activity waste streams. This would involve sludge washing and enhanced washing with sodium hydroxide, solid/liquid separations, evaporating the liquid stream to concentrate waste, and removing cesium from the low-activity waste feed using ion exchange. The separated cesium-containing liquid stream that would come out of the ion-exchange process would be further evaporated and fed into the HLW stream.

The low-activity waste vitrification facility would be operated to accomplish the following:

- Receive and sample waste.
- Evaporate water from the waste and collect evaporator condensate for treatment or reuse for waste retrieval.
- Operate vitrification melters. (The TWRS EIS processing alternatives were based on the use of fuel-fired melters, which have been included as a representative process detail for impact analysis. Future evaluation may result in the selection of another melter configuration.)
- Pour molten glass into 2.6 cubic meters disposal containers.
- Cool the containers.
- Weld lids on containers and decontaminate exterior surfaces.
- Transfer containers to lag storage pending shipment to the INEEL.

The HLW vitrification facility would be operated to accomplish the following:

- Receive and sample waste.
- Separate solids and liquid using a centrifuge.
- Evaporate excess water from liquid waste and collect condensate for treatment.
- Operate one joule-heated melter with a capacity of 5 metric tons per day.
- Form glass at approximately 20 weight percent waste oxides.
- Pour glass monoliths in 1.17 cubic meters canisters.
- Cool, seal, and decontaminate exterior canister surfaces.
- Package glass into transport casks for shipment to INEEL.

The off-gas treatment system at both HLW and low-activity waste vitrification facilities would be operated to quench and cool off-gas, remove radionuclides and recycle to the vitrification process, and destroy nitrogen oxides.

Liquid effluent from both HLW and low-activity waste vitrification facilities would be treated after transferring the effluent to the Effluent Treatment Facility. The liquid effluent would be similar to the 242-A Evaporator condensate liquid that meets current waste acceptance criteria for the Effluent Treatment Facility.

C.8.3 AFFECTED ENVIRONMENT

This section provides a summary description of the existing environment at the Hanford Site that could be impacted by TWRS activities under the Minimum INEEL Processing Alternative. More detailed descriptions of environmental baseline conditions are provided in Volume Five, Appendix I of the TWRS EIS (DOE 1996a), in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Cushing 1994 and 1995; Neitzel 1996 and 1997), in the *Hanford Site Environmental Report for Calendar Years 1994 and 1995*, (PNL 1995 and 1996), and in Jacobs (1998). All information contained in this section is from these sources unless otherwise noted.

The Hanford Site is in the semi-arid region of the Columbia Plateau in southeastern Washington State (Figure C.8-2). The Hanford Site occupies about 560 square miles of shrub-steppe and grasslands just north of Richland, Washington. The majority of this large restricted-access land area provides a buffer to the smaller areas within the Hanford Site historically used for nuclear materials production, waste storage, and waste disposal. About 6 percent of the land has been disturbed and is actively used. The Hanford Site extends approximately 48 miles north to south and 38 miles east to west.

The Columbia River flows through the northern part of the Hanford Site, turning south to form part of its eastern boundary. The Yakima River runs along part of the southern boundary and joins the Columbia River within the city of Richland. Adjoining lands to the west, north, and east are principally range and agricultural land. The cities of Richland, Kennewick, and Pasco (also known as the Tri-Cities) comprise the nearest population centers and are located southeast of the Site.

C.8.3.1 Geology and Soils

This geology section provides an overview of the Hanford Site's surface and subsurface environment and focuses primarily on the 200 Areas located in the center of the Site. With the exception of two potential borrow sites located approximately 4 miles to the north and west of the 200 Areas, and a third potential borrow site located between the 200-East and 200-West Areas, the 200 Areas would be the location of virtually all TWRS activities under the Minimum INEEL Processing Alternative.

Topography

The TWRS sites are located on and near a broad flat area of the Hanford Site commonly referred to as the Central Plateau. The Central Plateau is within the Pasco Basin, a topographic and structural depression in the southwest corner of the Columbia Basin. The basin is characterized by generally low-relief hills with deeply incised river drainage. The Central Plateau of the Hanford Site is an area of generally low relief, ranging from 390 feet above mean sea level at the Columbia River to 750 feet above mean sea level in the vicinity of the TWRS sites (see Figure C.8-3).

Geologic Structure and Soils

The Hanford Site is underlain by basalt flows. Sedimentary layers referred to as the suprabasalt sediments lie on top of the basalts. A thin layer of silt, sand, and gravel is found on the surface across much of the Site.

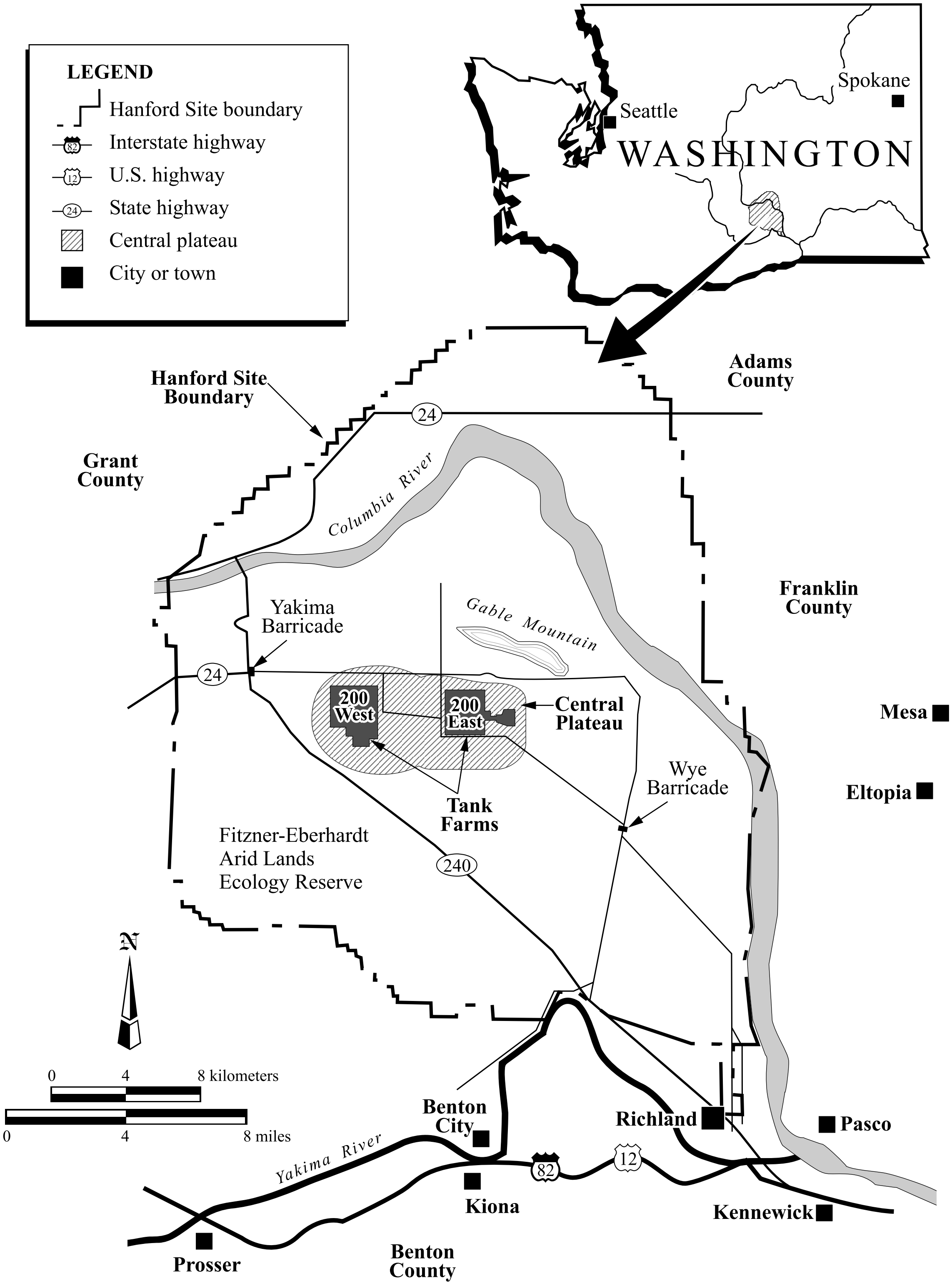
Soil in the 200 Areas consists of sand, loamy-sand, and sandy-loam soil types. Soil in the 200 Areas adjacent to facilities and other locations on the Hanford Site is slightly contaminated by various radionuclides.

Mineral Resources

The only mineral resources produced from the Pasco Basin are crushed rock, sand, and gravel. Deep natural gas production has been tested in the Pasco Basin without commercial success. Local borrow areas would supply rock, silt, sand, and gravel for processing alternatives requiring those materials.

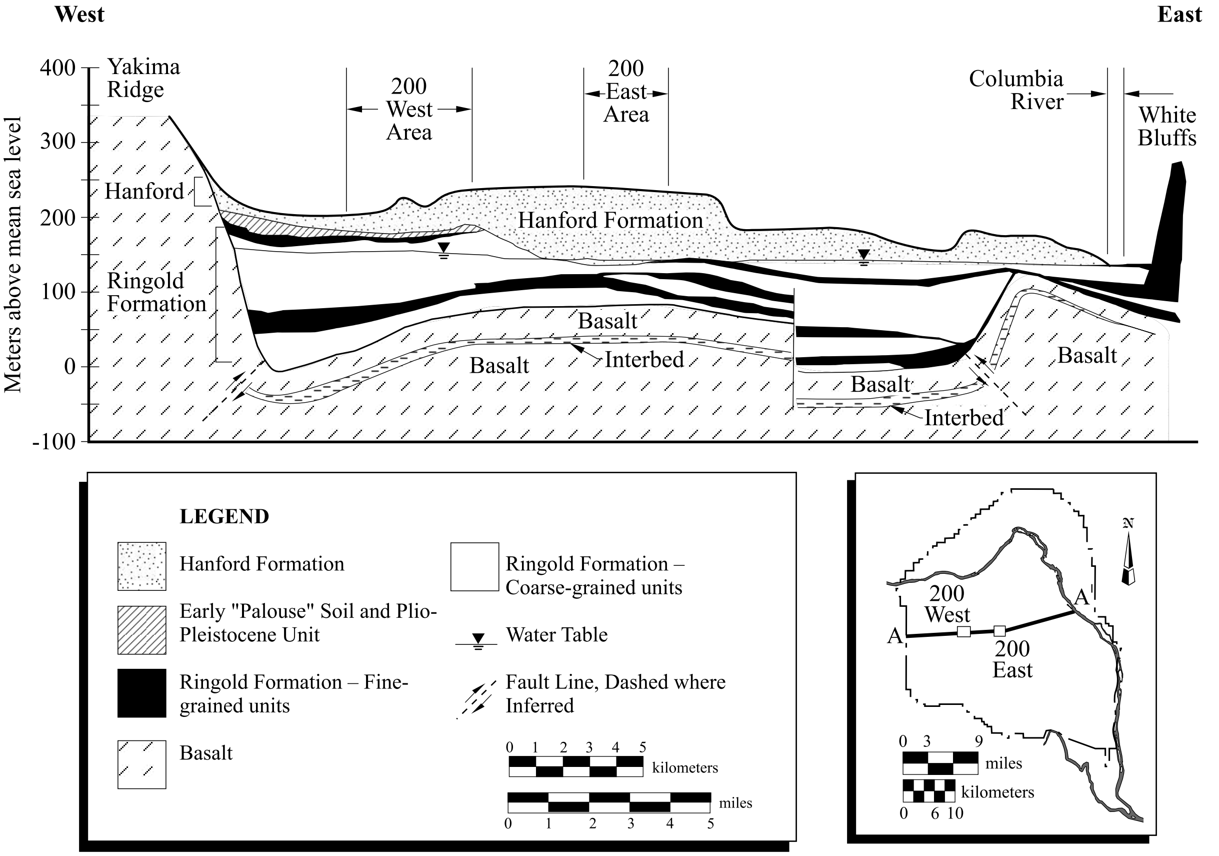
Seismicity

Seismic activity in the Hanford Site area is low compared to other regions of the Pacific Northwest. In 1936, the largest known earth-



SOURCE: DOE (1996a).

FIGURE C.8-2.
Hanford Site map and vicinity.



SOURCE: DOE (1996a).

FIGURE C.8-3.
Geologic cross section of the Hanford Site.

quake (a Richter magnitude of 5.75) in the Columbia Plateau occurred near Milton-Freewater, Oregon. Other earthquakes with a Richter magnitude of 5.0 or higher have occurred near Lake Chelan, Washington, to the northwest; along the boundary of the Columbia Plateau and the Cascade Mountain Range, west and north of the Hanford Site; and east of the Hanford Site in Washington State and northern Idaho. In addition, small-magnitude earthquake swarms that are not associated with mapped faults occur on and around the Hanford Site. An earthquake swarm is a series of earthquakes closely related in terms of time and location.

Four earthquake sources are considered relevant for the purpose of seismic design of TWRS sites: the Rattlesnake-Wallula alignment, Gable Mountain, an earthquake anywhere in the tectonic province, and the swarm area. For the Rattlesnake-Wallula alignment, which passes along the southwest boundary of the Hanford Site, a maximum Richter magnitude of 6.5 has been estimated. For Gable Mountain, an east-west structure that passes through the northern portion of the Hanford Site, a maximum Richter magnitude of 5.0 has been estimated. The estimate for the tectonic province was developed from the Milton-Freewater earthquake, with a Richter magnitude of 5.75. A Richter magnitude 4.0 event is considered the maximum swarm earthquake, based on the maximum swarm earthquake in 1973. The Hanford Site current design basis for new facilities is the ability to withstand a 0.2 gravity earthquake (Richter magnitude of approximately 6.4) with a recurrence frequency of 5.0×10^{-4}.

C.8.3.2 Water Resources

Water resources include surface water, the vadose zone (the area between the ground surface and underlying groundwater), and groundwater. The section also summarizes the existing quality of both surface and groundwater and withdrawal rates.

Surface Water

There are no naturally occurring water bodies or flood-prone areas near the TWRS sites. The Hanford Site and the surrounding communities draw all or most of their water from the Columbia River, which has radiological and nonradiological contamination levels below drinking water standards.

The onsite ponds (not used for human consumption) and springs that flow into the Columbia River all show radiological contamination from Hanford Site activities. Nonradiological contamination levels in the onsite ponds and springs are generally below limits set by drinking water standards.

Vadose Zone and Groundwater

A thick vadose 230 to over 300 feet, confined aquifer, and unconfined aquifers are present beneath the 200 Areas. The vadose zone is over 300 feet thick in the vicinity of the TWRS sites in the 200-East Areas. The confined aquifers are found primarily within the Columbia River Basalts. These aquifers are not a major focus of this appendix because they are separated from the TWRS sites by the vadose zone, an unnamed unconfined aquifer, and confining layers, and thus are not likely to be impacted.

Natural recharge to the unconfined aquifer of the Hanford Site is extremely low and occurs primarily in the upland areas west of the Hanford Site. Artificial recharge from retention ponds and trenches contribute approximately 10 times more recharge than natural recharge. Seasonal water table fluctuations are small because of the low natural recharge.

Water Quality and Supply

The following sections present water quality and supply for surface water and groundwater associated with the 200-East Area.

Surface Water

Water at the Hanford Site is supplied by the Columbia River, which is a source of raw water. River water is supplied to Hanford Site facilities through several distribution systems. In addition, wells supply water to the 400 Area and several remote facilities.

The Tri-Cities draw most (Richland and Kennewick) or all (Pasco) of their water supplies from the Columbia River. In 1994, water usage ranged from 2.4 billion gallons in Pasco to 7.4 billion gallons in Richland (Neitzel 1997). Each community operates its own water supply and treatment system.

The Columbia River provides water for both irrigation and municipal uses. Washington State has classified the water in the stretch of the Columbia River that includes the Hanford Reach as Class A, Excellent. Class A waters must be suitable for essentially all uses, including raw drinking water, recreation, and wildlife habitat. Both Federal and state drinking water quality standards apply to the Columbia River and are currently being met.

Groundwater

Groundwater is not used in the 200 Areas except for emergency cooling water, nor do any water supply wells exist downgradient of the 200 Areas. Three wells for emergency cooling water are located near B Plant in the 200-East Area. However, there are dry and groundwater monitoring wells in and around the 200 Areas. Hanford Site water supply wells are located at the Yakima Barricade, the Fast Flux Test Facility, and at the Hanford Safety Patrol Training Academy, all 8 miles or more from the TWRS sites in the 200-East Area.

Unconfined groundwater beneath the 200-East Area contains 14 different contaminants that have been mapped as plumes: arsenic, chromium, cyanide, nitrate, gross alpha, gross beta, tritium, cobalt-60, strontium-90, technetium-99, iodine-129, cesium-137, and plutonium-239 and -240.

In the 200-West Area, 13 overlapping contaminant plumes are located within the unconfined gravels of Ringold Unit E: technetium, uranium, nitrate, carbon tetrachloride, chloroform, trichloroethylene, iodine-129, gross alpha, gross beta, tritium, arsenic, chromium, and fluoride.

C.8.3.3 Meteorology and Air Quality

The following section describes meteorological and air quality conditions at the Hanford Site.

Meteorology

The Hanford Site is located in a semi-arid region. The Cascade Mountains to the west greatly influence the Hanford Site's climate by providing a rainshadow. This range also serves as a source of cold air drainage, which has a considerable effect on the Site's wind regime.

Good atmospheric dispersion conditions exist at the Hanford Site about 57 percent of the time during the summer. Less favorable dispersion conditions occur when the wind speed is light and the mixing layer is shallow. These conditions are most common during the winter, when moderately to extremely stable stratification exists about 66 percent of the time. The probability of an inversion period (e.g., poor dispersion conditions) extending more than 12 hours varies from a low of about 10 percent in May and June to a high of about 64 percent in September and October.

Air Quality

Air quality is good in the Hanford Site vicinity. The only air pollutant for which regulatory standards are exceeded is particulates. In 1994, concentrations of radionuclides and hazardous air pollutants were lower than regulatory standards both onsite and offsite.

C.8.3.4 Ecological Resources

Ecological resources on the Hanford Site are extensive, diverse, and important. Because the Hanford Site has not been farmed or grazed for over 50 years, it has become a refuge for a variety of plant and animal species.

The Hanford Site is one of the largest shrub-steppe vegetation areas remaining in Washington State, and nearly half of the Site's 560-square mile area is designated as ecological study areas or refuges. Shrub-steppe vegetation areas are considered priority habitat by Washington State because of their relative scarcity and their importance to wildlife species. The 200 Areas and the nearby potential borrow sites consist mostly of shrub-steppe habitat. The TWRS sites in the 200 Areas are currently heavily disturbed. However, the potential borrow sites are largely undisturbed.

Species of concern on the Hanford Site include Federal candidate species, Washington State threatened or endangered species, Washington State candidate species, and monitor species and sensitive plant species. No Federally-listed threatened or endangered plant or animal species occur on or around the Central Plateau (site of the TWRS facilities). Wildlife species of concern on the Central Plateau and vicinity include the loggerhead shrike, which is a Federal and Washington State candidate species, and the sage sparrow, which is a Washington State candidate species. Both species nest in undisturbed sagebrush habitat in the Central Plateau and nearby areas.

Other bird species of concern that may occur in shrub-steppe habitat of the Hanford Site are the burrowing owl, a Washington State candidate species; the ferruginous hawk, a Washington State threatened and Federal Category 2 candidate species; the golden eagle, a Washington State candidate species; the long-billed curlew, a Washington State monitor species; the sage thrasher, a Washington State candidate species; the prairie falcon, a Washington State monitor species; and Swainsons hawk, a Washington State candidate species. Nonavian wildlife species of concern include the striped whipsnake, a Washington State candidate species; the desert night snake, a Washington State monitor species; the pygmy rabbit, a Federal Category 2 candidate species; and the northern sagebrush lizard, also a Federal Category 2 candidate species (DOE 1996a).

Sensitive habitats on the Hanford Site include wetlands and riparian habitats. However, there are no sensitive habitats at or near any TWRS sites. The Hanford Site's primary wetlands occur along the Columbia River. Other Hanford Site wetland habitats are associated with human-made ponds and ditches (e.g., B Pond and its associated ditches located near the 200-East Area). Wetland plants occurring along the shoreline of B Pond include herbaceous and woody species such as showy milkweed, western goldenrod, three square bulrush, horsetail rush, common cattail, and mulberry, among others. Wildlife species observed at B Pond include a variety of mammals and waterfowl species. The fishery resource of the Columbia River is important to Native Americans.

C.8.3.5 Cultural Resources

Archaeological sites in the 200 Areas are scarce. Cultural resource surveys have been conducted within the 200-East Area covering all undeveloped areas. The number of prehistoric and historic archaeological sites recorded as the result of these surveys is very limited. Findings recorded in the areas around and including the TWRS sites consist of isolated artifacts and four archaeological sites. Cultural resources surveys of the TWRS sites and immediate vicinity in the 200-East Area, which were conducted in 1994, found no sites eligible for the National Register of Historic Places. Past surveys of the Phased Implementation Alternative site in the easternmost portion of the 200-East Area revealed no archaeological sites. However, both the 200-East and 200-West Areas contain potentially historic buildings and structures associated with the Hanford Site's defense mission.

Surveys of the 200-West Areas recorded a few historic sites, isolated archaeological artifacts, and a segment of the historic White Bluffs Road that runs across the Site between Rattlesnake Springs and the Columbia River. The White Bluffs Road, which has been nominated for the National Register of Historic Places, traverses the northwest corner of the 200-West Area. This road was used in prehistoric and historic times by Native Americans and was an important transportation route for Euro-Americans in the 19th and early 20th century for mining, agriculture, and other development uses. The segment in the 200-West Area is not considered an important element historically because it has been fragmented by past activities. However, the Confederated Tribes of the Umatilla Indian Reservation have indicated that the White Bluffs Road is important culturally to Native Americans even though it has been affected by past activities.

Native American Sites

The Hanford Site vicinity contains lands ceded to the United States both by the Confederated Tribes and Bands of the Yakama Indian Nation and the Confederated Tribes of the Umatilla Indian Reservation in the treaties of 1855. Until 1942, the Wanapum resided on land that is now part of the Hanford Site. In 1942, the Wanapum People moved to Priest Rapids when the Hanford Site was established. The Nez Perce Tribe also retained rights to the Columbia River under a separate treaty with the U.S. Government.

The area of the Hanford Site near the Columbia River has been occupied by humans for over 10,000 years, as reflected by the extensive archaeological deposits along the river shores. Inland areas with water resources also point to evidence of concentrated human activity. Recent surveys indicate extensive although dispersed use of semi-arid lowlands for hunting. However, surveys have recorded very few Native American sites or artifacts in and around the 200 Areas. Native American sites and artifacts have been identified at both McGee Ranch and the Vernita Quarry (potential borrow sites).

Native Americans have retained traditional secular and religious ties to the Hanford Site, although no specific sites of religious significance have been identified at the TWRS sites. However, affected Tribal Nations indicate that there are culturally important biota, sacred sites such as Gable Mountain, and other culturally important properties within areas that might be impacted by TWRS alternatives (e.g., groundwater downgradient from TWRS sites, the Columbia River, and locations downwind of possible TWRS air releases).

C.8.3.6 Socioeconomics

The socioeconomic analysis focuses on Benton and Franklin counties. These counties make up the Richland-Kennewick-Pasco Metropolitan Statistical Area, also known as the Tri-Cities. Other jurisdictions in Benton county include Benton City, Prosser, and West Richland. Connell is the largest city in Franklin county after Pasco. Neighboring counties (Yakima, Walla Walla, Adams, and Grant counties in Washington State, and Umatilla and Morrow counties in Oregon) are impacted by activities at the Hanford Site; however, in terms of socioeconomics, the Site's impacts on these counties are very small.

In 1995, the Hanford Site represented 22 percent of the area's total non-farm employment. With the rapid economic growth from the late 1980's, population rose as did the housing market. Housing prices declined in 1995 as the market softened when Hanford Site jobs were reduced.

As of 1990, the population within a 50-mile radius of the Hanford Site contained 19.3 percent minority and Native American residents and 17.3 percent low-income residents.

Most public service systems in the Tri-Cities operate well within their service capacity. Local school systems and some local public safety agencies are operating at or near their capacities.

Median household yearly income in Benton county was $43,684 in 1994, while per capita income was $22,053. Median household yearly income in Franklin county was $31,121 in 1994, while per capita income was $16,999. For Washington State, 1994 median household yearly income was $38,094 and per capita income was $22,526 (Neitzel 1997).

Benton county residents have approximately the same level of educational attainment as residents statewide, while Franklin county residents tend to have a lower level.

C.8.3.7 Land Use

Approximately 6 percent of the Hanford Site is actively used by Site operations, with the remainder left undeveloped. Nearly half the Site's area is designated for ecological or wildlife purposes.

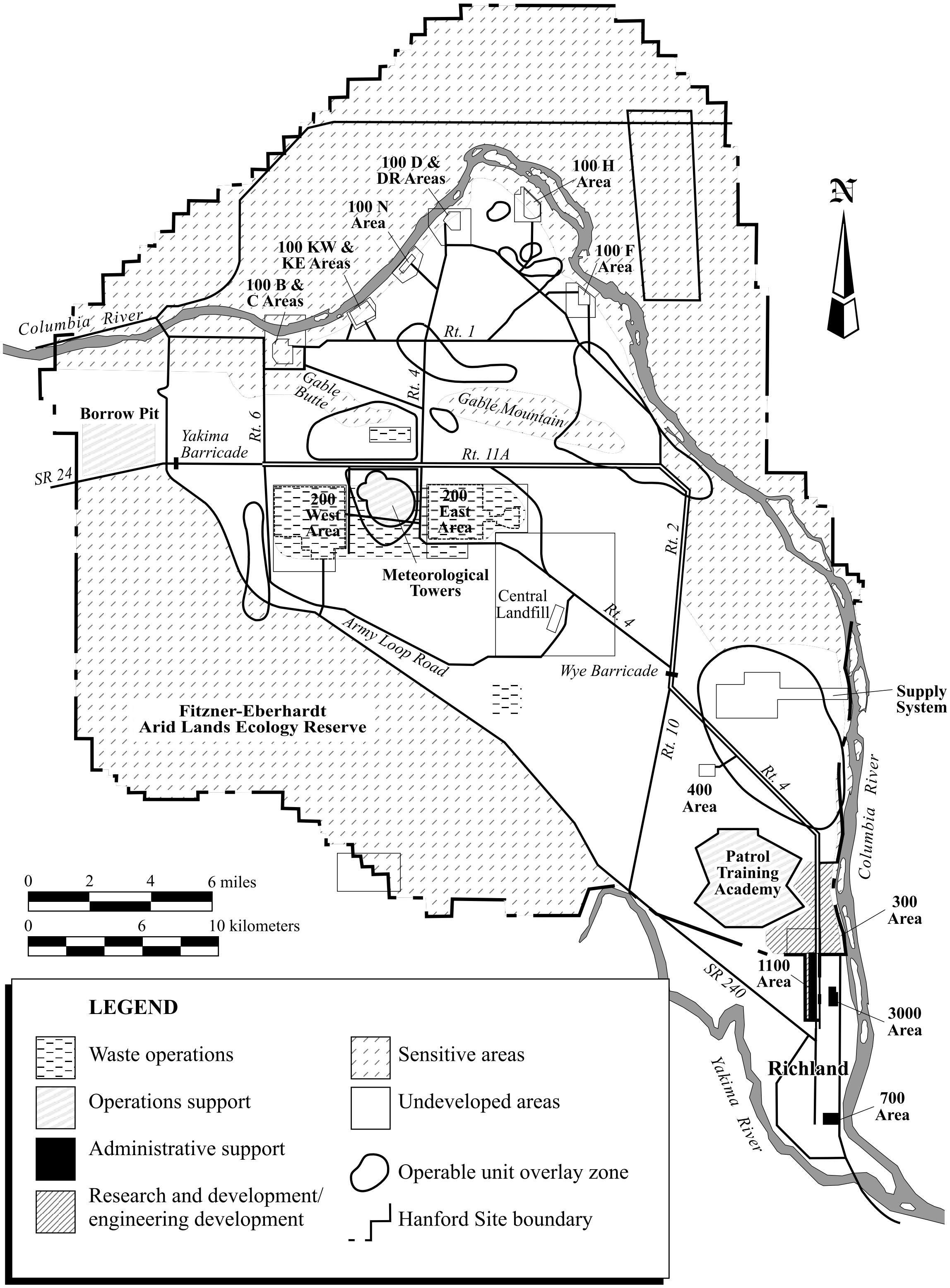
The 200 Areas historically have been used for processing and waste management activities. Current plans envision the 200 Areas to be dedicated exclusively as a waste management and disposal area for the entire Hanford Site (see Figure C.8-4).

The Draft Comprehensive Land-Use Plan for the Hanford Site, prepared by DOE, was released in August 1996. Both Benton County and the City of Richland released their land-use plans for the Site in 1996.

In April 1999, DOE issued a *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (DOE/EIS-0222D). This Revised Draft EIS will be used by DOE and its nine cooperating and consulting agencies to develop a comprehensive land-use plan for the next 50 years for the Hanford Site. Under DOE's preferred alternative, the Central Plateau (200 Areas) geographic area would be designated for Industrial-Exclusive use. An Industrial-Exclusive land-use designation would allow for continued waste management operations within the Central Plateau geographic area. This designation would also allow expansion of existing facilities or development of new waste management facilities.

Prime and Unique Farmland

The Farmland Protection Policy Act requires Federal agencies to consider prime or unique farmlands when planning major projects and programs on Federal lands (7 CFR 657.4). Federal agencies are required to use prime and unique farmland criteria developed by the U.S. Department of Agriculture Natural Resources Conservation Service. The Natural Resources Conservation Service has determined that due to low annual precipitation in southeast



SOURCE: DOE (1996a).

FIGURE C.8-4.
Existing land use map.

Washington State, none of the soil occurring on the Hanford Site would meet prime and unique farmland criteria without irrigation.

C.8.3.8 Aesthetic and Scenic Resources

Visually, the Hanford Site is characterized by wide-open vistas interspersed with over a dozen large industrial facilities (e.g., reactors and processing facilities). The 200 Areas contain several large processing facilities.

Site facilities can be seen from elevated locations (e.g., Gable Mountain), a few public roadways (State Routes 24 and 240), and the Columbia River. Facilities in the 200-East Area can be seen only in the visual background from offsite locations. For purposes of study, viewing areas are generally divided into four distance zones: the foreground, within 0.5 mile; the middleground, from 0.5 to 5 miles; the background, from 5 to 15 miles; and seldom-seen areas that are either beyond 15 miles or are unseen because of topography (Figure C.8-5).

C.8.3.9 Noise

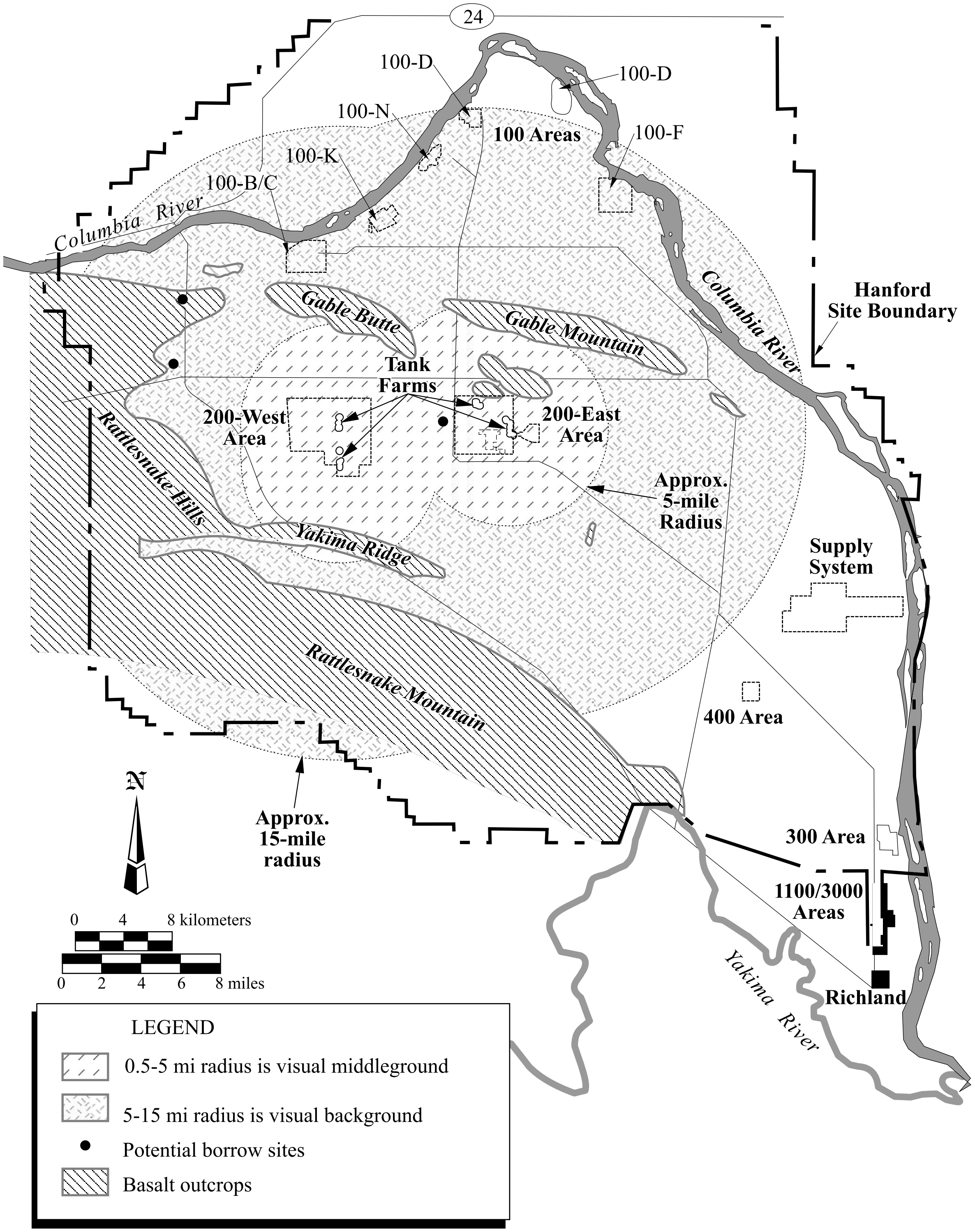
Noise produced by current, routine operations at the Hanford Site does not violate any Federal or Washington State standards (Washington Administrative Code 173-60). Even near the operating facilities along the Columbia River, measured noise levels are lower than noise experienced in parts of the city of Richland (less than 52 decibels on the A scale [dBA] versus 61 dBA) (dBA is a noise scale used to describe sounds in the frequencies most readily detected by human hearing). Noise levels measured near intake structures at the Columbia River are well within the 60 dBA tolerance levels for daytime residential use. Three miles upstream of the intake structures, measured noise levels fall well within levels suited for daytime and nighttime residential use. Moreover, the relative remoteness of population centers from the Hanford Site as a whole (and the TWRS sites in particular) gives the Site a Class C (industrial) classification with a maximum allowable equivalent sound level of 70 dBA in compliance with Washington State and Federal standards. The equivalent sound level integrates noise levels over time and expresses them as continuous sound levels. Native Americans have expressed the concern that Hanford Site religious locations such as Gable Mountain are near enough to TWRS areas to potentially be impacted by TWRS activities.

C.8.3.10 Traffic and Transportation

Direct rail service is provided to the Tri-Cities area by the Burlington Northern Santa Fe and Union Pacific Railroads. The rail system on the Hanford Site itself consists of approximately 130 miles of tracks. It extends from the Richland Junction (at Columbia Center in Kennewick) where it joins the Union Pacific commercial railroad track, to an abandoned commercial right-of-way near the Vernita Bridge in the northwest portion of the Site. There are currently about 1,400 railcar movements annually at the Site, transporting a wide variety of materials including coal, fuels, hazardous process chemicals, and radioactive materials and equipment. Radioactive waste has been transported on the Site without incident for many years.

Regional road transportation is provided by a number of major highways including State Routes 24 and 240 and U.S. Interstate Highways 82 and 182. State Routes 24 and 240 are both two-lane roads that traverse the Hanford Site. State Route 24 is an east-west highway that turns north at the Yakima Barricade in the northern portion of the Site. State Route 240 is a north-south highway that skirts the eastern edge of the Fitzner-Eberhardt Arid Lands Ecology Reserve (Figure C.8-6).

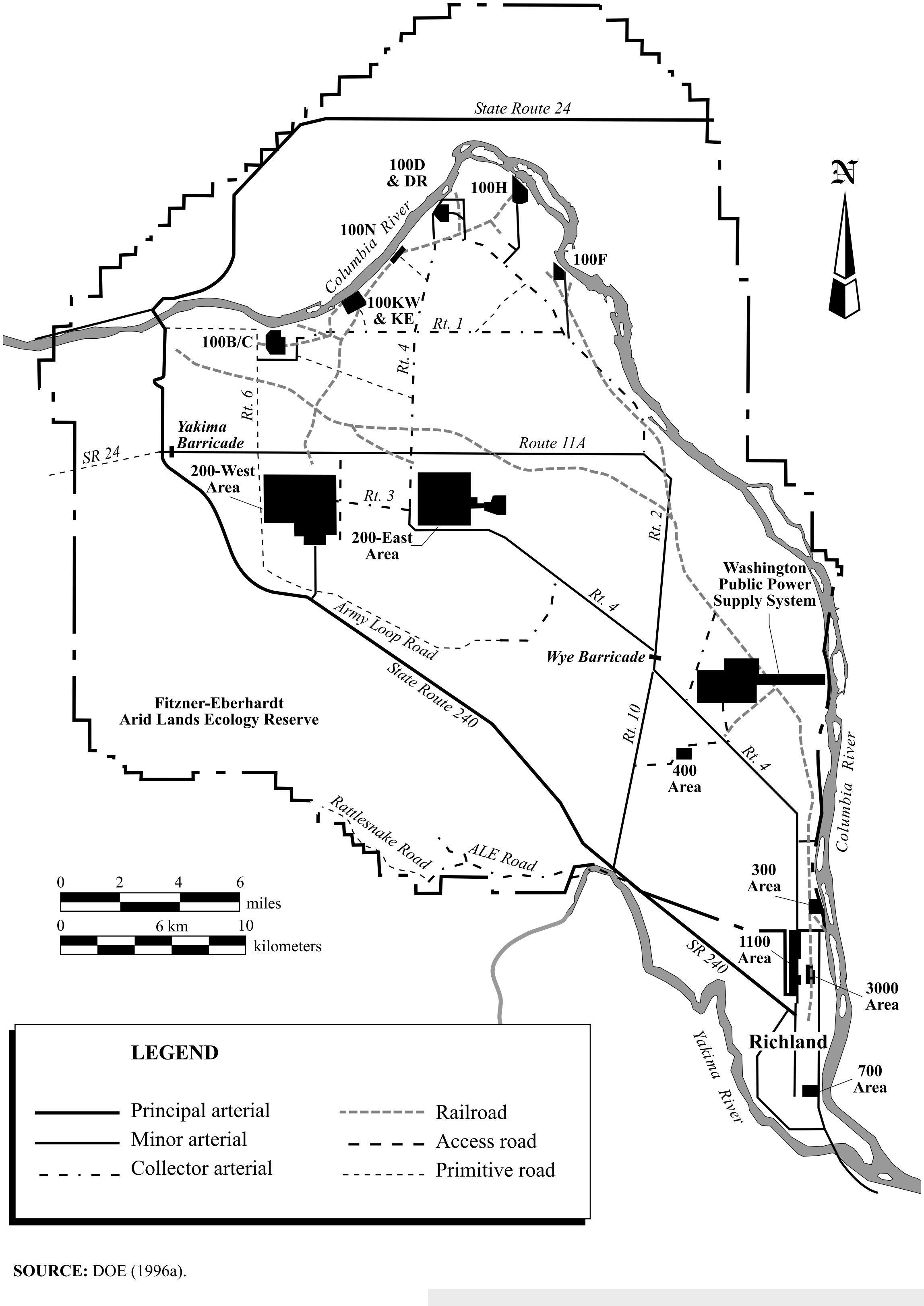
A DOE-maintained road network within the Hanford Site, mostly paved and two lanes wide, provides access to the various work centers. The primary access roads on the Site are Routes 2, 4, 10, and 11A. Primary access to the 200 Areas is by Route 4 South from Richland. The 200-East Area is also accessed from Route 4 North off Route 11A from the north. July 1994 traffic counts on Route 4 indicated severe congestion west of the Wye Barrier (at the intersection of Routes 10 and 4 South) during Hanford Site shift changes. However, completion of the State Route 240 Access Highway (Beloit Avenue) linking the 200 Areas with State Route 240 in late 1994, and declining Hanford Site employment, have reduced the congestion on Route 4.



SOURCE: DOE (1996a).

FIGURE C.8-5.

Potential viewing areas of 200-East and 200-West Areas.



SOURCE: DOE (1996a).

FIGURE C.8-6.
Hanford Site roadway and railroad system.

Stevens Road at the 1100 Area leading into the Site from Richland (Stevens Road becomes Route 4 South further north onsite) also has experienced severe congestion. The 240 Access Highway completion and reduction of Hanford Site employment appear to have reduced this congestion somewhat, although no specific traffic count data are available to quantify this assessment.

Access to the 200-West Area is also provided from Route 11A for vehicles entering the Site through the Yakima Barricade and from Route 6 off Route 11A from the north. No congestion problems are reported on these roadways.

Public access to the 200 Areas and interior locations of the Hanford Site are restricted by manned gates at the Wye Barricade and the Yakima Barricade (at the intersection of State Route 240 and Route 11A).

C.8.3.11 Radiological Environment

This section summarizes 1995 data on radiation doses from operations at the Hanford Site and the potential future fatal cancers attributable to exposures. More recent data indicate that the radiological conditions at the Hanford Site are not appreciably different from those described in this section.

Each year the potential radiation doses to the public from Hanford Site radiation sources are calculated as part of the Hanford Site Environmental Monitoring Program. In particular, the dose to the hypothetical maximally exposed individual is calculated as described in the Hanford Site Environmental Report published each calendar year. This hypothetical maximally exposed individual is assumed to live where the radiation dose from airborne releases would be larger than for a resident of any other offsite location. The maximally exposed individual also is assumed to drink water from the Columbia River; eat food grown with Columbia River irrigation water; and use the river extensively for boating, swimming, and fishing (including eating fish from the river). The exposure calculation for this hypothetical individual is based on Hanford Site data from actual reported releases, environmental measurements, and information about operations at Hanford Site facilities.

The calculated dose in 1995 to the maximally exposed individual near the Hanford Site was a total of 0.02 millirem compared to 0.05 millirem reported for 1994. The DOE radiation dose limit for a member of the public is 100 millirem. Thus, the 1995 total dose to the maximally exposed individual was far below the limit.

U.S. Environmental Protection Agency regulations impose a dose limit of 10 millirem to a member of the public from radioactivity released in airborne effluents. The 1995 Hanford Site airborne dose to the maximally exposed individual of 0.006 millirem was far below this limit.

To estimate health effects for radiation protection purposes, it usually is assumed that a collective dose of 2,000 person-rem in the general population will cause one extra latent cancer fatality. In these calculations it does not matter whether 20,000 people each receive an average of 0.1 rem or 2 million people each receive an average of 0.001 rem. In either case, the collective dose would equal 2,000 person-rem and thus, one additional latent cancer facility would be expected. The 1995 collective dose to people surrounding the Hanford Site from Site releases was calculated to be 0.3 person-rem, which is lower than the 0.6 person-rem calculated for 1994. Compared to 2,000 person-rem causing one extra latent cancer fatality, the 0.3 person-rem from the Hanford Site in 1995 is not likely to cause any latent cancer fatalities.

C.8.4 ENVIRONMENTAL IMPACTS

This section describes the potential impacts to the existing environment (described in Section C.8.3) of implementing the Minimum INEEL Processing Alternative (described in Section C.8.2) at the Hanford Site. This section also discusses potential cumulative impacts of the Minimum INEEL Processing Alternative when added to impacts from past, present, and reasonably foreseeable actions; unavoidable adverse impacts; the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity; and irreversible and irretrievable commitment of resources.

C.8.4.1 Geology and Soils

Geology and soil impacts would include potential impacts to mineral resources, topography, and soils. In general, the more land disturbed, the higher the level of potential impacts to geologic resources. Mineral resources (i.e., silt, sand, gravel, and riprap) are presented in Table C.8-1. The earthen materials would be used primarily to make concrete for constructing treatment facilities and vaults. Some soil disturbance would be temporary; some would be permanent. Temporary disturbances include areas such as the trample zones around construction sites and work areas. Permanent disturbances include areas where facilities are located.

Just-in-Time Shipping Scenario

Under this scenario, additional Hanford Site sand and gravel resources would be required to make concrete for the construction of the Calcine Dissolution Facility and for the disposition of this facility after its mission is completed (Table C.8-1). No additional silt and riprap resources would be required. Incremental impacts to the potential Pit 30 borrow site, where the additional borrow material would be secured, would increase by approximately 1.3 percent, or 3.4×10^4 cubic meters over the 2.6×10^6 cubic meters calculated in the TWRS EIS for the Phased Implementation Alternative. The Pit 30 borrow site is located on the Hanford Site's Central Plateau between the 200-East Area and 200-West Area.

Under this scenario, small additional changes in topography would result from constructing the Calcine Dissolution Facility and securing borrow materials. The Calcine Dissolution Facility is assumed to be located on the representative site in the 200-East Area analyzed in the TWRS EIS for Phase 2 of the Phased Implementation Alternative.

Implementing this scenario would result in additional soil disturbances associated with the construction of the Calcine Dissolution Facility and the removal of earthen materials from the potential Pit 30 borrow site (Table C.8-1). Assuming that an area equal to the footprint of the Calcine Dissolution Facility plus a small buffer zone would be permanently disturbed, the permanent soil disturbances would increase by approximately 3.3 percent, or 3.9 acres over the 120 acres calculated for the Phased Implementation Alternative. Assuming that soil disturbances associated with the potential Pit 30 borrow site would be temporary, the temporary soil disturbances would be approximately 0.4 percent or 2.9 acres greater than the 790 acres calculated for the Phased Implementation Alternative.

Table C.8-1. Mineral resources and soil impacts – Minimum INEEL Processing Alternative.

Tank Waste Alternative		Mineral resource in cubic meters			Soil disturbance[a] in acres	
		Sand and gravel	Silt	Riprap	Temporary	Permanent
Phased Implementation Alternative[b]		2.6×10^6	5.7×10^5	9.6×10^5	790	120
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	3.4×10^4	NR[d]	NR	2.9	3.9
	Interim Storage Shipping Scenario	2.9×10^5	NR	NR	48	3.9
Total impacts[c]	Just-in-Time Shipping Scenario	2.6×10^6	5.7×10^5	9.6×10^5	790	120
	Interim Storage Shipping Scenario	2.9×10^6	5.7×10^5	9.6×10^5	840	120

a. These estimates are based on closure of the Hanford Site Tank Farms by filling tanks and covering them with a Hanford Barrier.
b. Estimates include remediation and closure as landfill (Phase 1 and 2).
c. Impact estimates include the Phased Implementation Alternative (Phase 1 and 2) plus the Minimum INEEL Processing Alternative.
d. NR = None required.

None of the increased impacts associated with this scenario would affect the local cost or availability of mineral resources or substantively change the understanding of the geology and soils impacts presented in the TWRS EIS for the Phased Implementation Alternative.

Interim Storage Shipping Scenario

This scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario, in that it would include all of the impacts of the Just-in-Time Shipping Scenario plus the impacts associated with the construction and subsequent disposition of three new Canister Storage Buildings.

Additional sand and gravel for facility construction and subsequent disposition would be secured from the potential Pit 30 borrow site. Incremental impacts to this borrow site would increase by approximately 11 percent, or 2.9×10^5 cubic meters over the 2.6×10^6 cubic meters calculated in the TWRS EIS for the Phased Implementation Alternative (Table C.8-1). No additional silt or riprap resources would be required.

Under the Interim Storage Shipping Scenario, small additional changes in topography would result from constructing new facilities (Calcine Dissolution Facility and Canister Storage Buildings) and securing borrow materials. The Calcine Dissolution Facility is assumed to be located on the representative site in the 200-East Area analyzed in the TWRS EIS for Phase 2 of the Phased Implementation Alternative. The Canister Storage Buildings are assumed to be located in the 200 Areas adjacent to the site of the existing Hanford Site Canister Storage Building.

Soil disturbances associated with the Calcine Dissolution Facility are assumed to be permanent and would be the same as for the Just-in-Time Shipping Scenario (Table C.8-1). Soil disturbances associated with the potential Pit 30 borrow site (24 acres) and the Canister Storage Buildings (24 acres) are assumed to be temporary and would increase the temporary soil disturbances by approximately 6 percent, or 48 acres over the 790 acres calculated for the Phased Implementation Alternative.

Although this scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario, it would not affect the local price or availability of mineral resources or substantively change the understanding of the geology and soils impacts presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.2 Water Resources

The following section addresses water resources impacts related to the Minimum INEEL Processing Alternative. Surface water and groundwater are pathways for potential releases to the environment. Releases would travel by advection downward through the vadose zone, intercept the unconfined aquifer (saturated zone), and move laterally to points of discharge along the Columbia River. There would be no direct discharge to surface water.

Surface Water Releases

The Minimum INEEL Processing Alternative would generate liquid effluent; however, the effluent would not be discharged to surface waters and there would be no direct impacts to surface waters from the implementation of the alternative. Liquid stored in the double-shell tanks and liquid added to the tanks during waste retrieval activities ultimately would be removed and sent to an evaporator. Condensed water from the evaporator would be sent to the Effluent Treatment Facility in the 200-East Area. The water would be treated in the Effluent Treatment Facility using a variety of systems, including evaporation, to meet applicable regulatory standards. Ultimately the treated wastewater from vitrification processing would be discharged, with most contaminants removed, from the Effluent Treatment Facility to the State-approved land disposal facility site, a subsurface drain field near the north-central part of the 200-West Area. The discharged water would move through the vadose zone into the groundwater where it would slowly flow towards and discharge to seeps along the Columbia River and directly into the Columbia River. An estimated

100 years would be required for contaminants in groundwater to reach the Columbia River where they would rapidly mix with the large volumes of river water.

Concern has been raised in the past about the amount of tritium that would be released from the land disposal facility. The calcine would be in a solid state when shipped from INEEL to the Hanford Site, and the tritium would have been removed at INEEL. There would be no increase in tritium releases from the land disposal facility as a result of INEEL waste processing.

Surface Water Drainage Systems

The facilities for the Minimum INEEL Processing Alternative (Canister Storage Buildings for Interim Storage Shipping Scenario and Calcine Dissolution Facility) would be constructed on relatively level and flat terrain. No major drainage features are present. Construction activities would result in slightly altered localized drainage patterns for the temporary construction areas and for the permanent facilities. Excess water used for dust control purposes during construction and disposition activities would be collected and routed through erosion and sedimentation control measures prior to discharging to the existing approved National Pollutant Discharge Elimination System outfall and would be monitored following the current Storm Water Pollution Prevention Plan. The area around the Canister Storage Buildings, the Calcine Dissolution Facility, and the existing vitrification facilities would be recontoured to conform with the surrounding drainage patterns. Small increases in surface water runoff during the infrequent heavy precipitation events or rapid snowmelt would occur, but no flooding of drainage systems would occur.

Groundwater Releases

Potential impacts to groundwater would result from potential liquid losses during retrieval of tank waste and the leaching of residual waste that may be left in the double-shell tanks following retrieval. Waste transfer pipelines from the Calcine Dissolution Facility to the AP Tank Farm and from the AP Tank Farm to the vitrification facilities would be of double-wall construction in order to minimize the possibility of a leak to the environment. However, retrieval losses are not anticipated from these double-shell tanks or waste transfer systems. Therefore, no potential impact to the groundwater is anticipated for the Minimum INEEL Processing Alternative. In addition, all of the waste processing and treatment would be conducted in areas of the facility covered with a base that consists of a secondary spill containment system (e.g., engineered system constructed for detection and collection of spills) to prevent leaks and spills of waste until the accumulated materials are detected and removed. Such a base would prevent releases to the environment that could potentially impact groundwater.

For the Interim Storage Shipping Scenario, the Canister Storage Buildings are designed to include storage provisions to isolate containerized waste from the environment and prevent deterioration of container integrity. Additionally, secondary containment would be provided to prevent any inadvertent releases from entering the environment. Waste packages having a potential for residual liquid would have an absorbent agent added to ensure immobilization of potential liquid. In order to prevent contamination of the water supply, no restrooms or drinking water fountains would be located within the operational areas of the various facilities.

Implementing this alternative would result in minimal increases in impacts and would not change the understanding of the water resources impacts for surface water or groundwater presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.3 Air Quality

Air pollutant emission estimates were developed and air dispersion modeling performed to analyze air quality impacts for the Phased Implementation Alternative of the TWRS EIS. The emission rates for criteria pollutants and radionuclides for the Minimum INEEL Processing Alternative were scaled from the TWRS EIS. Supporting calculations can be found in Appendix E of Jacobs (1998). Compliance with Washington State and Federal ambient air quality standards for radionuclides were measured at the maximum receptor location at the Hanford Site boundary along the Columbia River and on State Route 240. Compliance with the Federal standard for radionuclide releases was measured at the nearest residence.

Just-in-Time Shipping Scenario

Under this scenario, INEEL waste would be transported to the Hanford Site just in time for vitrification, and there would be no need to construct additional Canister Storage Buildings for interim storage. Therefore, only the Calcine Dissolution Facility and the vitrification facility are evaluated in this scenario as potential sources of air emissions.

Air Emission Sources. Air emission sources for the Just-in-Time Shipping Scenario would include construction of the Calcine Dissolution Facility, unloading and dissolving the INEEL calcined waste at the Calcine Dissolution Facility, separating and vitrifying the waste at the vitrification facility, and decommissioning the Calcine Dissolution Facility. The criteria pollutant emission rates from construction, operations, and decommissioning are presented in Table C.8-2. The radionuclide emission rates from operations are presented in Table C.8-3. The criteria pollutant and radionuclide emission rates for constructing, operating, and decommissioning the Calcine Dissolution Facility are based on annual emissions calculated in the project data presented in Section C.8.5.2. The emission rates for criteria pollutants were then scaled from the emission rates calculated in the TWRS EIS for the Phased Implementation Alternative. The criteria pollutant and radionuclide emission rates from operation of the vitrification facility are based on emission rates calculated in the project data presented in Section C.8.5.3. Supporting calculations are provided in Appendix E of Jacobs (1998).

Air Emission Concentrations. The criteria pollutant emission concentrations were calculated using the ISC2 spreadsheets developed to calculate the air emission concentrations for the TWRS EIS. The criteria pollutant emission concentrations resulting from construction, operations, and decommissioning are compared with state and Federal standards presented in Table C.8-4. The radiological doses to the nearest resident and the nearest offsite receptor were scaled from the receptor doses calculated in the TWRS EIS for the Phased Implementation Alternative. The radiological modeling results are compared with state and Federal standards in Table C.8-5. Supporting calculations are provided in Appendix E of Jacobs (1998).

Emission concentrations of carbon monoxide would be less than 1 percent of the Federal and state standards for construction, operations, or decontamination and decommissioning. Nitrogen oxide would be less than 1 percent, sulfur oxides would be less than 2 percent, and particulate matter with a diameter of 10 micrometers or less would be less than 16 percent.

Table C.8-2. Criteria pollutant emission rates for Minimum INEEL Processing Alternative – Just-in-Time Shipping Scenario.

			Operations (grams/sec)		
				Vitrification	
Pollutant	Construction (grams/sec)	D&D (grams/sec)	Unloading/ dissolution	HAW	LAW
Sulfur oxides	1.1×10^{-4}	7.5×10^{-5}	0.42	NA[a]	0.35
Carbon monoxide	0.084	0.056	4.7	NA	3.9
Nitrogen dioxide	0.084	0.056	0.28	NA	0.24
PM-10	2.4	2.4	NA	NA	NA

a. NA = Not applicable.

D&D = decontamination and decommissioning; HAW = high-activity waste; LAW = low-activity waste.

PM-10 = particulate matter with a diameter of 10 micrometers or less.

Table C.8-3. Radiological emission rates for Minimum INEEL Processing Alternative – Just-in-Time Shipping Scenario – operations phase.

Radionuclide	Unloading/ dissolution (curies per year)	Vitrification (curies per year)	
		HAW	LAW
Strontium-90	5.1×10^{-5}	5.2×10^{-5}	9.2×10^{-7}
Technetium-99	2.6×10^{-8}	9.0×10^{-10}	4.0×10^{-9}
Cesium-137	4.7×10^{-5}	2.4×10^{-5}	1.8×10^{-7}
Plutonium-238	7.0×10^{-8}	1.7×10^{-7}	1.1×10^{-8}
Plutonium-239/240	9.3×10^{-9}	6.2×10^{-9}	4.2×10^{-10}
Plutonium-241	3.2×10^{-8}	8.4×10^{-8}	1.7×10^{-9}
Americium-241	5.3×10^{-8}	2.0×10^{-8}	1.8×10^{-8}

HAW = high-activity waste; LAW = low-activity waste.

Table C.8-4. Criteria pollutant modeling results for Minimum INEEL Processing Alternative – Just-in-Time Shipping Scenario.

Pollutant	Averaging period	Construction (μg/m^3)	Operations (μg/m^3)	D&D (μg/m^3)	Standard (μg/m^3)	
					Federal	State
Carbon monoxide	1 hour	1.5	54	1.0	40,000	40,000
	8 hour	1.1	38	0.72	10,000	10,000
Nitrogen oxide	Annual	0.27	0.58	0.18	100	100
Sulfur oxides	1 hour	2.0×10^{-3}	4.8	1.4×10^{-3}	NA[a]	655
	3 hour	1.8×10^{-3}	4.3	1.2×10^{-3}	1300	NA
	24 hour	8.2×10^{-4}	1.9	5.4×10^{-4}	365	260
PM-10	Annual	3.6×10^{-4}	0.86	2.4×10^{-4}	80	60
	24 hour	18	NA	18	150	150
	Annual	7.8	NA	7.8	50	50

a. NA = Not applicable.

μg/m^3 = micrograms per cubic meter; D&D = decontamination and decommissioning; PM-10 = particulate matter with a diameter of 10 micrometers or less.

Table C.8-5. Radionuclide modeling results for Minimum INEEL Processing Alternative – Just-in-Time Shipping Scenario.

Receptor	Maximum dose (millirem/year)	Standard	
		State	Federal
Nearest resident[a]	2.3×10^{-5}	NA[c]	10
Offsite receptor[b]	2.8×10^{-5}	25	NA

a. Maximum predicted dose at the nearest residence to the 10 mrem/yr effective dose equivalent standard of 40 CFR Part 61.

b. Maximum accumulated dose equivalent at any offsite receptor to the 25 millirem per year standard contained in Washington Administrative Code 173-480.

c. NA = Not applicable.

The radiological dose to the nearest residents from radiological emissions would be less than 1 percent of the Federal standard, and the nearest offsite receptor dose would be less than 1 percent of the state standard.

Hazardous and toxic air pollutant emissions evaluated in the TWRS EIS for the Phased Implementation Alternative were less than 1 percent of the state and Federal standards. Hazardous and toxic air pollutants emissions from the Minimum INEEL Processing

Alternative would not exceed the emissions evaluated in the TWRS EIS for the Phased Implementation Alternative and would, therefore, be less than 1 percent of the state or Federal standards, with the exception of mercury oxide. Mercury oxide would reach concentration levels of 0.019 microgram per cubic meter compared to the state standard of 0.17 microgram per cubic meter. Mercury oxide would be less than 12 percent of the state or Federal standard. Supporting calculations are provided in Appendix E of Jacobs (1998).

The air emissions for the Just-in-Time Shipping Scenario are below the state and Federal standards and would not substantively change the understanding of the air impacts presented in the TWRS EIS for the Phased Implementation Alternative.

Interim Storage Shipping Scenario

Under this scenario, INEEL waste would be transported to Hanford approximately 20 years prior to being vitrified, which would require additional Canister Storage Buildings to be built for interim storage. The Canister Storage Buildings, Calcine Dissolution Facility, and vitrification facility are evaluated in this scenario as potential air emission sources.

Air Emission Sources. Emission sources for the Interim Storage Shipping Scenario would include air emissions from construction of the Canister Storage Buildings, construction of the Calcine Dissolution Facility, unloading and dissolving INEEL calcine waste at the Calcine Dissolution Facility, separating and vitrifying waste at the vitrification facility, and decommissioning the Canister Storage Buildings and the Calcine Dissolution Facility. The criteria pollutant emission rates from construction and decommissioning are presented in Table C.8-6. Since criteria pollutant emission rates from construction of the Canister Storage Buildings would exceed those from construction of the Calcine Dissolution Facility, and since construction activities for either facility would not take place during the same year, only construction emissions associated with constructing the Canister Storage Buildings are evaluated in this scenario. The criteria pollutant and radionuclide emission rates during operations would be the same as the emission rates for operations presented in Tables C.8-2 and C.8-3, respectively. The criteria pollutant emission rates for constructing and decommissioning the Canister Storage Buildings are based on annual emissions calculated in the project data presented in Section C.8.5.1. The emission rates for decommissioning the Calcine Dissolution Facility are based on annual emissions calculated in the project data presented in Section C.8.5.2. The emission rates for criteria pollutants were then scaled from the emission rates calculated in the TWRS EIS for the Phased Implementation Alternative. Since the Canister Storage Buildings and the Calcine Dissolution Facility would be decommissioned during the same year, the air emissions were combined in Table C.8-6.

Air Emission Concentrations. The criteria pollutant emission concentrations resulting from construction and decommissioning are compared with state and Federal standards in Table C.8-7. The criteria pollutant emission concentrations and radiological modeling results from operations would be the same as those previ-

Table C.8-6. Criteria pollutant emission rates for Minimum INEEL Processing Alternative – Interim Storage Shipping Scenario.

Pollutant	Construction (g/sec)	D&D (g/sec)
Sulfur oxides	3.4×10^{-3}	3.7×10^{-3}
Carbon monoxide	2.5	2.8
Nitrogen dioxide	2.5	2.8
PM-10	2.4	4.8

D&D = decontamination and decommissioning; g/sec = grams per second.

PM-10 = particulate matter with a diameter of 10 micrometers or less.

Table C.8-7. Criteria pollutant modeling results for Minimum INEEL Processing Alternative – Interim Storage Shipping Scenario.

Pollutant	Averaging period	Construction ($\mu g/m^3$)	D&D ($\mu g/m^3$)	Standard ($\mu g/m^3$)	
				Federal	State
Carbon monoxide	1 hour	46	50	40,000	40,000
	8 hour	32	35	10,000	10,000
Nitrogen oxide	Annual	8.2	8.9	100	100
Sulfur oxides	1 hour	0.061	0.067	NA[a]	655
	3 hour	0.055	0.060	1,300	NA
	24 hour	0.025	0.027	365	260
PM-10	Annual	0.011	0.012	80	60
	24 hour	18	35	150	150
	Annual	7.8	16	50	50

a. NA = Not applicable.

$\mu g/m^3$ = micrograms per cubic meter; D&D = decontamination and decommissioning; PM-10 = particulate matter with a diameter of 10 micrometers or less.

ously shown in Tables C.8-4 and C.8-5, respectively.

Emission concentrations of carbon monoxide would less than 1 percent of the Federal and state standards for construction, operations, or decommissioning. Nitrogen oxide would be less than 9 percent, sulfur oxides would be less than 1 percent, and particulate matter with a diameter of 10 micrometers or less would be less than 32 percent.

The radiological dose to the nearest residents from radiological emissions would be less than 1 percent of the Federal standard and the nearest offsite receptor dose would be less than 1 percent of the state standard.

Hazardous and toxic air pollutant emissions would be the same as those previously discussed for the Just-in-Time Shipping Scenario.

The air emissions for the Interim Storage Shipping Scenario are below the state and Federal standards and would not substantively change the understanding of the air impacts presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.4 Ecological Resources

From an ecological resources standpoint, the key issues are (1) whether the land areas proposed for use currently are undisturbed or whether they have been disturbed by past activities; (2) the extent of potential impacts on sensitive shrub-steppe habitat, which is considered a priority habitat by Washington state; and (3) potential impacts on plant and animal species of concern (those listed or candidates for listing by the Federal government or Washington state as threatened, endangered, and sensitive). Most impacts would occur in the 200 Areas where TWRS waste is currently and projected to be stored and where waste treatment, storage, and disposal facilities would be located. Smaller impacts would be located at potential borrow sites where varying levels of borrow material would be secured to support facility construction.

Impacts to plant and animal species from exposures to radionuclides and chemicals were also evaluated in the TWRS EIS. Under the Phased Implementation Alternative, the consumption of contaminated groundwater that reaches the Columbia River was not expected to pose a threat to terrestrial or aquatic receptors. The primary radiological risk is a result of direct contact with stored waste, which is unlikely as long as institutional controls are present. This type of impact would not be expected under the Minimum INEEL Processing Alternative since all of the INEEL waste would have left the Hanford Site prior to the end of the institutional control period.

Just-in-Time Shipping Scenario

Under this scenario, the construction and subsequent decontamination and decommissioning of the Calcine Dissolution Facility would result in additional shrub-steppe habitat disturbances in the 200 Areas and at the potential Pit 30 borrow site (Figure C.8-7). To bound the impacts, it is assumed that the Calcine Dissolution Facility would be sited in an undisturbed portion of the representative 200-East Area site. Using this assumption, an additional 3.9 acres of shrub-steppe habitat would be disturbed in the 200-East Area. An additional 2.9 acres of shrub-steppe habitat at Pit 30 would also be disturbed to secure sand and gravel for facility construction and decontamination and decommissioning. There would be no additional impacts at the Vernita Quarry or McGee Ranch borrow sites. The total additional shrub-steppe habitat impacts would increase by approximately 1.3 percent, or 6.8-acres over the 540 acres calculated in the TWRS EIS for the Phased Implementation Alternative (Table C.8-8).

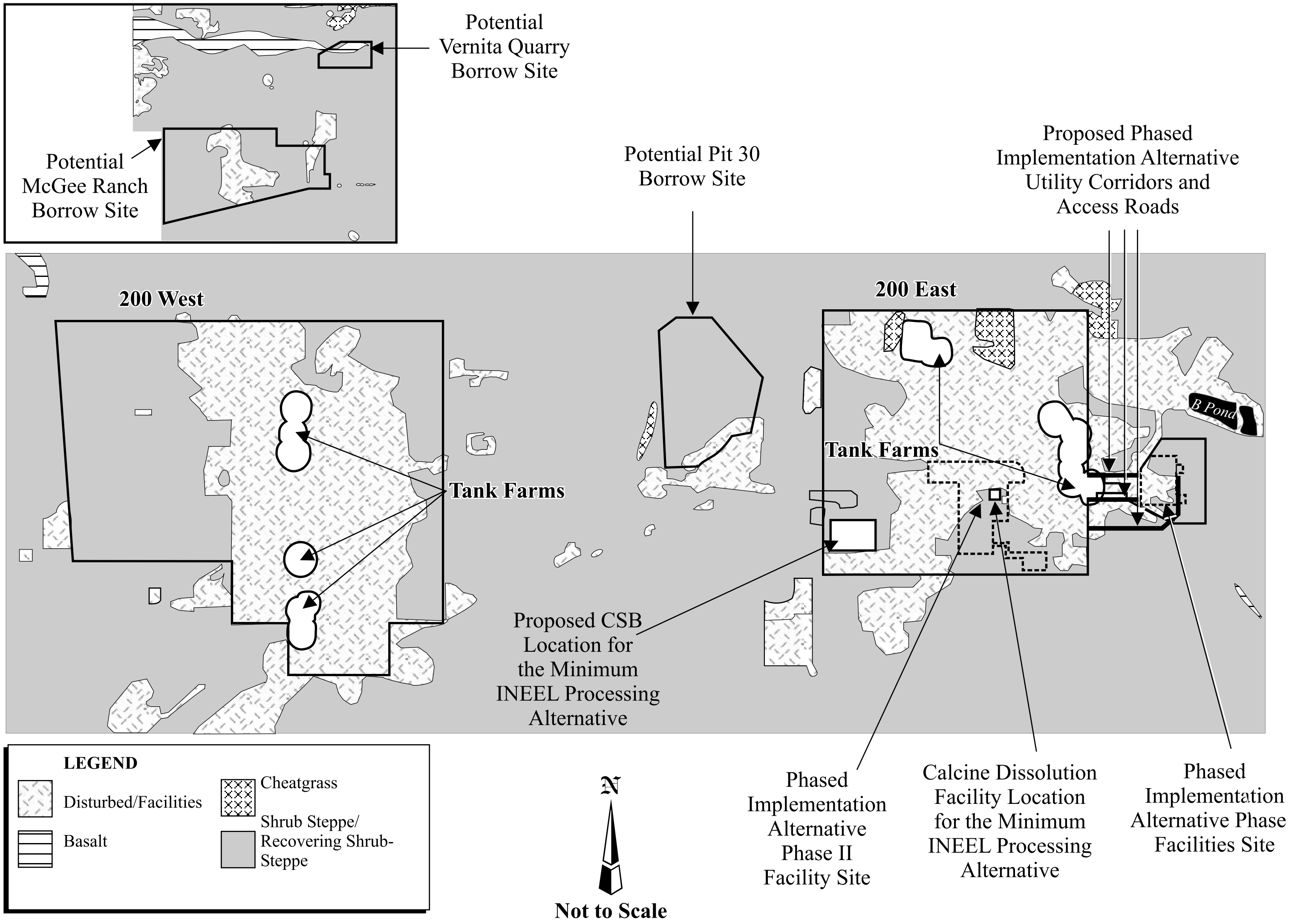
The additional impacts associated with this scenario would not substantively change the understanding of the ecological resource impacts presented in the TWRS EIS for the Phased Implementation Alternative. Shrub-steppe habitat impacts would still be less than 1 percent of the total remaining shrub-steppe on the Central Plateau and a small fraction of 1 percent of the Hanford Site's total shrub-steppe habitat. Implementing this scenario would not change the EIS's conclusion that there would be no adverse impacts to Hanford Site aquatic, wetland, or riparian habitats and no impacts to Federal- or state-listed threatened or endangered species. The incremental impacts to other species of concern would not be expected to result in substantive impacts to any species as a whole. Mitigation to reduce ecological impacts under this scenario would be performed in accordance with the Hanford Site Biological Resources Management Plan (DOE 1996b).

Interim Storage Shipping Scenario

This scenario would result in more impacts than the Just-in-Time Shipping Scenario because it would include all of the impacts of the Just-in-Time Shipping Scenario plus the impacts associated with the construction and subsequent decontamination and decommissioning of three new Canister Storage Buildings.

To bound the impacts, it is assumed that the Canister Storage Buildings would be sited in the 200-East Area adjacent to the site of the existing Canister Storage Building in undisturbed shrub-steppe habitat (Figure C.8-7). Using this assumption, as well as the bounding assumption that the Calcine Dissolution Facility would be sited in undisturbed habitat (as for the Just-in-Time Shipping Scenario), an additional 28 acres of shrub-steppe habitat would be disturbed in the 200-East Area. An additional 24 acres of shrub-steppe habitat at Pit 30 would also be disturbed to secure sand and gravel for facility construction and decontamination and decommissioning. There would be no additional impacts at Vernita Quarry or McGee Ranch. The total additional shrub-steppe habitat impacts would be approximately 9.5 percent, or a 52-acre increase to the 540 acres calculated in the TWRS EIS for the Phased Implementation Alternative.

Although this scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario, it would still not substantively change the understanding of the ecological resource impacts presented in the TWRS EIS for the Phased Implementation Alternative. While the total shrub-steppe habitat impacts under this scenario would be greater than for the Phased Implementation Alternative, the affected habitat would represent less than 2 percent of the total remaining shrub-steppe on the Central Plateau and a small fraction of 1 percent of the Hanford Site's total shrub-steppe habitat. Implementing this scenario would not change the EIS conclusion that there would be no adverse impacts to Hanford Site aquatic, wetland, or riparian habitats and no impacts to Federal- or state-listed threatened or endangered species. The level of impact to other species of concern is related to the amount of shrub-steppe disturbed. Thus, while the impacts to other species of concern would be greater, they would not be expected to result in substantive impacts to any species as a whole. Mitigation to reduce ecological impacts under this scenario would be performed in accordance with the Hanford sitewide biological resources management plan.



SOURCE: Adapted from DOE (1996a)

FIGURE C.8-7.
Habitat impacts of the Phased Implementation Alternative and the Minimum INEEL Processing Alternative.

Table C.8-8. Revised shrub-steppe impacts - Minimum INEEL Processing Alternative.

Alternative		Total shrub-steppe disturbed in acres[a]		
		200 Areas	Potential borrow sites	Total[b]
TWRS Phased Implementation Alternative[c]		240	300	540
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	3.9	2.9	6.8
	Interim Storage Shipping Scenario	28	24	52
Total impacts[d]	Just-in-Time Shipping Scenario	240	300	550
	Interim Storage Shipping Scenario	270	320	590

a. These estimates are based on closure of the Hanford Site Tank Farms by filling tanks and covering them with a Hanford Barrier. Numbers have been rounded to two significant digits.

b. Differences in total values reflect rounding.

c. Estimates include remediation and closure as landfill (Phase 1 and 2).

d. Revised impact estimates include the total Phased Implementation Alternative (Phase 1 and 2) plus the Minimum INEEL Processing Alternative.

TWRS = Tank Waste Remediation System.

C.8.4.5 Cultural Resources

The approach used to assess cultural resources for the Minimum INEEL Processing Alternative was to (1) define specific land areas that would be disturbed by construction, operation, and decommissioning and decontamination activities and (2) identify prehistoric or historical materials or sites at those locations that might be adversely impacted. Whether or not an area has been previously disturbed is an important variable in cultural resource impact analysis because areas previously disturbed are highly unlikely to have culturally or historically important resources.

Native American remains and other specific sites of religious and cultural importance exist at various locations around the Hanford Site; approximately 94 percent of these sites have not been disturbed by past activities and are currently unused. The Native American perspective on resources differs in many ways from that of Euro-Americans (Harper 1995).

Development of the Hanford Site has substantially altered the natural landscape. Buildings have been erected, soil and water have been disturbed, and the distribution of plants and animals has been altered. Environmental cleanup and restoration activities will cause further alterations in the visual landscape, disrupt wildlife, and change plant communities, taking the Site even farther away from its natural state. Such changes affect the relationship between the Native Americans and their native lands.

Access to the Hanford Site by Native Americans, as well as all members of the public, had been restricted until the end of the Hanford Site's production mission. Tribal Nations have continued to express the desire to access and use Hanford Site areas. The Phased Implementation Alternative would have long-term impacts on Native American land access and use. However, access to and use of the 200 Areas would be restricted despite the selection of the Phased Implementation Alternative because of environmental contamination of areas surrounding the Tank Farms (e.g., the existing processing facilities). Since the Calcine Dissolution Facility and the Canister Storage Buildings for the Minimum INEEL Processing Alternative would be decommissioned and decontaminated, this alternative would have no impact on future Native American land use or access.

In accordance with the mitigation action plan for the TWRS EIS, DOE completed a cultural resources review of the proposed location for the Phased Implementation Alternative facilities (HCRL 1998). That review concluded that although there are cultural resources within the proposed TWRS project area, they are not of local or national significance and do not qualify for listing in the National Register of Historic Places. DOE would amend the on-going TWRS cultural resources evaluation, if necessary, to include new activities associated with the Minimum INEEL Processing Alternative.

C.8.4.6 Socioeconomics

This section addresses socioeconomic impacts related to the Minimum INEEL Processing Alternative and compares this alternative to the TWRS EIS Phased Implementation Alternative. The socioeconomics analysis focuses on key indicators of the potentially impacted area, including Hanford Site employment and the effects of Site employment levels on employment, population, taxable retail sales, and housing prices in the surrounding area. DOE analyzed potential impacts to public services and facilities (schools; police and fire protection; medical services; sanitary and solid waste disposal; and electricity, natural gas, and fuel oil) based on the results of the socioeconomic modeling of the key indicators of socioeconomic impacts.

The Minimum INEEL Processing Alternative would exceed the Hanford Site baseline employment level by approximately 3.5 percent between 2023 and 2027. An additional increase for this alternative would occur in the operational years from 2028 to 2030. The increase exceeds the baseline by approximately 10 percent for the Interim Storage Shipping Scenario and 9.1 percent for the Just-in-Time scenario and would then sharply decline in 2031. Table C.8-9 presents the baseline employment for the Hanford Site and the impacts in total number of employees and the percent change that would occur for the Minimum INEEL Processing Alternative.

In comparison with the Phased Implementation Alternative, the Minimum INEEL Processing Alternative would increase the Hanford Site employment by 6 percent or 514 workers in the year 2030. This change would not have a substantial impact on Hanford employment.

Tri-Cities Area Employment. The Interim Storage Shipping Scenario of the Minimum INEEL Processing Alternative would increase the Hanford Site employment 0.63 percent over the baseline (about 530 jobs in 2030). A 0.56 percent increase in employment over the calculational baseline, or about 470 jobs in 2030 for the Just-in-Time Shipping Scenario would occur for employment impacts on the Tri-Cities.

Population and Housing. Population under the Minimum INEEL Processing Alternative would follow the changes related to Hanford Site employment resulting in a peak of 1.6 percent for the Interim Storage Shipping Scenario and 1.4 percent for the Just-in-Time Shipping Scenario above the calculational baseline in 2030, followed by a decline through 2032. This level of change would not result in a boom/bust pattern, which could impact housing and public facilities.

Housing prices reflected the pattern of employment under the Minimum INEEL Processing Alternative, with prices peaking in 2030 at 3.2 percent for the Interim Storage Shipping Scenario and 2.8 percent for the Just-in-Time Shipping Scenario above the calculational baseline. Prices would then fall through the year 2032.

Electricity, Natural Gas, and Fuel Oil. The Minimum INEEL Processing Alternative would peak for electrical demands during the operation phase. The peak would be more substantial than the population growth incremental demand. The peak for the operation phase would occur after the population demand peak since waste vitrification is an electrical power-intensive operation.

The incremental electrical demand would be a substantial increase over the 1994 estimated Hanford Site electrical requirements of approximately 57 megawatts. This demand is considerably lower than Site electrical usage in the 1980s, when average Site requirements were approximately 550 megawatts. The incremental demand under the Minimum INEEL Processing Alternative would be similar to the Phased Implementation Alternative, no more than 1.5 percent of the Pacific Northwest electrical generation system's guaranteed energy supply capacity. Additional hydroelectric generating capacity, which is the primary electrical power source in the region, is being constructed in the region. There are also proposals being consid-

Table C.8-9. Hanford Site employment changes from the baseline for selected years with TWRS Phased Implementation Alternative and Minimum INEEL Processing Alternative.

		Phased Implementation Alternative		Minimum INEEL Processing Alternative[a]	
Year	Baseline level	Change	Percent change	Change	Percent change
1997	14,900	790	5.3	0	0.0
1998	14,900	2,300	15.4	0	0.0
1999	14,800	3,300	22.3	0	0.0
2000	14,600	3,100	21.2	0	0.0
2001	14,400	1,400	9.7	0	0.0
2002	14,000	540	3.9	0	0.0
2003	13,500	540	4.0	0	0.0
2004	13,100	870	6.6	0	0.0
2005	12,800	2,400	18.8	0	0.0
2006	12,280	3,260	26.5	0	0.0
2007	11,760	4,120	35.0	0	0.0
2008	11,240	4,980	44.3	79	0.7
2009	10,720	5,840	54.5	79	0.7
2010	10,200	6,700	65.7	79	0.8
2011	10,200	6,100	59.8	88	0.9
2012	9,675	5,500	56.8	9	0.1
2013	9,150	4,900	53.6	88	1.0
2014	8,625	4,300	49.9	88	1.0
2015	8,100	3,700	45.7	88	1.1
2016	8,140	3,680	45.2	88	1.1
2017	8,180	3,660	44.7	9	0.1
2018	8,220	3,640	44.3	88	1.1
2019	8,260	3,620	43.8	88	1.1
2020	8,300	3,600	43.4	88	1.1
2021	8,320	3,340	40.1	88	1.1
2022	8,340	3,080	36.9	9	0.1
2023	8,360	2,820	33.7	9	0.1
2024	8,380	2,560	30.5	300	3.5
2025	8,400	2,300	27.4	300	3.5
2026	8,320	1,902	22.9	300	3.5
2027	8,240	1,504	18.3	300	3.6
2028	8,160	1,106	13.6	32	0.4
2029	8,080	708	8.8	740	9.2
2030	8,000	310	3.9	820	10.3
2031	7,760	252	3.2	310	4.0
2032	7,520	194	2.6	0	0.0
2033	7,280	136	1.9	0	0.0
2034	7,040	78	1.1	0	0.0
2035	6,800	20	0.3	0	0.0
2040	5,700	10	0.2	0	0.0

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a. The Minimum INEEL Processing Alternative includes the Interim Storage Shipping Scenario employment. For the Just-in-Time Shipping Scenario, employment would be substantially less from 2008 through 2024 and similar or slightly less from 2024 through 2032.

ered by various utilities in the region to construct natural gas-fired power plants.

Natural gas is a minor energy source in the Tri-Cities area, and incremental consumption related to population growth under the Minimum INEEL Processing Alternative would have negligible impacts. The operation phase of this alternative also would require up to 3,000 gallons per day of fuel oil. No substantial impacts on local supply or distribution systems would be expected from this level of demand.

C.8.4.7 Land Use

Land-use impacts are addressed in terms of the compatibility of temporary and permanent land-use commitments under each alternative with past, present, and planned and potential future uses of the land and the surrounding area. A map of planned land uses at the Hanford Site can be found on Figure C.8-8. Also addressed are potential conflicts with land uses adjacent to the land that would be impacted under the alternative and unique land uses near the TWRS sites. Nearby land includes the Hanford Reach of the Columbia River and the Fitzner-Eberhart Arid Land Ecology Reserve. Conflicts among alternative Federal, state, local, and tribal nation land-use policies, plans, and controls are described separately in Section C.8.4.17.

All major activities would occur within the current boundaries of the 200 Areas. For more than 40 years, the 200 Areas have been used for industrial and waste management activities associated with the Hanford Site's past national defense mission and current waste management and environmental restoration cleanup mission. The 200 Areas consist of approximately 6,400 acres.

Just-in-Time Shipping Scenario

Under this scenario, additional land-use commitments would result from construction of the Calcine Dissolution Facility and removal of earthen materials from the potential Pit 30 borrow site. No additional land would be committed at the potential Vernita Quarry and McGee Ranch borrow sites. Assuming an area equal to the footprint of the Calcine Dissolution Facility plus a small buffer zone would be permanently committed to waste disposal, the permanent land-use commitments would increase by approximately 3.3 percent, or 3.9 acres (Figure C.8-9) over the 120 acres calculated for the Phased Implementation Alternative. Assuming that disturbances at the potential Pit 30 borrow site would be temporary, the temporary land-use commitments would increase by approximately 0.4 percent, or 2.9 acres over the 790 acres calculated for the Phased Implementation Alternative (Table C.8-10).

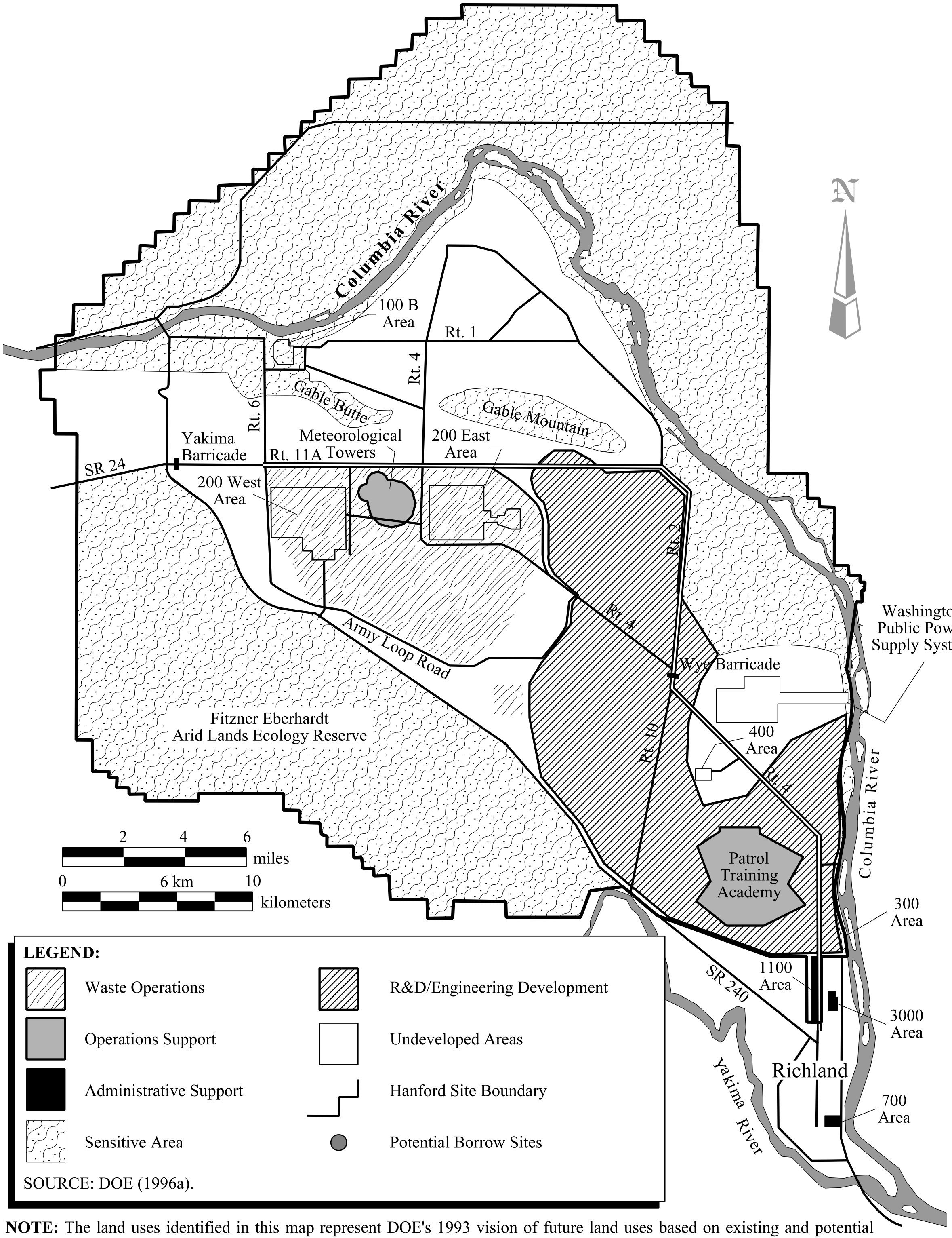
The small increases in land-use commitments resulting from this scenario would be confined to the 200 Areas and would not substantively affect the understanding of the land-use commitments presented in the TWRS EIS for the Phased Implementation Alternative. The land-use commitments would still constitute only a small fraction of the 6,400 acres of land within the 200 Areas and would be consistent with past, present, and planned and potential future uses of the land and surrounding area (Figure C.8-10).

Interim Storage Shipping Scenario

This scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario because it would include all of the impacts of the Just-in-Time Shipping Scenario plus the impacts associated with the construction and subsequent decontamination and decommissioning of three new Canister Storage Buildings.

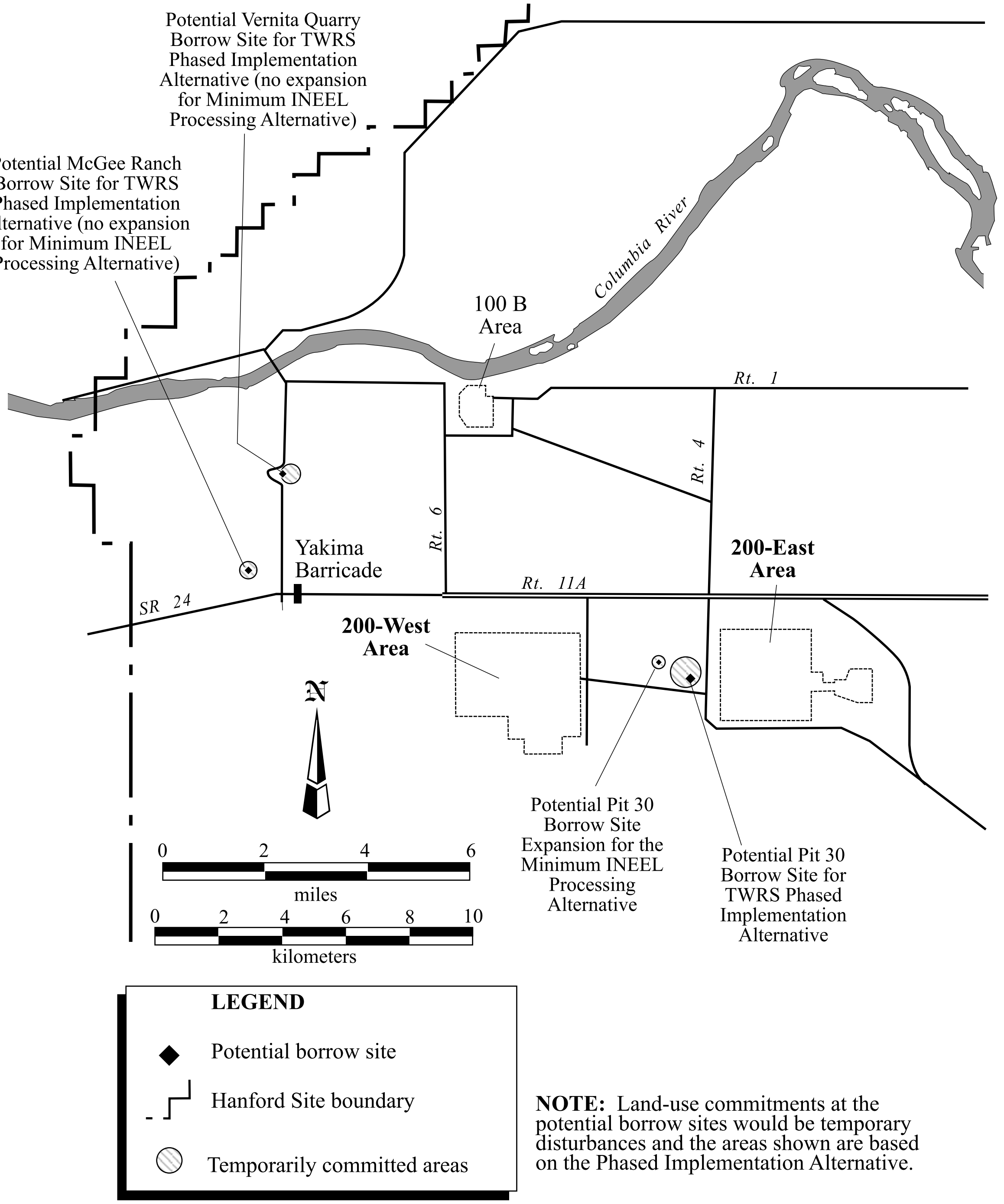
Land-use commitments associated with the Calcine Dissolution Facility are assumed to be permanent and would be the same as for the Just-in-Time Shipping Scenario. Disturbances associated with the potential Pit 30 borrow site (24 acres) and the Canister Storage Buildings (24 acres) are assumed to be temporary and would increase the temporary land-use commitments by approximately 6.1 percent, or 48 acres over the 790 acres calculated for the Phased Implementation Alternative.

Although this scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario, the additional land-use commitments would still be confined to the 200



NOTE: The land uses identified in this map represent DOE's 1993 vision of future land uses based on existing and potential Hanford missions. This map will be superseded by the Hanford Site Comprehensive Land Use Plan.

FIGURE C.8-8.
Future land use map for the Hanford Site.



NOTE: Land-use commitments at the potential borrow sites would be temporary disturbances and the areas shown are based on the Phased Implementation Alternative.

SOURCE: DOE (1996a).

FIGURE C.8-9.
Land-use commitments at potential borrow sites.

Table C.8-10. Revised land-use commitments – Minimum INEEL Processing Alternative.

Alternative		Temporary land commitments[a] (acres)	Permanent land commitments[b] (acres)
Phased Implementation Alternative[c]		790	120
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	2.9	3.9
	Interim Storage Shipping Scenario	48	3.9
Total Impacts[d]	Just-in-Time Shipping Scenario	790	120
	Interim Storage Shipping Scenario	840	120

a. Temporary land-use commitments include the construction and operation phases; land used for facilities, construction laydown areas, and materials storage areas; and land used at the three borrow sites.

b. Permanent land-use commitments include areas that would be covered by Hanford Barriers, low-activity waste disposal vaults, and the contaminated portions of processing facilities.

c. Estimates include remediation and closure as landfill (Phase 1 and 2).

d. Impact estimates include the total Phased Implementation Alternative (Phase 1 and 2) plus the Minimum INEEL Processing Alternative.

Areas and would still not substantively affect the land-use commitments as presented in the TWRS EIS for the Phased Implementation Alternative. While the land-use commitments would constitute a slightly larger fraction of the 6,400 acres of land within the 200 Areas, they would not exceed the land available for waste management within the 200 Areas. The land-use commitments would still be consistent with past, present, and planned and potential future uses of the land and surrounding area.

C.8.4.8 Aesthetic and Scenic Resources

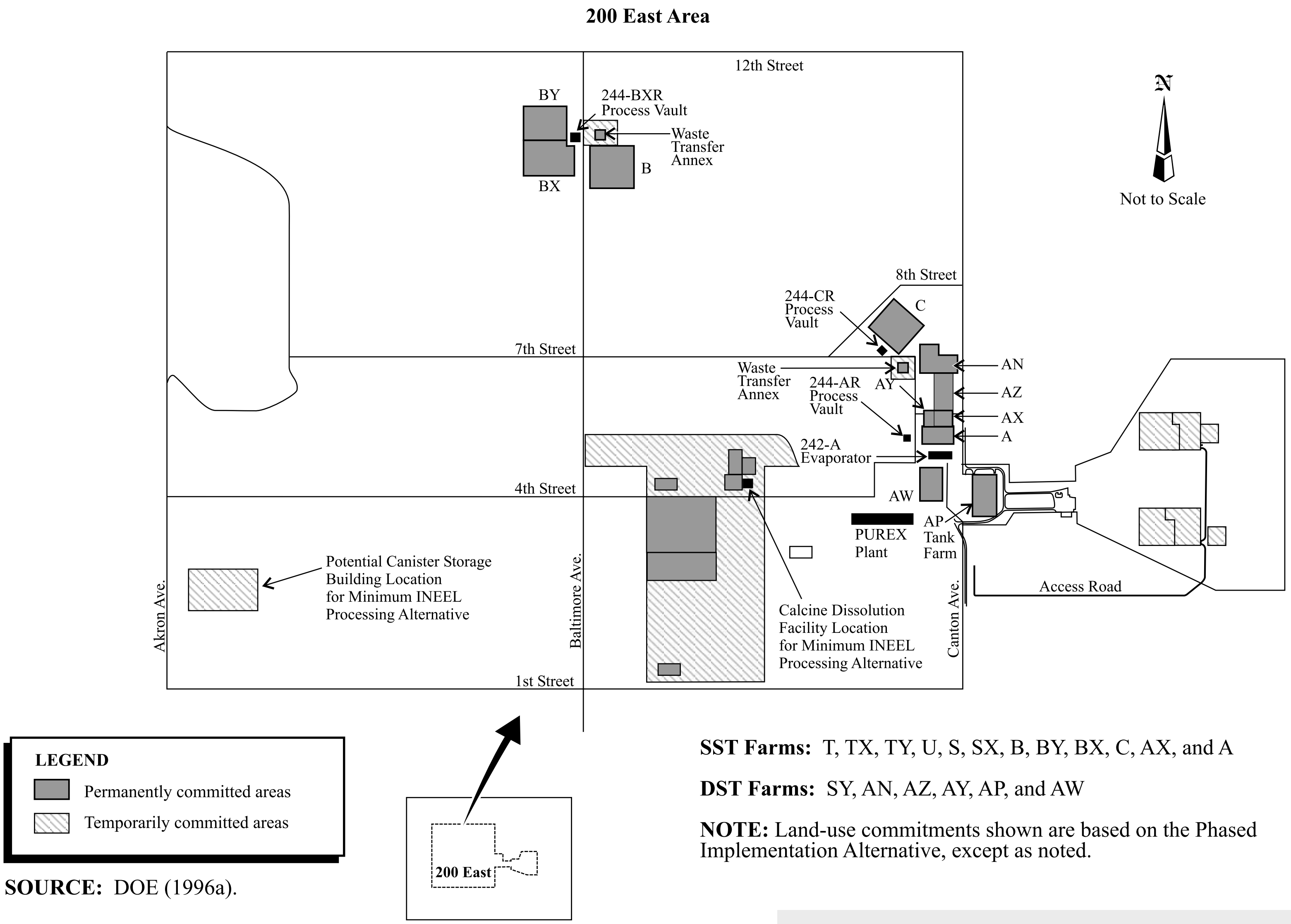
The visual impacts from the Phased Implementation Alternative would result from the construction of facilities associated with waste retrieval, processing, treatment, and storage. The Hanford landscape is characterized primarily by its broad plateau near the site's center. The visual setting provides sweeping vistas of the area broken up by more than a dozen large Hanford Site facilities (e.g., processing plants and nuclear reactors). The 200 Areas, where virtually all proposed facilities would be constructed, presently contain three large processing facilities as well as several multi-story support facilities. The facilities proposed for the Phased Implementation Alternative would be similar in size and appearance to the existing facilities.

The visual impacts from the Minimum INEEL Processing Alternative, both scenarios, would result from construction of facilities associated with waste storage, pretreatment, and treatment. The primary visual impact would be from the approximately 150 feet high stacks on each immobilization facility. The stacks would be visible from certain segments of State Route 240. Under certain atmospheric conditions, plumes would be visible at certain Site boundaries. No facilities or plumes would be visible from the Columbia River (DOE 1996a).

The facilities proposed for the Minimum INEEL Processing Alternative would be similar in size and appearance to the existing Hanford Site facilities. Visual impacts would be minor and similar to the impacts that currently exist.

C.8.4.9 Noise

Potential noise impacts would be minor. During both the construction and operation phases, some increase in noise levels onsite would occur due to the operation of heavy equipment and offsite due to vehicular traffic along existing roadways. Construction noises would result from the operation of scrapers, loaders, bulldozers, graders, cranes, and trucks. Because of the Site's remote and natural setting, noise impacts to resident wildlife species are a concern. Table



SOURCE: DOE (1996a).

SST Farms: T, TX, TY, U, S, SX, B, BY, BX, C, AX, and A

DST Farms: SY, AN, AZ, AY, AP, and AW

NOTE: Land-use commitments shown are based on the Phased Implementation Alternative, except as noted.

FIGURE C.8-10.
Land-use commitments in the 200-East Area.

C.8-11 presents an analysis in which a scraper, bulldozer, and grader were assumed to operate at the same location to assess the upper impact limit likely to occur. To place these noise levels in perspective, the table also presents reference noise levels. The table shows there would be some short-term disturbance of noise-sensitive wildlife near the TWRS activities during construction. Construction noise levels would approach background levels at 2,000 feet. Noise levels due to operations would be low and would result almost exclusively from traffic.

Operational phase noise impacts would be largely related to operating process equipment (e.g., evaporator, mixer pumps, and melter and quencher) and from traffic. Because the waste treatment process equipment would be operating inside enclosed structures, exterior noise levels would not substantially increase. All facilities and working conditions would be in compliance with the Occupational Safety and Health Administration's occupational noise requirements (29 CFR 1910.95). Pursuant to these requirements, noise exposures for an 8-hour duration would not exceed 85 dBA. In cases where the workers would be exposed to noise levels exceeding this value, administrative controls, engineering controls, or personal protective equipment use would be required to reduce the noise exposures below the allowable maximum.

The above assessment characterizes potential noise impacts from the TWRS Phased Implementation Alternative. Under the Minimum INEEL Processing Alternative, noise impacts would be less because there would be less construction activity.

C.8.4.10 Traffic and Transportation

This section describes how vehicular traffic associated with the Minimum INEEL Processing Alternative would impact the roadway system of the Hanford Site and vicinity. The roadways of primary concern would be (1) the segment of Stevens Road at the 1100 Area, which is the primary Site entrance for the city of Richland and (2) the segment of Route 4, which is a continuation of Stevens Road northward into the Hanford Site, west of the Wye Barricade. Stevens Road and Route 4 are by far the Hanford Site's most heavily traveled north-south route. Both of the road segments experienced heavy peak hour congestion in the recent past, although congestion has declined in 1995 as Site employment levels declined. The standard traffic level of service hierarchy ranges from Level of Service A (least congested) to Level of Service F (most congested). Conditions worse than Level of Service D are considered unacceptable. Prior to mid-1995, morning peak hour congestion on Stevens Road frequently reached Level of Service F, while on Route 4, it frequently reached Level of Service E.

To estimate vehicular traffic impacts, expected incremental traffic volumes (approximately 98 percent personal vehicles and 2 percent trucks) were added to estimated future baseline Hanford Site traffic volumes. The analysis focused on the peak year of activity. The approximate timeframes before and after the peak year when increased traffic congestion also would be expected were identified as well. Because Hanford Site traffic volumes typically reach their daily peaks during the morning shift change, this analysis focused on the morning peak hour, the time period of expected greatest impact.

Table C.8-11. Probable bounding case cumulative noise impact during the construction phase.

Equipment type	Noise level 15 meters (dBA)	Cumulative noise level (dBA)[a] at 15 meters (50 feet)	at 100 meters (330 feet)	at 400 meters (1,300 feet)
Scraper	88	90	74	62
Dozer	80			
Grader	85			

a. dBA is decibels on the A scale, which adjusts noise levels to account for human hearing capabilities. These levels compare to a food blender (90 dBA), riding inside a car at 40 miles per hour (70 dBA), and normal speech (60 dBA).

The impact of the vehicular traffic associated with the traffic volume was estimated based on the number of people who would be commuting to and from work to support the Minimum INEEL Processing Alternative activities, including construction and operations. Peak traffic flows would occur in the year 2030 and would result in extreme peak hour congestion (level of service E) on Stevens Road at the 1100 Area. On Stevens Road the morning peak hour volume would be approximately 2,200 vehicles. On Route 4 the incremental Minimum INEEL Processing Alternative traffic volume of 360 vehicles would produce peak hour traffic that would result in level of service B or C conditions. Congestion associated with the Phased Implementation Alternative for Stevens Road would begin to build in 2007 and would continue at high levels until a 2031 peak, the end of activities associated with the Minimum INEEL Processing Alternative. Most traffic would be associated with the TWRS EIS Phased Implementation Alternative until 2029.

For the Phased Implementation Alternative, congestion on Route 4 west of the Wye Barricade would begin to build in 2007 and would continue at high levels until 2024, prior to activities associated with the Minimum INEEL Processing Alternative. Most traffic would be associated with the TWRS EIS Phased Implementation Alternative until 2029.

Traffic and Transportation Accidents. The traffic scenarios analyzed included employee traffic to and from work and transportation of building materials and other miscellaneous materials to support the alternatives. The incidence rates for injuries and fatalities were based on U. S. Department of Transportation statistics, Washington State Highway accident reports, and Hanford Site statistics.

The projected traffic accidents calculated for the Minimum INEEL Processing Alternative were 14 injuries and 0.18 fatalities for commuter traffic accidents. For truck transportation accidents, the total injuries were projected to be 15; for rail accidents resulting in injuries, 0.66. Fatalities would be less than 1 for each case. Supporting calculations are provided in Appendix E of Jacobs (1998).

Rail Traffic. The Minimum INEEL Processing Alternative would involve 26 rail shipments per year to bring materials onto the Site. Offsite shipments of HLW are addressed in Section 5.2.9.

Other Risks Associated With Traffic/Transportation. Chemical exposures from potential transportation accidents while transporting chemicals to support dissolution, pretreatment, and treatment (similar chemicals that would be used for the Phased Implementation Alternative) would result in health consequences similar to those evaluated in the TWRS EIS for the Phased Implementation Alternative. However, more shipments would be required to support the Phased Implementation Alternative resulting in a higher probability of an accident and therefore would bound chemical health risk for the Minimum INEEL Processing Alternative.

C.8.4.11 Health and Safety

Carcinogenic and noncarcinogenic adverse health effects on humans from exposure to radioactive and chemical contaminants associated with each of the following categories of risk were evaluated for the Phased Implementation Alternative in the TWRS EIS.

- Remediation risk resulting from routine remediation activities, such as retrieving waste from tanks and waste treatment operations

- Post remediation risk, such as the risk resulting from residual contamination remaining after the completion of remediation activities

- Post remediation risk resulting from human intrusion directly into the residual tank waste remaining after remediation.

Just-in-Time Shipping Scenario

Under this scenario, there would be radiological risk because of airborne releases and direct exposures associated with operations and decontamination and decommissioning at the Calcine Dissolution Facility and operations at the separations and vitrification facilities (Table C.8-12). The risk to the maximally exposed individual involved worker was calculated in the TWRS EIS based on an assumed dose rate equal to the administrative control limit of 500 millirem per year and an exposure duration equal to the duration of the operation requiring the greatest amount of time, up to a maximum of 30 years. For the Phased Implementation Alternative, the exposure duration was the full 30 years (based on continued Tank Farm and evaporator operations), which resulted in a radiation dose to the maximally exposed individual involved worker of 15 rem. The operation requiring the greatest amount of time under the Just-in-Time Shipping Scenario would be calcine dissolution (estimated to require 2.25 years, see Section C.8.5.2). This would result in a radiation dose to the maximally exposed individual involved worker of 1.1 rem. Because the TWRS EIS radiation dose is greater than the dose calculated for this scenario, the TWRS EIS radiation dose is bounding and this scenario would not change the understanding of the maximally exposed individual involved worker dose presented in the TWRS EIS.

The radiological risk to the involved worker population was calculated in the TWRS EIS based on the number of workers required for each operation, the anticipated dose each individual would receive (assumed to be either 200 millirem per year or 14 millirem per year, depending on the operation), and the duration of each operation. The Phased Implementation Alternative was calculated to result in approxi-

Table C.8-12. Estimated public and occupational radiological impacts.[a]

		Minimum INEEL Processing Alternative	
Receptor	Phased Implementation Alternative	Just-in-Time Shipping Scenario	Interim Storage Shipping Scenario
Total collective involved worker dose (person-rem)	8,200	320	350
Total number of involved worker latent cancer fatalities	3.3	0.13	0.14
Maximally exposed offsite individual dose (millirem/year)	0.29	1.7×10^{-5}	1.7×10^{-5}
Integrated offsite maximally exposed individual dose (millirem)	4.9	2.9×10^{-5}	2.9×10^{-5}
Noninvolved worker dose (millirem/year)	0.23	1.3×10^{-5}	1.3×10^{-5}
Integrated noninvolved worker dose (millirem)	2.4	2.3×10^{-5}	2.3×10^{-5}
Dose to population within 80 kilometers of Hanford Site (person-rem per year)	23	1.3×10^{-3}	1.3×10^{-3}
Total collective dose to population (person-rem)	390	2.3×10^{-3}	2.3×10^{-3}
Estimated number of latent cancer fatalities in population within 80 kilometers of Hanford Site	0.19	1.1×10^{-6}	1.1×10^{-6}

a. Derived from Jacobs (1998).

mately 3.27 latent cancer fatalities to the involved worker population. Under the Just-in-Time Shipping Scenario, the worker population would receive additional dose from calcine dissolution operations (23 persons per year × 2.25 years × 0.2 rem = 10 person-rem, see Section C.8.5.2); Calcine Dissolution Facility decontamination and decommissioning (312 persons per year × 2 years × 0.2 rem = 130 person-rem, see Section C.8.5.2); and separations and vitrification operations (657 persons per year × 1.4 years × 0.2 rem = 180 person-rem, see Section C.8.5.3). The cumulative additional dose (320 person-rem) would result in an additional latent cancer fatality risk to the worker population of 0.13, which represents an increase of 3.9 percent over the 3.27 latent cancer fatalities calculated for the Phased Implementation Alternative in the TWRS EIS (Table C.8-12). Because this scenario would result in less than one additional latent cancer fatality, it would not appreciably change the understanding of involved worker risk presented in the TWRS EIS for the Phased Implementation Alternative.

Under this scenario, there would be additional risk to the noninvolved worker and general public associated with the radiological air emissions from the Calcine Dissolution Facility and the separations and vitrification facilities. Air emissions data for these two sources are provided in Sections C.8.5.2 and C.8.5.3, respectively. The dose to each receptor resulting from the additional emissions was estimated by scaling from the doses calculated for the Phased Implementation Alternative (see Appendix E of Jacobs 1998). Two scaling factors were developed, one for each emission source, based on emissions at the stack before dispersion. The dose to each receptor was estimated by applying the scaling factors to the dose calculated for the TWRS EIS and then summing the doses from the two sources. Calculation results are presented in Table C.8-12. For both the noninvolved worker and general public, the latent cancer fatality risk would increase by less than 1 percent over the risk calculated in the TWRS EIS. Thus, this scenario would not substantively change the understanding of risk to the noninvolved worker and general public presented in the TWRS EIS for the Phased Implementation Alternative.

This scenario would not result in any additional vitrified HLW being shipped from the Hanford Site to a geologic repository. The latent cancer fatality risk due to HLW transportation would, therefore, remain unchanged from that presented in the TWRS EIS (Table C.8-13). Transportation of INEEL HLW to the Hanford Site and the return of the vitrified HLW and low-activity waste to INEEL are addressed in Section 5.2.9.

This scenario would also result in very small nonradiological chemical risk due to chemical emissions from the Calcine Dissolution Facility and the separations and vitrification facilities. The chemical emission rates for this scenario would be three to five orders of magnitude lower than the comparable rates for the Phased Implementation Alternative (Tables C.8-14 and C.8-15) and the duration of the emissions would be much shorter than for the Phased Implementation Alternative, with the exception of mercury. The INEEL waste would have a higher mercury concentration than the TWRS EIS waste and would result in higher air emission concentration levels. The maximally exposed individual noninvolved worker and maximally exposed individual general public exposure to mercury would result in a hazard quotient of 5.4×10^{-3} and 8.7×10^{-4} respectively [supporting calculations provided in Appendix E of Jacobs (1998)], well below the benchmark value of 1.0. The resulting nonradiological chemical emissions for this scenario would be only a small fraction of the chemical emissions calculated for the Phased Implementation Alternative. Thus, the TWRS EIS risk is bounding, and this scenario would not change the understanding of the nonradiological chemical risk presented in the TWRS EIS.

Interim Storage Shipping Scenario

This scenario would result in slightly greater additional risk to the involved worker than the Just-in-Time Shipping Scenario because it would include all of the exposures associated with the Just-in-Time Shipping Scenario plus the exposures associated with operations at the Canister Storage Buildings (Table C.8-12). The operation requiring the greatest amount of time under this scenario would be the Canister

Table C.8-13. Vitrified HLW transportation risk – Phased Implementation Alternative.

Receptor	LCF risk
Onsite population	3.1×10^{-4}
Offsite population	3.2×10^{-3}

LCF = latent cancer fatality.

Table C.8-14. Chemical emissions during routine operations – Phased Implementation Alternative.

Receptor	Hazard quotient
Maximally exposed individual involved worker	0.31
Maximally exposed individual noninvolved worker	0.13
Maximally exposed individual general public	7.5×10^{-5}

Table C.8-15. Comparison of chemical emissions during routine operations from the Phased Implementation Alternative and Minimum INEEL Processing Alternative.

	Emission rate (mg/sec)	
Emissions[a]	TWRS EIS Phased Implementation Alternative	Minimum INEEL Processing Alternative[b]
Boron	6.4×10^{-4}	5.8×10^{-8}
Barium	4.7×10^{-6}	1.5×10^{-9}
Cadmium	1.2×10^{-5}	1.4×10^{-8}
Chromium	2.5×10^{-4}	5.4×10^{-9}

a. Emissions listed are releases that would occur under the Phased Implementation Alternative that would also occur under the Minimum INEEL Processing Alternative.

b. These values represent the combined emission rates from the Calcine Dissolution Facility and the separations and vitrification facilities.

mg/sec = milligrams per second

Storage Building operation (estimated to require 19 years; see Section C.8.5.1). Canister Storage Building operations would result in a radiation dose to the maximally exposed individual involved worker of 9.5 rem. Because the TWRS EIS radiation dose is greater than the dose calculated for this scenario, the TWRS EIS radiation dose is bounding and this scenario would not change the understanding of the maximally-exposed individual involved worker dose presented in the TWRS EIS.

The involved worker population dose would increase by approximately 34 person-rem due to operations at the Canister Storage Buildings (see Section C.8.5.1.), bringing the cumulative additional dose for this scenario to 350 person-rem. This cumulative dose would result in an additional latent cancer fatality risk to the worker population of 0.14, or a 4.3 percent increase over the 3.3 latent cancer fatalities calculated in the TWRS EIS for the Phased Implementation Alternative (Table C.8-12). Although the worker risk would increase under this scenario, there would be less than one additional latent cancer fatality. Thus, this scenario would not appreciably change the understanding of involved worker risk presented in the TWRS EIS for the Phased Implementation Alternative.

Under this scenario, the additional radiological risk to the noninvolved worker and general public would be the same as for the Just-in-Time Shipping Scenario because operations at the Canister Storage Buildings are assumed to result in no additional airborne radiological releases (see Section C.8.5.1).

This scenario would not result in any additional vitrified HLW being shipped from the Hanford Site to a geologic repository. The latent cancer fatality risk due to HLW transportation would, therefore, remain unchanged from that presented in the TWRS EIS (Table C.8-13). Transportation of INEEL HLW to the Hanford Site and the return of the vitrified HLW and low-activity waste to INEEL are addressed in Section 5.2.9.

This scenario would result in the same nonradiological risk as the Just-in-Time Shipping Scenario because operations at the Canister Storage Buildings are assumed to result in no additional airborne chemical releases (see Section C.8.5.1).

Long-Term Anticipated Health Effects

The Minimum INEEL Processing Alternative would result in no additional long-term human health risks to future users of the Hanford Site. Following processing and treatment, the immobilized INEEL HLW and low-activity waste canisters would be transported back to INEEL for interim storage and eventual disposal. There would be no additional sources of potential groundwater contamination left onsite following completion of remediation. Implementing either shipping scenario would result in the same long-term human health risk impacts as calculated in the TWRS EIS for the Phased Implementation Alternative (Table C.8-16).

Intruder Scenario

The TWRS EIS included an analysis of long-term intruder risk. The intrusion scenario used was a postulated well-drilling scenario on the Hanford Site after the assumed loss of institutional control. The latent cancer fatality risk was calculated for a hypothetical driller and a post-drilling resident. The driller was assumed to be an individual who drills a well through the tank waste. The post-drilling resident was assumed to be an individual who lives on a parcel of land over the exhumed waste, from which he obtains 25 percent of his vegetable intake. For the Phased Implementation Alternative, the latent cancer fatality risk was calculated to be 8.5×10^{-5} for the driller and 4.2×10^{-4} for the post-drilling resident.

The Minimum INEEL Processing Alternative would result in no additional risks from inadvertent human intrusion at Hanford Site. Following processing and treatment, the immobilized INEEL HLW and low-activity waste canisters would be transported back to INEEL for interim storage and eventual disposal. There would be no additional onsite sources of contamination to increase the potential risks from a postulated well drilling intrusion scenario. Implementing either shipping scenario would result in the same risks to the driller and post-drilling resident as calculated in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.12 Accidents

The accident analysis considers human health risks from (1) nonradiological/nontoxicological occupational accidents and (2) radiological and toxicological accidents. Accidents could potentially result from current Tank Farm operations and from construction and operations of pretreatment, treatment, and storage and disposal facilities to support the Phased Implementation Alternative.

Just-in-Time Shipping Scenario

Under this scenario INEEL waste would be transported to Hanford just in time for vitrification, and there would be no need to construct additional Canister Storage Buildings for interim storage. Therefore, only the Calcine Dissolution Facility and the vitrification facility are evaluated in the scenario as potential sources of accidents.

Nonradiological Nontoxicological Occupational Risk. The numbers of worker-years required to construct, operate, and decommission the Calcine Dissolution Facility were calculated from the data provided in Section C.8.5.2, to be 1,100; 52; and 620, respectively. The number of worker-years required to operate the vitrification facility was calculated from the data provided in

Table C.8-16. Long-term anticipated health effects – Phased Implementation Alternative.[a]

Risk / Hazard	Year	Exposure scenario	Bounding[b]	Nominal[c]
Incremental Lifetime Cancer Risk[d]	2,500	Native American	1.2×10^{-4}	2.6×10^{-5}
		Residential farmer	9.6×10^{-6}	1.9×10^{-6}
		Industrial worker	3.0×10^{-6}	7.2×10^{-8}
		Recreational user	2.7×10^{-7}	1.2×10^{-8}
	5,000	Native American	4.3×10^{-3}	7.1×10^{-4}
		Residential farmer	3.4×10^{-4}	2.0×10^{-5}
		Industrial worker	1.0×10^{-4}	2.6×10^{-6}
		Recreational user	9.6×10^{-6}	2.6×10^{-7}
	10,000	Native American	6.9×10^{-4}	6.2×10^{-4}
		Residential farmer	6.8×10^{-5}	4.0×10^{-5}
		Industrial worker	7.4×10^{-6}	6.2×10^{-6}
		Recreational user	7.8×10^{-7}	6.0×10^{-7}
Hazard quotient	2,500	Native American	0.72	0.6
		Residential farmer	0.12	0.11
		Industrial worker	1.1×10^{-4}	9.1×10^{-5}
		Recreational user	1.6×10^{-5}	1.2×10^{-5}
	5,000	Native American	120	34
		Residential farmer	21	6.3
		Industrial worker	0.022	5.2×10^{-3}
		Recreational user	3.0×10^{-3}	7.1×10^{-4}
	10,000	Native American	7.7×10^{-3}	1.4
		Residential farmer	1.6×10^{-3}	2.2×10^{-3}
		Industrial worker	3.7×10^{-4}	4.7×10^{-4}
		Recreational user	4.9×10^{-5}	6.3×10^{-5}

a. Source: DOE (1996a).

b. Bounding case health effects are based on conservative assumptions designed to ensure that the results provide an upper bound of long-term risks.

c. Nominal case health effects are based on average rather than conservative assumptions.

d. Incremental lifetime cancer risk based on long-term exposure to radionuclides and carcinogenic chemicals in groundwater (risk below 1.0×10^{-6} is considered low, risk above 1.0×10^{-4} is considered high).

Section C.8.5.3 to be 990. The total recordable cases, lost workday cases, and fatalities were calculated using the same incidence rates used in the TWRS EIS. The results of the calculations are presented in Table C.8-17. The supporting calculations are provided in Appendix E of Jacobs (1998). The Just-in-Time Shipping Scenario would result in an incremental worker risk of 4 percent for construction and 1 percent for operations as shown in the revised impacts to the Phased Implementation Alternative. It should be noted that decommissioning was added to construction.

Radiological and Toxicological Accidents. The potential accidents evaluated in the TWRS EIS are those that could occur while storing, transferring, pretreating, and vitrifying the INEEL waste. The radiological and chemical constituents and concentrations in the INEEL waste inventory are not the same as the Hanford waste and for a given accident would result in lower dose consequences. To determine the dose consequences of comparable accidents evaluated in the TWRS EIS, a unit-liter dose was calculated for the INEEL waste and compared with the unit-liter dose that was used in the TWRS EIS analysis. Assuming the same atmospheric dispersion factors, respirable rates, fraction of respirable material released in the accident, and dose-to-risk conversion factors, scaling factors based on the difference in the unit-liter doses were developed for estimating the latent cancer fatality risk resulting from INEEL waste accidents. The scaling factors are presented in Table C.8-18 and the supporting calculations for the scaling factors are provided in Appendix E of Jacobs (1998).

Applying the scaling factors in Table C.8-18 to the accident scenarios evaluated in the TWRS EIS for the Hanford waste would result in the latent cancer fatality risks presented in Table C.8-19. The INEEL waste spray release accident scenario would be bound by the comparable TWRS EIS accident by one order of magnitude. The INEEL waste deflagration scenario would be bound by the comparable TWRS EIS accident by two orders of magnitude. The INEEL waste line-break scenario would be bound by the comparable TWRS EIS by a factor of two. The INEEL waste breached canister of vitrified HLW scenario would be bound by the comparable TWRS EIS by two orders of magnitude. The INEEL waste beyond-design-basis earthquake would be bound by the comparable TWRS EIS by one order of magnitude. Retrieval accidents were not evaluated in this analysis. It was assumed that after the calcined waste has been dissolved and transferred to the storage tanks the condition of the waste would make it readily transferable to the separations facility and, as a result, would require a minimum amount of sluicing.

The chemical risk from the postulated accident for the INEEL waste was based on the relatively large concentration of mercury in the waste. The organic constituents have been removed from the waste during the calcine process at INEEL. Mercury is the only chemical in the waste with a concentration that could exceed the American Industrial Hygiene Association Emergency Response Planning Guidelines (ERPG)-1 severity level. The mercury concentrations were calculated for the various receptors and the corresponding Emergency Response Planning Guideline levels are presented in Table C.8-20.

Supporting calculations are provided in Appendix E of Jacobs (1998). The chemical accidents evaluated in the TWRS EIS would remain bounding for all accidents except for the line-break accident and the spray release accident scenarios. The INEEL waste line-break scenario would result in an ERPG-2 for the noninvolved worker receptor compared to ERPG-1 calculated in the comparable TWRS EIS accident. The INEEL waste spray release accident scenario would result in an ERPG-3 for the noninvolved worker receptor compared to ERPG-2

Table C.8-17. Occupational accident risk.

		Construction			Operations		
Alternative		TRC	LWC	Fatality	TRC	LWC	Fatality
Phased Implementation Alternative		4,200	1,100	1.4	1,900	940	2.7
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	170	43	0	23	12	0
	Interim Storage Shipping Scenario	230	57	0	27	13	0
Total Impacts	Just-in-Time Shipping Scenario	4,400	1,100	1.4	1,900	950	2.7
	Interim Storage Shipping Scenario	4,400	1,200	1.4	1,900	950	2.7

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a. LWC = lost workday cases; TRC = total recordable cases.

Table C.8-18. Scaling factors for estimating latent cancer fatality risk for INEEL waste accidents.

Accident scenario	Scaling factor
Spray scenario	0.097
Hydrogen gas deflagration	0.012
Line break during pretreatment	0.58
Breached canister	3.7×10^{-3}
Beyond design basis earthquake	0.033

Table C.8-19. Radiological accident impacts for the Minimum INEEL Processing Alternative.[a]

Process title	Maximally-exposed individual dose (rem)	Noninvolved worker dose (rem)	Offsite population (person-rem)	Latent cancer fatalities to offsite population
Spray release from jumper pit	0.19	42	390	0.19
Hydrogen deflagration in waste storage tanks	0.050	21	44	0.022
Line break during pretreatment	2.6×10^{-4}	0.060	0.56	2.8×10^{-4}
Dropped canister of vitrified HLW	2.2×10^{-12}	1.5×10^{-9}	4.9×10^{-9}	2.5×10^{-12}
Beyond design basis earthquake	0.15	64	130	0.067
Breached calcine canister while unloading[b]	4.7×10^{-6}	3.3×10^{-3}	0.010	5.2×10^{-6}

a. Derived from Jacobs (1998).

b. This accident scenario is unique to the INEEL waste form (calcine). Impacts for this scenario were not scaled from the TWRS EIS.

Table C.8-20. Toxicological accident impacts for the Minimum INEEL Processing Alternative.[a]

Process title	MEI[b] involved worker	MEI noninvolved worker	MEI general public	Involved worker population	Noninvolved worker population	General public population
Spray release from jumper pit	ERPG-2[c]	ERPG-3	<ERPG-1	ERPG-2	ERPG-3	<ERPG-1
Hydrogen deflagration in waste storage tanks	ERPG-2	ERPG-2	<ERPG-1	ERPG-2	ERPG-2	<ERPG-1
Line break during pretreatment	<ERPG-1	ERPG-2	<ERPG-1	<ERPG-1	ERPG-2	<ERPG-1
Dropped canister of vitrified HLW	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1
Beyond design basis earthquake	ERPG-2	ERPG-3	<ERPG-1	ERPG-2	ERPG-3	<ERPG-1
Breached calcine canister while unloading[d]	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1

a. Derived from Jacobs (1998).

b. MEI = maximally-exposed individual.

c. ERPG = Emergency Response Planning Guidelines.

d. This accident scenario is unique to the INEEL waste form (calcine). Impacts for this scenario were not scaled from the TWRS EIS.

calculated in the comparable TWRS EIS accident.

In addition to the accidents evaluated in the TWRS EIS, a breached canister of calcine waste was analyzed. A dropped canister of calcine waste could potentially occur in the canister dissolution facility while the canister is being transferred from the transportation cask. The accident could occur as a result of mechanical failure or human error. It is assumed that 40 percent of the 1.17 cubic meters of waste in the canister is released and suspended in the air. It is further assumed that each stage of a two-stage high-efficiency particulate air filter system filters 99.95 percent of the suspended waste. The radiological and toxicological impacts to the various receptors are presented in Tables C.8-19 and C.8-20. Supporting calculations are provided in Appendix E of Jacobs (1998).

The radiological latent cancer fatality risk from accidents evaluated for the Just-in-Time Shipping Scenario are less than the risk from comparable accidents evaluated in the TWRS EIS. Only the chemical risk from the spray accident and line-break accident would exceed the chemical risk to the noninvolved worker evaluated for comparable accidents in the TWRS EIS. However, the spray accident and line-break accident are bound by other accidents evaluated in the TWRS EIS. The hydrogen gas deflagration, high-efficiency particulate air filter failure, and beyond-design-basis earthquake accidents evaluated in the TWRS EIS would exceed ERPG-3 for the noninvolved worker. Therefore, the Just-in-Time Shipping Scenario would not substantively change the understanding of impacts from radiological and chemical accidents presented in the TWRS EIS for the Phased Implementation Alternative.

Interim Storage Shipping Scenario

Under this scenario INEEL waste would be transported to the Hanford Site approximately 20 years prior to being vitrified. This would require additional Canister Storage Buildings to be built for storage of INEEL waste prior to vitrification. The Canister Storage Buildings, Calcine Dissolution Facility, and the vitrification facility are evaluated in this scenario as potential sources of accidents.

Nonradiological Nontoxicological Occupational Risk. The number of worker-years required to support the Calcine Dissolution Facility and vitrification facility would be the same as was previously discussed for the Just-in-Time Shipping Scenario. However, additional worker years would be required to construct, operate, and decommission the Canister Storage Buildings. The results of the calculations are presented in Table C.8-17. The Interim Storage Shipping Scenario would result in an incremental worker risk of 5.5 percent for construction and 1.5 percent for operations as shown in the revised impacts to the Phased Implementation Alternative.

Radiological and Toxicological Accidents. The radiological and toxicological accidents evaluated in the Just-in-Time Shipping Scenario would be common to the Interim Storage Shipping Scenario. The potential for a dropped canister of calcine waste could occur in a Canister Storage Building as the canister is being transferred from the transportation cask. However, this accident would be comparable to the canister accident in the Calcine Dissolution Facility and would result in the same radiological and chemical risk. As with the Just-in-Time Shipping Scenario, the Interim Storage Shipping Scenario would not substantively change the understanding of impacts from radiological and chemical accidents presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.13 Cumulative Impacts

The NEPA implementation regulations define the term "cumulative impact" as the impact on the environment that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes those actions. Cumulative impacts result from individually minor but collectively significant actions taking place over time (40 CFR 1508.7).

This section describes potential cumulative impacts associated with implementing the Minimum INEEL Processing Alternative. Other actions that could impact the Hanford Site are also identified, and, when possible, a qualitative discussion of their potential cumulative impact is provided.

The Minimum INEEL Processing Alternative, as described in Section ***C.8.2***, would involve treatment of INEEL waste at the Hanford Site. It would also require waste management activities at INEEL, transportation of the untreated waste to Hanford, and transportation of the treated waste from Hanford to INEEL. The activities analyzed in this appendix included only those that would take place at the Hanford Site. Implementation of the Minimum INEEL Processing Alternative would require additional offsite activities not analyzed here (e.g., waste transportation). Such activities would result in cumulative impacts that are not described.

There would be no long-term disposal of INEEL waste at Hanford as the result of the Minimum INEEL Processing Alternative and, therefore, there would be no cumulative long-term disposal impacts to the Hanford Site. Because the INEEL waste would be processed following completion of planned retrieval and treatment of the Hanford Site tank waste, many of the resource area impacts would not be cumulative.

Actions at the Hanford Site that could result in cumulative impacts with the Minimum INEEL Processing Alternative include the Hanford Site waste management and environmental restoration programs, operation of the Environmental Restoration and Disposal Facility, the management of spent nuclear fuel, and activities at the U.S. Ecology Site. The level of activity associated with many of the Hanford Site cleanup functions would be declining by the time treatment of the INEEL waste would begin. Among the cumulative impacts that would occur are impacts to land use and biological resources, human health, transportation, and socioeconomics.

Actions at Other DOE Sites or Facilities and Programmatic Actions that Could Potentially Impact the Hanford Site

Programs or actions at other DOE sites and DOE programmatic evaluations that could impact the Hanford Site are discussed in the TWRS EIS. Potential cumulative impacts would be similar to those identified for the TWRS waste treatment alternatives and include impacts on land use, habitat, health, air quality, transportation, and socioeconomic issues.

Actions Adjacent to the Hanford Site

In addition to DOE waste management activities, there are other nuclear facilities at, or near, the Hanford Site that could contribute to radioactive releases. These facilities include a commercial radioactive waste burial site, a commercial nuclear power plant, a nuclear fuel production plant, and a commercial low-level radioactive and low-level mixed waste treatment facility. These ongoing operations, combined with the proposed Minimum INEEL Processing Alternative, would cumulatively impact socioeconomics, air emissions, health, transportation, and land use.

Currently Planned or Reasonably Foreseeable DOE Actions at the Hanford Site

This section describes the currently planned and reasonably foreseeable actions at the Hanford Site having potential cumulative impacts. The activities are grouped into actions on the Central Plateau and actions in other Hanford Site areas. A number of proposed actions at the Hanford Site may contribute to the cumulative impacts from proposed actions under the Minimum INEEL Processing Alternative. Because the majority of the activity associated with the proposed action would occur approximately 30 years in the future, a quantitative analysis of cumulative impacts from all potential projects is not possible. A complete description of currently planned or reasonably foreseeable DOE actions at the Hanford Site is provided in the TWRS EIS.

The facilities and operations associated with the Minimum INEEL Processing Alternative would occur on the Central Plateau. Currently planned or reasonably foreseeable actions that would occur on the Central Plateau include:

- Closure of the single-shell tanks and double-shell tanks. Current planning includes closure of the Hanford Site Tank Farms following completion of waste retrieval actions. The end state for the Tank Farms is not currently defined. There is a potential for cumulative impacts on land use and habitat resources, air emissions, and socioeconomics.

- Waste Receiving and Processing Facility. The Waste Receiving and Processing Facility would be used to process alpha-contaminated waste for onsite disposal or transuranic waste for eventual shipment to the Waste Isolation Pilot Plant. No potentially cumulative impacts have been identified for this action.

- Effluent Treatment Facility and Liquid Effluent Retention Facility. These facilities would provide for collection, retention, treatment, and disposal of liquid waste, including liquid effluents from the TWRS treatment facilities. No potentially cumulative impacts have been identified for this action.

- U.S. Ecology Low-Level Radioactive Waste Disposal Facility. The U.S. Ecology Low-Level Radioactive Waste Disposal Facility occupies 100 acres of land leased by DOE to Washington state. The facility is located just southwest of the 200-East Area and receives low-level waste from commercial organizations. U.S. Ecology is assumed to continue to receive and emplace commercial low-level waste onsite through the year 2063. There is a potential for cumulative impacts on land use and transportation.

Other currently planned or reasonably foreseeable DOE actions at other Hanford Site areas are documented in the TWRS EIS. To the extent that some of these activities would take place during the same time as the Minimum INEEL Processing Alternative, they have the potential to result in cumulative impacts on land use, habitat, traffic, and socioeconomics.

Summary of Cumulative Impacts

Although many of the activities described previously would occur at the same general time as the Minimum INEEL Processing Alternative, few quantifiable cumulative impacts would be expected because of differences in the nature of the activities and their physical separation.

From a broader environmental perspective, cumulative impacts can be expected in such areas as land use and habitat resources. For example, multiple projects each impacting a small amount of sensitive shrub-steppe habitat eventually could have a more substantial impact by fragmenting the habitat and reducing the total amount of shrub-steppe habitat remaining on the Hanford Site. The cumulative population dose would increase slightly as a result of additional waste treatment operations. Other resource areas such as air quality, socioeconomics, and transportation would have less potential for cumulative impacts due to the schedule for the various activities. Retrieval and treatment of Hanford Site tank waste would be completed prior to initiating INEEL waste processing, so there would be no cumulative air quality impacts from waste processing. Finally, the baseline employment levels at the Hanford Site are projected to be approximately one-half of the current level by 2029 when treatment of the INEEL waste would take place.

The proposed activities would be carried out against the baseline of overall Hanford Site operations. Assuming the Hanford Site's environmental restoration and waste management mission does not change, it is likely that the future range of operational impacts would not be greater than the current impacts associated with Hanford Site waste and operations.

C.8.4.14 Unavoidable Adverse Impacts

This section summarizes the potential unavoidable adverse impacts at the Hanford Site associated with the Minimum INEEL Processing Alternative. Identified herein are those unavoidable adverse impacts that would remain after incorporating all mitigation measures that were part of the development of the TWRS EIS alternatives. Potentially adverse impacts for the Minimum INEEL Processing Alternative are described in Sections C.8.4.1 through C.8.4.12. Additional practicable mitigation measures are identified in Section C.8.4.20 that could further reduce the impacts described in this section.

Geology and Soils

Total soil disturbance would be 52 acres for the Minimum INEEL Processing Alternative (Section C.8.4.1). Large volumes of borrow material would be excavated at the Pit 30 potential borrow site. Borrow material excavation would leave shallow terrain depressions at the excavation site.

Air Quality

Although no applicable air quality standards would be exceeded, substantial air emissions would occur, even with applicable implementation of additional practicable mitigation measures (Section C.8.4.3). Construction and operation activities would result in increased levels of air emissions. Construction activities would produce fugitive dust (particulates) and combustion emissions from the use of heavy equipment and motor vehicles. Operation activities would produce radionuclide emissions, combustion emissions, and hazardous air pollutants. Radionuclide emissions would include strontium-90, technetium-99, americium-241, plutonium isotopes, and cesium-137.

Water Resources

The vadose zone and groundwater aquifer beneath portions of the Hanford Site, including the 200 Areas, currently are contaminated at levels that exceed drinking water standards. Controls on the use of Hanford Site groundwater currently are in place and are expected to continue well into the future.

The Minimum INEEL Processing Alternative would not involve release of waste into the currently contaminated vadose zone beneath the 200 Areas, and eventually into the underlying groundwater aquifer. Therefore, this alternative would not result in levels that exceed water quality requirements (Section C.8.4.2)

Land Use

Permanent land-use commitments would be 3.9 acres for the Minimum INEEL Processing Alternative; however, the potential exists that permanent commitment of land in the 200 Areas to waste disposal uses could occur at the Hanford Site. While the TWRS EIS alternative land use would be compatible with current land use and current plans for future land use of the 200 Areas, the committed areas would be inaccessible for alternative land use. The amount of land involved would be small compared to the total Central Plateau waste management area of the Hanford Site (Section C.8.4.7).

Transportation

The Minimum INEEL Processing Alternative would involve additional motor vehicle traffic, mostly from employees commuting to and from TWRS sites. There would be an increased traffic congestion during daytime peak hours on Stevens Road north of Richland and on Route 4 west of the Wye Barricade. This congestion would especially occur during the period of peak employment (2028 to 2030), which is largely associated with operational activities. Potential transportation accidents, both onsite and offsite, could cause injuries, illness, and a small risk for a fatality (Section C.8.4.10).

Noise

Because the TWRS sites would be located in the interior of the Hanford Site and would be a long distance from populated offsite areas, the only unavoidable adverse noise impact would be temporary wildlife disturbances near construction sites from heavy equipment use (Section C.8.4.9).

Aesthetic and Scenic Resources

Constructing facilities and performing borrow site excavation activities would affect the visual environment, particularly from elevated locations onsite (e.g., Gable Mountain, Gable Butte, and Rattlesnake Mountain that are used by Native Americans for religious purposes). Facilities developed in the 200-East Area would be visible in the distant background from State Route 240 and from offsite elevated locations. Section C.8.4.8 provides more detail on unavoidable adverse impacts.

Biological and Ecological Resources

The Minimum INEEL Processing Alternative would affect shrub-steppe habitat in the 200 Areas and at least one of the three potential borrow sites (Section C.8.4.4). In the affected shrub-steppe habitat areas, there would be a loss of plants; loss or displacement of wildlife species (e.g., birds, small mammals); and a resulting loss of food supplies for birds of prey and predatory mammals.

A small percentage (less than one-half of 1 percent) of the Hanford Site's total shrub-steppe area would be affected, and only individual species members potentially would be impacted, rather than the species as a whole. However, a number of plant and wildlife species of concern (species that are classified as candidates for listing as threatened or endangered, or by the state as monitor or sensitive species) potentially would be affected.

Given that the sites proposed for HLW management facilities under the Minimum INEEL Processing Alternative all lie within the boundaries of 200 East Area, habitat fragmentation is not a concern. All of the proposed sites are in an area dedicated to industrial use since the 1940s that already contains a number of established facilities and is encircled by perimeter roads. Although some shrub-steppe habitat is present in undeveloped portions of 200 East Area, its value as wildlife habitat is diminished by the fact that it is effectively isolated from large, unbroken expanses of shrub-steppe to the north and south. One of the proposed facilities would be placed outside of 200 East Area, thus no unbroken tracts of shrub-steppe habitat (or any other habitat) would be affected.

Cultural Resources

Prehistoric and historical materials and sites in the 200 Areas are scarce, and the TWRS sites currently are heavily disturbed (the 18 Tank Farms) or partly disturbed (the proposed waste treatment facility sites) (Section C.8.4.5).

Socioeconomics

The Minimum INEEL Processing Alternative would involve short-term socioeconomic impacts that would stem largely from rapid fluctuations in employment during construction and operations (Section C.8.4.6). However, these impacts would not affect the on-going Phased Implementation Alternative and would not produce impacts on housing prices stemming from rapid increases in local population. The increases in local population also would not require hiring additional local police and fire department personnel. The increase in local population would lead to increased enrollment in schools but not to an adverse effect.

Health Effects

The Minimum INEEL Processing Alternative would pose some risks of adverse health effects. The risk of adverse health effects would be limited mainly to workers (Section C.8.4.11).

Accidents

The Minimum INEEL Processing Alternative would involve potential accidents. This would include occupational, radiological, and chemical accidents that could cause injuries, illness, and latent cancer fatalities. Occupational injuries, illnesses, and fatalities would be directly dependent on the number of person-years of labor required to complete the activity. Thus, the more person-years of labor the more injuries, illnesses, and fatalities (Section C.8.4.12 for accidents).

Committed Resources

The Minimum INEEL Processing Alternative would consume water, concrete, and electricity; would use borrow materials; and would consume process chemicals. Although all of these resource consumption impacts would be within existing capacity, the resources would be unavailable for alternative uses.

C.8.4.15 Relationship Between Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

For the Minimum INEEL Processing Alternative, the short-term period was considered to be the construction, operation, and decontamination and decommissioning phases (scheduled to be completed by 2032). Most short-term environmental impacts would occur during the construction and operations phases. Over the short-term there would be increased air emissions and noise, solid and liquid waste generation, and increased risk of accidents and illness, primarily to workers involved with implementing the alternative compared to not performing remedial action. Implementing the alternative would consume both natural and human-made resources (e.g., fuels, concrete, steel, and chemicals) but would not be expected to cause shortages or price increases as a result of their resource consumption. Over the short term, land areas would be committed that would affect biological resources.

Compared with performing no Hanford Site tank waste remedial action, the Minimum INEEL Processing Alternative would increase expenditure of Federal funds in the Tri-Cities. These would result in increased employment and economic activity associated with these expenditures. The Minimum INEEL Processing Alternative would have short-term impacts on the human environment through short-term fluctuations in employment and population and the associated impacts on public services.

The long-term impacts on the natural environment of the Minimum INEEL Processing Alternative would be due in large part to how much waste would remain on the Hanford Site after the alternative was fully implemented, and how much of the remaining waste would be immobilized or left untreated. Since all the waste is shipped to the Hanford Site from INEEL and then returned to INEEL, no long-term impacts associated with disposal or storage would occur.

C.8.4.16 Irreversible and Irretrievable Commitment of Resources

Just-in-Time Shipping Scenario

Under this scenario, additional irreversible and irretrievable commitment of resources would be required to support the construction, operation, and decontamination and decommissioning of the Calcine Dissolution Facility and operations at the separations and vitrification facilities (Table C.8-21). Resource requirements for the Calcine Dissolution Facility and the separations and vitrification facilities are provided in Sections C.8.5.2 and C.8.5.3, respectively. Incremental impacts for most resource commitments would range from 1 to 32 percent but would be generally very small (less than 5 percent). The largest incremental impact (32 percent) would be for fossil fuel, which would result primarily from operations at the separations and vitrification facilities. This scenario would not substantially change the understanding of irreversible and irretrievable commitment of resources presented in the TWRS EIS for the Phased Implementation Alternative.

Interim Storage Shipping Scenario

This scenario would result in slightly greater irreversible and irretrievable commitments of resources than the Just-in-Time Shipping Scenario because of the additional resource requirements for construction, operation, and decontamination and decommissioning of three new Canister Storage Buildings (Table C.8-21). Resource requirements for the Canister Storage Buildings, the Calcine Dissolution Facility, and the separations and vitrification facilities are provided in Sections C.8.5.1, C.8.5.2, and C.8.5.3, respectively. Incremental impacts would be slightly larger than for the Just-in-Time Shipping Scenario but would still be small (generally less than 10 percent). The largest incremental impact (34 percent) would again be for fossil fuel, due primarily to operations at the separations and vitrification facilities. Although the incremental impacts for this scenario would be slightly greater, this scenario still would not substantially change the understanding of irre-

Table C.8-21. Revised irreversible and irretrievable commitment of resources – Minimum INEEL Processing Alternative.

Tank Waste Alternative		Component	Commitment
Phased Implementation Alternative[a]		Land permanently committed (acres)	120
		Sand/gravel/silt/rip rap (cubic meters)	4.1×10^6
		Steel (metric tons)	3.4×10^5
		Concrete (cubic meters)	1.1×10^6
		Total water usage (cubic meters)	1.9×10^7
		Electric power (GWh)	1.1×10^4
		Fossil fuel (cubic meters)	1.9×10^5
		Process chemicals (metric tons)	9.8×10^5
		Cost (billions of dollars[b])	30 to 38
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	Land permanently committed (acres)	3.9
		Sand/gravel/silt/rip rap (cubic meters)	3.4×10^4
		Steel (metric tons)	3.2×10^3
		Concrete (cubic meters)	2.6×10^4
		Total water usage (cubic meters)	1.6×10^5
		Electric power (GWh)	930
		Fossil fuel (cubic meters)	5.9×10^4
		Process chemicals (metric tons)	1.0×10^5
		Cost (millions of dollars)	360
	Interim Storage Shipping Scenario	Land permanently committed (acres)	3.9
		Sand/gravel/silt/rip rap (cubic meters)	2.9×10^5
		Steel (metric tons)	1.6×10^4
		Concrete (cubic meters)	7.0×10^4
		Total water usage (cubic meters)	1.7×10^5
		Electric power (GWh)	940
		Fossil fuel (cubic meters)	6.4
		Process chemicals (metric tons)	1.0×10^5
		Cost (millions of dollars)	820
Total impacts[c]	Just-in-Time Shipping Scenario	Land permanently committed (acres)	120
		Sand/gravel/silt/rip rap (cubic meters)	4.1×10^6
		Steel (metric tons)	3.4×10^5
		Concrete (cubic meters)	1.1×10^6
		Total water usage (cubic meters)	1.9×10^7
		Electric power (GWh)	1.2×10^4
		Fossil fuel (cubic meters)	2.5×10^5
		Process chemicals (metric tons)	1.1×10^5
		Cost (billions of dollars[b])	30 to 39
	Interim Storage Shipping Scenario	Land permanently committed (acres)	120
		Sand/gravel/silt/rip rap (cubic meters)	4.4×10^6
		Steel (metric tons)	3.6×10^5
		Concrete (cubic meters)	1.2×10^6
		Total water usage (cubic meters)	1.9×10^7
		Electric power (GWh)	1.2×10^4
		Fossil fuel (cubic meters)	2.5×10^5
		Process chemicals (metric tons)	1.1×10^6
		Cost (billions of dollars[b])	31 to 39

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a. Estimates include remediation and closure as landfill (Phase 1 and 2).

b. Total estimated cost range including repository fee.

c. Total impact estimates include the total Phased Implementation Alternative (Phase 1 and 2) plus the Minimum INEEL Processing Alternative.

versible and irretrievable commitment of resources presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.17 Conflict Between the Proposed Action and the Objectives of Federal, Regional, State, Local, and Tribal Land-Use Plans, Policies or Controls

All activities proposed for the Hanford Site, under both the Just-in-Time Shipping Scenario and the Interim Storage Shipping Scenario of the Minimum INEEL Processing Alternative, would occur with the 200 Areas. Thus there would be no conflicts between land use plans associated with construction andoperations of waste storage and treatment facilities under this alternative and Federal, state, or local plans and policies. However, the Minimum INEEL Processing Alternative would present similar conflicts with land use plans and policies of Tribal Nations as presented in the TWRS EIS for the Phased Implementation Alternative. These conflicts are summarized in Sections C.8.4.5 and C.8.4.19.

C.8.4.18 Pollution Prevention

The Minimum INEEL Processing Alternative would be required to incorporate pollution prevention into their planning and implementation activities as would be required by the Phased Implementation Alternative. This includes reducing the quantity and toxicity of hazardous, radioactive, mixed, and sanitary waste generated at the Hanford Site; incorporating waste recycle and reuse into program planning and implementation; and conserving resources and energy.

C.8.4.19 Environmental Justice

For each area of technical analysis presented in the TWRS EIS, a review of impacts to the human and natural environment was conducted to determine whether any potentially disproportionately high and adverse impacts on minority populations or low-income populations would occur. The review included potential impacts on land use; socioeconomics (e.g., employment, housing prices, public facilities, and services); water quality; air quality; health effects; accidents; and biological and cultural resources. For each of the areas of analysis, impacts were reviewed to determine whether there would be any potential high and adverse impacts to the population as a whole due to construction, routine operations, or accident conditions. If an adverse impact was identified, a determination was made as to whether minority populations or low-income populations would be disproportionately affected.

For the purposes of that assessment, disproportionate impacts were defined as impacts that would affect minority and Native American populations or low-income populations at levels appreciably greater than their effects on non-minority populations or non-low-income populations. Adverse impacts were defined as negative changes to the existing conditions in the natural environment (e.g., land, air, water, wildlife, vegetation) or in the human environment (e.g., employment, health, land use).

During consultation with affected tribal nations on the TWRS EIS, representatives of the Yakama Indian Nation and the Confederated Tribes of the Umatilla Indian Reservation expressed the view that impacts associated with the alternatives could adversely impact the cultural values of affected tribal nations to the extent that they involve disturbance or destruction of ecological and biological resources, alter land forms, or pose a noise or visual impact to sacred sites. The level of impact to cultural values associated with natural resources would be proportional to the amount of land disturbed under each alternative.

A similar concern to Native American populations may be raised by the Minimum INEEL Processing Alternative. This concern would involve continued restrictions on access to portions of the 200 Areas that could restrict access to the 200 Areas by all individuals, including the Confederated Tribes and Bands of the Yakama Indian Nation and the Confederated Tribes of the Umatilla Indian Reservation. The Tribes have expressed an interest in access to and unrestricted use of the Hanford Site. Land use restrictions under the Minimum INEEL Processing Alternative would last until 2032.

The Department has concluded that the Minimum INEEL Processing Alternative would not result in high and adverse impacts on the population as a whole, but recognizes that Native American tribes in the Hanford region consider the continuation of restrictions on access to lands at Hanford to have an adverse impact on all elements of the natural and physical environment and to their way of living within that environment.

C.8.4.20 Mitigation Measures

In the TWRS EIS, measures were addressed to mitigate potential impacts of the Phased Implementation Alternative, including (1) measures to prevent or mitigate environmental impacts and (2) additional measures that could further reduce or mitigate potential environmental impacts described previously in other portions of the TWRS EIS, if deemed necessary. The TWRS EIS focused on measures to mitigate potential impacts during remediation and indicated that future NEPA documentation would specifically address in detail impacts and mitigation of post-remediation tank closure where, for example, most of the borrow site activity impacts would occur.

The type of impacts resulting from the Minimum INEEL Processing Alternative would be similar to those evaluated in the TWRS EIS for the Phased Implementation Alternative. Therefore, the same type of mitigation measures would be included for the Minimum INEEL Processing Alternative.

C.8.5 CALCINE PROCESSING PROJECT DATA

C.8.5.1 Canister Storage Buildings

Overview

This project describes the costs and impacts of the Canister Storage Buildings (Canister Storage Buildings) necessary to store INEEL calcined waste under the Interim Storage Shipping Scenario. Under this scenario, the INEEL calcine would be shipped to the Hanford Site for storage in a Canister Storage Building beginning in 2012. Each year, approximately 260 canisters (308 cubic meters) of calcine would be shipped from INEEL to the Hanford Site. Additional Canister Storage Buildings would be constructed as needed. A total of three Canister Storage Buildings would be required to store the INEEL calcine. Shipments to the Hanford Site would be completed in 2025, and the INEEL waste would remain in storage pending the availability of the Calcine Dissolution Facility (Section C.8.5.2) and TWRS separations/vitrification facilities (Section C.8.5.3).

General Project Objectives

The project described in this Project Summary is part of the Interim Storage Shipping Scenario under the Minimum INEEL Processing Alternative of this Idaho HLW & FD EIS. The Interim Storage Shipping Scenario involves shipments of calcine from INEEL to the Hanford Site for storage in Canister Storage Buildings prior to the availability of the TWRS treatment facilities. The project addresses the costs and provides data to support the impacts analysis for the Canister Storage Buildings.

Process Description

The Canister Storage Buildings receive solid calcine from the INEEL. Calcine would be packaged in Hanford Site HLW canisters, each with a capacity of approximately 1.17 cubic meters. The calcine canisters would be stored until the calcine dissolution processes begin in 2028 (timed to coincide with the availability of double-shell tank storage space in the AP Tank Farm).

Facility Description

The Canister Storage Building presented is based upon a three-bay facility currently under construction at the Hanford Site to store spent nuclear fuel canisters. Over the last 10 years, several design packages have been developed for Canister Storage Buildings at both the Hanford Site and the Savannah River Site. The following three design documents were reviewed as part of this analysis:

- Project W-379 Spent Nuclear Fuel Canister Storage Building Detail Design Report August 1996

- Project W-464 Conceptual Design Report for Immobilized High-Level Waste Interim Storage Facility (Phase 1) HNF-2298, Revision 1

- DWPF Sludge Plant CAC Cost Estimate, dated December 14, 1983

Each Canister Storage Building would be approximately 3,700 cubic meters in plan area and would consist of a large subsurface vault with three individual bays. Each bay could hold 440 Hanford HLW canisters [the Hanford canisters are 0.61 meter (2 feet) in diameter by 4.5 meter (14 feet and 9 inches) long], for a total of approximately 1,320 Hanford HLW canisters per Canister Storage Building.

The Canister Storage Buildings consist of below grade concrete vaults accessed through a grade level operating deck. The operating deck is enclosed by a prefabricated metal structure. The operating deck is designed to support a 160,000 pound shielded canister transporter. The canister load-in/load-out area, operating deck, and support building are equipped with a HVAC system with high-efficiency particulate air filters. The Canister Storage Building vault areas are cooled by a natural convection cooling system that utilizes once-through unfiltered air, which exits through a common stack. The Canister Storage Building has a material service/design life of 75 years.

The cost data for this project are based upon current Hanford conceptual design information presented in Hanford Project W-464 for a three-bay Canister Storage Building constructed in the 200-East Area of the Hanford Site. The cost of the shielded canister transporter and other canister handling equipment was not included in the cost estimate for this project. It is assumed that all HLW canister handling equipment would have been purchased previously by the Hanford TWRS program and can be utilized for the INEEL waste. Construction and operations project data appear in Table C.8-22; decontamination and decommissioning data appear in Table C.8-23.

C.8.5.2 Calcine Dissolution Facility

Overview

This project describes the costs and impacts of the Calcine Dissolution Facility. The Calcine Dissolution Facility receives solid calcine from the Canister Storage Buildings (under the Interim Storage Shipping Scenario) or directly from INEEL (under the Just-in-Time Shipping Scenario). The calcine is received in Hanford Site HLW canisters, which are emptied and the solids dissolved using nitric acid. Undissolved solids (gamma-emitting alumina and zirconia) are removed and the resultant solution is neutralized using sodium hydroxide to a pH of 7. The dissolved calcine product is stored in existing double-shell tanks (specifically the AP Tank Farm which is well within its 50-year design life). The solution is then transferred to the existing TWRS separations/vitrification facilities (see Section C.8.5.3) for final treatment.

General Project Objectives

The project described in this Project Summary is part of the Minimum INEEL Processing Alternative of this Idaho HLW & FD EIS. INEEL waste would be received at the Hanford Site in a solid (calcine) form and would be dissolved at the Calcine Dissolution Facility to produce a material compatible with the existing double-shell tanks and TWRS separations/vitrification processes. This project addresses the costs and provides data to support the impacts analysis for the Calcine Dissolution Facility.

Process Description

Canisters containing calcine would be transported from a Canister Storage Building to the Calcine Dissolution Facility in a shielded canister transporter (under the Interim Storage Shipping Scenario), or unloaded from rail cars shipped from the INEEL (under the Just-in-Time Shipping Scenario). The Calcine Dissolution Facility would process the calcine over 27 months, starting in February 2028 and ending in April 2030. It is assumed that the calcine would be processed as a mixed alumina/zirconium calcine at average concentrations. At 80-percent

Table C.8-22. Construction and operat ion project data for Canister Storage Building (HCSB-1).

Generic Information	
Description/function and EIS Project number:	Interim storage of INEEL Calcine
EIS alternatives/options:	Min. INEEL Proc. Alternative
Project type or waste stream:	Calcine
Action type:	New
Structure type:	Concrete and steel buildings
Size: (m^2)	11,710
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Hanford 200 Area
Inside/outside of building:	
Construction Information	
Schedule start/end:	
Preconstruction:	
CSB #1:	January 2009-January 2010
CSB #2:	January 2014-January 2015
CSB #3:	January 2019-January 2020
Construction:	
CSB #1:	January 2010-January 2012
CSB #2:	January 2015-January 2017
CSB #3:	January 2020-January 2022
Number of workers: (new/existing)	79/0 each yr
Nonradiation	79
Number of radiation workers	None
Average annual worker radiation dose (rem/yr)	None
Transportation mileage	
Truck: (km/yr)	200,000
Rail:	0
Employees: (km/yr)	2,130,074
Heavy Equipment:	
Equipment used	Excavator, grader, crane, delivery trucks
Hours of operation: (hr/ yr)	15,600
Acres disturbed (per CSB)	
New (acres)	15
Previous (acres)	None
Revegetated (acres)	None
Air Emissions:	
Construction total: (tons/ yr)	1,022
Dust: (tons/yr)	216
Major gas (CO_2) from diesel exhaust: (tons/ yr)	764
Contaminants[a] from diesel exhaust: (tons/ yr)	42
Effluents:	
Sanitary wastewater: (L/ yr)	1,943,598
Solid wastes:	
Construction trash: (m^3/yr)	936
Hazardous/toxic chemicals and wastes	
Generation (used lube oil): (m^3/yr)	3
Storage/inventory: (m^3/yr)	0.2
Pits/ponds created: (m^2/yr)	465 (per CSB)

Table C.8-22. Construction and operation project data for Canister Storage Building (HCSB-1) (continued).

Construction Information (continued)	
Water Usage:	
Dust control: (L/yr)	151,400
Domestic water: (L/yr)	1,943,598
Energy requirements	
Electrical: (MWH/yr)	2,850
Fossil fuel: (L/yr)	354,276
Operational Information	
Schedule start/end:	
CSB #1	January 2012-April 2030
CSB #2	January 2017-April 2030
CSB #3	January 2022-April 2030
Number of workers each year of operation (new/existing)	
Total:	9/0
Radiation workers:	9/0
Average annual worker radiation dose: (person-rem/yr)	1.8
Transportation mileage	
Truck:	0
Rail:	0
Employees: (km/yr)	242,667
Heavy equipment:	Canister transporter, occasional delivery trucks
Hours of operation: (hrs/yr)	5,840
Air emissions:	
Fossil fuel emissions: (tons/yr)	302
Effluents:	
Sanitary wastewater: (L/yr)	221,423
Solid wastes:	
Sanitary/industrial trash: (m^3/yr)	50
Radioactive wastes:	None
Hazardous/toxic chemicals and wastes	
Generation: (m^3/yr)	1.11
Pits/ponds used: (m^2)	None
Water usage	
Process water: (L/yr)	0
Domestic water: (L/yr)	221,423
Energy requirements	
Electrical: (MWH/yr)	44
Fossil fuel: (L/yr)	132,626

a. CO, NO_x, SO_2, hydrocarbons, particulates.

operating efficiency, the facility has the capacity to handle six Hanford (1.17-cubic meters) canisters per day. This is also the feed rate necessary to meet the TWRS vitrification plant operating capacities.

The Calcine Dissolution Facility processing zones are Unloading/Loading, Air Lock/Decon, and Hot Cell with Inter Zone Transfer.

Unloading/Loading. Calcine is delivered into the unloading/loading bay by a shielded canister transporter, which contains the canister enclosed within a shielded cask. This cask is centered over a receiving plug within the unloading/loading building. The transporter removes the plug and lowers the canister into the transfer cage located below ground level which moves the canister through the rest of the process. The transporter then replaces the plug and returns to retrieve another canister.

Air Lock/Decon. Calcine canisters are moved into the air lock in preparation for hot cell entry.

Table C.8-23. Decontamination and decommissioning project data for Canister Storage Building (HCSB-1).

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	June 2030-June 2031
Number of workers each year of D&D (new/existing):	84/0 per year
Number of radiation workers (D&D):	None
Avg. annual worker radiation dose:	0 (person-rem/yr)
Transportation mileage	
Truck: (km/yr)	390,000
Rail:	0
Employee: (km/yr)	2,264,889
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	49,920
Acres disturbed	
New: (acres)	None
Previous: (acres)	None
Revegetation: (acres)	45
Air emissions: (None/Reference)	
Dust: (tons/yr)	0
Gases (CO_2): (tons/yr)	2,445
Contaminants[a]: (tons/yr)	134
Effluents	
Non-radioactive sanitary wastewater: (L)	2,066,610
Solid wastes	
Non-radioactive (industrial): (m^3/yr)	996
Hazardous/toxic chemicals & wastes	
Generation (used lube oil): (m^3/yr)	9.45
Storage/inventory: (m^3/yr)	0.73
Pits/Ponds created:	None
Water usage	
Process water: (L)	151,400
Domestic water: (L)	2,066,610
Energy requirements	
Electrical: (MWh/yr)	1,500
Fossil fuel: (L)	1,133,683

a. CO, NO_x, SO_2, hydrocarbons.

This area is also used for decontamination during normal operation and also for maintenance operations on cranes and equipment within the hot cell. Normal decontamination occurs within this area on empty canisters and cages. Empty calcine canisters are decontaminated for reuse in the HLW vitrification process.

Hot Cell. Canisters are delivered through the air lock into the hot cell. The first operation is to cut open the canister. The cutting operation also bevels the edge to allow for rewelding and reuse of the canisters. This operation is required to be under a negative pressure relative to the surroundings and provide positive dust control and total spark control. Cutting waste is directed to a grinder to granularize the cutting waste for subsequent processing.

After opening, the canister contents are removed using a vacuum-assisted auger design which transfers the calcine to one of two bins. The canister is then pre-cleaned to remove or stabilize the remainder of the powder. The entire operation of cutting, vacuuming, and pre-cleaning the canister is within a constant dust controlled process, sealed to prevent dust migration.

The calcine is delivered by vacuum to a cyclone separator which discharges into one of two feed bins. The feed bins are equipped with 0.03 micron sintered metal filters. Exhaust from the feed bin filters is routed through dual high-efficiency particulate air filters prior to discharging to the atmosphere.

Calcine is delivered from the feed bins to the dissolving tanks using rotary feeders. The dissolving tanks are operated using 6 molar nitric acid and are heated by steam for 2 hours prior to discharge. The dissolving tanks are agitated using a bottom rake and propeller design with a thorough mixing level of agitation. The concentration of the nitric acid is monitored during the cooking stage to keep above a 1-molar concentration. This should dissolve the majority (approximately 97 weight percent) of the calcine solids. Once the cooking stage is completed, any undissolved solids are separated and the solution is transferred to pH adjustment tanks where the pH is adjusted to basic conditions (above a pH of 7) with sodium hydroxide. This solution is then pumped into the double-shell tanks of the AP Tank Farm for lag storage pending further processing in the TWRS separations/vitrification facility. Assuming the calcine can be placed in solution using 10 liters (2.6 gallons) of nitric acid per kilogram of calcine, dissolution and neutralization of the INEEL HLW calcine would result in approximately 19.8 million gallons of calcine solution over a 17-month period of operations. Although the volume of the dissolved calcine is relatively large, the total radioactivity of this material is small in comparison to the Hanford tank wastes. The undissolved solids are transferred to the TWRS vitrification facility for processing into HLW glass.

Inter Zone Transfer. The transfer cage is mounted on wheels and is transported by gravity on an inclined track. Stops are installed at each key point to hold the cage in place while undergoing different handling steps. After the calcine is unloaded, the canister is returned through a continuous track to the unloading/loading building. The empty canister is removed by a transporter vehicle in a similar manner as the unloading operation and the cage is returned to its original position for processing another canister. Up to five canisters would be in process at any one time.

Double-Shell Tanks Lag Storage

The eight 1-million gallon double-shell tanks in the AP Tank Farm would be used for lag storage of the dissolved calcine solution prior to separations and vitrification. This would require that the Calcine Dissolution Facility be located close to the double-shell tanks. The solution from the Calcine Dissolution Facility pH control tanks would be pumped into the tanks for lag storage. While in storage, the slurry would be continuously mixed to prevent sludge settling. Once sufficient waste had accumulated in the tanks to support operations of the TWRS separations/vitrification facilities, the waste would be slurried using a mixer pump and pumped to the separations facility through the waste transfer lines.

Facility Description. This project addresses the costs and impacts of the Calcine Dissolution Facility. The Calcine Dissolution Facility includes three operating levels with floor space of 16,256 square feet on the Main Floor, 9,640 square feet on the Lower Floor, and 14,567 square feet on the Upper Floor. The Calcine Dissolution Facility is designed to house the equipment and systems for receiving the INEEL calcine canisters, dissolving the calcine, transferring the neutralized calcine solution to the double-shell tanks, and collecting any undissolved solids for processing in the HLW vitrification facility.

The Calcine Dissolution Facility building consists of four potentially contaminated zones and a clean zone for normal office and control operations. Zone 1, Hot Cell and the Crane Maintenance area, is kept at -0.75 inch W.C.; Zone 2 is at -0.25 inch W.C.; Zone 3 is a -0.1 inch W.C.; and Zone 4 is at -0.05 inch W.C. The clean zone is at 0.1 inch W.C.

Zone 1 is supplied with high-efficiency particulate air filtered air from an incoming air handler as well as air from Zone 3 which is not required for Zone 2. Negative pressure is maintained and the exhaust air is filtered through two high-efficiency particulate air filters prior to exhausting to outside air environment.

Zone 2, which is made up of the Air Lock/Decon area and the transport trenches, receives air from Zone 3 and pressure is maintained negative to Zone 3. Exhaust air is filtered by two high-efficiency particulate air filters prior to exhausting to the outside air environment.

Zone 3 contains the Direct Operations, Motor Gallery, and Mechanical Room. Zone 3 supplies air to Zone 1 and Zone 2 is kept negative to outside air and to Zone 4. Because this is air is completely used by other zones it is also filtered by two high-efficiency particulate air filters prior to exhausting to the outside air environment.

Zone 4 is the canister incoming and outgoing area. It has its own air supply and provides an air lock between the building and outside air for incoming and outgoing materials. It is maintained negative to outside air, and the exhaust air is filtered by two high-efficiency particulate air filters prior to exhausting to the outside air environment.

The clean zone is maintained positive to outside air and contains offices, change rooms, control room and storage. This space is separately heated and air conditioned from the rest of the space.

The construction and operations project data for the Calcine Dissolution Facility appear in Table C.8-24; the decontamination and decommissioning data appear in Table C.8-25.

C.8.5.3 Calcine Separations and Vitrification

Overview

This project describes the costs and provides data to support the impacts analysis associated with the processing of dissolved calcine from the Calcine Dissolution Facility in the TWRS separations/vitrification facilities. The separations/vitrification facilities are existing TWRS facilities as described in the TWRS EIS under the Phased Implementation Alternative. The separations/vitrification facilities would process INEEL calcine waste for 17 months. This project provides covers operational impacts only; construction and decontamination and decommissioning of the TWRS separations/vitrification facilities are covered in the TWRS EIS.

General Project Objectives

The project described in this Project Summary is part of the Minimum INEEL Processing Alternative of this Idaho HLW & FD EIS. This project addresses the costs and impacts of operating the TWRS separations/vitrification facilities to process the INEEL waste.

Process Description

Separations and vitrification of the INEEL waste would require operation of the existing TWRS equipment, transfer line(s) from the double-shell tanks to the separations/vitrification facilities, and continuous mixing of the double-shell tanks.

The separations process would involve the following steps:

- Solids washing and solid-liquid separations
- Separations processing to remove cesium, technetium, strontium, and transuranics from the liquid stream
- Vitrification of the solid fraction and any undissolved solids from calcine dissolution in the Calcine Dissolution Facility in the TWRS HLW vitrification facility
- Vitrification of the liquid fraction in the TWRS low activity waste vitrification facility

After washing and separations processing, the waste would be stored in tanks within the vitrification facilities where it would be characterized and evaporated to remove excess water. The concentrated liquid or slurry waste would then enter the melter feed section of the vitrification facility.

The low-activity waste stream would be combined with glass formers. In order to produce a glass product with acceptable properties, the low-activity waste glass formulation is limited to 15 weight percent sodium oxide in the glass. Glass formers would be added to the melter feed to maintain the required sodium oxide loading. Following vitrification, the molten low-activity waste glass would be poured into 1.8 meters long by 1.2 meters wide by 1.2 meters high (2.6 cubic meters) steel boxes. A total of 14,400 cubic meters or 5,550 containers of vitrified low-activity waste would be produced.

Table C.8-24. Construction and operation project data for the Calcine Dissolution Facility (CALDIS-001).

Generic Information	
Description/function and EIS project number:	Facility to unload INEEL calcine containing canisters and separate waste into HAW and LAW
EIS alternatives/options:	Minimum INEEL Processing Alternative
Project type or waste stream:	INEEL Aluminum and Zirconium Calcine and SBW Ion Exchange Resin
Action type:	New
Structure type:	Concrete and steel building
Size: (m^2)	3,761
Other features: (pits, ponds, power/water/sewer lines)	Extension to existing underground utilities
Location:	Hanford 200 Area
Construction Information	
Schedule start/end:	
Construction:	Dec. 2023 - Dec. 2027
Number of workers: (new/existing)	
Nonradiation	286/0 each yr
Number of radiation workers	None
Average annual worker radiation dose (rem/yr)	None
Transportation mileage	
Truck: (km/yr)	67,500
Rail:	0
Employees: (km/yr)	7,711,407
Heavy Equipment:	
Equipment used	Excavators, graders, cranes, concrete trucks, material delivery trucks, and water trucks
Hours of operation: (hr/yr)	2,080
Acres disturbed and duration:	August 2010 – December 2037
New (acres)	6.80
Previous (acres)	None
Revegetated (acres)	None
Air Emissions:	
Construction total: (tons/yr)	83
Dust: (tons/yr)	56
Major gas (CO_2) from diesel exhaust: (tons/yr)	25
Contaminants[a] from diesel exhaust: (tons/yr)	1.4
Effluents:	
Sanitary wastewater: (L/yr)	7,035,679
Solid wastes:	
Construction trash: (m^3/yr)	3,384
Hazardous/toxic chemicals and wastes	
Generation (used lube oil): (m^3/yr)	0.39
Storage/inventory: (m^3/yr)	0.36
Pits/ponds created: m^2	465
Water Usage:	
Dust control: (L/yr)	151,400
Domestic water: (L/yr)	7,035,679
Energy requirements	
Electrical: (MWH/yr)	208
Fossil fuel: (L/yr)	47,237

Table C.8-24. Construction and operation project data for the Calcine Dissolution Facility (CALDIS-001) (continued).

Operational Information	
Schedule start/end:	February 2028-April 2030
Number of workers each year of operation (new/existing)	
Operations	15/0
Maintenance	6/0
Support	2/0
Total:	23/0
Radiation workers:	23 (included in above total)
Average annual worker radiation dose: (person-rem/yr)	4.6 (200 millirem/worker)
Transportation mileage	
Truck:	662,990
Rail:	0
Employees: (km/yr)	620,148
Heavy equipment:	
Hours of operation: (hrs/yr)	3,650
Air emissions:	
CO_2 from diesel exhaust (tons/yr)	3,431
Contaminants[a]: (tons/yr)	187
Process radioactive air emissions: (Ci/yr)	1.99×10^{-4}
Other oxide air emissions: (kg/yr)	
B_2O_3	6.52×10^{-7}
BaO	2.44×10^{-8}
CaO	1.12×10^{-6}
CdO	2.40×10^{-7}
Cr_2O_3	9.41×10^{-8}
Fe_2O_3	1.50×10^{-7}
$MgCO_3$	6.79×10^{-7}
MnO	3.48×10^{-9}
Effluents:	
Sanitary wastewater: (L/yr)	565,858
Solid wastes:	
Sanitary/industrial trash: (m^3/yr)	127
Process output	
Dissolved calcine to TWRS treatment system: (L/yr)	33,288,889
Radioactive wastes:	
HEPA filters: (m^3/yr)	8
Misc. radioactive wastes: (m^3/yr)	34
Total: (m^3/yr)	42
Hazardous/toxic chemicals and wastes	
Generation (hazardous wastes): (m^3/yr)	1

Table C.8-24. Construction and operation project data for the Calcine Dissolution Facility (CALDIS-001) (continued).

Operational Information (continued)	
Process chemicals (nitric acid, sodium hydroxide): (m^3/yr)	31,371
Pits/ponds used: (m^2)	None
Water usage	
Process water: (L/yr)	26,750,511
Domestic water: (L/yr)	565,858
Energy requirements	
Electrical: (MWH/yr)	13,615
Equivalent fuel oil to generate required steam: (L/yr)	670,197
Equipment/vehicle fuel: (L/yr)	82,892
Total fossil fuel: (L/yr)	753,089

a. CO, NO_x, SO_2, hydrocarbons.

The HLW stream would also be combined with glass formers. The limiting constituent in the HLW stream is zirconium. In order to produce a glass product with properties acceptable for disposal in the proposed geologic repository, the HLW glass formulation is limited to 13 weight percent zirconium oxide in the glass. Glass formers would be added to the melter feed to maintain the required zirconium oxide loading. Following vitrification, the molten HLW glass would be poured into 1.17 cubic meters canisters. A total of ***3,500*** cubic meters or ***3,000*** canisters of vitrified HLW would be produced.

The vitrification processes would generate large off-gas streams that would be treated to minimize air emissions. The off-gas treatment systems would capture and partially recycle contaminants in the off-gas streams back to the melter feed streams.

Liquid effluents from both the HLW and low-activity waste vitrification facilities would be treated at the existing Effluent Treatment Facility. The liquid effluent from processing the INEEL waste would be similar to Hanford's 242-A Evaporator condensate stream, which meets the current waste acceptance criteria for the Effluent Treatment Facility.

Facility Description

This project addresses the cost and impacts of the operation of the TWRS separations/vitrification facilities to process the INEEL calcine waste. The separations/vitrification facilities and support facilities would be constructed as described for the Phased Implementation Alternative in the TWRS EIS. The HLW vitrification facility would be designed to produce 20 metric tons of HLW glass per day. The low-activity waste facility would be designed to produce 185 metric tons per day of low-activity waste glass. Vitrified low-activity waste and HLW would be placed on pads in the 200-East Area or returned to Canister Storage Buildings until it can be transported back to INEEL. Construction and operations project data appear in Table C.8-26.

Table C.8-25. Decontamination and decommissioning project data for the Calcine Dissolution Facility (CALDIS-001).

Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	April 2030-April 2032
Number of workers each year of D&D (new/existing):	312/0 each yr
Number of radiation workers (D&D):	312
Avg. annual worker radiation dose:	62 (200 mrem/worker)
Transportation mileage	
Truck: (km/yr)	42,500
Rail:	0
Employee: (km/yr)	8,405,631
Heavy equipment	
Equipment used:	Dozers, dump trucks, loaders, cranes, concrete trucks
Hours of operation: (hrs)	2,080
Acres disturbed	
New: (acres)	None
Previous: (acres)	None
Revegetation: (acres)	6.80
Air emissions	
Non-radioactive:	
Gases (CO_2): (tons/yr)	51
Contaminants[a]: (tons/yr)	2.78
Radioactive	
HEPA filtered offgas: (Ci/yr)	0.80
Effluents	295,264
Radioactive	132,860
Spent decontamination solution: (L/yr)	
Non-radioactive	
Sanitary wastewater: (L)	7,669, 763
Radioactive wastes	3,679
Radioactive waste quantity[b]: (m^3/yr) (Ci/yr)	37
Solid wastes	
Industrial trash: (m^3/yr)	3,689
Hazardous/toxic chemicals & wastes	
Generation (used lube oil): (m^3/yr)	394
Storage/inventory: (m^3/yr)	0.02
Pits/Ponds created:	None
Water usage	
Dust control water: (L/yr)	151,400
Process water: (L/yr)	295,264
Domestic water: (L/yr)	7,669,763
Total water: (L/yr)	8,116,427
Source of water:	Columbia River
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel: (L)	47,237

a. CO, particulates, NO_x, SO_2, hydrocarbons.

b. All tanks, pipes, vessels, pumps, filters and other equipment in immediate contact with process stream.

Table C.8-26. Project data for Calcine Separations/Vitrification (CALVIT-001).

Generic Information	
Description/function and EIS Project number:	Separation and Vitrification of HAW and LAW component at Hanford Treatment Facilities
EIS alternatives/options:	Min. INEEL Proc. Alternative
Project type or waste stream:	INEEL Aluminum and Zirconium Calcine and SBW
Action type:	Ion Exchange Resin
Structure type:	Existing facility
Size: (plain view)	
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	Hanford 200 Area
Inside/outside of fence:	Inside
Inside/outside of building:	Inside
Operational Information	
Schedule start/end:	
Construction:	January 2029-April 2030
Number of workers: (new/existing)	708/0 each yr
Nonradiation	657/0 each yr
Number of radiation workers	131
Average annual worker radiation dose (rem/yr)	(200 millirem/worker)
Heavy equipment	
Hours of operation	0
Transportation mileage	
Truck: (km/yr)	250,000
Rail:	283,000
Employees: (km/yr)	19,089,778
Air emissions from vitrification	
HAW component	
Radionuclides (Ci/yr)	
Cs-137	2.36×10^{-5}
Sr-90	2.57×10^{-5}
Y-90	2.57×10^{-5}
Tc-99	8.99×10^{-10}
Am-241	2.02×10^{-8}
Pu-238	1.73×10^{-7}
Pu-239 and 240	6.125×10^{-9}
Pu-241	8.40×10^{-8}
LAW Component	
Chemicals (g/sec)	
SO_2	4.98×10^{-1}
NO_2	5.63×10^{-1}
CdO	3.80×10^{-12}
Cr_2O_3	1.21×10^{-12}
Cl_2	8.02×10^{-4}
B_2O_3	2.90×10^{-11}
CaO	7.52×10^{-10}
Fe_2O_3	2.99×10^{-12}
UO_2	7.04×10^{-15}
BaO	3.94×10^{-13}

Table C.8-26. Project data for Calcine Separations/Vitrification (CALVIT-001) (continued).

Operational Information (continued)	
LAW Component (continued)	
Radionuclides (Ci/yr)	
Cs-137	1.79×10^{-7}
Sr-90	4.62×10^{-7}
Y-90	4.62×10^{-7}
Tc-99	3.98×10^{-9}
Am-241	1.84×10^{-8}
Pu-238	1.14×10^{-8}
Pu-239 and 240	4.16×10^{-10}
Pu-241	1.69×10^{-9}
Effluents:	
Sanitary wastewater: (L/yr)	17,418,570
Solid wastes:	
Construction trash: (m^3/yr)	3,925
Radioactive wastes:	
Vitrified waste output:	
LAW volume (m^3/yr)	10,417
LAW boxes (2.6 m^3/box) per year	4,019
HAW volume (m^3/yr)	530
HAW glass canisters (1.17 m^3/canister) per year	453
HEPA filters: (m^3/yr)	8
(Ci/yr)	23
Misc. radioactive wastes: (m^3/yr)	966
(Ci/yr)	966
Hazardous/toxic chemicals and wastes	
Generation (hazardous wastes) (m^3/yr)	0
Pits/ponds used:	None
Water usage	
Process (HAW and LAW processing): (L/yr)	1,826,200,000
Domestic (HAW and LAW processing): (L/yr)	17,418,570
Energy requirements	
Electrical: (MWH/yr)	642,857
Fossil fuel: (L/yr)	4,140,000

Appendix C.8 References

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Appendix C.9

Facility Disposition Modeling

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Appendix C.9

Facility Disposition Modeling

This appendix analyzes the long-term consequences (generally over a 10,000-year analysis period) of leaving contamination in major Idaho Nuclear Technology and Engineering Center (INTEC) facilities that would be closed as part of the waste processing and facility disposition alternatives described in this Environmental Impact Statement (EIS). The U.S. Department of Energy (DOE) acknowledges that impact projections that extend 10,000 years into the future are not likely to be exact. However, these projections of impacts presented in this appendix are useful in that they employ the same methodology, thus permitting comparisons of alternatives.

DOE has revised waste inventory data and has modified certain model assumptions and parameters from those used in the Draft EIS. Therefore, this appendix provides the methodology and revised impacts for all facility disposition alternatives analyzed in this EIS. A Calculation Package (TtNUS 2001) is the major sources of technical information used to support this appendix. The appendix provides a descriptive interface between the facility disposition impacts reported in this EIS and the Calculation Package.

Section 5.3 of this EIS presents the impacts from the facility disposition alternatives. In most cases, these impacts are the immediate, short-term impacts from the activities associated with disposition. Facility disposition could leave some residual contamination that could result in long-term consequences. The Clean Closure Alternative could leave residuals that would be indistinguishable from background concentrations. Under the alternatives that dispose of contaminated grout on the Idaho National Engineering and Environmental Laboratory (INEEL) or leave stored materials in the facilities indefinitely, quantities of contamination would remain in perpetuity.

C.9.1 INTRODUCTION

C.9.1.1 Problem Statement

When high-level waste (HLW) facilities have completed their missions, good environmental stewardship and Federal law require that the facilities be closed in a systematic fashion that addresses future risk to the environment and to people who could be impacted by any remaining contamination. Two of the ways of addressing these risks are to remove as much of the contaminated material as is feasible and to stabilize that which remains. Radiological contamination left in the facilities can impact humans by direct radiation, and radiological and hazardous contaminants can migrate from the facilities through the environment such that air, soil, groundwater, and surface water could become contaminated. Once these media are contaminated, drinking water or eating foods that have taken up the contamination can result in adverse health effects. This appendix presents the analytical results of modeling potential contaminant contributions from these existing facilities and the low-level waste disposal options, so that relative comparison can be made between impacts of various facility disposition alternatives.

As discussed in Chapter 3, DOE considered multiple conditions in which the facilities could be readied for ultimate disposition. Some of these alternatives would result in residual radioactivity and nonradiological constituents that would remain in the facilities after disposition and could be transported to the environment at some point in the future. DOE identified six alternatives that could be implemented for disposition of some or all of the existing INTEC facilities. These alternatives are summarized here; more detailed descriptions can be found in Section 3.2.1.

No Action - Under the No Action Alternative, the calcine in the bin sets and the liquid mixed transuranic waste/sodium-bearing waste (referred to as mixed transuranic waste/SBW) in the Tank Farm would not be treated and would remain in existing storage facilities. During the period of active institutional control through 2095, surveillance and maintenance necessary to protect the environment and safety and health of workers would be performed in the normal course of INTEC operations. Beyond the period of institutional control, storage facilities could deteriorate and fail, allowing contaminants to migrate into the environment. (The Continued Current Operations Alternative described in Section 3.1.2 would calcine all remaining mixed transuranic waste/SBW and store the calcine in the bin sets indefinitely. As a result, the bin set source terms would be somewhat increased from those evaluated for the No Action Alternative. Although this alternative was not specifically analyzed in this appendix, the impact of the increased source term is discussed qualitatively in Section C.9.6.)

Clean Closure - Under this alternative, facilities would have the hazardous wastes and radiological contaminants, including contaminated equipment, removed from the site or treated so that the hazardous and radiological contaminants would be indistinguishable from background concentrations. Clean Closure could require total dismantlement and removal of facilities. Use of the facilities (or the facility sites) after Clean Closure would present immeasurably small risk to workers or the public from contaminants from previous activities.

Performance-Based Closure - Closure methods would be dictated on a case-by-case basis depending on the risk associated with radiological and chemical hazards. The facilities would be decontaminated such that residual waste and contaminants no longer pose an unacceptable exposure or risk to workers or to the public. For the Tank Farm and bin sets, DOE anticipates using a specially engineered grout mixture to be placed in these facilities as a waste stabilization method. The grout would be specially engineered to provide favorable characteristics that would provide long-term structural support and that would bind any residual contaminants to reduce leaching to groundwater. The specially engineered grout produces reducing conditions and is commonly referred to as reducing grout.

Closure to Landfill Standards - The facility would be closed in accordance with the state and Federal requirements for closure of landfills. Closure to landfill standards is intended to protect the health and safety of the workers and the public from potential releases of contaminants from the facility. This could be accomplished by installing an engineered cap, establishing a groundwater monitoring system, and providing post-closure monitoring and care of the waste containment system, depending on the type of contaminants. As with the Performance-Based Closure, DOE anticipates using a specially engineered (reducing) grout mixture to be placed in these facilities as a stabilization method for the Tank Farm and bin sets. The reducing grout would be designed to provide favorable characteristics that would provide long-term structural support and that would bind contaminants to reduce leaching to groundwater.

Performance-Based Closure with Class A Grout Disposal - As discussed in Section 3.1, some of the Separations Alternative options remove sufficient quantities of transuranics and highly radioactive nuclides such that the remaining fraction could be stabilized with grout and categorized as Class A-type low-level waste. In such cases, this grouted waste could be disposed in (1) a near-surface disposal facility on or off the INEEL or (2) the Tank Farm and bin sets. Under this facility disposition alternative, the Tank Farm and bin sets would be closed as described for the Performance-Based Closure Alternative. Following completion of these closures, the Class A-type low-level waste grout would be placed in the underground tanks and bin sets. The grout would be designed to provide favorable characteristics that would provide long-term structural support and bind contaminants to reduce leaching to groundwater.

Performance-Based Closure with Class C Grout Disposal - As discussed above for Performance-Based Closure with Class A Grout Disposal, radionuclide separations could result in a low-level waste fraction that would be suitable for disposal in the underground tanks and bin sets at INTEC. If the separations process is designed to leave higher concentrations of some radionuclides in the low-level waste fraction, that fraction could be stabilized with grout and categorized as Class C-type low-level waste. Under this facility disposition alternative, the Tank Farm and bin sets would be closed as described above for the Performance-Based Closure Alternative. Following completion of these closures, the Class C-type low-level waste grout would be placed in the underground tanks and bin sets. The grout would be designed to provide favorable characteristics that would provide long-term structural support and bind contaminants to reduce leaching to groundwater.

The Class A or Class C-type low-level waste grout could also be disposed in a near surface disposal facility on or off the INEEL. If the disposal option selected for the grouted Class A or Class C-type low-level waste fraction is an off-site near-surface landfill, the waste would be prepared for transport and shipped accordingly. If the onsite near-surface landfill option is selected, DOE would construct the new Low-Activity Waste Disposal Facility on the INEEL. For purposes of analysis in this EIS, this facility would be built in the vicinity of INTEC and would be designed in accordance with applicable regulations. In addition to the six alternatives for disposition of existing facilities, this appendix analyzes the long-term impacts associated with the new Low-Activity Waste Disposal Facility.

C.9.1.2 Long-Term Impact Analysis for Facility Disposition Alternatives

For purposes of long-term impacts analysis in this EIS, DOE determined that the Clean Closure Alternative removes residual contamination to be indistinguishable from background levels so there is no long-term impact. In addition, DOE estimated that the residual inventories under the Performance-Based Closure Alternative and the Closure to Landfill Standards Alternative are so similar that a single analysis can accommodate both alternatives. Finally, with regard to offsite low-level waste disposal options, DOE assumed that such facilities would have undergone all the necessary environmental review and permitting in accordance with applicable regulation. Therefore, this appendix analyzes long-term impacts for only the following alternatives:

- No Action
- Performance-Based Closure/Closure to Landfill Standards
- Performance-Based Closure With Class A Grout Disposal
- Performance-Based Closure With Class C Grout Disposal
- Class A Grout Disposal in a New Low-Activity Waste Disposal Facility
- Class C Grout Disposal in a New Low-Activity Waste Disposal Facility

Table 3-3 identifies the many facilities at INTEC that are subject to facility disposition and the facility disposition alternatives applicable to each.

For long-term impacts analysis, the facility list was narrowed because DOE determined that just five facilities contain, by far, most of contamination that could contribute to long-term impacts. These facilities are identified in Table C.9-1, along with the applicable facility disposition alternative and the general type of contamination remaining in the closed facility.

C.9.1.3 General Analytical Method

The approach DOE used to calculate long-term impacts is outlined in Figure C.9-1. The steps and activities associated with facility disposition modeling are very complex and this appendix provides an overview of the process. Details of the approach are available in the supporting Calculation Package (TtNUS 2001).

Develop Conceptual Models - Conceptual models are simplified representations of real-world conditions. For long-term impact modeling, the conceptual model includes identification or specification of the geometry of the contamination, the nature and geometry of the engineered containment, the timing of the failure of engineered containment, the natural mechanisms that can release the contamination to various media, the methods by which people can be exposed, the types of people that would be exposed, and the parameters that will be reported as final results. As an example, for Performance-Based Closure of a HLW tank, the contamination could be modeled as a pancake of contamination at the bottom of the tank, with grout and soil above and concrete and soil below. The conceptual model could choose to ignore the stainless steel tank. Infiltration of water through the soil, grout, and

Table C.9-1. Facilities selected for long-term closure analysis.

Facility	Applicable alternative	Contaminant description
Tank Farm	No Action	Stored SBW
	Performance-based Closure/Closure to Landfill Standards	Residual contamination
	Class A or Class C Grout Disposal	Residual plus Class A or Class C-type grout
Bin sets	No Action	Stored calcine
	Performance-based Closure/Closure to Landfill Standards	Residual contamination
	Class A or Class C Grout Disposal	Residual plus Class A or Class C-type grout
Process Equipment Waste Evaporator	Performance-based Closure/Closure to Landfill Standards	Residual contamination
New Waste Calcining Facility	Performance-based Closure/Closure to Landfill Standards	Residual contamination
Low-Activity Waste Disposal Facility	Class A or Class C Grout Disposal	Class A or Class C-type grout

contamination could then release the constituents of the contamination to move downward through the concrete, soil, and eventually into the groundwater. Containment failure at 500 years would accelerate the release process. Following assumed loss of institutional control in 2095, a future resident could drill a well into the aquifer below INTEC and drink the water, resulting in radiation exposure expressed in terms of lifetime dose in millirem. The conceptual models DOE used (see Section C.9.2) are consistent with this example but have more elements and are more detailed. Separate conceptual models were developed for each combination of disposition alternative and facility.

Determine Initial Contaminant Inventory - DOE used engineering studies to determine a best estimate of the contents of the tanks, bin sets, and other facilities selected for closure under the various alternatives. These studies were based on records of what materials went into the facilities, an accounting of changes that have occurred since the materials were placed into the facilities, and direct measurements of existing volumes and contaminant concentrations. The initial inventories are described in Section C.9.4.1.

Screen Contaminants - Since only a limited number of contaminants contribute appreciably to long-term impacts, DOE developed and applied a method (referred to here as "screening") to identify those contaminants of potential concern that warrant detailed quantitative analysis. The multi-step screening process, which is described more fully in Section C.9.4.2, results in the identification of a few constituents that would produce the greatest long-term impacts. The screening process is dependent on the conceptual models, as indicated in Figure C.9-1. For example, a constituent that is very insoluble in water, and thus potentially insignificant in a water pathway, might prove to be a key constituent in a direct radiation pathway. The screening process for direct radiation is different than screening for a groundwater release pathway. As described in Section C.9.2, the conceptual model development resulted in only two major exposure modes being analyzed: groundwater and direct radiation.

Calculate Water Infiltration Releases from Facilities - Transport of contaminants to the groundwater requires infiltration of water through the facilities. DOE used a computer program (MEPAS) to estimate release rates of

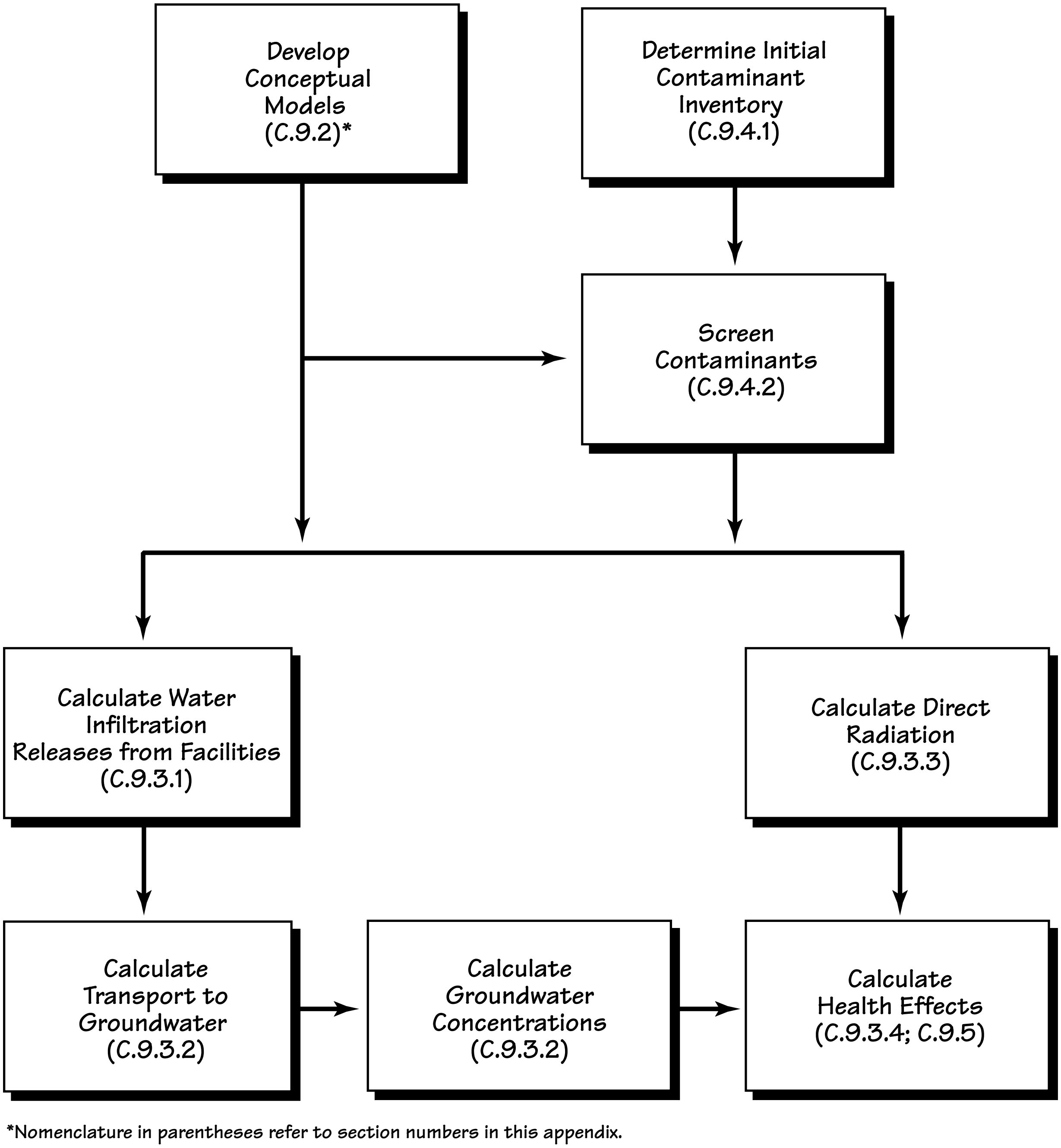

FIGURE C.9-1.
General Analytical Method.

constituents that would result from infiltration of water through the closed facilities.[1] The computer program was configured to represent the conceptual models (Section C.9.2) and the input parameters were tailored for the conditions in the facilities and their environs. The resulting release rates were presented as a function of time over the analysis period of 10,000 years. Section C.9.3.1 describes the computer program and explains how this analysis was performed.

Calculate Transport to Groundwater - DOE used another computer program (TETRAD) that incorporates the constituent release rates from the facilities as inputs and calculates contaminant transport through the unsaturated soil to the groundwater. The TETRAD model was configured for a reasonable representation of the subsurface conditions known to exist under INTEC. The result of this calculation is groundwater concentrations, as a function of time, in the Snake River Plain Aquifer underneath INTEC. Section C.9.3.2 provides more information on calculation of contaminant transport to the groundwater.

Calculate Groundwater Concentrations - Groundwater concentrations are important endpoints because they are used as inputs to the human health impact analysis and because the concentrations can be compared to Federal drinking water regulations. These concentrations were calculated using the TETRAD computer program described in the previous step. Section C.9.3.2 provides more information on calculating groundwater concentrations.

Calculate Direct Radiation - Based on the contaminant screening results described in Section C.9.4.2 and the geometries of the conceptual models (Section C.9.2), it is possible to calculate radiation dose rate from radiologically contaminated soils and closed facilities. The conceptual models also identify the assumptions governing receptors which lead to direct exposure to radiation so that radiation dose to these receptors can be calculated. Section C.9.3.3 describes how the direct radiation doses were calculated.

Calculate Health Effects - Once direct radiation fields and groundwater concentrations are known, this information, combined with the living habits of the receptors (Section C.9.2.2), can be used to calculate contaminant intake (mainly by ingestion and inhalation) and direct radiation exposure of human receptors. This allows the determination of human health impacts in terms of the analytical endpoints described in C.9.2.4. Section C.9.3.4 describes these calculations of impacts to human receptors. The results are summarized in Section C.9.5.

C.9.2 CONCEPTUAL MODELS

C.9.2.1 Release and Exposure Modes

DOE has identified three general mechanisms by which individuals could be impacted by residual contamination as follows:

- Contaminants could be transported to the aquifer under the facilities and eventually reach wells allowing humans to access the contaminated water for drinking, irrigation, and other purposes. (Surface water exposure scenarios were not considered credible events for the setting and time frames analyzed.)
- Contaminants in closed facilities could emit gamma radiation which could directly irradiate humans in the vicinity.
- Contaminants could be released to the environment through airborne pathways due to degradation and weathering of the bin sets under the No Action Alternative.

Except for the scenario of the bin sets under No Action identified in the third bullet above, and airborne pathways resulting from groundwater pumped to the surface, DOE does not believe that there are other credible ways in which con-

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[1] The term “closed” is used in the Resource Conservation and Recovery Act (RCRA) sense of the word - that is, approved closure plans would be prepared and implemented for the underground tanks, bin sets, and new Low-Activity Waste Disposal Facility in accordance with applicable hazardous waste regulations.

taminants could be introduced to the air after closure of the underground tanks, bin sets, or new Low-Activity Waste Disposal Facility. More specifically, where approved closure plans have been implemented for these facilities, it is assumed that water infiltration will eventually move contaminants down to the groundwater as waste containment structures gradually lose integrity, and that this will occur before weather erodes the surface exposing contaminants for air transport.

The airborne pathways associated with the bin set - No Action scenario are addressed as facility accidents in Section 5.2.14 and Appendix C.4. The abnormal event accident described in Table C.4-2 provides the bounding long-term air release analysis for bin set failure. This accident involves the degradation and ultimate failure of one of the bin sets after the end of the institutional control period at 2095. Since the air impacts due to bin set accidents are addressed in Appendix C.4, the remaining subsections in this appendix only describe the conceptual models for groundwater and direct radiation exposures.

C.9.2.1.1 Groundwater Release and Exposure

Figure C.9-2 illustrates the conceptual model used by DOE in evaluating the impacts to individuals from groundwater releases following facility closure. As shown in the figure, the transport of contaminants would be accomplished via infiltration of rainwater, which would eventually leach contaminants from the facilities and transport them down through the unsaturated zone to the aquifer. DOE's conceptual model for infiltration begins with the rainfall in the INTEC area and deducts run-off and evapotranspiration typical of the INTEC area. The permeability of the overlaying soil, engineered structures, and contaminate layer all influence the flux of water through and from the facility. The chemical properties of the water after passing through the engineered structures and the tenacity (known as a distribution coefficient) of the concrete, soil, and contaminant medium to retain radioactive or hazardous constituents determine the concentration of contaminants in the water.

The conceptual model also accounts for methods by which people could be exposed to groundwater. These methods include the following exposure pathways, which all rely on the water being pumped from the Snake River Plain Aquifer to the surface:

- Drinking contaminated groundwater
- Using groundwater to irrigate food crops and to water animals used for food
- Inadvertent ingestion of soil contaminated by groundwater irrigation
- Breathing air containing contaminated soil particles
- Absorption through skin contact with contaminated soil or water

DOE conservatively assumed that the well water is withdrawn from the location of peak aquifer concentration for each contaminant, even if the peak concentration for different contaminants occur at different points within the aquifer. Similarly, cumulative dose and risk are determined assuming that peak aquifer concentrations for each contaminant overlap in time. The method used for estimating intakes of contaminants from ingestion of contaminated groundwater or crops grown on contaminated site soils or irrigated with groundwater is based on the methodology developed for baseline risk assessments previously performed for INTEC (DOE 1994, Rodriguez et al. 1997). DOE evaluated these exposure routes by assuming that the contaminants in soil and groundwater (irrigation water) are transferred to various food crops by means of deposition (from overhead irrigation) and root uptake. The soil concentrations used for root uptake (as well as inadvertent soil ingestion) were calculated under the assumption that the only significant pathway for soil contamination was through irrigation with contaminated groundwater.

The major assumptions that DOE made in its assessment of groundwater release impacts are as follows:

- To be conservative, any residual contaminants left in the tanks and bin sets after flushing and/or final cleaning would be assumed to reside on the floor of the facility, thereby creating a higher

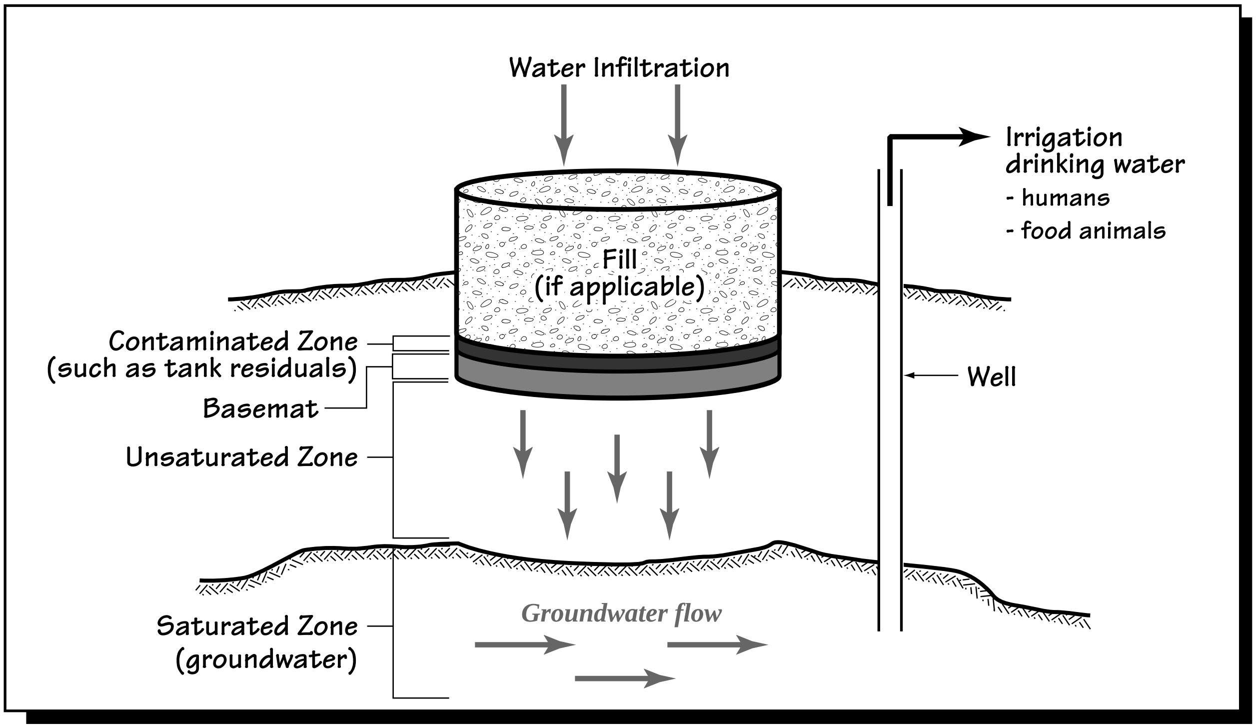

FIGURE C.9-2.
Generalized conceptual model for groundwater release.

concentration layer. Contaminants in the Class A and Class C-type grout are assumed to be uniformly distributed throughout the grout.

- At 500 years, the concrete and grout in the tanks and bin sets assumes the same hydrogeologic transport characteristics as the surrounding soil; however, chemical properties of grout and concrete are assumed to remain unchanged.

- The present environmental conditions including meteorology, infiltration rates, and geologic conditions would remain constant throughout the entire 10,000-year period of analysis. (The sensitivity studies discussed in Section C.9.6 explore the impacts of changing precipitation.)

Assumptions for specific receptors are provided in Section C.9.2.2. Conceptual assumptions specific to alternatives or facilities are provided in Section C.9.2.3.

C.9.2.1.2 *Direct Radiation*

The assessment of direct radiation exposure scenarios includes cases where future receptors are exposed to direct radiation from (a) radionuclides in contaminated soil and (b) residual radioactivity in closed facilities including the Tank Farm, bin sets, New Waste Calcining Facility, Process Equipment Waste Evaporator, and (c) Class A or Class C-type grout in the Tank Farm, bin sets, or a new Low-Activity Waste Disposal Facility. DOE developed exposure scenarios for contaminated soil and closed facilities for which some of the assumptions are described below. Separate discussions are provided for soil and closed facility contamination assessments since there are major differences in the methodology between the two.

Direct Radiation from Contaminated Soil

The conceptual model for direct radiation from soil is based on soil that has been contaminated by irrigation from contaminated groundwater. As a result, the radioactive contaminants in groundwater are the only ones assumed to be found in the soil. These radionuclides are further assumed to be evenly distributed in the top 6 inches of soil; the contaminated land extends infinitely in all directions. The concentration of contaminants in the soil has been calculated based on equations presented in Section 3.6 of the Calculation Package. The dose rate at 1 foot above the surface is used to calculate total lifetime dose for the various receptors.

Direct Radiation from Dispositioned Facilities

The approach for modeling external radiation dose from radionuclides in dispositioned facilities begins with the development of a conceptual model which defines the source geometry, dimensions, and shielding materials for each source facility. For some existing facilities, this model is closely patterned after the actual construction of the facility under evaluation, while for others simplifying assumptions were necessary. For example, the source geometry and construction materials used for the Tank Farm model closely approximate those of existing storage tanks, whereas a simplified geometry is used to approximate the more complex array of calcine storage bins within a bin set. DOE then made conservative estimates for the average distance between receptor and source for each category of receptor and source facility. The radionuclide inventories in the closed facilities are based on estimates for the year 2016 (Staiger and Millet 2000; Demmer and Archibald 1995; Barnes 2000) and then decay-corrected to apply to the time frame of the specific cases assessed. More details on these conceptual models are found in Section 5.2.2 of the Calculation Package.

C.9.2.2 Receptor Identification

In its consideration of disposition activities, DOE recognized that certain types of receptors are the most likely to be impacted by the closure scenarios. To identify the specific receptors for which analyses would be performed, DOE considered real receptors (known individuals and populations) that could be impacted in the present or near-term time frame, as well as hypothetical receptors that could be exposed under bounding conditions at any time throughout the 10,000-year period of analysis. In postulating these receptors, DOE assumed that certain activities, such as construction of residences or industrial complexes, could occur on or near the land where the dispositioned facilities are located.

DOE evaluated impacts to eight receptors. Two of these receptors, the INEEL Worker and the Unauthorized Intruder, had exposures before the end of institutional control and were thus not truly representative of long-term impacts. One receptor, Average Resident, was similar in nature and bounded by the Maximally Exposed Resident. The Indoor Worker was similar in nature and bounded by the Construction Worker. Therefore, the analysis in this EIS is simplified to cover the following four receptors, which represent several potential future uses of the land.

- **Maximally Exposed Resident -** a resident farmer who lives in a dwelling constructed at the INTEC site after the period of institutional control and who uses the land for subsistence. This receptor would obtain all of his domestic and agricultural water supply from a well drilled into the aquifer, which is assumed to be affected by contaminant releases from compromised dispositioned facilities. The maximally exposed resident is assumed to be exposed for a duration of 30 years.

- **Future Industrial Worker -** an adult who would have access to the site after the period of institutional control but who is considered to be a member of the public for compliance purposes. The future worker is assumed to be exposed for a duration of 25 years.

- **Future Intruder -** a person who gains access to the site after the period of institutional control and engages in activities (such as digging around buried radiation sources) that exacerbate the radiation exposure hazard. For Tank Farm scenarios, it is assumed that the intruder unknowingly excavates to the top level of a HLW tank, eliminating the shielding afforded by the soil overburden. This assumption results in higher projected impacts from the Tank Farm scenarios than from the equivalent scenarios for the bin sets. By design, the Tank Farm relies on soil overburden for shielding. The intruder would remove that soil overburden, causing a substantial rise in dose rate. The 1 1/2 feet thickness of concrete on top of the tanks is ignored in calculating impacts to the intruder. In contrast, the bin sets have thick shielding built into their design (because they are not completely under ground), which result in lower impacts for the intruder. Although the intruder was assessed primarily for exposure to external radiation sources, exposure to soil contaminated with radionuclides was also considered. The intruder was not analyzed for non-radiological risk since the contaminant intake potential is very much lower than for other receptor categories. The intruder is assumed to be exposed for a duration of 1 day.

- **Recreational User -** a person who routinely would visit the affected area after the period of institutional control and use the area for recreational activities, including camping, hiking, and hunting. The recreational user is assumed to be exposed for a duration of 2 weeks per year for 24 years.

Table C.9-2 identifies which exposure pathways apply to each of the four receptors and provides the defining characteristics of each receptor.

C.9.2.3 Analyzed Scenarios

A scenario is a specific combination of a facility closure alternative and a facility. DOE has identified 12 separate combinations of alternatives and facilities, each of which has been analyzed for all the selected receptors. Table C.9-3 identifies these scenarios. For example, the first scenario (facility-alternative combination) identified in the table is Tank Farm - No Action. Some of the assumptions that apply to the scenarios generally are as follows:

- The impact area in question is the general vicinity of the current INTEC. Institutional control would be maintained over this area until the year 2095. After that time, it is assumed for purposes of analysis that this area would not be controlled, and could be used for residential, agricultural, industrial, or recreational purposes for a period of roughly 10,000 years.

- For alternatives other than the No Action Alternative and Performance-based Closure with Class A or Class C Grout Disposal, DOE assumed that a clean grout material would be used to fill the Tank Farm and bin sets to provide long-term structural stability. DOE also assumed that this would be a reducing grout in order to provide favorable characteristics that would inhibit the leaching of some contaminants to the aquifer.

- Except for the case of No Action for the bin sets, there would be no credible scenario under which significant amounts of radionuclides from closed facilities would be released to air.

- Surface water exposure scenarios were not considered credible events for the setting and time frames analyzed.

Assumptions related to specific alternatives or scenarios are described below.

No Action Alternative

As discussed in Chapter 3, under the No-Action waste processing alternative, waste would remain in the Tank Farm and bin sets. Because the Tank Farm and bin sets under No Action contain the great majority of contaminants among all the HLW facilities, only these two scenarios are analyzed as part of No Action. In its evalua-

Table C.9-2. Exposure pathways for each receptor.

Receptor	Primary exposure sources	Exposure pathways
Maximally exposed resident	groundwater	- drinking water - soil ingestion - dermal contact with soil and groundwater - eating food from irrigated garden a. vegetables and fruits b. grains - eating food from watered animals a. meat b. poultry c. milk and milk products d. eggs - inhalation of soil particles suspended in air
	facility sources	- direct radiation from contaminated soils - direct radiation from dispositioned facilities
Future industrial worker	groundwater	- drinking water - soil ingestion - dermal contact with soil and groundwater - inhalation of soil particles suspended in air
	facility sources	- direct radiation from contaminated soils - direct radiation from dispositioned facilities
Future intruder	groundwater	- soil ingestion - inhalation of soil particles suspended in air
	facility sources	- direct radiation from contaminated soils - direct radiation from dispositioned facilities
Recreational user	groundwater	- drinking water - soil ingestion - dermal contact with soil and groundwater - eating meat of game animals - inhalation of soil particles suspended in air
	facility sources	- direct radiation from contaminated soils - direct radiation from dispositioned facilities

tion of impacts, DOE has assumed that no fill material is placed in the facilities. Section 2.3 of the Calculation Package provides more detail on the No Action scenarios.

Under the Tank Farm - No Action scenario, which is represented in Figure C.9-3, a composite tank is assumed which contains all of the contents of the tanks (five full tanks of mixed transuranic waste/SBW and six tanks emptied to their heels and containing residual contamination). The contents of the composite tank are assumed to leach through the basemat and into the soil beneath the composite tank as described in Section C.9.2.1.1. Water infiltration would continue to wash contaminants out of the tank. For direct radiation, the receptor is assumed to stand immediately above the tanks, which would be shielded by 10 feet of soil, except for the intruder, which gets no benefit of shielding. In addition, DOE analyzed the impacts of a direct release of contaminants from the five full mixed transuranic waste/SBW tanks to the soil. Section C.9.6 provides further description of this scenario.

Table C.9-3. Analyzed scenarios.

Alternative	Applicable Facilities
No Action	Tank Farm (stored mixed transuranic waste/SBW) bin sets (stored calcine)
Performance-Based Closure and Closure to Landfill Standards	Tank Farm (residual) bin sets (residual) New Waste Calcining Facility (residual) Process Equipment Waste Evaporator (residual)
Performance-Based Closure with Class A and Class C Grout Disposal	Tank Farm (residual plus Class A-type grout) Tank Farm (residual plus Class C-type grout) bin sets (residual plus Class A-type grout) bin sets (residual plus Class C-type grout)
Disposal of Class A or Class C Grout in a New Low-Activity Waste Disposal Facility	Low-Activity Waste Disposal Facility (Class A-type Grout) Low-Activity Waste Disposal Facility (Class C-type Grout)

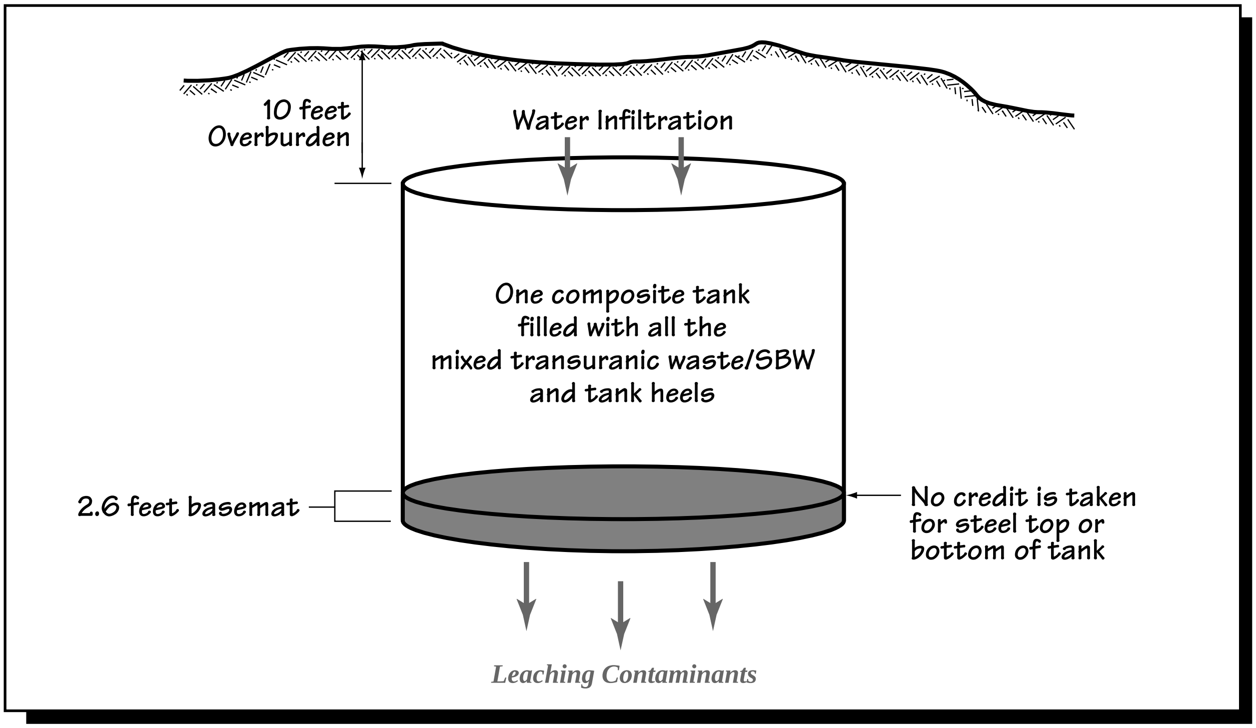

FIGURE C.9-3.
Conceptual diagram of the Tank Farm - No Action scenario.

Under the bin sets - No Action scenario, which is represented in Figure C.9-4, water is allowed to infiltrate through a partially buried composite bin set containing all the calcine of the six currently used bin sets. The constituents in the calcine are then leached through the basemat and eventually reach groundwater. Also, the degraded bin set can release calcine to the air. The impact of the degraded bin sets is analyzed as a facility accident and the results are presented in Section 5.2.14 and Appendix C.4. For direct radiation, dose rates are calculated at 3 feet and 10 feet from the outer surface of a bin set (a nominal distance that a person might normally be expected to stand or walk in the presence of a very large structure), which provides 5.3 feet of concrete shielding.

DOE has selected dimensions of the composite Tank Farm tanks and composite bin sets, which are representative of all tanks and bin sets considered in the analysis. Dimensional difference of these facilities is discussed in the sensitivity analysis section (C.9.6).

Performance-Based Closure or Closure to Landfill Standards

Under these alternatives, the Tank Farm, bin sets, New Waste Calcining Facility, and Process Equipment Waste Evaporator would be closed to meet performance-based objectives. For all four scenarios associated with these alternatives, a clean grout material would be used to fill the volume of these facilities. Although studies have shown that cementitious materials (such as grout or concrete) can be engineered to last for extended periods of time approaching 1,000 years or more (Poe 1998), the uncertainties of unpredictable natural and man-made events this far into the future requires a more conservative approach. Hence, DOE assumes that the grout and concrete structure of the bin sets and tanks will instantaneously become more permeable at 500 years post-closure. The grout is assumed to completely cover the contaminants, which were assumed to reside on the floor of the facilities. Figures C.9-5, C.9-6, and C.9-7 depict these scenarios for contaminant releases. In these figures,

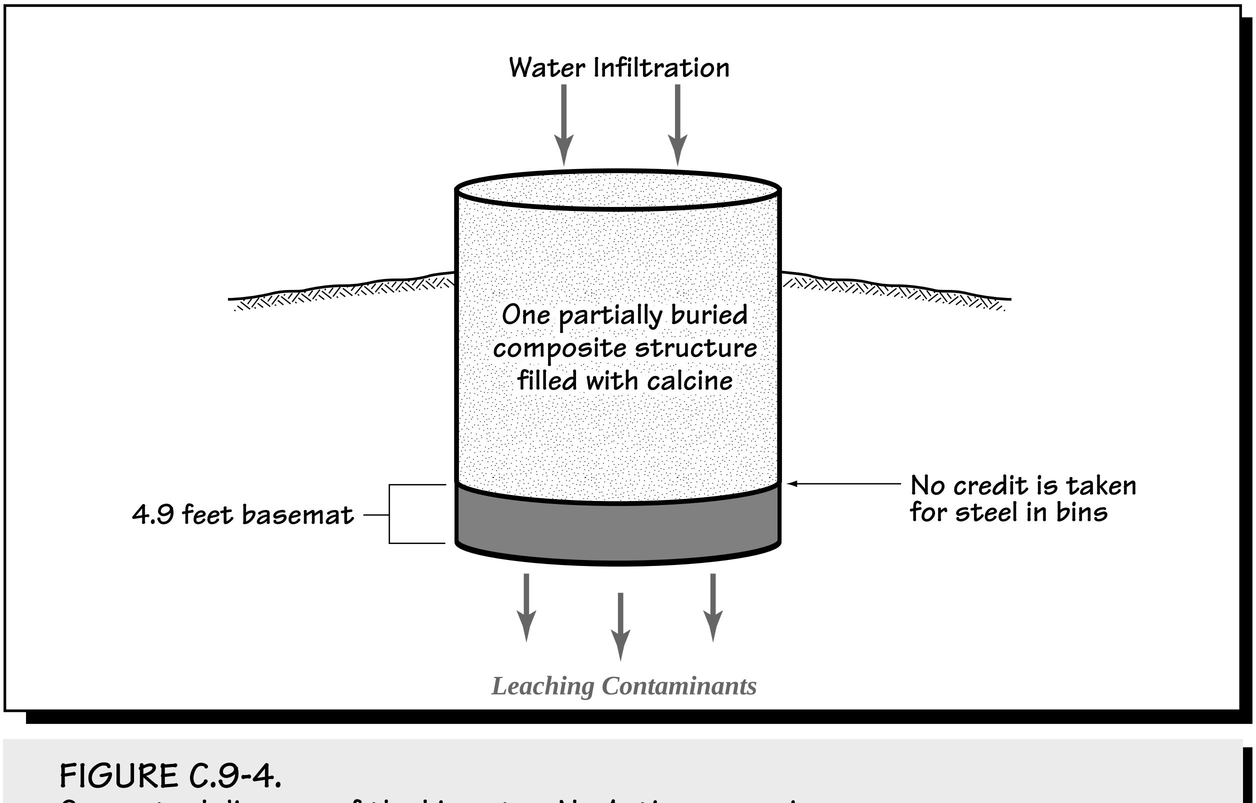

FIGURE C.9-4.
Conceptual diagram of the bin sets - No Action scenario.

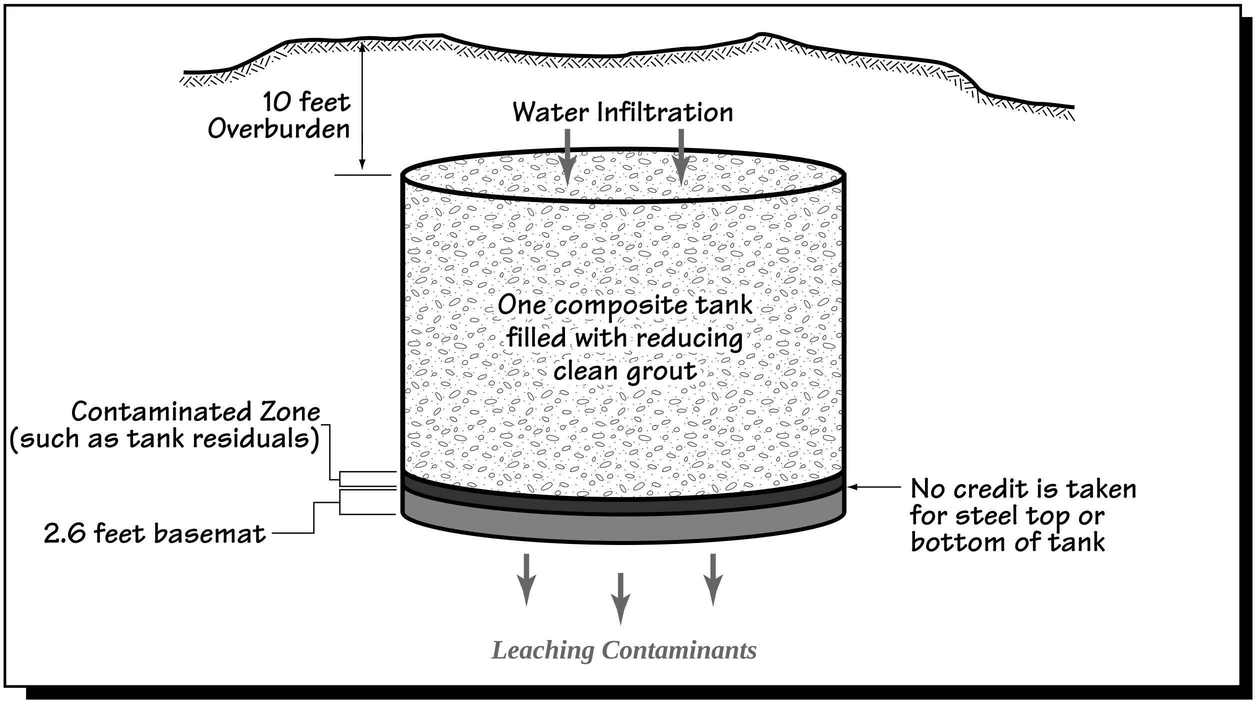

FIGURE C.9-5.
Conceptual diagram of the Tank Farm - Performance-Based Closure or Closure to Landfill Standards scenario.

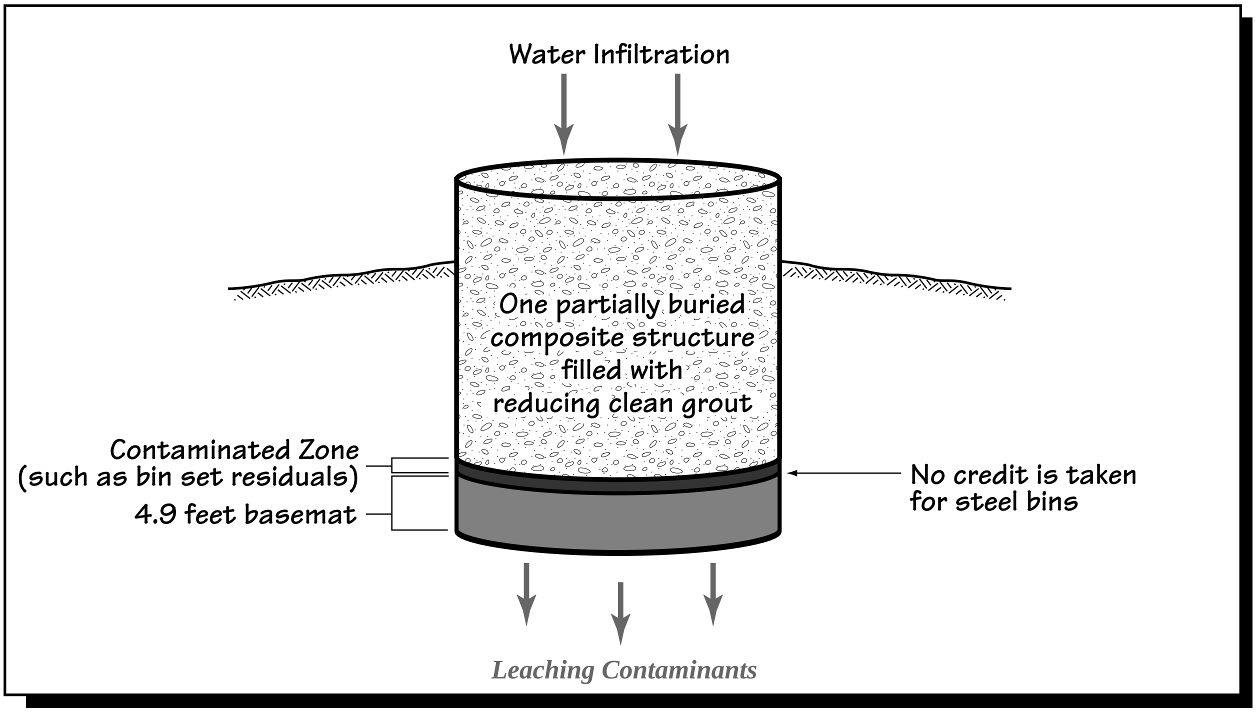

FIGURE C.9-6.
Conceptual diagram of the bin sets - Performance-Based Closure or Closure to Landfill Standards scenario.

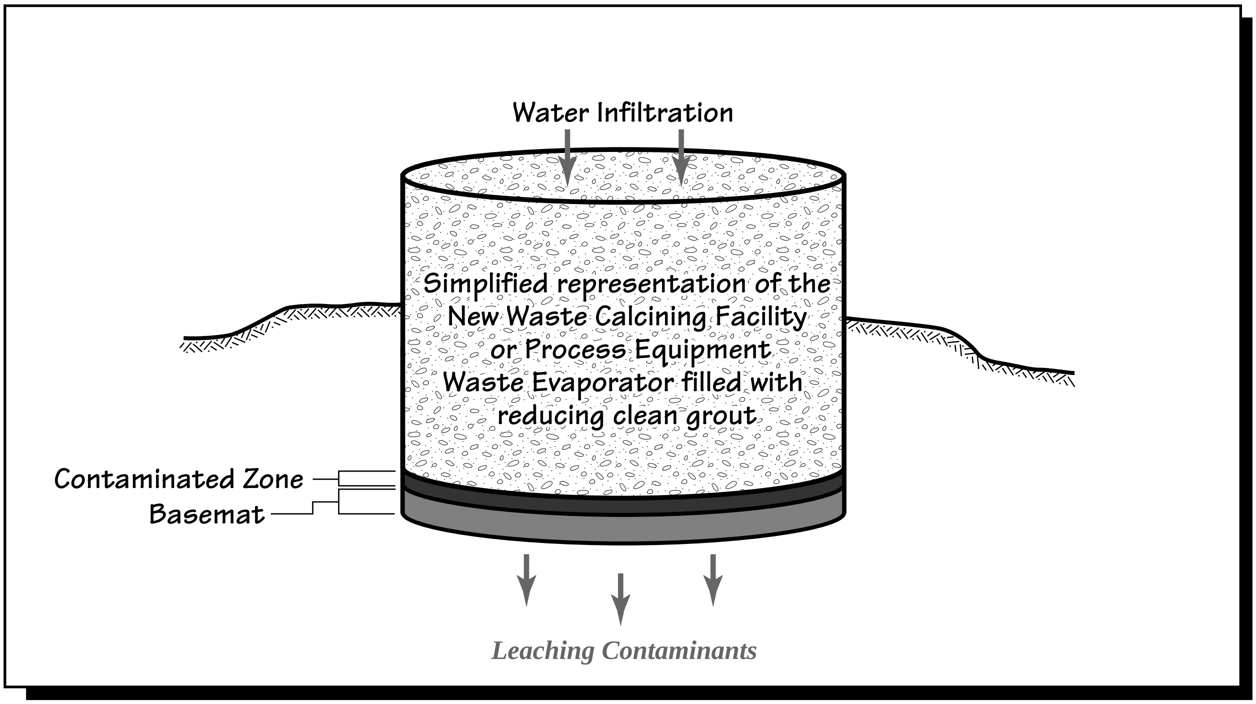

FIGURE C.9-7.
Conceptual diagram of the New Waste Calcining Facility and Process Equipment Waste Evaporator - Performance-Based Closure or Closure to Landfill Standards scenario.

the contaminated zone refers to a layer of contaminated material that cannot be readily removed from the bottom of the tanks or bin sets. This layer of contaminated material in the tanks is conservatively estimated, on the average, to be about 4 inches thick. In actual practice, most of the contaminant layer is expected to be removed during tank closure operations.

As described in Section C.9.2.1, a major mechanism for contaminant transport out of these facilities would be leaching by water. Because the facilities are above the aquifers underlying INTEC, the primary source of water for leaching would be precipitation that moves vertically through the facilities and transports contaminants to the aquifer system. Precipitation in the region of INTEC averages approximately 9 inches per year. However, due to evaporation and runoff, the actual infiltration rate into soils in this area is about 1.6 inches per year (Rodriguez et al. 1997).

During the 500 years prior to the assumed failure of the grout and concrete structure, a minimal amount of leaching was assumed to occur, and DOE took no credit for the presence of steel liners in the Tank Farm or bin sets. The hydraulic conductivity of the grout and the concrete in the facilities would limit the actual amount of water that can move through the facilities. However, after the assumed failure at 500 years occurs, the cementitious materials were assumed to have a much higher hydraulic conductivity, allowing more water to pass through the facilities and leach contaminants to the aquifer system. The chemical characteristics of the grout, however, are expected to persist long after the analysis period of 10,000 years (DOE 1998). Therefore, DOE believes that the chemical characteristics of the water passing through the grout would continue to inhibit the amount of leaching that would occur after failure.

Direct radiation is also another exposure mode and would be modeled in a manner similar to that for the No Action scenarios for Tank Farm and bin sets (except for different inventories and shielding). For the New Waste Calcining Facility and the Process Equipment Waste

Evaporator, the receptor is assumed to stand on top of the entombed facility. Section 2.4 of the Calculation Package provides additional details.

Performance-Based Closure with Class A and Class C Grout Disposal

As discussed earlier, a Class A or Class C-type grout mixture would be generated as a result of some potential waste processing alternatives involving separations that are described in Chapter 3. DOE assumes for purposes of analysis that this grout would be similar in chemical composition to that described above for the Performance-Based Closure Alternative, except that the grout in this alternative would also carry contaminants as a result of implementing the waste processing alternatives.

This grout would be used to fill the Tank Farm and bin sets, resulting in two scenarios. The grout contains contaminants in addition to those that would be present in the facilities to be closed. Therefore, there would be two sources of contaminants in the Tank Farm and bin sets: the residual contamination following cleaning activities and the contamination in the Class A or Class C-type grout to be poured into the facilities. Figures C.9-8 and C.9-9 represent the two scenarios. Direct radiation would be modeled in a manner similar to that done for the Performance-Based Closure Alternative (except for a different contaminant inventory). Section 2.4 of the Calculation Package provides more details.

Disposal of Class A or Class C Grout in a New Low-Activity Waste Disposal Facility

The Class A or Class C-type grout could be disposed in a new Low-Activity Waste Disposal Facility specially constructed to minimize leaching. Under this alternative, the grout is assumed to remain intact for 500 years, after which time the grout would fail in a similar fashion as that described for the Performance-Based Closure Alternative. The increased hydraulic conductivity would allow more water to flow through the grout, but the chemical properties of the reducing grout are assumed to remain unchanged over the period of analysis. Figure C.9-10 depicts the conceptual model of the two scenarios associated with this alternative. Direct radiation would be modeled with the receptor standing on top of the facility, which would be covered by 7 feet of soil and 3.5 feet of concrete. Section 2.4 of the Calculation Package provides more details on the conceptual model for this alternative.

The analysis of the Low-Activity Waste Disposal Facility in this appendix is based on the preliminary design prepared for the EIS (Kiser et al. 1998).[2] If the onsite near surface landfill option is selected, DOE would develop a detailed design for the Low-Activity Waste Disposal Facility in accordance with applicable regulations. The final design could include features that would influence the long-term performance of this facility. DOE would conduct supplemental National Environmental Policy Act evaluation, if necessary, and prepare a radiological performance assessment as required by DOE Order 435.1 prior to finalizing the design for a near-surface disposal facility. Additional review would also occur during the permitting process for such a facility.

C.9.2.4 Analytical Endpoints

Future human receptors who work at or near the closed INTEC facilities may be exposed to radionuclides and to carcinogenic and noncarcinogenic chemical contaminants. For radionuclide exposures, commonly used endpoints to report comparative analyses results are lifetime dose and lifetime latent cancer risk. Specifically, the term "lifetime dose" means total effective dose equivalent that results from a given expo-

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[2] The reference design used to analyze impacts for this appendix does not include some of the features normally associated with RCRA disposal facilities (such as clay liners, leachate collection and contaminant collection systems, etc.), some of which provide retardation of contaminants to the soil column. Thus, the environmental impacts analyzed for disposal of Class A or Class C-type grout in this appendix are extremely conservative.

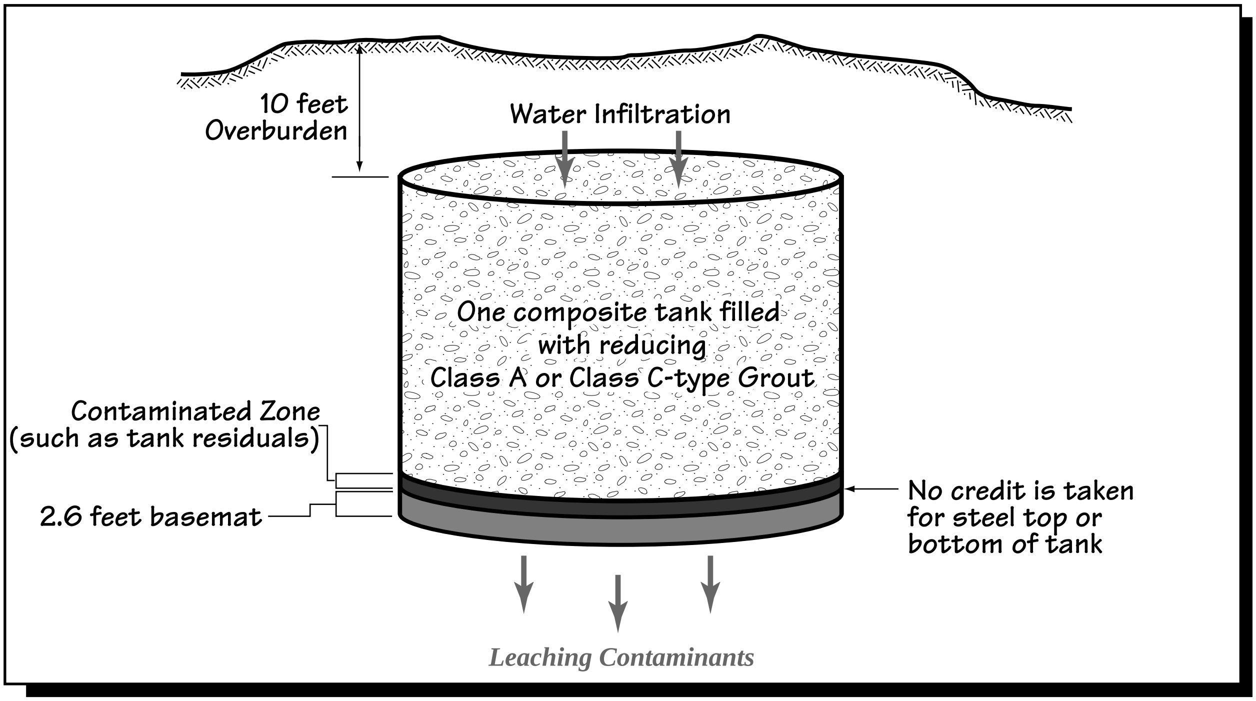

FIGURE C.9-8.
Conceptual diagram of the Tank Farm - Performance-Based Closure with Class A or Class C Grout Disposal scenarios.

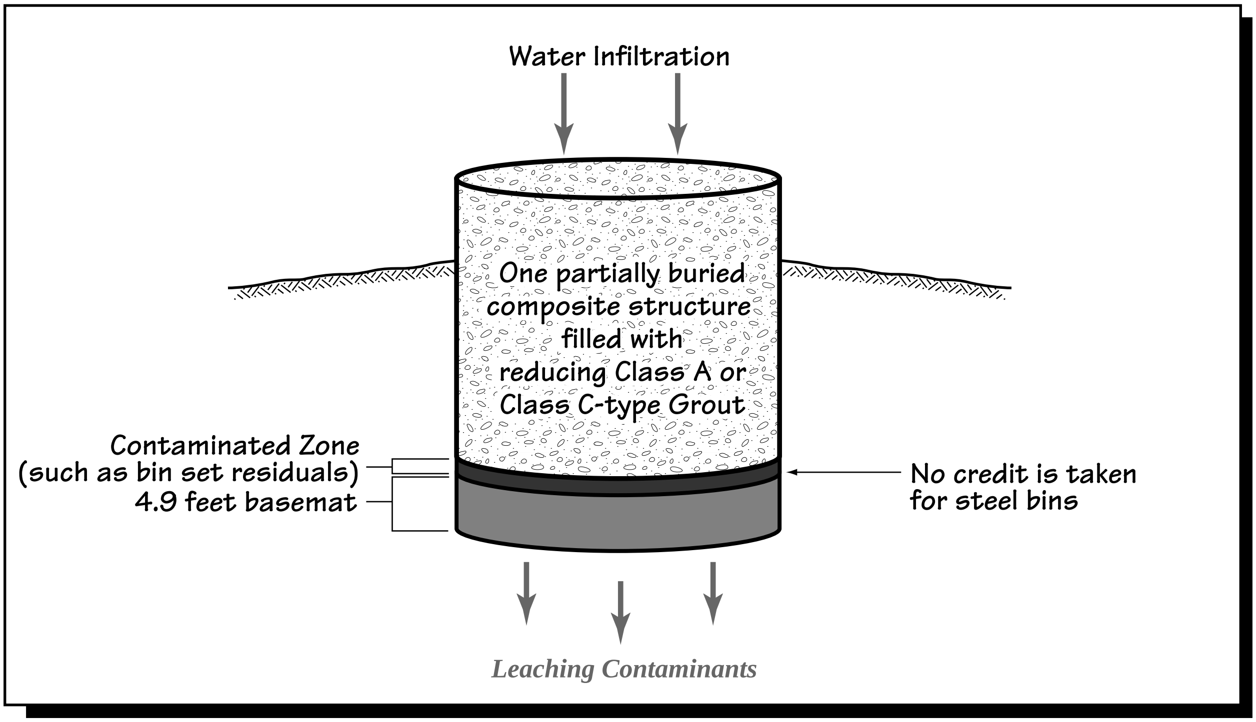

FIGURE C.9-9.
Conceptual diagram of the bin sets - Performance-Based Closure with Class A or Class C Grout Disposal scenarios.

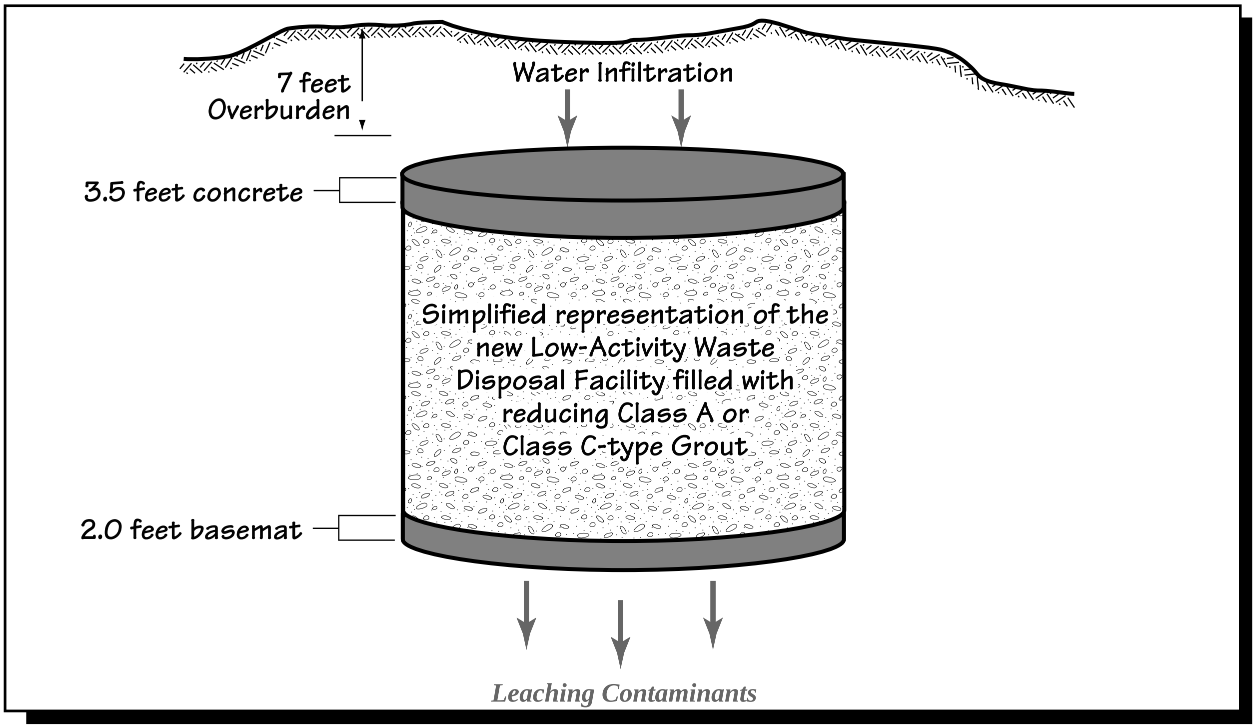

FIGURE C.9-10.
Conceptual diagram of Class A or Class C grout disposal in new Low-Activity Waste Disposal Facility.

sure scenario. This term includes the external dose received during the exposure period as well as the committed effective dose equivalent that results from the intake of radionuclides over the exposure period. Since contaminant concentrations in the environment vary with time, doses are calculated for periods when the overall dose rate would be highest. For nonradiological constituents, human health hazard quotients are used as a measure of the ratio of the chronic intake rate to the U.S. Environmental Protection Agency (EPA) reference dose. Since it is not appropriate to sum hazard quotients for contaminants with different toxicological endpoints, these are reported separately for each contaminant. Hazard quotients are also calculated at the time of maximum environmental concentration. Another basic endpoint is the lifetime cancer risk from exposure to carcinogenic chemicals, calculated for the period of peak environmental concentrations. Finally, groundwater concentrations of the individual contaminants during the peak year are presented for comparison to regulatory standards. Drinking water standards (40 CFR 141) are based on intake of radionuclides and are calculated using specified methodology and assumptions to derive radionuclide-specific concentration limits. All these endpoints apply to all receptors and are reported in Section C.9.5 by scenario.

In addition to these basic endpoints, there are several intermediate results that could be reported. These include individual pathway results for each receptor and individual constituent, reported by scenario. These intermediate results are not provided in this appendix but appear in the Calculation Package.

In summary, Section C.9.5 reports the following analytical endpoints:

- peak contaminant groundwater concentrations for comparison to drinking water standards
- total lifetime radiation dose by receptor, facility and scenario

- excess radiogenic cancer probabilities by receptor, facility and scenario
- human health hazard quotients by contaminant, receptor, facility and scenario
- nonradiological cancer probability (summary description only)

C.9.3 EXPOSURE AND TRANSPORT MODELING DESCRIPTION

C.9.3.1 Releases From Closed Facilities

C.9.3.1.1 *Model Description*

The leaching of contaminants out of the closed facilities[3] to the unsaturated zone would be primarily one-dimensional movement in the downward direction. Therefore, DOE used the MEPAS (Buck et al. 1995) code developed at Pacific Northwest National Laboratories (PNNL) to calculate the flux of contaminants from the facilities. The calculational methodology for MEPAS was developed by PNNL in the 1980s and is based on active transport in one dimension with dispersion allowed in three dimensions. MEPAS uses analytical solutions incorporating partitioning coefficients expressed as distribution coefficients, the porosity and hydraulic conductivity of the media, the water infiltration rate, and a dispersivity coefficient to calculate the amount of leaching that occurs in the source zone and ultimately the flux from the facility.

C.9.3.1.2 *Conceptual Model Configuration*

Due to the one-dimensional nature of MEPAS, the solutions are based on the assumption that precipitation will move through the residual contaminants based on the infiltration rate and hydraulic conductivity of the layers between the residual contaminants and the ground surface, leach material as determined by the partitioning coefficient, and move the contaminants downward to the soil beneath the tanks. Because MEPAS was used only for flux calculations from the facilities, the groundwater modeling portions of this code were not used, and the flux results were coupled with results from TETRAD to determine the groundwater concentrations.

DOE calculated the fluxes assuming that the facilities would remain intact until structural failure (physical degradation of the concrete and grout) is assumed to occur at 500 years post-closure. Therefore, the flux from the facilities is expected to leach a negligible small amount of contaminants prior to the assumed failure time. After 500 years, the grout and concrete are assumed to instantly become more permeable, with the structural failure allowing an increased flow of water through the facilities and providing greater volumes of leachate to the vadose zone. Section 5.1 of the Calculation Package presents further details on the methodology for calculating contaminant releases from closed HLW facilities.

Because the driving force for contaminant migration out of closed HLW facilities has been assumed to consist of infiltration of water through the closed facility, the most important parameters in modeling the leaching of contaminants are distribution coefficient (K_d), hydraulic conductivity, infiltration rate, and porosity. To support the selection of parameter values, DOE conducted a literature search of published parameter values considered to be reasonable for INEEL conditions (Kimmel 2000a). Based on this review and an understanding of the chemical and physical conditions related to the closed HLW facilities, a set of parameter values were selected for the facility release modeling. Section 5.1 of the Calculation Package presents further description of the source, identity, and use of these input parameter values.

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[3] Closed facilities analyzed for leaching of contaminants include: (1) the tanks and bin sets, closed with clean or Class A or Class C-type grout; (2) the new Low-Activity Waste Disposal Facility; and (3) the Process Equipment Waste Evaporator and New Waste Calcining Facility, facilities that could have a significant inventory of radioactive materials after closure.

C.9.3.2 Vadose Zone and Aquifer Transport Modeling

In order to model contaminant transport from the closed facilities through the vadose zone, and eventually through the aquifer, DOE used two conceptual models that have been used successfully in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process at INTEC for the Waste Area Group 3 (WAG 3) Remedial Investigation/Feasibility Study (RI/FS) (Rodriguez et al. 1997). The first of these two models was used to model the infiltration of water and the subsequent transport of contaminants through the vadose zone. The vadose zone was modeled with contaminants originating primarily near ground surface and allowed to infiltrate vertically as well as to spread laterally. DOE updated and simplified this approach (Schafer 1998) for the modeling performed at INTEC. This updated methodology was checked against previous model runs for various fluxes and found to be in close agreement with the model predictions (Schafer 1998).

Water and contaminant mass flow through the bottom layer of the vadose zone model were then used as the upper boundary condition for the aquifer simulation domain. The overall model was optimized to predict contaminant concentrations for a typical contaminant with specific characteristics (e.g., half-life, distribution coefficient).

The overall model was adjusted for hydrogeologic conditions at INTEC (Rodriguez et al. 1997) and the simplified approach was used to assess the specific disposition scenarios. In general, representative locations were selected and, for each of the locations, full three-dimensional vadose and aquifer models were simulated to inject a "unit" mass of a contaminant. Mass flux to the aquifer resulting from the unit mass of contaminant was computed and used to estimate contaminant concentrations in the aquifer. These concentrations were used for subsequent risk calculations (see Section C.9.3.4).

C.9.3.2.1 Model Description

In the WAG 3 RI/FS (Rodriguez et al. 1997), the vadose zone-aquifer system at INTEC was simulated using a three-dimensional transient program called TETRAD. This model was successfully used and gained the approval of regulators. The TETRAD program allows incorporation of the heterogeneous physical properties necessary to solve the vadose zone infiltration problem with the large areal and point source influxes of water and contaminants. During the WAG 3 RI/FS modeling, the simulation was divided into a vadose zone conceptual domain and an aquifer conceptual domain. The bulk of the computational time was expended solving the vadose zone transport equations mainly due to the nonlinearity introduced through the dependence of permeability on pressure and saturation. However, in a steady state flow system, the permeability becomes a constant in time, and the system of equations become linear. The linearity is achieved by allowing the vadose zone to reach steady state conditions, which implies that contaminants released at a particular surface location follow the same flow path regardless of when the release occurs. Using a steady-state approach, an updated methodology was developed (Schafer 1998) to estimate the mass flux to the aquifer by scaling from a previous computer simulation. Mass flux estimates were prepared using this methodology and were compared with the TETRAD model results and found to be in good agreement. This methodology provides an estimate of the cumulative mass flux to the aquifer. A similar approach was used for the HLW facility disposition modeling.

During the TETRAD simulation, the contaminant mass flux through the bottom plane of the vadose zone model was the output throughout the vadose zone modeling time frame. These mass fluxes were then used as input as source terms for the top plane of the aquifer model. During the WAG 3 RI/FS, the sensitivity of predicted contaminant migration to the parameters used to implement the conceptual model was obtained. The base-case conceptualization of the flow and hydraulic transport domain was representative, rather than overly conservative. The TETRAD model was calibrated using concentration distributions of known contaminants from known releases. As a result, predicted concentrations in the WAG 3 RI/FS were based on the best information available, within acceptable accuracy. The use and utility of TETRAD and its specific attributes have been well documented in the following references: Shook (1995), Shook and Faulder (1991), Magnuson (1995), and Vinsome and Shook (1993).

The updated methodology using previously calibrated TETRAD model results involved the following.

- Representative locations were selected and for each of the facilities, full three dimensional vadose and aquifer models were used to inject a "unit" mass of a contaminant.
- Mass flux to the aquifer resulting from the unit mass of contaminant was computed and used to estimate contaminant concentrations in the aquifer.
- These concentrations were used for subsequent risk calculations.

C.9.3.2.2 Model Configuration

The physical and hydrogeologic setting of INTEC is highly complex, consisting of layered basalt and sediment units. Perched water zones exist within the vadose zone and several large water sources at the surface currently contribute to them. As INTEC facilities are dispositioned, these water sources will also be closed except for local precipitation and flow in the Big Lost River as discussed in Section 4.8.1. Therefore, most water sources would cease to contribute to the perched water during the 10,000-year period of analysis. In order to account for the complex nature of the subsurface at INTEC, three-dimensional modeling (using TETRAD) was used.

Simulation Domains

The domains were similar to the ones considered during the WAG 3 RI/FS. The vadose zone model extends 2,000 meters in the east-west directions and 3,000 meters in the north-south direction. This area extends approximately 800 meters beyond the INTEC boundaries in the north-south direction and 600 meters in the east-west direction (Rodriguez et al. 1997).

Simulation of Source Area Locations

Based on the facility disposition scenario, contaminant sources were defined and incorporated into the simulation model at a grid block or a set of grid blocks. Similar methodology has been successfully used during the WAG 3 RI/FS (Rodriguez et al. 1997). In the numerical simulation model, the horizontal grid block locations for all sources were defined by overlaying the numerical grid on a map of the INTEC area. Each contaminant source was identified by a grid block and source input parameters were applied for the corresponding block. Using the surface source term information on a unit basis, the updated methodology (Schafer 1988) was used to simulate the transport of a contaminant through the vadose zone and a mass flux curve was computed for a facility. Cumulative mass flux to the aquifer was then calculated. The mass flux was then used to simulate the transport of contaminants in the aquifer and to estimate the resulting concentrations. These concentrations were used for subsequent risk calculations.

Scope of the Model

The horizontal extent of the vadose zone model was defined by the INTEC footprint. Contaminant transport was first simulated through the vadose zone model and the mass flux out the bottom of the vadose model is used as an input to the aquifer model. Model predictions were made to estimate the magnitude and time of peak concentrations within the domain. The simulations were focused on obtaining future groundwater concentrations to support the 10,000-year risk evaluation.

C.9.3.2.3 Modeling Assumptions and Uncertainties

Several assumptions were made during the simulation of TETRAD for the WAG 3 RI/FS. As the same model is projected to be used for closure modeling, previous assumptions and approximations (made during the RI/FS) for parameters/methods to estimate some properties are applicable. A key assumption for this approach was that the steady-state vadose zone model adequately describes the flux to the aquifer.

Uncertainties associated with model predictions include the degree to which the conceptual model represents unsaturated and saturated zone flow and transport processes at the INTEC, the choice of contaminant-specific distribution coefficients, and the accuracy of the estimated source term. However, during the RI/FS, the model was calibrated with collected data and was found to predict the contaminant movement effectively.

C.9.3.3 Direct Radiation Exposure

The assessment of exposure scenarios includes cases where future receptors are exposed to direct radiation from either (a) radionuclides in contaminated soil; (b) residual radioactivity in closed facilities; or (c) facilities used for radioactive waste disposal. The latter include the Tank Farm, bin sets, and other facilities that could have a significant inventory of radioactive materials after closure. External dose rates were developed for soil and facilities using the IDF code, which is part of the GENII package (Napier et al. 1988). The conceptual models used to facilitate these assessments are described in Section C.9.2.1. A summary of general assumptions and considerations used in the external dose assessment is provided below. For additional detail, the reader is referred to Sections 3.4 and 3.6 of the Calculation Package.

Exposure to direct radiation from soil results from irrigation of land using groundwater contaminated with radionuclides. During the contaminant screening process described in Section C.9.4.2, only Tc-99 and I-129 remained for groundwater pathway analysis. These radionuclides were assumed to be pumped from the groundwater to the surface for irrigation and to be evenly distributed in a 6 inch-thick soil layer which is modeled as an infinite slab. The dose is evaluated at a point 1 foot above the slab. The soil exposure pathway is only credible in the distant future, since considerable time would be required for these radionuclides to leach from closed facilities (which are assumed to remain intact for 500 years), migrate through the vadose zone and reach the aquifer. Exposure to radionuclides in soil is assumed to coincide in time with radionuclide intakes from other groundwater-derived exposure modes (ingestion of water, soil, food products, etc.). Therefore, doses from these exposures are additive.

For radiation emanating from closed facilities, DOE calculated dose rates based on available radionuclide inventory ("source term") data in conjunction with a conceptual model (geometry, shielding materials and thicknesses, etc.) that approximated the system under evaluation. The source term for the reference HLW tank or bin set was based on the individual tank or bin set with the highest projected inventory for each closure scenario. The estimated radionuclide inventory (in curies) was converted into units of activity per unit volume or area, depending on the system being modeled, for use as input to the IDF model. (See Section 5.4 of the Calculation Package for facility-specific source terms.) The radionuclide inventory was evaluated at 2095, and dose rates were calculated for all radionuclides with significant penetrating emissions (not just Tc-99 and I-129 as in the soil case). These dose rates were then summed to determine a total dose rate. For below-grade (buried) sources, substantial shielding is provided by the soil overburden. This shielding is assumed to remain intact in all cases except intruder scenarios, which assume that an individual unknowingly removes soil shielding by excavating around a buried source. In contrast to the soil exposure case, which is driven by contaminated groundwater, exposure to direct radiation from closed facilities is only important for a few hundred years after the period of institutional control. This is because the dose rate is driven by relatively short-lived radionuclides (primarily Cs-137/Ba-137m) that will undergo considerable decay by the time groundwater-derived pathways become credible.

C.9.3.4 Calculation of Impacts to Receptors

The general methods and data that DOE used to calculate impacts to receptors are consistent with those used in previous baseline risk assessments performed at the INTEC. The process involves the use of conceptual models, equations and data to calculate the transfer of contaminants to media that serve as intake or exposure sources for the postulated receptors. Various constants are used to account for individual habits of these postulated receptors. These constants may be either generic, or they may be specific to receptors, scenarios or contaminants. Body weight of an adult receptor is an example of generic data, whereas parameters such as exposure duration, food or water intake rates, etc. use receptor-specific data. Dose factors and toxicological data are examples of contaminant-specific constants. The data and equations used are detailed in the supporting Calculation Package, while a general overview of the method is presented below.

The impact calculation process can be broadly divided into radiological and nonradiological assessments. The primary goal of the radiological assessment is to estimate radionuclide intakes, internal and external dose, and associated radiogenic cancer risk for specific receptors under various facility closure scenarios. Radionuclide intake and internal dose are calculated only for the groundwater pathway, including all significant ways that radionuclides in groundwater could reach human receptors. The exposure pathways are identified in Table C.9-2.

The radionuclide intake (in units of picocuries) was calculated and then multiplied by the appropriate ingestion or inhalation dose factor (with units of millirem per picocurie) to determine effective dose equivalent in millirem. Dose from external radiation exposure was calculated simply as the product of the dose rate (in millirem per hour) and the total exposure period (hours). As previously mentioned, concurrent internal (from groundwater) and external (from closed facilities) doses are not credible. For this analysis, the maximum of the two is used to represent peak dose. Radiogenic cancer risk from internal exposure was estimated by multiplying the internal dose (millirem) by the appropriate cancer slope factor (risk per millirem). Cancer risk from external exposure was estimated using cancer risk factors (risk per millirem) for workers or the general population, as applicable, recommended by the International Commission on Radiological Protection. The radiogenic cancer risk value can be loosely interpreted as the increased probability that the individual will develop a fatal or nonfatal cancer over his or her lifetime as a result of receiving the specified dose.

The method used to calculate nonradiological contaminant intake closely parallels the method used for radionuclides. Contaminant intake rates [milligrams (of contaminant) per kilogram (of body weight)-day] were calculated for each pathway, and these were then converted to health hazard quotients by dividing by the corresponding EPA reference dose (which has the same units of milligrams per kilogram-day). Of the nonradiological contaminants assessed, only cadmium is considered a human carcinogen, and cancer risk is only quantifiable for this substance via the inhalation mode of intake. The cancer risk was calculated as the product of inhalation intake (milligrams per kilogram-day) and slope factor (risk per milligrams per kilogram-day). For the scenarios considered here, intake rates from inhalation of contaminated soil are very low, resulting in risk values of less than 10^{-12}, or one in a trillion. Thus, scenario-specific nonradiological cancer risk values are not presented.

For both radiological and nonradiological contaminants, DOE developed "summary intake factors" to facilitate the calculation of intake by each receptor category and exposure mode. These summary intake factors provide a simple but effective means of calculating contaminant intake from media concentration by incorporating all applicable constants into a single expression. These are then multiplied by appropriate media concentrations to determine contaminant intake. For example, the summary intake factor for radionuclides via groundwater ingestion by the maximally exposed resident has a value of 2.1×10^{4} in units of liters. Multiplying this value by the groundwater concentration in picocuries per liter yields the estimated intake of the radionuclide, in picocuries, by this receptor. Summary intake factors were derived and entered into Microsoft Excel™ workbooks to execute the calculations and organize the results.

C.9.4 CONTAMINANT SOURCES

This section describes the methodology and assumptions used by DOE to estimate the amount of material remaining in INTEC HLW facilities after closure for each of the facility disposition scenarios described in Section C.9.2. The amount of contaminants within the facility affects the quantity that could ultimately be transferred to the aquifer. Larger initial amounts would lead to greater fluxes to the aquifer while lower initial amounts would cause lower fluxes and hence lower concentrations of contaminants in the aquifer. DOE performed the following activities to identify the source term values for use in this analysis:

- Estimate the amount of contaminants that could be left in facilities following disposition
- Perform screening to identify those contaminants that warrant detailed quantitative analysis
- Identify the final list of contaminants for further detailed analysis

Each of these activities is described in further details in the following sections. Section 4 of the Calculation Package presents further technical details on the screening process methods used to determine the source term values.

C.9.4.1 Inventory Identification

DOE performed engineering studies to estimate the amount of contaminants that could be left in facilities following disposition. Section 4.1 of the Calculation Package lists these values for radiological and nonradiological constituents by facility and scenario. As discussed in Section C.9.1, for purposes of analysis, DOE assumed that the amount and character of the residual inventory would be the same for both Performance-Based Closure and Closure to Landfill Standards (for those facilities for which both facility disposition alternatives are applicable).

For all pathways except external irradiation, the source inventories provided in the Calculation Package were used because the entire inventories were available to be released to the ecosystem. The radionuclide source term was decayed to a constant year to provide a consistent basis for analysis. For external irradiation, however, DOE postulated that the receptor would be closer to a particular facility (i.e., the one that would result in the highest radiation dose) than the others. Consequently, the receptor would not be exposed to all the contaminants in all the facilities to the same degree.

C.9.4.1.1 No Action Alternative

Tank Farm

DOE developed Tank Farm inventory and source terms for the No Action Alternative (Staiger and Millet 2000) using the following assumptions:

- The liquid waste from the pillar and panel tanks would be transferred out and concentrated in the evaporators.
- The concentrate would be stored in five of the monolithically vaulted tanks.
- These five monolithically vaulted tanks would be subsequently filled to capacity with the existing mixed transuranic waste/SBW and with newly generated liquid waste. The newly generated liquid waste, which is defined in Section 3.1, would be lower in radioactivity relative to existing waste.
- Contributions from the concentration of existing Tank Farm liquid waste and New Waste Calcining Facility decontamination effluents are considered to be internal recycle and would not be "new" source material.
- The emptied pillar and panel tanks would be flushed with 40,000 gallons of water and pumped to their heel volumes and the liquid evaporated.

Based on these assumptions, DOE estimated the contents of each of the five 300,000-gallon storage tanks and the eventual date they would be filled. These results were then used to generate an estimated source term. The source terms are listed in the Calculation Package.

Bin Sets

Since December 1963, fluid-bed calcining has been used at INTEC to convert aqueous wastes to granular solids. The wastes were processed in a heated fluidized-bed calciner to metallic oxides or fluorides, water vapor, and nitrogen oxides. The solids are transported to stainless steel bins for interim storage. Detailed operational chronologies for the various calcination campaigns are presented by Staiger (1999).

Source term estimates for the calcine in the bin sets under the No Action Alternative are described in Staiger and Millet (2000) and listed in the Calculation Package. These source term estimates employ the most conservative information on isotopic ratios and are conservatively based on liquid fed to the calciners and assume no recycle.

Iodine, mercury, and tritiated water are volatile at calcination temperatures. Therefore, their retention in the calcine is reduced. Only 13 percent of the iodine in the waste feed is estimated to remain with the calcine (Staiger and Millet 2000). Mercury retention in the calcine is calculated to be 70 percent for calciner operation at 400 degrees Celsius and 1 percent when operation was 500 degrees Celsius and above (Staiger and Millet 2000). Water (tritium) accumulation in the calcine is expected to be very low. Retention in the calcine is conservatively estimated at 0.1 percent of that processed (Staiger and Millet 2000).

C.9.4.1.2 Performance-Based Closure or Closure to Landfill Standards

Tank Farm

The residual source terms remaining in the Tank Farm after closure (for Performance-Based Closure or Closure to Landfill Standards) were based on the assumption that all the tanks would be emptied to heel volume and that the heel would be flushed with one 40,000-gallon flush of water, which would be pumped out to heel volume with installed equipment. All solids are assumed to remain in the tank after flushing. The flush solutions would not remove any radioactivity from the solids. Source term estimates for the residual material remaining in the tanks are further described in Staiger and Millet (2000) and listed in the Calculation Package.

Bin Sets

The volume of the solids in the emptied bin set vessels is assumed to be 0.5 percent of the filled volume (Staiger 1998). The concentrations of radiological and chemical constituents in the emptied vessels is assumed to be the same as for the filled bin sets under the No Action Alternative, described above. The residual activity in the bin sets after closure is listed in the Calculation Package.

Other Facilities

Other existing INTEC HLW facilities evaluated in this appendix are the Process Equipment Waste Evaporator (CPP-604) and the New Waste Calcining Facility (CPP-659). DOE previously estimated (Beck 1998) that the residual inventory in these facilities after closure would be less than the amount remaining in the Waste Calcining Facility (CPP-633) after it was closed. Therefore, for this analysis, DOE conservatively assumed that the residual inventory in the Process Equipment Waste Evaporator and New Waste Calcining Facility would be equal to that in the Waste Calcining Facility. The characteristics of the residual remaining in the Waste Calcining Facility are described by Demmer and Archibald (1995). The residual activity in the Process Equipment Waste Evaporator and New Waste Calcining Facility after closure is listed in the Calculation Package.

C.9.4.1.3 Class A or Class C Grout Disposal in a New Low-Activity Waste Disposal Facility

As described in Chapter 3, approximately 27,000 cubic meters of Class A-type grout would be produced under the Full Separations Option and approximately 22,700 cubic meters of Class C-type grout would be produced under the Transuranic Separations Option. One method evaluated for disposal of this grout is disposal in a new Low-Activity Waste Disposal Facility, an engineered near-surface disposal facility. The characteristics of the radioactive and chemical constituents in this Class A or Class C-type grout are described by Barnes (2000) and are listed in the Calculation Package.

C.9.4.1.4 *Performance-Based Closure with Class A or Class C Grout Disposal*

In addition to disposal in a new Low-Activity Waste Disposal Facility, as described in Section C.9.2.3, DOE evaluated a second onsite method for disposal of the Class A or Class C-type grout produced under the Full Separations and Transuranic Separations Options. This second onsite disposal method is disposal in the Tank Farm and bin sets, after these facilities have undergone performance-based closure. The Class A or Class C-type grout would serve to bind residual contaminants remaining in these facilities and provide structural stability in the closed facilities.

DOE assumed that the Class A or Class C-type grout would be emplaced in both the Tank Farm and bin sets. DOE assumes that 22,000 cubic meters of grout would be emplaced in the bin sets and the remainder (5,000 cubic meters of Class A-type grout and 700 cubic meters of Class C-type grout) would be emplaced in the Tank Farm (Kimmel 2000b). The Class A or Class C-type grout would be in addition to the residual contamination remaining in the Tank Farm and bin sets after performance-based closure (as discussed above). The Calculation Package lists the characteristics of the radioactive and chemical constituents in Tank Farm and bin sets under the Performance-Based Closure with Class A Grout Disposal and the Performance-Based Closure with Class C Grout Disposal scenarios.

C.9.4.2 Contaminant Screening

C.9.4.2.1 *Groundwater Pathway Screening*

The original list of contaminants present in HLW facilities to be closed included a long list of radiological and chemical constituents. For example, the initial Tank Farm inventory data included 143 radionuclides and 20 chemical constituents (plus numerous other chemicals present in only trace amounts). Therefore, DOE developed and applied a screening method to identify those contaminants of potential concern that warrant detailed quantitative analysis. Section 5.3 of the Calculation Package presents the entire initial list of radiological and chemical constituents present in HLW facilities to be closed.

The screening method described in this section was specifically developed for the Tank Farm and bin set closure scenarios. Contaminants that were identified as significant for closure of these facilities were also analyzed for the closure of other INTEC facilities (the New Waste Calcining Facility and the Process Equipment Waste Evaporator), as well as alternative concepts for the disposal of Class A or C-type grout (in the Tank Farm or bin sets, or in a new Low-Activity Waste Disposal Facility).

Radionuclide Screening

An illustration of the general process used for radionuclide screening is presented in Figure C.9-11. The screening of both the Tank Farm and bin sets contaminants started with total decay-corrected residual inventories for the years 2095 and 2516 (Staiger and Millet 2000). DOE performed the following steps in the radionuclide screening process. Section 5.3 of the Calculation Package presents further details on each of these steps.

1. The first step screened out all radionuclides that either (a) had half-lives less than 10 years, or (b) were present in very small amounts. No specific numerical criteria were used for the latter, although a nominal value of one-billionth (1×10^{-9}) of the total activity in the Tank Farm or bin set inventory was used as a guideline. The short half-life criterion was used since previous analysis has shown that for even the most mobile species the migration time through the tank or bin structures (tanks, vaults, etc.) and the underlying vadose (unsaturated) zone to the aquifer is on the order of hundreds of years.

2. The next step was to apply a more quantitative screening factor. The parameter used for this purpose is the radionuclide-specific "ground-burial screening factor" from the National Council on Radiation Protection and Measurements

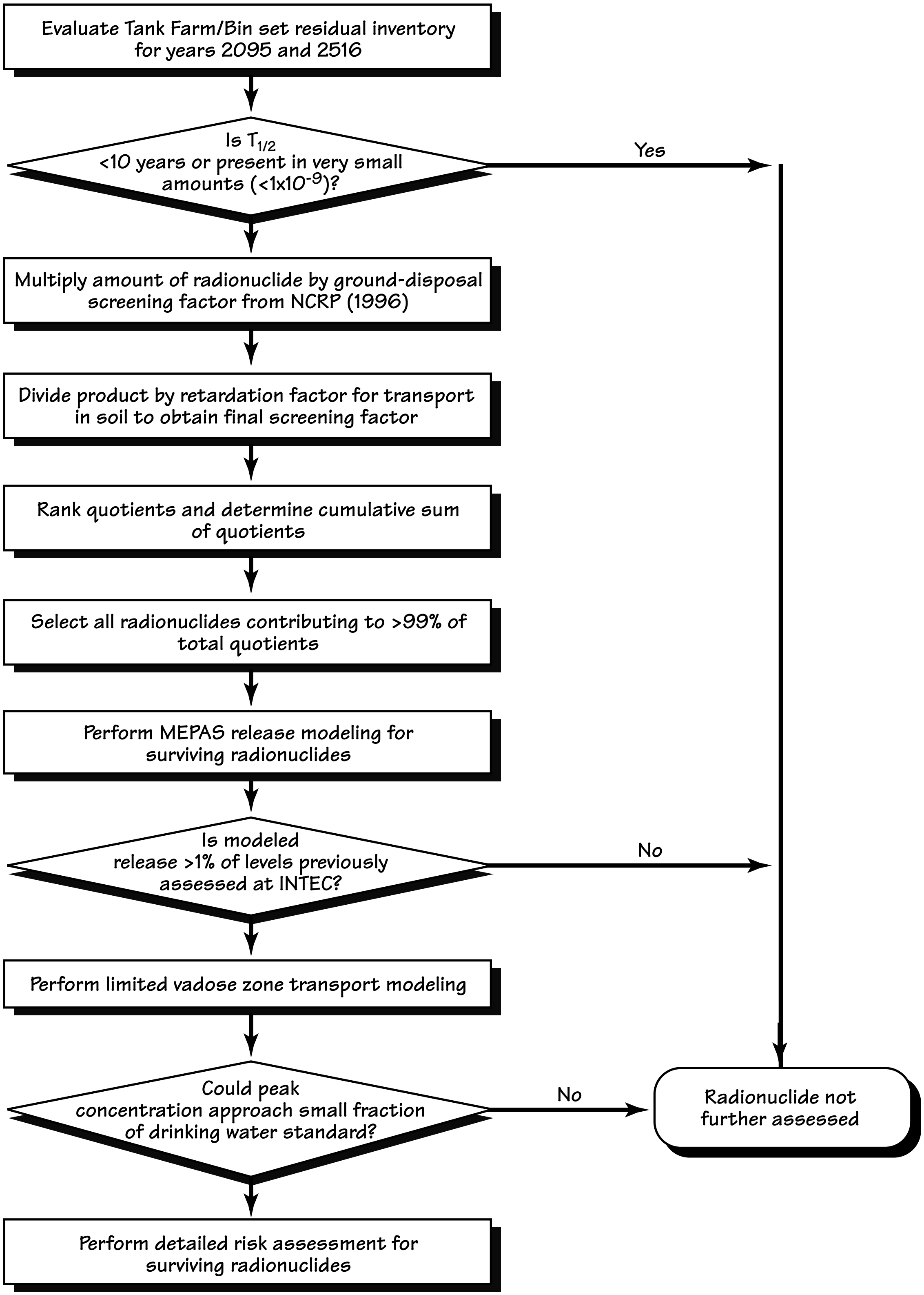

FIGURE C.9-11.
General process used for radionuclide screening for groundwater pathway assessment.

Report No. 123, *Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground* (NCRP 1996). This screening factor is well suited for this purpose, in that it considers a range of factors, including half-life, leach rate and release delay time, and potential dose to receptors by inhalation, ingestion and external exposure modes. DOE performed this screening step by multiplying the amount of each radionuclide remaining in the inventory by the total screening factor for the groundwater pathway to obtain a "screening factor product." Since the National Council on Radiation Protection and Measurements method does not specifically address the migration rate of radionuclides in the unsaturated zone beneath the waste layer, DOE applied an additional screening step to modify the screening factor product by a soil retardation factor. The resulting quotients were then summed, and the radionuclides that collectively accounted for greater than 99 percent of the total radionuclide inventory were selected for further analysis.

3. DOE then performed release modeling using the MEPAS code and compared the results to those of other modeling evaluations previously performed for INTEC activities. Specifically, in order for the radionuclide to be further evaluated, the estimated total activity released to the vadose zone under any facility disposition scenario (including landfill scenarios) must be greater than one percent of the release evaluated for that same radionuclide in the WAG 3 RI/FS (Rodriguez et al. 1997). That study established the health risk to future human receptors for releases which are generally much larger than those projected under the facility disposition scenarios. The WAG 3 RI/FS results enabled DOE to apply this comparison step to screen out those radionuclides that previous analyses have clearly shown will not pose a significant additional risk via the groundwater pathway at the projected level of release.

4. The final screening step involved vadose zone modeling to estimate radionuclide concentrations in the vadose zone at the aquifer interface. This process is described in Section C.9.3.2 and Section 3 of the Calculation Package. Radionuclides projected to be below the 40 CFR 141 maximum contaminant level (MCL) in the pore water of the vadose zone-aquifer interface were eliminated, since dilution in the upper aquifer would quickly dilute contaminant levels to small fractions of the MCL.

As a result of this process, two radionuclides passed the screening and qualified for detailed quantitative analysis: Tc-99 and I-129. The dose and heath risk impacts associated with these long-lived radionuclides were then quantitatively assessed for all facility disposition scenarios (not just those which met the one percent release criterion).

Nonradiological Contaminant Screening

The approach used in identifying chemical contaminants of potential concern warranting further analysis was based primarily on inventory estimates, toxicity, and results of previous evaluations. DOE used the Tank Farm and bin sets inventory data from Staiger and Millet (2000), which contained estimates of bulk chemicals as well as elements formed by fission product decay and neutron activation. The bulk species inventory does not depend on time, but the inventory of some fission and activation species can increase with time. Therefore, the fission and activation species inventory is conservatively based on Year 2516. DOE performed the following steps in the nonradiological contaminant screening process. Section 5.3 of the Calculation Package presents further details on each of these steps.

1. The first step was to identify all chemicals that are both (a) potentially toxic or carcinogenic, and (b) present in the inventory in greater than trace quantities. For the latter, a nominal value of one kilogram was used as a threshold for

human carcinogens, while a 10-kilogram threshold was used for other chemicals (out of a total inventory of hundreds of thousands of kilograms). A noncarcinogenic chemical is considered potentially toxic if an oral reference dose has been established in the EPA's Integrated Risk Information System database (EPA 1998). If an oral reference dose was not available, the contaminant was not selected for further evaluation since ingestion is by far the most important exposure mode for the groundwater pathway. Similarly, a chemical was considered potentially carcinogenic if it is classified within EPA's database as either a human carcinogen or probable human carcinogen.

2. All potential human carcinogens meeting the inventory-based screening criteria were selected for further evaluation by release and vadose zone transport modeling. For noncarcinogenic substances, DOE developed a screening parameter based on inventory and potential toxicity. The screening parameter is the inverse of the product of the inventory and the reference dose. An adjustment to this step was required to account for the effect of lead. No reference dose is established for lead in EPA's database because all levels of intake are considered toxic, and no safe threshold can be assumed. For screening purposes, lead was included in the list of chemicals warranting further evaluation. The screening products for chemicals excluding lead were then ranked, and the chemicals that individually accounted for one percent or more of the total screening product were retained for further evaluation by release and vadose zone transport modeling.

   For bulk species, fluoride, mercury and nitrate accounted for over 99 percent of the screening product total and were selected for further evaluation. Lead and the potential carcinogens cadmium, chromium and nickel were also selected. The screening process conservatively assumes that all of the chromium in the inventory consists of the carcinogenic hexavalent form. The fission and activation species that passed the screening process included uranium, barium, and molybdenum, along with lead and the potential carcinogens arsenic, beryllium and cadmium. For both the Tank Farm and bin set scenarios, the combined total dose for the selected species (excluding lead and carcinogens) would be about 99 percent of the total screening product.

3. The final steps were the same as those used in the radionuclide screening, namely, a comparison of release rates to those previously analyzed in the baseline risk assessment (Rodriguez et al. 1997), and release and transport modeling to estimate contaminant levels at the vadose zone-aquifer interface.

C.9.4.2.2 Direct Radiation Pathway Screening

The initial source term for each facility is the estimated radionuclide contents decay-corrected to the Year 2016. For the Tank Farm and bin set modeling, the single tank or bin set with the highest inventory was selected as the source facility to be used for the residual contamination and No Action scenarios. For cases in which the tank or bin sets are filled with Class A or C-type grout, the dose from both residual activity and radionuclides in the waste materials are included. From the original list of contaminants present in HLW facilities to be closed, DOE identified those radionuclides that account for more than 99 percent of the external dose rate over the period of evaluation. The radionuclide inventory was decay-corrected to 2095, which is assumed to be the earliest date at which institutional control could be lost.

C.9.4.3 Contaminant Source Development for Modeling

As a result of the screening analysis described above, DOE has selected the final list of contaminants shown in Table C.9-4 for both the groundwater and direct radiation pathways.

Table C.9-4. Final list of contaminants after screening that were analyzed for facility disposition impacts.

Groundwater Pathway	Direct Radiation Pathway	
Technetium-99	Americium-241	Plutonium-241
Iodine-129	Barium-137m	Radium-225
Cadmium	Cobalt-60	Radium-226
Fluoride	Cesium-137	Samarium-151
Nitrate	Europium-154	Strontium-90
	Iodine-129	Technetium-99
	Neptunium-237	Thorium-229
	Protactinium-233	Thorium -230
	Plutonium-238	Uranium-233
	Plutonium-239	Uranium-234
	Plutonium-240	Yttrium-90

C.9.5 RESULTS OF IMPACT ANALYSIS

This section describes the potential human health risk posed by contaminants released to groundwater from INTEC HLW facilities over the long term (10,000 years) following ultimate disposition of those facilities. The basis for these evaluations are projected long-term peak groundwater concentrations, which have been reassessed (Schafer 2001) since the issuance of the Draft EIS. Summary results are presented for each of the facility disposition scenarios, and are listed by receptor category, individual facility and closure method. Peak groundwater concentrations and comparison to drinking water standards are also presented. Radiological dose and risk results are presented first, followed by nonradiological health hazard quotients and risks. Results of a more detailed nature are presented in the supporting Calculation Package.

C.9.5.1 Radiological Dose and Risk

As described in Section C.9.4.2, the radionuclides that remained after screening for the groundwater pathway and were subsequently evaluated in detail are Tc-99 and I-129. Table C.9-5 compares the calculated peak groundwater concentrations (in the aquifer beneath INTEC) against the MCLs specified for drinking water by 40 CFR 141. The year when the peak groundwater concentration would occur is also shown. With the exception of Tc-99 in the bin sets - No Action scenario, all radionuclide concentrations are well below their MCLs.

In addition, DOE assessed the external dose to receptors from other radionuclides in dispositioned facilities. The radiation doses resulting from these evaluations are presented in Table C.9-6. The results represent doses over the entire period of exposure for each receptor that would occur during peak years of exposure (peak groundwater concentration or highest external dose rates, depending on receptor). The resultant cancer risk associated with these doses is presented in Table C.9-7. These values represent the probability of developing an excess cancer (fatal and non-fatal) in a receptor receiving the specified dose.

For the maximally exposed resident, doses are highest under the bin sets - No Action scenario (Table C.9-6). The dose of 490 millirem (equivalent to about 16 millirem per year) is dominated by Tc-99 intake via groundwater and food product ingestion. A dose of 84 millirem to the maximally exposed resident is estimated for the Tank Farm - No Action scenario.

Much higher doses are calculated for Tank Farm intruder scenarios than for other facility cases. This disparity is a direct result of the scenario conditions underlying the calculation. The HLW tanks were designed to rely heavily on the soil overburden for radiation shielding, and this soil (as well as a 6-inch concrete layer) is assumed to be removed by the intruder, leaving only the

Table C.9-5. Projected long-term peak groundwater concentrations for contaminants associated with the facility disposition scenarios.

	Contaminant concentration (picocuries per liter or milligrams per liter)			
Contaminant	Calculated peak groundwater concentration	Reference MCL[a]	Concentration as a percent of MCL	Time (years after closure) of peak concentration
Tank Farm - No Action				
Technetium-99	440	900	49	600
Iodine-129	0.19	1.0	19	700
Cadmium	5.2×10^{-4}	5.0×10^{-3}	10	3,200
Fluoride	1.2×10^{-4}	4.0	< 1	2,800
Nitrate	0.62	44 [b]	1.4	600
Bin Sets - No Action				
Technetium-99	2.6×10^{3}	900	290	600
Iodine-129	0.51	1.0	51	800
Cadmium	0.011	5.0×10^{-3}	210	6,500
Fluoride	5.1×10^{-3}	4.0	< 1	10,000[c]
Nitrate	0.048	44	< 1	600
Tank Farm - Performance-Based Closure or Closure to Landfill Standards				
Technetium-99	15	900	1.7	700
Iodine-129	0.13	1.0	13	600
Cadmium	6.8×10^{-5}	5.0×10^{-3}	1.4	3,000
Fluoride	8.1×10^{-7}	4.0	< 1	3,000
Nitrate	2.6×10^{-3}	44	< 1	600
Bin Sets - Performance-Based Closure or Closure to Landfill Standards				
Technetium-99	7.1	900	0.79	900
Iodine-129	2.8×10^{-3}	1.0	0.28	700
Cadmium	7.9×10^{-5}	5.0×10^{-3}	1.6	4,700
Fluoride	4.3×10^{-5}	4.0	< 1	5,000
Nitrate	7.4×10^{-4}	44	< 1	600
New Waste Calcining Facility - Performance-Based Closure or Closure to Landfill Standards				
Technetium-99	0.18	900	< 1	900
Iodine-129	-[d]	1.0	-	-
Cadmium	-	5.0×10^{-3}	-	-
Fluoride	2.8×10^{-6}	4.0	< 1	5,400
Nitrate	1.2×10^{-5}	44	< 1	700
Process Equipment Waste Evaporator - Performance-Based Closure or Closure to Landfill Standards				
Technetium-99	0.19	900	< 1	900
Iodine-129	-	1.0	-	-
Cadmium	-	5.0×10^{-3}	-	-
Fluoride	8.1×10^{-6}	4.0	< 1	1,400
Nitrate	1.2×10^{-5}	44	< 1	700

Table C.9-5. Projected long-term peak groundwater concentrations for contaminants associated with the facility disposition scenarios (continued).

	Contaminant concentration (picocuries per liter or milligrams per liter)			
Contaminant	Calculated peak groundwater concentration	Reference MCL[a]	Concentration as a percent of MCL	Time (years after closure) of peak concentration
Tank Farm - Performance-Based Closure with Class A Grout Disposal				
Technetium-99	15	900	< 1	700
Iodine-129	0.18	1.0	24	700
Cadmium	1.1×10^{-3}	5.0×10^{-3}	22	6,300
Fluoride	5.2×10^{-4}	4.0	< 1	10,000
Nitrate	0.092	44	< 1	600
Bin Sets - Performance-Based Closure with Class A Grout Disposal				
Technetium-99	7.2	900	< 1	800
Iodine-129	0.071	1.0	7.1	1,200
Cadmium	1.5×10^{-3}	5.0×10^{-3}	30	10,000
Fluoride	7.4×10^{-4}	4.0	< 1	10,000
Nitrate	0.47	44	1.1	600
Tank Farm - Performance-Based Closure with Class C Grout Disposal				
Technetium-99	15	900	< 1	700
Iodine-129	0.14	1.0	14	700
Cadmium	5.2×10^{-4}	5.0×10^{-3}	90	3,200
Fluoride	2.8×10^{-4}	4.0	< 1	3,500
Nitrate	0.013	44	< 1	600
Bin Sets - Performance-Based Closure with Class C Grout Disposal				
Technetium-99	7.7	900	< 1	800
Iodine-129	0.053	1.0	5.3	1,200
Cadmium	1.8×10^{-3}	5.0×10^{-3}	36	10,000
Fluoride	9.0×10^{-4}	4.0	< 1	10,000
Nitrate	0.37	44	< 1	600
Disposal of Class A Grout in a New Low-Activity Waste Disposal Facility				
Technetium-99	0.90	900	< 1	1,000
Iodine-129	0.55	1.0	55	900
Cadmium	0.012	5.0×10^{-3}	250	6,500
Fluoride	6.5×10^{-3}	4.0	< 1	9,300
Nitrate	0.13	44	< 1	700
Disposal of Class C Grout in a New Low-Activity Waste Disposal Facility				
Technetium-99	5.7	900	< 1	1,000
Iodine-129	0.39	1.0	39	900
Cadmium	0.014	5.0×10^{-3}	280	6,000
Fluoride	7.9×10^{-3}	4.0	< 1	8,000
Nitrate	0.037	44	< 1	700

a. Maximum contaminant levels are drinking water standards specified in 40 CFR 141.

b. The MCL for nitrate in 40 CFR 141 is 10 milligrams per liter for the nitrogen component, which equates to approximately 44 milligrams per liter of nitrate.

c. Peak concentration occurs near or after 10,000 years. For those contaminants that have peak concentrations occurring after 10,000 years, the analysis indicates that the concentrations would not approach MCLs (Schafer 2001).

d. A dashed line indicates that there is no significant release.

Table C.9-6. Lifetime radiation dose (millirem) for Tc-99 and I-129 by receptor and facility disposition scenario.

Facility	Maximally exposed resident	Future industrial worker	Future intruder	Recreational user
No Action				
Tank Farm	84	4.4	5.1×10^{4}	0.64
Bin sets	490	25	2.3×10^{-4}	3.7
Performance-Based Closure or Closure to Landfill Standards				
Tank Farm	4.4	0.36	1.9×10^{4}	0.057
Bin sets	1.3	0.070	6.6×10^{-9}	0.010
New Waste Calcining Facility	0.034	1.7×10^{-3}	9.1×10^{-11}[a]	2.4×10^{-4}
Process Equipment Waste Evaporator	0.036	1.8×10^{-3}	9.6×10^{-11}[a]	2.6×10^{-4}
Performance-Based Closure with Class A Grout Disposal				
Tank Farm[b]	5.0	0.44	2.0×10^{4}	0.070
Bin sets[b]	2.2	0.19	6.7×10^{-9}	0.030
Performance-Based Closure with Class C Grout Disposal				
Tank Farm[c]	4.6	0.38	2.5×10^{5}	0.061
Bin sets[c]	2.1	0.16	2.4×10^{-7}	0.025
Class A or C Grout Disposal in a New Low-Activity Waste Disposal Facility				
Class A disposal facility	6.9	0.95	2.8×10^{-6}	0.16
Class C disposal facility	5.8	0.72	4.4×10^{-3}	0.12

a. Direct radiation dose to intruder from exposure to residual activity in closed New Waste Calcining Facility and Process Equipment Waste Evaporator was not assessed. Doses shown for these facilities are from groundwater pathway, which includes soil ingestion and inhalation of soil particles as shown in Table C.9-2.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

steel shell of the tank between source and receptor. Alternatively, substantial radiation shielding is provided by structural elements of the bin sets and Low-Activity Waste Disposal Facility, and this shielding is assumed to remain intact during the intrusion scenario for those facilities.

C.9.5.2 Nonradiological Dose and Risk

Nonradiological risk is incurred from intake of cadmium, fluorides and nitrates via ingestion of groundwater, soil and food products, inhalation of dust, and dermal absorption. These intake scenarios are only credible over distant timeframes, well beyond the period of institutional control. Table C.9-5 shows peak aquifer concentrations while Table C.9-8 summarizes noncancer risks associated with intakes in terms of a health hazard quotient, which is the ratio of contaminant intake to the applicable inhalation or oral reference dose. The results represent hazard quotients that would occur during peak years of exposure (peak groundwater concentration). A hazard quotient greater than one indicates that the intake is higher than the reference value. The highest values result from cadmium intake by the maximally exposed resident under the bin sets - No Action scenario and the scenarios involving disposal of Class A or C-type grout in a Low-Activity Waste Disposal Facility. The health hazard quotient is slightly below one for the bin sets - No Action and Class A Grout Disposal in a new Low-Activity Waste Disposal Facility scenarios (0.81 and 0.96, respectively), and slightly above one (1.1) for the Class C Grout Disposal in a new Low-Activity Waste Disposal Facility scenario. Table C.9-5 also compares the peak, long-term groundwater concentrations for nonradionuclides to the MCLs specified in 40 CFR 141. With the exception of cadmium, all concentrations are within currently specified limits. Cadmium concentrations could exceed the MCL under the bin sets - No Action scenario and the scenarios involving disposal of Class A or C-type grout in a Low-Activity Waste Disposal Facility.

Table C.9-7. Lifetime excess radiogenic cancer risk for facility disposition scenarios.

Facility	Maximally exposed resident	Future industrial worker	Future intruder	Recreational user
No Action				
Tank Farm	8.0×10^{-5}	4.1×10^{-6}	0.031	6.0×10^{-7}
Bin sets	4.7×10^{-4}	2.4×10^{-5}	1.4×10^{-10}	3.5×10^{-6}
Performance-Based Closure or Closure to Landfill Standards				
Tank Farm	3.8×10^{-6}	2.8×10^{-7}	0.012	4.4×10^{-8}
Bin sets	1.3×10^{-6}	6.5×10^{-8}	4.0×10^{-15}	9.6×10^{-9}
NWCF	3.2×10^{-8}	1.6×10^{-9}	2.3×10^{-10}[a]	2.3×10^{-10}
PEW Evaporator	3.4×10^{-8}	1.7×10^{-9}	2.5×10^{-10}[a]	2.5×10^{-10}
Performance-Based Closure with Class A Grout Disposal				
Tank Farm[b]	4.1×10^{-6}	3.3×10^{-7}	0.012	5.3×10^{-8}
Bin sets[b]	1.9×10^{-6}	1.4×10^{-7}	4.0×10^{-15}	2.3×10^{-8}
Performance-Based Closure with Class C Grout Disposal				
Tank Farm[c]	3.9×10^{-6}	3.0×10^{-7}	0.15	4.7×10^{-8}
Bin sets[c]	1.8×10^{-6}	1.3×10^{-7}	1.5×10^{-13}	2.0×10^{-8}
Class A or C Grout Disposal in a New Low-Activity Waste Disposal Facility				
Class A disposal facility	4.6×10^{-6}	6.4×10^{-7}	1.7×10^{-12}	1.1×10^{-7}
Class C disposal facility	4.2×10^{-6}	4.9×10^{-7}	2.6×10^{-9}	8.1×10^{-8}

a. Direct radiation dose to intruder from exposure to residual activity in closed New Waste Calcining Facility and Process Equipment Waste Evaporator was not assessed. Doses shown for these facilities are from groundwater pathway, which includes soil ingestion and inhalation of soil particles as shown in Table C.9-2.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

For the cases assessed here, quantifiable cancer risk is associated only with inhalation of cadmium entrained in fugitive dust. These cancer risks were assessed and found to be exceedingly low (less than 1×10^{-10} in all cases), and are therefore not presented in table form.

C.9.5.3 Conclusion

The long-term human health risk associated with various facility disposition scenarios has been assessed using conservative assumptions and refined modeling. For all scenarios other than No Action, all projected radiological doses and risks to residents and workers are very low and meet current regulatory criteria. Protection against intrusion would be required to preclude potentially high doses under some intrusion scenarios. For nonradiological contaminants, current regulatory criteria would be met for all scenarios other than cadmium under the bin set - No Action scenario and Class A or C Grout Disposal in a new Low-Activity Waste Disposal Facility scenarios. Although conservative assumptions have been applied to these analyses, the only projected adverse health effect would be noncancer effects from cadmium intakes that could exceed the reference dose under the Class C Grout Disposal in a new Low-Activity Waste Disposal Facility scenario.

C.9.6 SENSITIVITY ANALYSIS

In additional to the baseline calculations described above, DOE performed a quantitative sensitivity analysis to assess the impact of parameter variability on the contaminant flux to groundwater. Sensitivity analyses were performed by varying the values of a number of parameters used to model the contaminant flux from the closed facilities into the vadose zone. The following sections describe the parameters and the methodology used to implement the sensitivity analysis.

Table C.9-8. Noncarcinogenic health hazard quotients.

Contaminant	Cadmium			Fluoride			Nitrate		
Facility	Maximally exposed resident	Future industrial worker	Recreational user	Maximally exposed resident	Future industrial worker	Recreational user	Maximally exposed resident	Future industrial worker	Recreational user
No Action									
Tank Farm	0.040	8.5×10^{-3}	9.7×10^{-4}	1.6×10^{-4}	1.9×10^{-5}	3.8×10^{-6}	0.047	3.8×10^{-3}	6.5×10^{-4}
Bin sets	0.81	0.17	0.020	7.1×10^{-3}	8.3×10^{-4}	1.7×10^{-4}	3.6×10^{-3}	2.9×10^{-4}	5.0×10^{-5}
Performance-Based Closure or Closure To Landfill Standards									
Tank Farm	5.3×10^{-3}	1.0×10^{-3}	1.2×10^{-4}	1.1×10^{-6}	1.3×10^{-7}	2.7×10^{-8}	1.7×10^{-4}	1.4×10^{-5}	2.4×10^{-6}
Bin sets	6.1×10^{-3}	1.3×10^{-3}	2.8×10^{-3}	6.0×10^{-5}	7.1×10^{-6}	1.4×10^{-6}	5.6×10^{-5}	4.6×10^{-6}	7.8×10^{-7}
NWCF	- [a]	-	-	3.8×10^{-6}	4.5×10^{-7}	9.2×10^{-8}	8.9×10^{-7}	7.2×10^{-8}	1.2×10^{-8}
PEW Evaporator	-	-	-	1.1×10^{-5}	1.3×10^{-6}	2.7×10^{-7}	9.2×10^{-7}	7.5×10^{-8}	1.3×10^{-8}
Performance-Based Closure with Class A Grout Disposal									
Tank Farm[b]	0.088	0.019	2.1×10^{-3}	7.2×10^{-4}	8.5×10^{-5}	1.7×10^{-5}	6.9×10^{-3}	5.6×10^{-4}	9.6×10^{-5}
Bin sets[b]	0.12	0.026	5.5×10^{-3}	1.0×10^{-3}	1.2×10^{-4}	2.5×10^{-5}	0.035	2.9×10^{-3}	4.9×10^{-4}
Performance-Based Closure with Class C Grout Disposal									
Tank Farm[c]	0.040	8.4×10^{-3}	9.6×10^{-4}	3.8×10^{-4}	4.5×10^{-5}	9.3×10^{-6}	9.1×10^{-4}	7.5×10^{-5}	1.3×10^{-5}
Bin sets[c]	0.14	0.031	6.1×10^{-3}	1.2×10^{-3}	1.5×10^{-4}	3.0×10^{-5}	0.028	2.3×10^{-3}	1.4×10^{-4}
Class A or C Grout Disposal In a New Low-Activity Waste Disposal Facility									
Class A disposal facility	0.96	0.20	0.023	9.1×10^{-3}	1.1×10^{-3}	2.2×10^{-4}	9.8×10^{-3}	8.0×10^{-4}	1.4×10^{-4}
Class C disposal facility	1.1	0.23	0.026	0.011	1.3×10^{-3}	2.6×10^{-4}	2.8×10^{-3}	2.3×10^{-4}	3.9×10^{-5}

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a. A dash indicates that there is no quantifiable exposure to this toxicant.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

NWCF = New Waste Calcining Facility; PEW = Process Equipment Waste.

C.9.6.1 Methodology

In this EIS, DOE has made assumptions on numerical parameters that affect the calculated impacts. There is some uncertainty associated with the values of these parameter due to unavailable data and current state of knowledge about closure processes and long-term behavior of materials. The purpose of this section is to discuss the primary sources of uncertainty in the prediction of the mass flux of contaminants leaching from storage containment and being released to the vadose zone. This leaching rate, which is subsequently used as the source term for vadose zone and aquifer concentrations, requires estimation of several parameters, including the following:

- **Inventory:** The amount of material in the closed tanks and facilities directly, linearly affects the concentrations at any given location. The inventories have been estimated as described in Section C.9.4.

  The Continued Current Operations Alternative described in Section 3.1.2 would calcine all remaining mixed transuranic waste/SBW and store the calcine in the bin sets indefinitely. As a result, the volume of calcine stored in the bin sets would be increased by about 20 percent from that evaluated for the No Action Alternative. The amount of radioactivity (total curies) remaining in the bin sets would be increased by about 5 percent. The long-term impacts associated with the bin sets under the Continued Current Operations Alternative would be slightly larger than those presented for the bin set - No Action Scenario. Conversely the long-term impacts associated with the Tank Farm - No Action Scenario would decrease because the liquid mixed transuranic waste/SBW would have been removed from the Tank Farm tanks and calcined.

- **Facility Dimensions:** The physical dimensions of the facilities are important parameters in modeling contaminant releases from closed HLW facilities. DOE made several simplifying assumptions related to facility dimensions in modeling the contaminant transport for this EIS. The Tank Farm and bin sets were each modeled as a single "composite" tank or bin having the characteristics of the individual tanks and bin sets. The surface area of the composite tank/bin set was modeled as the sum of the surface areas of the individual tanks and bin sets. For example, the surface area of the bottoms of the 11 HLW tanks is 1,963.5 square feet each (Spaulding et al. 1998). The total surface area of the composite tank is thus 21,598.5 square feet. Similarly, the basemat thickness was modeled as an average of the basemat thicknesses of the individual tanks and bin sets. For example, the basemat thickness of Tanks WM-180 and WM-181 is 3.0 feet and the basemat thickness of Tanks WM-182 to WM-190 is 2.5 feet (Spaulding et al. 1998). The average basemat thickness is therefore 2.59 feet. Since the basemat thickness is an important parameter, the results would be sensitive to changes in assumed basemat thickness. If the basemat thickness of an individual tank or bin set was smaller that the average basemat thickness of the composite tank/bin, the results for that tank/bin could be higher than that tank or bin set's portion of the composite tank/bin set. Using an average basemat thickness for the composite analysis is a reasonable model simplification.

- **Infiltration Rate:** The driving force for contaminant migration has been assumed to consist of infiltration through the closed facility, which is assumed to remain constant over the entire 10,000-year period of analysis. The infiltration rates through the closed facilities would be less than the annual precipitation rate of 9 inches per year (assuming no localized ponding occurs on top of the closed facilities). Previous INEEL Studies (Rodriguez et al. 1997) have indicated that average infiltration through sediments at the INEEL is on the order of 1.6 inches per year, which is equal to the precipitation rate minus evaporation and plant transpiration. In the area of each of the closed facilities, evaporation would continue as a natural process, reducing the infiltration from the precipitation rate of 9 inches per year. However, it is unlikely that plant transpiration would occur as a result of vegetation growth on top of the closed facilities. This lack of vegetation would probably be offset by run-off from these facilities to lower elevation areas, offsetting the loss of infiltration due to lack of transpiration. Given these competing factors, the MEPAS simulations were performed assuming the site average infiltration rate of 1.6 inches per year.

DOE performed a quantitative sensitivity analysis of the effect of changes in assumed infiltration rate on the resulting groundwater concentrations discussed in Section C.9.5. The effect of increasing or decreasing this value by a factor of 10 was investigated for the contaminant/scenario combinations listed in Table C.9-9.

- **Time of Assumed Grout Failure -** Studies have shown that cementitious materials (such as grout or concrete) can be expected to last for extended periods of time approaching 1,000 years or more (Poe 1998). Therefore, it is likely that the grout would retain its original hydraulic properties for much longer than the 500 years assumed in this analysis. However, the modeling assumes that at 500 years, the concrete and grout in the tanks and facilities would assume the same hydrogeologic transport characteristics as the surrounding soil; however, chemical properties of grout and concrete would remain unchanged. DOE performed a quantitative sensitivity analysis of the effect of changes in assumed time of grout failure. This time of grout failure was varied from the baseline value by assuming that failure occurred earlier (100 years) or later (1,000 years). The effect of an earlier or later time to failure was investigated for the contaminant/scenario combinations listed in Table C.9-9.

- **Distribution Coefficient -** The distribution coefficient (K_d) affects the rate at which contaminates move through strata. Large K_d values retard contaminant movement. Although the reducing grout is assumed to lose hydraulic containment at 500 years, the reducing grout would retain its chemical composition. As a result, the grout would still retard the migration of reactive (adsorbing) chemicals and radioactive constituents. The actual K_d values used in this analysis were selected based on laboratory work performed for reducing cementitious environments (Kimmel 2000a). Sensitivity analyses were performed on the K_d values for the same contaminants that had passed the initial screening and for which MEPAS baseline analyses were performed (Section C.9.3.1) for several of the analyzed scenarios. Table C.9-9 shows the K_d values that were assumed for the contaminant/scenario combinations for which a sensitivity analysis run was performed. These sensitivity analysis runs also serve as an indicator of the effects of different chemical properties of the residual waste or facility basemat layers (i.e., if the residual waste has an oxidizing rather than a reducing environment).

- **Tank Failure:** In the No Action scenario, the 5 tanks in the monolithic tank vaults are assumed to be filled to capacity and the other 6 tanks have residual heels. After being filled to capacity it was conservatively assumed that the tanks degrade and would fail simultaneously at 500 years. For the base case analysis reported in Section C.9.5, some retardation credit was taken for the facility structure. However, there is uncertainty concerning the capability of the structure to retard the liquid once the tanks are assumed to fail. The worst-case event would assume that there is a direct path from the liquid to the soil column.

  Additional analysis was conducted to determine the impact on groundwater from the degradation and simultaneous failure of 5 full mixed transuranic waste/SBW tanks at Year 2516. This

Table C.9-9. Description of sensitivity analysis runs.

Contaminant	Run	K_d (basemat/heel)	Infiltration rate (in/yr)	Fail time (yrs)
Infiltration rate sensitivity runs				
Tank Farm – Performance-Based Closure or Closure to Landfill Standards				
I-129	Base case	2/2	1.6	500
	#17	2/2	0.16	500
	#18	2/2	16	500
Sr-90	Base case	1/8	1.6	500
	#19	1/8	0.16	500
	#20	1/8	16	500
Tc-99	Base case	1/500	1.6	500
	#21	1/500	0.16	500
	#22	1/500	16	500
Time of assumed grout failure sensitivity runs				
Tank Farm - Performance-Based Closure or Closure to Landfill Standards				
I-129	Base case	2/2	1.6	500
	#11	2/2	1.6	100
	#12	2/2	1.6	1000
Sr-90	Base case	1/8	1.6	500
	#13	1/8	1.6	100
	#14	1/8	1.6	1000
Tc-99	Base case	1/500	1.6	500
	#15	1/500	1.6	100
	#16	1/500	1.6	1000
Distribution coefficient sensitivity runs				
Tank Farm - Performance-Based Closure or Closure to Landfill Standards				
I-129	Base case	2/2	1.6	500
	#1	0.2/0.2	1.6	500
	#2	20/20	1.6	500
Tc-99	Base case	1/500	1.6	500
	#3	0.1/50	1.6	500
	#4	10/5000	1.6	500
	#24	0.1/0.1	1.6	500
Sr-90	Base case	1/8	1.6	500
	#5	0.1/0.8	1.6	500
	#6	10/80	1.6	500
Hg	Base case	100/60	1.6	500
	#7	10/6	1.6	500
	#8	1000/600	1.6	500

Table C.9-9. Description of sensitivity analysis runs (continued).

Contaminant	Run	K_d (basemat/heel)	Infiltration rate (in/yr)	Fail time (yrs)
Distribution coefficient sensitivity runs (continued)				
Tank Farm - Performance-Based Closure or Closure to Landfill Standards (continued)				
Cd	Base case	40/23	1.6	500
	#9	4/2.3	1.6	500
	#10	400/230	1.6	500
Pu-239	Base case	5000/2800	1.6	500
	#23	500/280	1.6	500
Np-237	Base case	5000/5000	1.6	500
	#25	5/100	1.6	500
F	Base case	87/44	1.6	500
	#27	0/0	1.6	500
Cr	Base case	360/7.9	1.6	500
	#28	36/0.8	1.6	500
Mo	Base case	280/0	1.6	500
	#29	28/0	1.6	500
Ba	Base case	16,000/16,000	1.6	500
	#30	50/50	1.6	500
Tank Farm - Performance-Based Closure with Class A Grout Disposal				
Np-237	Base case	5000/5000	1.6	500
	#31	5/100	1.6	500
Tc-99	Base case	1/500	1.6	500
	#32	0.1/0.1	1.6	500
F	Base case	87/87	1.6	500
	#33	0/0	1.6	500
Cr	Base case	360/7.9	1.6	500
	#34	36/0.8	1.6	500
Mo	Base case	280/0	1.6	500
	#35	28/0	1.6	500
Ba	Base case	16,000/16,000	1.6	500
	#36	50/50	1.6	500
Tank Farm - Performance-Based Closure with Class C Grout Disposal				
Np-237	Base case	5000/5000	1.6	500
	#37	5/100	1.6	500
Tc-99	Base case	1/500	1.6	500
	#38	0.1/0.1	1.6	500
F	Base case	87/87	1.6	500
	#39	0/0	1.6	500

Table C.9-9. Description of sensitivity analysis runs (continued).

Contaminant	Run	K_d (basemat/heel)	Infiltration rate (in/yr)	Fail time (yrs)
Distribution coefficient sensitivity runs (continued)				
Tank Farm - Performance-Based Closure with Class C Grout Disposal (continued)				
Cr	Base case	360/7.9	1.6	500
	#40	36/0.8	1.6	500
Mo	Base case	280/0	1.6	500
	#41	28/0	1.6	500
Ba	Base case	16,000/16,000	1.6	500
	#42	50/50	1.6	500
Bin Sets - No Action				
Pu-239	Base case	5000/2800	1.6	500
	#26	500/280	1.6	500
Bin Sets - Performance-Based Closure or Closure to Landfill Standards				
Np-237	Base case	5000/5000	1.6	500
	#43	5/100	1.6	500
Tc-99	Base case	1/500	1.6	500
	#44	0.1/0.1	1.6	500
F	Base case	87/44	1.6	500
	#45	0/0	1.6	500
Cr	Base case	360/7.9	1.6	500
	#46	36/0.8	1.6	500
Mo	Base case	280/0	1.6	500
	#47	28/0	1.6	500
Ba	Base case	16,000/16,000	1.6	500
	#48	50/50	1.6	500
Bin Sets – Performance-Based Closure with Class A Grout Disposal				
Np-237	Base case	5000/5000	1.6	500
	#49	5/100	1.6	500
Tc-99	Base case	1/500	1.6	500
	#50	0.1/0.1	1.6	500
F	Base case	87/87	1.6	500
	#51	0/0	1.6	500
Cr	Base case	360/7.9	1.6	500
	#52	36/0.8	1.6	500
Mo	Base case	280/0	1.6	500
	#53	28/0	1.6	500
Ba	Base case	16,000/16,000	1.6	500
	#54	50/50	1.6	500

Table C.9-9. Description of sensitivity analysis runs (continued).

Contaminant	Run	K_d (basemat/heel)	Infiltration rate (in/yr)	Fail time (yrs)
Distribution coefficient sensitivity runs (continued)				
Bin Sets - Performance-Based Closure with Class C Grout Disposal				
Np-237	Base case	5000/5000	1.6	500
	#55	5/100	1.6	500
Tc-99	Base case	1/500	1.6	500
	#56	0.1/0.1	1.6	500
F	Base case	87/87	1.6	500
	#57	0/0	1.6	500
Cr	Base case	360/7.9	1.6	500
	#58	36/0.8	1.6	500
Mo	Base case	280/0	1.6	500
	#59	28/0	1.6	500
Ba	Base case	16,000/16,000	1.6	500
	#60	50/50	1.6	500
Class A Grout Disposal in a New Low-Activity Waste Disposal Facility				
Np-237	Base case	5000/5000	1.6	500
	#61	5/100	1.6	500
Tc-99	Base case	1/500	1.6	500
	#62	0.1/0.1	1.6	500
F	Base case	87/87	1.6	500
	#63	0/0	1.6	500
Cr	Base case	360/7.9	1.6	500
	#64	36/0.8	1.6	500
Mo	Base case	280/0	1.6	500
	#65	28/0	1.6	500
Ba	Base case	16,000/16,000	1.6	500
	#66	50/50	1.6	500
Class C Grout Disposal in a New Low-Activity Waste Disposal Facility				
Np-237	Base case	5000/5000	1.6	500
	#67	5/100	1.6	500
Tc-99	Base case	1/500	1.6	500
	#68	0.1/0.1	1.6	500
F	Base case	87/87	1.6	500
	#69	0/0	1.6	500
Cr	Base case	360/7.9	1.6	500
	#70	36/0.8	1.6	500
Mo	Base case	280/0	1.6	500
	#71	28/0	1.6	500
Ba	Base case	16,000/16,000	1.6	500
	#72	50/50	1.6	500

assessment was made for four key radionuclides using similar modeling methods as those used in the WAG 3 RI/FS (Rodriguez et al. 1997). The results indicate that groundwater concentrations could reach approximately 42 percent of the drinking water standards for Tc-99, 47 percent for I-129, 2.3 percent for Np-237, and 57 percent for plutonium isotopes. This event is treated as an accident and the associated impacts are analyzed and reported in Appendix C.4 and Section 5.2.14.

Analysis was also conducted to determine the impact on groundwater from the degradation and failure of a single full mixed transuranic waste/SBW tank at year 2001. This assessment was made for the same four key radionuclides again using the WAG 3 RI/FS modeling methodology. The results indicate that groundwater concentrations could reach approximately 13 percent of the drinking water standards for I-129, 11 percent for Tc-99, 2.0 percent for Np-137, and 7.3 percent for plutonium isotopes. This event is also treated as an accident and the associated impacts are analyzed and reported in Appendix C.4 and Section 5.2.14.

For tank failures analyzed as accidents, if different modeling assumptions than those considered in the WAG 3 RI/FS were used, calculated groundwater impacts could be much larger. These modeling assumptions are discussed in Appendix C.4 and Section 5.2.14.

- **Interbed continuity and thickness:** In the vadose zone and aquifer transport modeling performed for the WAG 3 RI/FS (Rodriguez et al. 1997), which is the basis for the simplified modeling described in Section C.9.3.2, DOE grouped the sediment interbeds into four relatively thick and continuous interbeds. However, actual observations indicate that the interbeds have a thin and discontinuous nature. Also, more recent interpretation of the INTEC subsurface suggests that sediments comprise about 5 percent of the subsurface rather than the 23 percent assumed for the vadose zone and aquifer modeling. An assumption of thin, discontinuous interbeds would result in faster travel times through the vadose zone and higher peak aquifer concentrations. Reducing the sediment proportion would result in a further reduction in the travel time through the vadose zone.

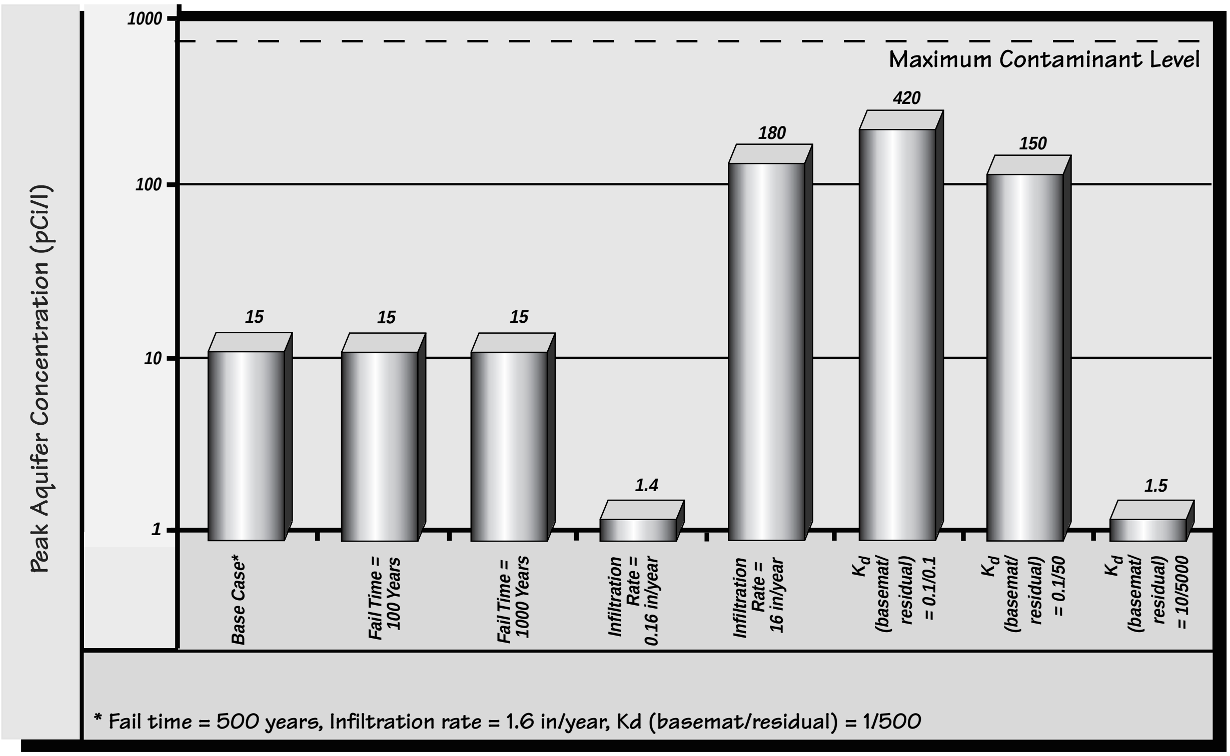
The period of analysis for this modeling was 10,000 years. For constituents that have not reached a peak concentration within 10,000 years (e.g., plutonium), additional sensitivity analysis runs were performed to determine when these constituents reach a peak concentration in the aquifer and at what level. The results of these sensitivity analyses are presented in the Calculation Package.

After selection of these properties and processes, MEPAS simulations were used to predict the flux rate to the soil under the facilities. This mass flux was then used as input into the vadose zone and subsequently into the aquifer. At this point, the analytical approach used in this Appendix is equivalent to that used for the WAG 3 RI/FS (Rodriguez et al. 1997), which provides a discussion of the uncertainties related to the vadose zone and aquifer modeling.

C.9.6.2 Results and Conclusions

DOE performed quantitative sensitivity analyses for the contaminant/scenario combinations listed in Table C.9-9. The results of these analyses are presented in the Calculation Package. To graphically illustrate the sensitivity analysis results, this appendix presents the results of the Tc-99 and I-129 (which constitute the majority of the dose for the base case) Tank Farm - Performance-Based Closure or Closure to Landfill Standards scenario sensitivity analyses. These results are shown in Figures C.9-12 through C.9-15.

Changes in the time of assumed grout failure do not appreciably change the magnitude of the predicted peak groundwater concentrations. In reality, it is expected that failure of the fill material and facility basemat in the individual tanks would occur randomly over time, rather than simultaneously as assumed in this appendix.



* Fail time = 500 years, Infiltration rate = 1.6 in/year, Kd (basemat/residual) = 1/500

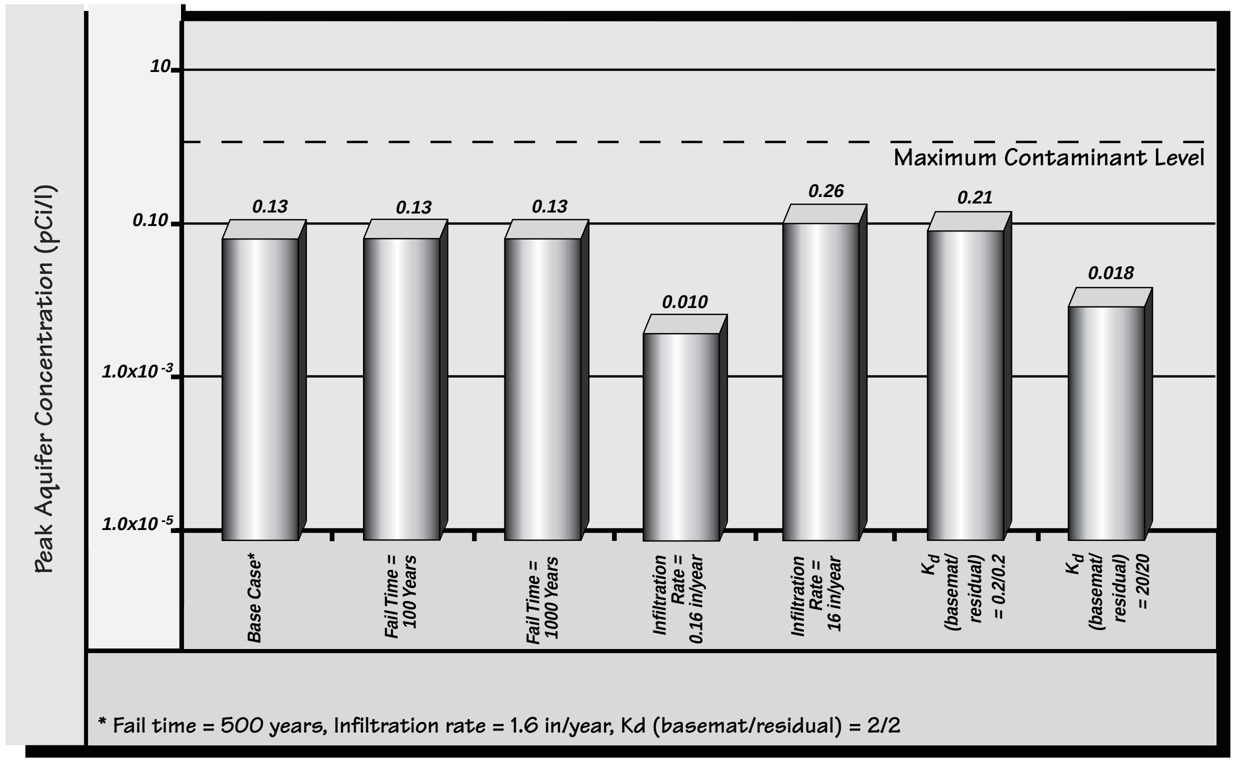
FIGURE C.9-12.
Sensitivity Analysis Results (peak aquifer concentration) for Tc-99: Tank Farm Performance-Based Closure or Closure to Landfill Standards.

Therefore, the assumed time of grout failure has the conservative impact of overestimating the actual transport of contaminants into the environment.

Changes in assumed infiltration rate result in substantial changes in the magnitude of the predicted peak groundwater concentrations. Increasing the infiltration rate results in an increase in predicted peak groundwater concentration. Because the assumed infiltration rate was based on previous INEEL studies (Rodriguez et al. 1997), DOE believes that this value is reasonable for the analyses presented in the appendix.

The distribution coefficient is the most sensitive parameter in estimating the initial leaching of contaminants from the source material (residual contamination or Class A/C-type grout) into the infiltrating water. Therefore, as expected, for all contaminants, decreasing the distribution coefficient results in large increases in the predicted peak groundwater concentrations. As discussed in Section C.9.3.1.2, DOE conducted a literature search of published values for distribution coefficients considered to be reasonable for INEEL conditions (Kimmel 2000a). Based on this review and an understanding of the chemical and physical conditions related to the closed HLW facilities, DOE believes that the set of distribution coefficients values selected for use in the modeling are reasonable for the analyses presented in this appendix.

As described in this appendix, a number of conservative assumptions were included as part of this modeling effort. This has the effect of providing dose/concentration estimates that may be greater than values that might actually be measured. The relative lack of sensitivity of the magnitude of the results to many of the parameters listed above, however, suggests that the estimates depend on a limited few key parameters, such as source term, distribution coefficient, and infiltration rate. DOE recognizes that over the period of analysis in this EIS, there is uncertainty in the structural behavior of materials and the



* Fail time = 500 years, Infiltration rate = 1.6 in/year, Kd (basemat/residual) = 2/2

FIGURE C.9-13.
Sensitivity Analysis Results (peak aquifer concentration) for I-129: Tank Farm Performance-Based Closure or Closure to Landfill Standards.

geologic and hydrogeologic setting of the INTEC. DOE realizes that overly conservative assumptions can be used to bound the estimates of impacts; however, DOE believes that this approach could result in masking of differences of impacts among facility disposition alternatives. Therefore, DOE has attempted to use assumptions in its modeling analysis that are reasonable based on current knowledge so that meaningful comparisons among scenarios can be made.

C.9.7 UNCERTAINTY ANALYSIS

A number of conservative assumptions were included as part of this modeling effort. This has the effect of providing dose/concentration estimates that may be greater than values that might actually be measured. The relative lack of sensitivity of the magnitude of the results to many of the parameters listed above, however, suggests that the estimates depend on a limited few key parameters, such as source term, distribution coefficient, and infiltration rate. It is recognized that over the period of analysis in this EIS, there is uncertainty in the structural behavior of materials and the geologic and hydrogeologic setting of the INTEC. Overly conservative assumptions can be used to bound the estimates of impacts; however, it is believed that this approach could result in masking of differences in impacts among facility disposition alternatives. Therefore, the assumptions used in its modeling analysis, which are reasonable based on current knowledge, allow for meaningful comparisons among scenarios to be made.

The ability of the modeling described in Sections C.9.1 through C.9.5 to represent, or adequately predict, contaminant transport through closed HLW facilities and the subsurface of the INTEC is inherently uncertain. The uncertainties associated with these prediction are primarily functions of (1) the degree to which the conceptual model represents actual contaminant flow and transport processes, (2) the choice of the contaminant specific K_d values and other parame-

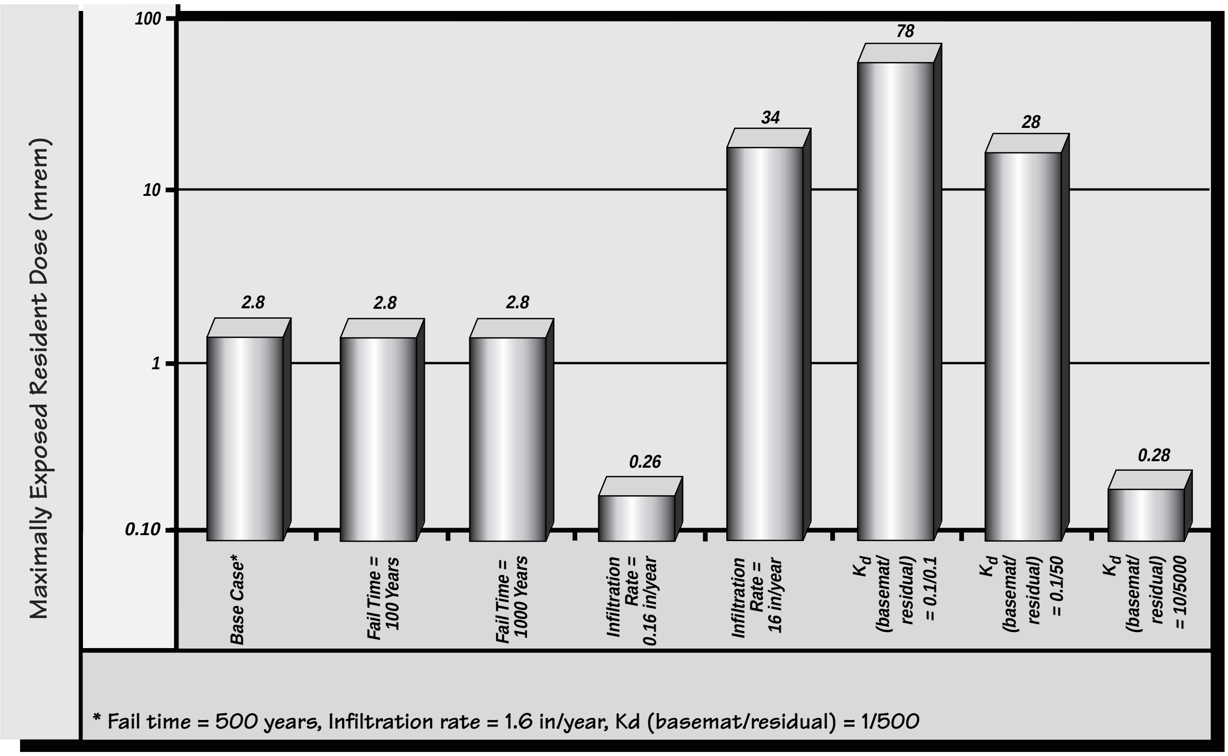


FIGURE C.9-14.
Sensitivity Analysis Results (maximally exposed resident dose) for Tc-99: Tank Farm Performance-Based Closure or Closure to Landfill Standards.

ters, and (3) the accuracy of the estimated source term. The uncertainties related to physical parameters (including the conceptual model and K_d values) are summarized in Section C.9.7.1, and the accuracy of the source term is addressed in Section C.9.7.2.

C.9.7.1 Discussion of Physical Parameter Uncertainty

Conceptual Models

As described in Section C.9.2, the conceptual model includes three general mechanisms by which individuals could be impacted by residual contamination as follows:

- Contaminants could be transported to the aquifer under the facilities and eventually reach wells allowing humans to access the contaminated water for drinking, irrigation, and other purposes.

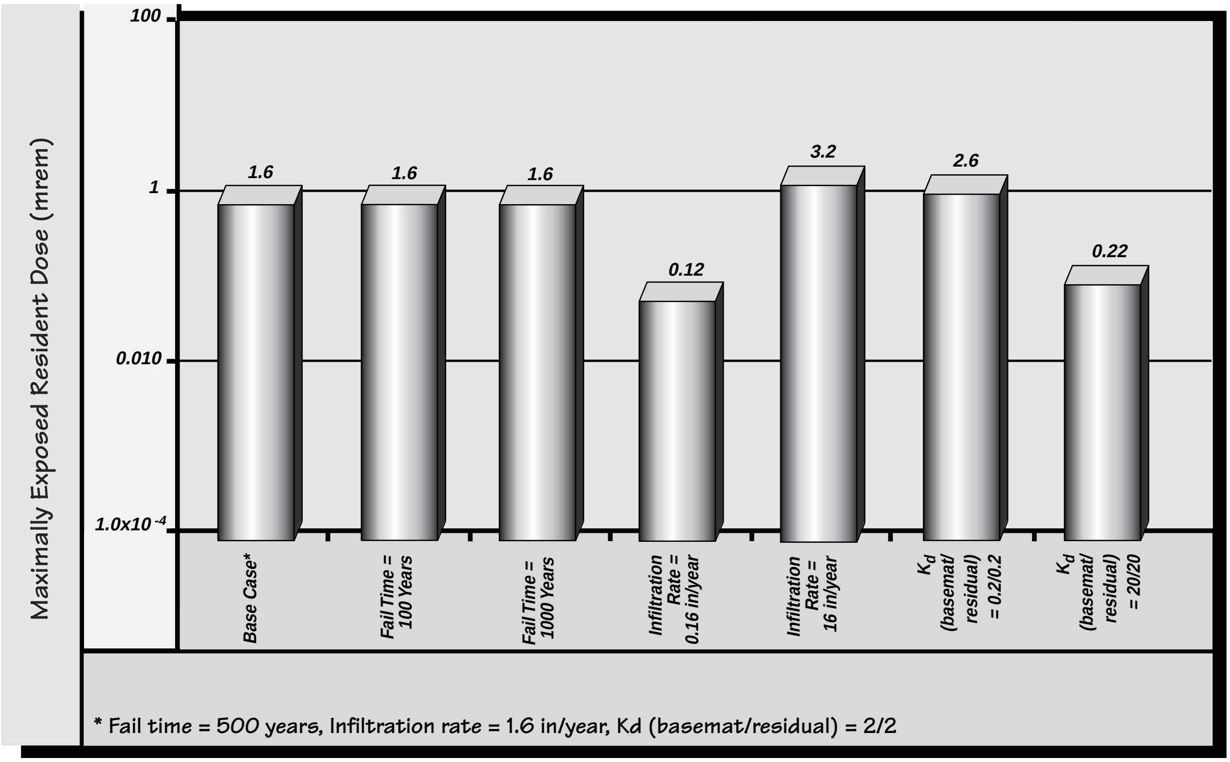
- Contaminants in closed facilities could emit gamma radiation which could directly irradiate humans in the vicinity.

- Contaminants could be released to the environment through airborne pathways due to degradation and weathering of the bin sets under the No Action Alternative.

Uncertainties associated with the vadose zone and aquifer modeling were addressed in Sections 9, 10, and 11 of Appendix F of Rodriguez et al. (1997). The discussions and conclusions in those sections also apply to the updated and simplified approach used in this modeling, as described in Section C.9.3.2.

Uncertainties associated with the conceptual model for the facility basemat modeling include:

- The analysis is based on the assumption that any residual contaminants left in the tanks and bin sets after flushing and/or



* Fail time = 500 years, Infiltration rate = 1.6 in/year, Kd (basemat/residual) = 2/2

FIGURE C.9-15.
Sensitivity Analysis Results (maximally exposed resident dose) for I-129: Tank Farm Performance-Based Closure or Closure to Landfill Standards.

final cleaning would reside on the floor of the facility, thereby creating a higher concentration layer. If residual contaminants were to actually reside on locations other than the floor (i.e., tank walls), this could have the effect of decreasing the predicted contaminant flux out of the facility basemat (by spreading the contaminants through a larger thickness of grout), or it could have the effect of increasing the predicted contaminant flux out of the facility basemat (if the contamination was in an area that was subject to greater water infiltration, such as a void space between the tank walls and the fill material.

- The analysis is based on the assumption that the concrete and grout in all of the tanks and bin sets simultaneously assumes the same hydrogeologic transport characteristics as the surrounding soil at 500 years. In reality, failure of the facility basemat and fill materials would occur randomly over time, which would lead to lower total contaminant flux out of the facility basemat.

- The analysis is based on the assumption that the present environmental conditions including meteorology, infiltration rates, and geologic conditions would remain constant throughout the entire 10,000-year period of analysis. This modeling is dependent on parameter values, such as the infiltration rate, that correspond to these environmental conditions. As discussed in Section C.9.6 the infiltration rate is a sensitive parameter in the facility basemat modeling. Changes in assumed infiltration rate result in substantial changes in the magnitude of the predicted peak groundwater concentrations. Increasing the infiltration rate results in an increase in predicted peak groundwater concentration. Because the assumed infiltration rate was based on previous INEEL studies (Rodriguez et al. 1997), DOE believes that this value is reasonable for this analyses.

Distribution Coefficients (K_ds)

There is considerable range of K_d values for the various contaminants of concern in this modeling. In addition to these different K_d values, there are several different materials through which the contamination would be transported, including calcine, ungrouted Tank Farm residuals, sand pads, facility basemats, reducing grout (Class A or Class C-type grout), and grouted residual waste.

The assumption that the chemical characteristics of the grout are expected to persist long after the analysis period of 10,000 years, and therefore, that the chemical characteristics of the water passing through the grout would continue to inhibit the amount of leaching that would occur after failure also has a significant impact on the calculated contaminant transport. If this assumption were to not occur and the assumed reducing conditions did not exist, the contaminants would migrate into the infiltrating water at a higher rate (i.e., the K_d value would be lower) than was predicted for the reducing environment.

As shown above in Section C.9.6, the K_d value is the most sensitive parameter in estimating the initial leaching of contaminants from the source material (residual contamination or Class A/C-type grout) into the infiltrating water. Therefore, differences in assumed K_d value result in large changes in the predicted peak groundwater concentrations. For these reasons, DOE conducted a literature search of published values for distribution coefficients considered to be reasonable for INEEL conditions (Kimmel 2000a). Kimmel (2000a) presents the rationale for the selected K_d values for each transport layer. Based on this review and an understanding of the chemical and physical conditions related to the closed HLW facilities, it is believed that the set of distribution coefficients values selected for use in the modeling are reasonable for the analyses.

Facility Disposition Alternatives

As described in Section C.9.2, the EIS considered multiple conditions in which the facilities could be readied for ultimate disposition. Some of these alternatives would result in residual radioactivity and nonradiological contaminants that would remain in the facilities after disposition and could be transported to the environment at some point in the future. DOE identified six alternatives that could be implemented for disposition of some or all of the existing INTEC HLW management facilities. These facility disposition alternatives were defined based on the current regulatory requirements for closure of HLW management facilities and do not define *a priori*, what is an acceptable level of residual contamination in each HLW management facility. Therefore, there is uncertainty regarding the exact method in which a facility disposition alternative would be applied to a given HLW management facility.

For existing HLW management facilities, the Preferred Alternative, as described in Section 3.4.2, was to apply performance-based closure methods on a case-by-case basis. These methods would provide a systematic reduction of risks due to residual wastes and contaminants. Closure would be performed to levels economically, practically, and technically feasible such that satisfactory protection of the environment and the public is achieved. Given that these levels depend on a full and accurate characterization of the residual material remaining in the facilities prior to closure, they would not be fully defined until the facilities reach the closure stage. A discussion of uncertainties associated with the contaminant and source term estimates is provided in Section C.9.7.2.

Exposure Receptor Assumptions

As described in Section C.9.2.2, since the nature of land use after the period of institutional control cannot be accurately predicted, a spectrum of potential receptors was identified, and for each of these, a set of exposure-related conditions was developed based on applicable reference sources or reasonable assumptions. (In the context used here, the term receptor refers to categories of persons that may be impacted, after the period of institutional control, by the disposition of HLW management facilities at INTEC.) There is uncertainty related to the definition of these receptors and their habits, and thus potential exposure pathways.

One assumption made in this analysis was that for the impact area in question (the general vicinity of the current INTEC), institutional control would be maintained over this area until the year 2095. After that time, it is assumed for purposes of analysis that this area would not be controlled, and could be used for residential, agricultural, industrial, or recreational purposes for a period of roughly 10,000 years. This assumption would tend to lead to conservative results, since receptors having agricultural habits (including consumption and other use of potentially contaminated groundwater) tend to have the highest intake of contaminants. If this assumption regarding institutional control was to prove to be incorrect and institutional controls over the impact area were to remain in effect, the calculated impacts to these receptors would be less than those reported in this analysis.

C.9.7.2 Uncertainty in the Contaminants and Source Term Estimates

As described in Section C.9.4, engineering studies were performed to estimate the amount of contaminants that could be left in facilities following disposition. These engineering studies relied primarily on process knowledge, supported by limited sampling data. For example, the radionuclide quantities in the solids assumed to be present in the Tank Farm residual were based on analysis of the Tank WM-188 residual solids. However, the I-129 content of the Tank WM-188 solids was below the analytical method detection limit. Therefore, the process knowledge values for I-129 were used in the Tank Farm inventory.

Visual inspections also form the basis for estimating Tank Farm heel solids. In early 1999, a video inspection of Tank WM-188 resulted in an estimate of the residual solids estimate accumulation of one inch (actually ¼ to ½ inch, but conservatively assumed to be one inch). Recent video inspections have subsequently revealed greater accumulations in tanks WM-182 and WM-183, which are estimated to have accumulations of four inches and eight inches, respectively. For the bin sets, the source term estimates were based on measured values, to the extent that these values exist, supplemented by calculated radionuclide ratios to fill in any gaps. These Tank Farm and bin set values subsequently formed the basis for the Class A and Class C-type grout source terms.

DOE expects the residual inventory in the Process Equipment Waste Evaporator (CPP-604) and the New Waste Calcining Facility (CPP-659) after closure would be less than the amount remaining in the Waste Calcining Facility (CPP-633) after it was closed. For this analysis, it was conservatively assumed that the residual inventory in each of the Process Equipment Waste Evaporator and New Waste Calcining Facility would be equal to that in the Waste Calcining Facility. Since residual contamination in these facilities has not been fully characterized (as neither facility has begun waste removal or closure activities), the actual characteristics of the residual have not been measured or otherwise quantified. Therefore, there is substantial uncertainty regarding the residual contaminant source term in these facilities.

It is expected that the source term values for all of the facilities addressed in this modeling represent conservative estimates and that the actual inventories remaining in closed HLW management facilities would be lower than these estimates. As described above in Section C.9.6, the amount of material in the closed tanks and facilities directly, linearly affects the concentrations at any given location. Therefore, any changes in the actual residual source term values from those used in this analysis would strongly influence the final calculated result. Before facilities at INTEC would be closed, the residual contamination would be characterized to quantify the amount of residual material and its concentrations of radioactive and nonradioactive contaminants.

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Appendix C.10

Environmental Consequences Data

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Environmental Consequences Data

C.10.1 WASTE PROCESSING ALTERNATIVES AND OPTIONS

This section presents a summary of data that were used to discuss environmental consequences in the quantitative sections of Chapter 5. The data are presented for each alternative and option. For the Minimum INEEL Processing Alternative, data have been presented for impacts at both the Idaho National Engineering and Environmental Laboratory (INEEL) and the Hanford Site. Five categories of construction data, named in the first column of Table C.10-1, were discussed in Chapter 5 and summarized by discipline below. Eight categories of operations data, named in the first column of Table C.10-2, were discussed in Chapter 5 and are also summarized by discipline below.

Land Use - For the operations phase, the values presented in Table C.10-2 are estimates of the amount of land outside of established facility areas that would be disturbed if a particular waste processing alternative is implemented. Land use impacts are discussed in Section 5.2.1.

Socioeconomics - The values presented are the estimated peak year employment and total earnings for both construction and operational phases for each of the proposed waste processing activities for the period ***through*** 2035. These employment levels are not the result of substantial new job creation but reflect the retraining and reassignment of existing personnel. Waste processing related employment is discussed in Section 5.2.2. The employment levels reported in Section 5.2.2 do not distinguish between jobs that are retained and those that are newly generated. A detailed analysis of socioeconomic impacts is provided in Appendix C.1.

Air Resources - The values presented for the construction phase are for parameters associated with nonradiological airborne emissions from construction activities (i.e., operation of heavy equipment, etc.). The values presented for the operations phase are for parameters associated with both radiological and nonradiological airborne emissions during normal waste processing activities. Radiological parameters are the radiation doses from airborne radionuclide emissions that would be received by (a) a hypothetical person residing at the offsite location of highest predicted dose (called the offsite maximally exposed individual); (b) an INEEL worker who is assumed to spend all of his work time at the onsite area of highest predicted dose (called the noninvolved worker); and (c) the entire population located within 50 miles of the Idaho Nuclear Technology and Engineering Center (INTEC). These doses are calculated using a combination of historical monitored emissions data, projected emissions estimates, atmospheric dispersion modeling using annual average meteorological data measured near INTEC, and exposure and dose modeling.

Nonradiological parameters for the operations phase include: (a) maximum ambient air concentration of a criteria air pollutant, expressed in terms of the highest percentage of an applicable ambient air quality standard and allowable increment under Prevention of Significant Deterioration rules; (b) maximum ambient air concentration of carcinogenic and noncarcinogenic toxic air pollutants, expressed as the maximum percentage of any level allowed by State of Idaho regulations; and (c) maximum onsite concentration of toxic air pollutants, expressed as the maximum percentage of any occupational exposure limit. Nonradiological pollutant concentrations were calculated using a combination of historical monitored emissions data, projected emissions estimates, and atmospheric dispersion modeling using the ISC-3 ***and ISCST-3 codes*** and hourly meteorological data measured near INTEC, as described in Appendix C.2. ***In response to recommendations made by the U.S. National Park Service, the U.S. Department of Energy (DOE) also performed dispersion modeling using the CALPUFF model to assess potential impacts at Class I areas (Craters of the Moon National Wilderness Area and Yellowstone and Grand Teton National Parks).***

Health and Safety - Health and safety impacts for the construction and operational phases are presented in terms of radiological, nonradiological, and occupational injury impacts. The estimated radiation dose is presented for the onsite noninvolved ***worker*** and offsite maximally exposed individual. The ***total campaign collective worker*** dose and related increase in latent cancer fatalities

Table C.10-1. Summary of construction impacts by waste processing alternatives and options.[a]

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	At INEEL	At Hanford	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
Socioeconomics														
Direct employment	Number of jobs	20	90	850	870	680	360	400	330	***550***	200	290	***350***	***670***
Indirect employment	Number of jobs	20	90	***830***	***840***	***650***	***350***	***390***	***320***	***530***	***190***	***280***	***340***	***650***
Total employment	Number of jobs	40	180	1.7×10^{3}	***1.7×10^{3}***	***1.3×10^{3}***	***710***	***790***	***650***	***1.1×10^{3}***	***390***	***570***	***690***	***1.3×10^{3}***
Total earnings	***2000*** dollars ***(millions)***	1.0	4.4	42	43	34	18	20	16	***27***	***9.8***	14	***17***	***33***
Air Resources														
Criteria pollutant emissions	Total tons	18	61	790	750	810	630	740	580	***340***	470	350	***610***	***760***
	Tons per year	3.5	18	250	250	240	180	200	160	***110***	120	59	***150***	***220***
Toxic air pollutant emissions	Total pounds	20	68	880	840	910	710	830	650	***370***	530	390	***670***	***840***
	Pounds per year	3.9	20	280	280	270	800	220	180	***120***	130	66	***170***	***240***
Fugitive dust emissions	Total tons	110	210	2.8×10^{3}	680	2.6×10^{3}	670	910	550	***240***	2.6×10^{3}	1.3×10^{3}	***630***	***850***
	Tons per year	22	46	490	200	430	190	240	150	***83***	420	220	***160***	***210***
Health and Safety														
Total campaign collective worker dose	Person-rem	***37***	***97***	***170***	***200***	***170***	***200***	***200***	***140***	***140***	***170***	NA[b]	***140***	***140***
Total worker latent cancer fatalities	Latent cancer fatalities	***0.015***	***0.039***	***0.069***	***0.078***	***0.069***	***0.078***	***0.078***	***0.054***	***0.054***	***0.069***	NA	***0.054***	***0.054***
Total recordable cases	Cases	***3.9***	14	***190***	***200***	***150***	***67***	81	***69***	***100***	***81***	230	***93***	***170***
Total lost workdays	Days	***30***	***110***	***1.5×10^{3}***	***1.5×10^{3}***	***1.1×10^{3}***	***520***	***620***	***530***	***770***	***620***	NR[c]	***710***	***1.3×10^{3}***
Utilities and Energy														
Potable water use	Million gallons per year	0.12	0.77	6.6	6.8	4.7	3.0	3.2	2.5	***4.1***	2.9	1.8	***2.4***	***4.7***
Baseline potable water use, INTEC operations	Million gallons per year	55	55	55	55	55	55	55	55	***55***	55	NA	***55***	***55***
Percent of baseline INTEC potable water use	Percentage	0.22	1.4	12	12	8.5	***5.5***	5.8	4.5	***7.5***	5.3	NA	***4.4***	***8.5***
Nonpotable water use	Million gallons per year	***0.041***	0.11	0.38	0.41	0.27	0.28	0.46	0.30	***0.15***	0.29	0.040	***0.31***	***0.30***
Baseline nonpotable water use, INTEC operations	Million gallons per year	400	400	400	400	400	400	400	400	***400***	400	NA	***400***	***400***

Table C.10-1. Summary of construction impacts by waste processing alternatives and options [a] (continued).

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	At INEEL	At Hanford	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
Utilities and Energy (continued)														
Percent of baseline INTEC nonpotable water use	Percentage	0.010	***0.028***	***0.095***	0.10	***0.068***	0.070	0.12	***0.075***	***0.038***	***0.073***	NA	***0.078***	***0.075***
Electricity use	Megawatt-hours per year	180	3.4×10^{3}	3.3×10^{3}	6.5×10^{3}	2.9×10^{3}	4.0×10^{3}	4.0×10^{3}	900	***3.1×10^{3}***	1.1×10^{3}	2.9×10^{3}	***1.1×10^{3}***	***3.5×10^{3}***
Baseline INTEC electricity use	Megawatt-hours per year	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	***8.8×10^{4}***	8.8×10^{4}	NA	***8.8×10^{4}***	***8.8×10^{4}***
Percent of INTEC electricity use	Percentage	0.20	3.9	***3.8***	7.4	3.3	4.5	4.5	1.0	***3.5***	1.3	NA	***1.3***	***4.0***
Sanitary wastewater	Million gallons per year	0.12	0.77	6.6	6.8	4.7	3.0	3.2	2.5	***4.1***	2.9	1.8	***2.4***	***4.7***
Baseline INTEC sanitary wastewater	Million gallons per year	55	55	55	55	55	55	55	55	***55***	55	NA	***55***	***55***
Percent of baseline INTEC sanitary wastewater	Percentage	0.22	1.4	12	12	8.5	5.5	5.8	4.5	***7.5***	5.3	NA	***4.4***	***8.5***
Fossil fuel use	Million gallons per year	6.6×10^{-3}	***0.036***	0.43	0.41	0.45	0.35	0.39	0.30	***0.26***	0.23	***0.092***	***0.66***	***0.81***
Baseline INTEC fossil fuel use	Million gallons per year	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	***0.98***	0.98	NA	***0.98***	***0.98***
Percent of baseline INTEC fossil fuel use	Percentage	***0.67***	***3.7***	***44***	***42***	***46***	***36***	***40***	***31***	***27***	***23***	NA	***67***	***83***
Waste and Materials[d]														
Mixed low-level waste generation[e]	Cubic meters	220	240	1.1×10^{3f}	1.1×10^{3}	1.1×10^{3f}	1.1×10^{3}	1.1×10^{3}	1.1×10^{3}	***1.1×10^{3}***	1.1×10^{3}	0	***1.1×10^{3}***	***1.1×10^{3}***
Low-level waste generation[e]	Cubic meters	0	20	330[f]	210	210[f]	260	340	310	***0***	110	0	***1.6×10^{3}***	***1.7×10^{3}***
Hazardous waste generation[e]	Cubic meters	0	30	790[f]	880	280[f]	790	560	640	***200***	340	20	***570***	***840***
Industrial waste generation[e]	Cubic meters	1.4×10^{3}	6.8×10^{3}	5.5×10^{4f}	6.0×10^{4}	3.9×10^{4f}	2.6×10^{4}	3.0×10^{4}	2.3×10^{4}	***2.4×10^{4}***	2.6×10^{4}	1.9×10^{4}	***2.3×10^{4}***	***4.3×10^{4}***

a. The categories of land use, traffic and transportation, and facility accidents do not have construction impacts.
b. NA = Not applicable or not assessed.
c. NR = Not reported.
d. Construction does not generate HLW ***or*** transuranic waste.
e. Values presented represent totals for the duration of the project.
f. This value represents the highest quantity among the disposal methods considered.

Table C.10-2. Summary of operations impacts by waste processing alternatives and options.

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	At INEEL	At Hanford	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
Land Use														
Open land converted to industrial use for new facilities	Acres	0	0	22[a]	0[a]	22[a]	0	0	0	***0***	22[a]	52	***0***	***0***
Socioeconomics[b]														
Direct employment	Number of jobs	***73***	280	440	480	320	460	530	330	***170***	330	740	***310***	***440***
Indirect employment	Number of jobs	***140***	***550***	***870***	***950***	***630***	***910***	***1.0×10^{3}***	***650***	***340***	***650***	***1.5×10^{3}***	***600***	***880***
Total employment	Number of jobs	***220***	***830***	***1.3×10^{3}***	***1.4×10^{3}***	***950***	***1.4×10^{3}***	***1.6×10^{3}***	***980***	***520***	***980***	***2.2×10^{3}***	***910***	***1.3×10^{3}***
Total earnings	***2000*** dollars ***(millions)***	***5.8***	***22***	***35***	***38***	***25***	***37***	***42***	***26***	***14***	***26***	***59***	***24***	***35***
Air Resources														
Dose to offsite maximally exposed individual	Millirem per year	6.0×10^{-4}	1.7×10^{-3}	1.2×10^{-4}	1.8×10^{-3}	6.0×10^{-5}	1.8×10^{-3}	1.7×10^{-3}	8.9×10^{-4}	***6.2×10^{-4}***	9.5×10^{-4}	2.8×10^{-5}	***6.5×10^{-4}***	***6.8×10^{-4}***
Dose to noninvolved worker	Millirem per year	7.0×10^{-6}	1.8×10^{-5}	4.4×10^{-5}	9.0×10^{-5}	3.4×10^{-5}	3.6×10^{-5}	3.0×10^{-5}	4.8×10^{-5}	***2.2×10^{-5}***	1.0×10^{-4}	1.3×10^{-5}	***2.3×10^{-5}***	***2.3×10^{-5}***
Collective dose to population within 50 miles of INTEC	Person-rem per year	***0.038***	***0.11***	***6.6×10^{-3}***	***0.11***	***3.6×10^{-3}***	***0.11***	***0.11***	***0.056***	***0.040***	***0.056***	1.3×10^{-3}	***0.045***	***0.047***
Maximum ambient concentration of criteria air pollutant (highest percent of ambient air quality standard - ***respirable particulates on public roads)***	Percentage	***13***	***13***	***14***	***14***	***13***	***13***	***13***	***13***	***13***	***13***	NA	***13***	***13***
Prevention of Significant Deterioration increment consumption (highest percent of allowable increment in Class I area - ***24-hour sulfur dioxide at Craters of the Moon)***	Percentage	***34***	***35***	***38***	***40***	***36***	***36***	***36***	***34***	***34***	***34***	NA	***34***	***38***
Prevention of Significant Deterioration increment consumption (highest percent of allowable increment in Class II area - ***24-hour sulfur dioxide; INEEL boundary and roads)***	Percentage	***38***	***38***	***38***	***38***	***38***	***38***	***38***	***38***	***38***	***38***	NA	***38***	***38***

Table C.10-2. Summary of operations impacts by waste processing alternatives and options (continued).

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	At INEEL	At Hanford	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
Air Resources (continued)														
Maximum offsite concentration of carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration for carcinogens)	Percentage	***1.2***	***1.9***	***8.1***	***10***	***4.5***	***2.9***	***1.7***	***0.95***	***0.71***	***0.95***	NA	***1.7***	***9.5***
Maximum ambient (offsite or public road location) concentration of non-carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration)	Percentage	***0.03***	***0.05***	***0.18***	***0.23***	***0.10***	***0.08***	***0.07***	***0.03***	***0.02***	***0.02***	NA	***0.03***	***0.20***
Maximum onsite concentration of toxic air pollutant [highest percent of occupational exposure limit (8-hour time weighted average)]	Percentage	***0.013***	***0.32***	***0.69***	***0.88***	***0.49***	***0.33***	***0.33***	***0.017***	***0.085***	***0.16***	NA	***0.017***	***0.49***
Health and Safety														
Total campaign collective worker dose	Person-rem	***350***	***410***	***780***	***980***	***680***	***790***	***1.1×10^{3}***	***710***	***630***	***690***	350	***500***	***650***
Total worker latent cancer fatalities	Latent cancer fatalities	***0.14***	***0.16***	***0.31***	***0.39***	***0.27***	***0.31***	***0.43***	***0.29***	***0.25***	***0.27***	0.14	***0.20***	***0.26***
Integrated noninvolved worker dose	Millirem	2.5×10^{-4}	2.0×10^{-4}	9.2×10^{-4}	8.6×10^{-4}	7.1×10^{-4}	5.8×10^{-4}	3.6×10^{-4}	1.3×10^{-3}	***4.8×10^{-4}***	1.4×10^{-3}	2.3×10^{-5}	***4.8×10^{-4}***	***4.8×10^{-4}***
Integrated offsite maximally exposed individual dose	Millirem	***0.022***	***0.019***	2.5×10^{-3}	6.3×10^{-3}	1.3×10^{-3}	0.020	***0.019***	***0.031***	***0.022***	***0.024***	5.0×10^{-5}	***0.022***	***0.023***
Total recordable cases	Cases	***110***	***150***	***400***	***480***	***300***	***320***	***370***	***330***	***180***	***270***	27	***250***	***330***
Total lost workdays	Days	***850***	***1.1×10^{3}***	***3.0×10^{3}***	***3.7×10^{3}***	***2.3×10^{3}***	***2.5×10^{3}***	***2.9×10^{3}***	***2.5×10^{3}***	***1.4×10^{3}***	***2.0×10^{3}***	NR	***1.9×10^{3}***	***2.5×10^{3}***

Table C.10-2. Summary of operations impacts by waste processing alternatives and options (continued).

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	At INEEL	At Hanford	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
Utilities and Energy														
Potable water use	Million gallons per year	1.4	2.7	4.0	5.8	2.8	3.8	4.8	2.9	***2.0***	2.8	4.8	***2.9***	***4.4***
Baseline potable water use, INTEC operations	Million gallons per year	55	55	55	55	55	55	55	55	***55***	55	NA	***55***	***55***
Percent of baseline INTEC potable water use	Percentage	2.5	4.9	***7.3***	11	5.1	6.9	8.7	5.3	***3.6***	5.1	NA	***5.3***	***8.0***
Nonpotable water use	Million gallons per year	14	62	5.0	69	53	89	62	6.3	***6.1***	6.3	500	***6.2***	***11***
Baseline nonpotable water use, INTEC operations	Million gallons per year	400	400	400	400	400	400	400	400	***400***	400	NA	***400***	***400***
Percent of baseline INTEC nonpotable water use	Percentage	3.5	16	1.3	17	13	22	16	1.6	***1.5***	1.6	NA	***1.6***	***2.8***
Electricity use	Megawatt-hours per year	1.2×10^4	1.8×10^4	4.0×10^4	5.0×10^4	2.9×10^4	3.3×10^4	2.8×10^4	3.9×10^4	***2.4×10^4***	2.5×10^4	6.6×10^5	***3.9×10^4***	***5.2×10^4***
Baseline INTEC electricity use	Megawatt-hours per year	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	***8.8×10^4***	8.8×10^4	NA	***8.8×10^4***	***8.8×10^4***
Percent of INTEC electricity use	Percentage	***14***	20	45	57	33	38	32	44	***27***	28	NA	***44***	***59***
Sanitary wastewater	Million gallons per year	1.4	2.7	4.0	5.8	2.8	3.8	4.8	2.9	***2.0***	2.8	4.8	***2.9***	***4.4***
Baseline INTEC sanitary wastewater	Million gallons per year	55	55	55	55	55	55	55	55	***55***	55	NA	***55***	***55***
Percent of baseline INTEC sanitary wastewater	Percentage	2.5	4.9	***7.3***	11	5.1	6.9	8.7	***5.3***	***3.6***	5.1	NA	***5.3***	***8.0***
Fossil fuel use	Million gallons per year	0.64	1.9	4.5	6.3	2.2	2.8	2.5	1.1	***0.40***	0.49	1.3	***1.3***	***5.0***

Table C.10-2. Summary of operations impacts by waste processing alternatives and options (continued).

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	At INEEL	At Hanford	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
Utilities and Energy (continued)														
Baseline INTEC fossil fuel use	Million gallons per year	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	***0.10***	0.10	NA	***0.10***	***0.10***
Percent of baseline INTEC fossil fuel use	Percentage	640	1.9×10^{3}	4.5×10^{3}	6.3×10^{3}	2.2×10^{3}	2.8×10^{3}	2.5×10^{3}	1.1×10^{3}	***400***	490	NA	***1.3×10^{3}***	***5.0×10^{3}***
Waste and Materials[c]														
Mixed low-level waste generation	Cubic meters	1.3×10^{3}	3.2×10^{3}	***5.9×10^{3d}***	7.9×10^{3}	***5.3×10^{3d}***	6.4×10^{3}	8.6×10^{3}	6.0×10^{3}	***4.1×10^{3}***	5.7×10^{3}	0	***6.0×10^{3}***	***7.5×10^{3}***
Low-level waste generation	Cubic meters	190	9.5×10^{3}	1.2×10^{3}	1.0×10^{4}	960	1.0×10^{4}	1.0×10^{4}	750	***560***	700	1.5×10^{3}	***700***	***1.3×10^{3}***
Hazardous waste generation	Cubic meters	0	0	1.6×10^{3}	1.2×10^{3}	960[d]	4	4	4	***58***	40	23	***4.0***	***1.4×10^{3}***
Industrial waste generation	Cubic meters	1.4×10^{4}	1.9×10^{4}	5.3×10^{4d}	5.2×10^{4}	4.3×10^{4d}	4.3×10^{4}	5.0×10^{4}	4.2×10^{4}	***2.5×10^{4}***	3.5×10^{4}	6.7×10^{3}	***3.0×10^{4}***	***4.2×10^{4}***
Traffic and Transportation														
Estimated total latent cancer fatalities from cargo-related incident-free transportation	Latent cancer fatalities													
Truck		NA	***0.013***	***0.077***	***0.091***	0.23	0.47	***1.4***	0.98	***0.78***	***1.1***	NA	***0.99[e]***	***0.12[e]***
Rail		NA	9.1×10^{-5}	5.0×10^{-4}	6.3×10^{-4}	7.6×10^{-3}	9.4×10^{-4}	***2.7×10^{-3}***	***2.0×10^{-3}***	***3.0×10^{-3}***	***3.0×10^{-3}***	NA	***1.9×10^{-3}***	***5.9×10^{-4e}***
Estimated total number of latent cancer fatalities from cargo-related transportation accidents	Latent cancer fatalities													
Truck		NA	***5.7×10^{-4}***	8.9×10^{-5}	***6.7×10^{-4}***	***0.10***	***5.7×10^{-4}***	0.023	1.5×10^{-6}	***0.039***	0.018	NA	***1.5×10^{-6}***	***7.9×10^{-5}***
Rail		NA	***4.6×10^{-5}***	1.8×10^{-5}	***6.6×10^{-5}***	***0.038***	***4.6×10^{-5}***	1.3×10^{-3}	7.8×10^{-8}	***2.0×10^{-3}***	***2.9×10^{-3}***	NA	***9.9×10^{-8e}***	***1.2×10^{-5}***
Estimated total number of vehicle-related traffic fatalities from transportation accidents	Fatalities													
Truck		NA	8.9×10^{-3}	***0.10***	0.12	0.98	0.21	***0.63***	0.44	***0.42***	***0.51***	NA	***0.45[e]***	***0.13[e]***
Rail		NA	2.1×10^{-3}	0.026	0.030	0.13	0.038	0.11	0.080	***0.088***	***0.094***	NA	***0.077***	***0.027***

Table C.10-2. Summary of operations impacts by waste processing alternatives and options (continued).

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification Alternative	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Steam Reforming Option	At INEEL	At Hanford	Vitrification Without Calcine Separations Option	Vitrification With Calcine Separations Option
Facility Accidents														
Estimated maximum latent cancer fatalities within 50 miles population from bounding accident	Latent cancer fatalities													
Abnormal event		270	270	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	NA	0.23	0.23
Design basis		29	29	29	29	29	29	29	29	29	29	NA	29	29
Beyond design basis		61	61	76	76	61	61	61	61	61	61	NA	61	76
Estimated maximum population dose from bounding accident	Person-rem													
Abnormal event		5.3×10^5	5.3×10^5	470	470	470	470	470	470	470	470	NA	470	470
Design basis		5.7×10^4	5.7×10^4	5.7×10^4	5.7×10^4	5.7×10^4	5.7×10^4	5.7×10^4	5.7×10^4	5.7×10^4	5.7×10^4	NA	5.7×10^4	5.7×10^4
Beyond design basis		1.2×10^5	1.2×10^5	1.5×10^5	1.5×10^5	1.2×10^5	1.2×10^5	1.2×10^5	1.2×10^5	1.2×10^5	1.2×10^5	NA	1.2×10^5	1.5×10^5
Estimated dose to maximally exposed individual from bounding accident	Millirem													
Abnormal event		8.3×10^4	8.3×10^4	40	40	40	40	40	40	40	40	NA	40	40
Design basis		880	880	880	880	880	880	880	880	880	880	NA	880	880
Beyond design basis		1.4×10^4	1.4×10^4	1.7×10^4	1.7×10^4	1.4×10^4	1.4×10^4	1.4×10^4	1.4×10^4	1.4×10^4	1.4×10^4	NA	1.4×10^4	1.7×10^4
Estimated maximum dose to noninvolved worker from bounding accident	Millirem													
Abnormal event		5.7×10^6	5.7×10^6	2.7×10^3	2.7×10^3	2.7×10^3	2.7×10^3	2.7×10^3	2.7×10^3	2.7×10^3	2.7×10^3	NA	2.7×10^3	2.7×10^3
Design basis		5.9×10^4	5.9×10^4	5.9×10^4	5.9×10^4	5.9×10^4	5.9×10^4	5.9×10^4	5.9×10^4	5.9×10^4	5.9×10^4	NA	5.9×10^4	5.9×10^4
Beyond design basis		9.3×10^5	9.3×10^5	1.2×10^6	1.2×10^6	9.3×10^5	9.3×10^5	9.3×10^5	9.3×10^5	9.3×10^5	9.3×10^5	NA	9.3×10^5	1.2×10^6

a. Low-Activity Waste Disposal Facility.

b. Values presented are for peak year.

c. Values presented are totals for the duration of the project.

d. This value represents the highest quantity among the disposal methods considered.

e. Values presented for mixed transuranic waste/SBW transport to the Waste Isolation Pilot Plant.

over the entire period of waste processing activities are presented for the collective worker population. The annual offsite maximally exposed individual, ***noninvolved worker, and collective*** population radiological impact data are discussed in Section 5.2.10 for the waste processing options. The nonradiological data is presented in terms of the projected noncarcinogenic and carcinogenic toxic pollutant concentrations at the site boundary for the waste processing options. The pollutant concentrations and their hazard quotients (ratio of expected concentration to the Idaho regulatory standard) are discussed in Section 5.2.10. The projected occupational injury data associated with waste processing options is presented in terms of total lost workdays and total recordable cases that would occur over the entire ***construction and*** operations ***phases*** of each option. The projected lost workdays and total recordable case rates are based on INEEL historic injury rates multiplied by the predicted employment levels for each option. Further data on lost workdays and total recordable cases for peak employment years are discussed in Section 5.2.10.

Utilities and Energy - The values presented for the construction and operational phases are for water use (potable and non-potable), electricity use, sanitary wastewater, and fossil fuel use. They represent an estimate of the change in annual consumption (water, electricity, and fossil fuels) and generation (sanitary wastewater) that may result from proposed waste processing activities for each alternative and option. ***Baseline utilities and energy values (annual consumption value for the site for all operations) are presented along with the utility and energy use associated with each waste processing option and the subsequent percentage increase from the baseline value.*** Water use, electricity use, sanitary wastewater, and fossil fuel use, and related consequences are discussed in Section 5.2.12.

Waste and Materials - For the construction and operational phases, the generation of mixed low-level, low-level, hazardous, and industrial (non-hazardous and nonradiological) wastes (in cubic meters) is provided. The operational periods for the various alternatives and options would begin at different times, but the period of evaluation ends with the year 2035 in all cases. Correspondingly, the total waste generation values presented here are only for activities through the year 2035. The waste volumes are discussed in Section 5.2.13. It should be noted that the three options under the Separations Alternative in both tables include waste generation from the base case disposal option (i.e., disposal in a new Low-Activity Waste Disposal Facility) for the grouted low-level waste fraction. Section 5.2.13 includes waste generation estimates for other disposal options in addition to the base case.

Traffic and Transportation - For incident free high-level waste transportation ***and cargo related transportation accidents*** under the operations phase, the values in Table C.10-2 represent the total ***latent cancer*** fatalities from shipments of waste for each alternative by truck and rail. The estimated risks of latent cancer fatalities represent the radiological risk from transportation accidents. The estimated risk of vehicle related traffic fatalities represents the nonradiological risk from traffic accidents. Both quantities are based on the total number of shipments associated with each alternative. These data are an aggregate of the data presented in Section 5.2.9 and Appendix C.5.

Facility Accidents - For accidents under the operational phase, the maximally exposed individual***, noninvolved worker, and maximum population*** dose values in the tables are for the accident having the highest consequences to workers or the public. ***The estimated maximum latent cancer fatalities within the 50 mile population from bounding accidents are also presented.*** The accidents selected for reporting are not necessarily the same for workers and the general population. In each category (abnormal event, design basis, and beyond design basis), the accident with the highest consequences was selected, which may be different for workers and the general population. Accident analyses reported in this summary are based on waste processing-related activities only and are found in Section 5.2.14 and in Appendix C.4.

C.10.2 FACILITY DISPOSITION ALTERNATIVES

This section presents a summary of data that were used to discuss facility disposition in the quantitative sections of Section 5.3. The data are presented for new facilities in Table C.10-3 and for existing facilities in Table C.10-4. In Table C.10-3, the data are presented for disposition ***of*** the new facilities that are associated with each of the waste processing options. All new facilities would be dispositioned to clean closure standards at the conclusion of all waste processing activities. Since there are no new facilities under the No Action Alternative, there is no column for No Action in Table C.10-3. Five disposition alternatives are under consideration for the existing facilities. In Table C.10-4, data are presented for each of the proposed disposition alternatives. Descriptions of these alternatives are provided in Section 5.3. Five categories of quantitative data were discussed in Section 5.3, are summarized by discipline below, and presented in Tables C.10-3 and C.10-4. Tables C.10-5 and C.10-6 present the result of the long-term facility disposition fate and transport modeling.

The long-term facility disposition modeling has been revised since the Draft EIS. Since publication of the Draft EIS, DOE has obtained revised waste stream inventory data and has modified certain model assumptions and parameters used in this analysis. Appendix C.9 presents further details on this revised long-term facility disposition fate and transport modeling.

Socioeconomics - The values presented are for the estimated peak year employment and income and are the estimated totals for the life of the disposition activity. These employment levels are not the result of substantial new job creation but reflect the retraining and reassignment of existing personnel. ***Facility disposition*** related employment is discussed in Section 5.3.2. A detailed analysis of socioeconomic impacts is provided in Appendix C.1.

Air Resources - The values presented are for parameters associated with total radiological and nonradiological airborne emissions from normal disposition activities. Radiological parameters are the radiation doses from airborne radionuclide emissions that would be received by (a) a hypothetical person residing at the offsite location of highest predicted dose (called the offsite maximally exposed individual); (b) an INEEL worker who is assumed to spend all of his work time at the onsite area of highest predicted dose (called the noninvolved worker); and (c) the entire population located within 80 kilometers (50 miles) of INTEC. These doses are calculated using a combination of historical monitored emissions data, projected emissions estimates, atmospheric dispersion modeling using annual average meteorological data measured near INTEC, and exposure and dose modeling as described in Appendix C.2.

Nonradiological parameters include: (a) maximum ambient air concentration of a criteria air pollutant, expressed in terms of the highest percentage of an applicable ambient air quality standard and allowable increment under Prevention of Significant Deterioration rules; (b) maximum ambient ***(offsite)*** air concentration of carcinogenic and noncarcinogenic toxic air pollutants, expressed as the maximum percentage of health-based reference levels designated (for new facilities) by State of Idaho regulations; and (c) maximum onsite concentration of toxic air pollutants, expressed as the maximum percentage of any occupational exposure limit. Nonradiological pollutant concentrations were calculated using a combination of historical monitored emissions data, projected emissions estimates, and atmospheric dispersion modeling using the ISC-3 ***and ISCST-3 codes*** and hourly meteorological data measured near INTEC, as described in Appendix C.2.

Health and Safety - Health and safety impacts are presented in terms of total radiological and occupational injury impacts for the entire period of the disposition activities. The estimated increase in latent cancer fatalities is presented for the collective involved worker population. The dose to the collective involved worker group is based on expected radiological conditions from prior INEEL exposure data for similar facility operations. The projected occupational injury data associated with waste processing options is presented in terms of total lost workdays and total recordable cases that would occur over the entire operations phase of each option. The projected lost workdays and total recordable case rates are based on INEEL historic injury rates multiplied by the predicted employment levels for disposition activities following each waste processing option and for each disposition alternative for the existing facilities. Further data on lost workdays and total recordable cases are discussed in Section 5.3.8.

Table C.10-3. New facility disposition data.

			Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
	Units	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
Socioeconomics[a]												
Direct employment	Number of jobs	***58***	***790***	***660***	***730***	***450***	***420***	***320***	***280***	***320***	***340***	***710***
Indirect employment	Number of jobs	***56***	***760***	***640***	***710***	***440***	***400***	***310***	***270***	***310***	***330***	***690***
Total employment	Number of jobs	***110***	***1.6×10^{3}***	***1.3×10^{3}***	***1.4×10^{3}***	***890***	***820***	***630***	***550***	***640***	***670***	***1.4×10^{3}***
Total earnings	***2000*** dollars ***(millions)***	***4.4***	***59***	***50***	***55***	***34***	***31***	***24***	***21***	***24***	***26***	***54***
Air Resources												
Dose to maximum offsite individual	Millirem per year	1.1×10^{-10}	3.3×10^{-10}	3.9×10^{-10}	4.7×10^{-10}	1.8×10^{-10}	1.3×10^{-10}	1.4×10^{-10}	***2.4×10^{-10}***	5.6×10^{-10}	***2.1×10^{-10}***	***3.0×10^{-10}***
Dose to noninvolved worker	Millirem per year	2.0×10^{-11}	6.0×10^{-11}	7.0×10^{-11}	1.4×10^{-10}	3.7×10^{-11}	2.1×10^{-11}	2.8×10^{-11}	***4.3×10^{-11}***	1.6×10^{-10}	***4.3×10^{-11}***	***6.0×10^{-11}***
Collective dose to population within 50 miles of INTEC	Person-rem per year	***4.0×10^{-9}***	***1.2×10^{-8}***	***1.4×10^{-8}***	***1.3×10^{-8}***	***5.7×10^{-9}***	***4.5×10^{-9}***	***4.6×10^{-9}***	***8.8×10^{-9}***	***1.6×10^{-8}***	***7.0×10^{-9}***	***9.9×10^{-9}***
Maximum ambient concentration of criteria air pollutant (highest percent of ambient air quality standard - ***24-hour respirable particulates at public roads)***	Percentage	***15***	***20***	***21***	***19***	***19***	***19***	***18***	***15***	***19***	***18***	***20***
Maximum offsite concentration of carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration for carcinogens)	Percentage	0.65	2.1	2.6	1.8	1.9	2.1	1.7	***0.7***	2.0	***1.6***	***2.2***
Maximum ambient (offsite or public road location) concentration of non-carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration)	Percentage	0.13	0.43	0.53	0.36	0.38	0.43	0.35	***0.15***	0.4	***0.32***	***0.44***
Maximum onsite concentration of toxic air pollutant [highest percent of occupational exposure limit (8-hour time weighted average)]	Percentage	6.5	21	26	18	19	21	17	***7.2***	20	***16***	***22***

Table C.10-3. New facility disposition data (continued).

			Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
	Units	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimum INEEL Processing Alternative	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
Health and Safety												
Estimated latent cancer fatalities in involved worker population	Latent cancer fatalities	***0.017***	***0.11***	***0.11***	***0.077***	***0.12***	***0.084***	***0.068***	***0.033***	***0.055***	***0.071***	***0.12***
Total recordable cases	Cases	***9.2***	***74***	***74***	***54***	***79***	***54***	67	***19***	***45***	***68***	***79***
Total lost workdays	Days	***70***	***570***	***570***	***420***	***610***	***410***	***510***	***140***	***350***	***520***	***610***
Utilities and Energy												
Potable water use	Million gallons per year	1.2	5.2	5.6	4.2	4.9	5.5	3.8	***2.0***	3.5	***4.4***	***5.2***
Nonpotable water use	Million gallons per year	0.80	1.8	3.1	1.7	2.6	1.8	1.2	***1.6***	1.4	***1.4***	***2.5***
Electricity use	Megawatt-hours per year	490	1.3×10^3	1.8×10^3	1.1×10^3	1.4×10^3	1.4×10^3	1.1×10^3	***890***	1.1×10^3	***1.1×10^3***	***1.5×10^3***
Sanitary wastewater	Million gallons per year	1.2	5.2	5.6	4.2	4.9	5.5	3.8	***2.0***	3.5	***4.4***	***5.2***
Fossil fuel use	Million gallons per year	0.21	0.84	1.0	0.69	0.79	0.82	0.65	***0.30***	***0.47***	***0.68***	***0.93***
Waste and Materials												
Mixed low-level waste	Cubic meters	11	***900***[b]	480	***710***[b]	340	350	480	***69***	140	***530***	***900***
Low-level waste	Cubic meters	5.6×10^3	6.8×10^4	7.3×10^4	4.4×10^4	5.0×10^4	4.9×10^4	4.1×10^4	***1.5×10^4***	1.5×10^4	***4.1×10^4***	***8.0×10^4***
Hazardous waste	Cubic meters	260	***48***[b]	290	***50***[b]	340	410	160	***2.5×10^3***	56	***200***	***110***
Industrial waste	Cubic meters	4.8×10^3	***7.0×10^4***[b]	7.2×10^4	***4.4×10^4***[b]	6.8×10^4	9.5×10^4	8.0×10^4	***1.8×10^4***	2.8×10^4	***8.1×10^4***	***$7.7x10^4$***

a. Peak ***year*** values.

b. Values represent the highest quantity among the disposal methods considered.

Table C.10-4. Existing facility disposition data.

		Alternatives									
		Clean Closure		Performance based Closure		Closure to landfill standards		Performance based closure with Class A grout disposal		Performance based closure with Class C grout disposal	
	Units	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets
Socioeconomics											
Direct employment	Number of jobs	***280***	***58***	20	***55***	***12***	***27***	***11***	***11***	***49***	***49***
Indirect employment	Number of jobs	***270***	***56***	***19***	***53***	***12***	***26***	***11***	***11***	***47***	***47***
Total employment	Number of jobs	***550***	***110***	***39***	110	***24***	***53***	***22***	***22***	***96***	***96***
Total earnings	***2000*** dollars ***(millions)***	***21***	***4.4***	***1.5***	***4.1***	***0.90***	***2.0***	***0.83***	***0.83***	***3.7***	***3.7***
Air resources											
Dose to offsite maximally exposed individual	Millirem per year	1.2×10^{-9}	1.0×10^{-10}	1.5×10^{-10}	1.3×10^{-10}	1.1×10^{-9}	9.2×10^{-10}	1.5×10^{-10}	1.3×10^{-10}	1.5×10^{-10}	1.3×10^{-10}
Dose to noninvolved worker	Millirem per year	1.2×10^{-9}	2.3×10^{-11}	1.5×10^{-10}	3.0×10^{-11}	1.1×10^{-9}	2.2×10^{-10}	1.5×10^{-10}	3.0×10^{-11}	1.5×10^{-10}	3.0×10^{-11}
Collective dose to population within 50 miles of INTEC	Person-rem per year	***3.7×10^{-8}***	***6.6×10^{-9}***	***4.6×10^{-9}***	***8.6×10^{-9}***	***3.4×10^{-8}***	***6.1×10^{-8}***	***4.7×10^{-9}***	***8.6×10^{-9}***	***4.7×10^{-9}***	***8.6×10^{-9}***
Maximum ambient concentration of criteria air pollutant (highest percent of ambient air quality standard)	Percentage	***14***	***13***	***13***	***13***	***13***	***13***	***13***	***13***	***13***	***13***
Maximum offsite concentration of carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration for carcinogens)	Percentage	0.19	9.0×10^{-3}	***0.037***	8.0×10^{-3}	***0.026***	8.0×10^{-3}	***0.023***	***0.012***	***0.023***	***0.012***
Maximum ambient (offsite or public road location) concentration of non-carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration)	Percentage	***0.038***	2.0×10^{-3}	8.0×10^{-3}	2.0×10^{-3}	5.0×10^{-3}	2.0×10^{-3}	5.0×10^{-3}	2.0×10^{-3}	5.0×10^{-3}	2.0×10^{-3}
Maximum onsite concentration of toxic air pollutant [highest percent of occupational exposure limit (8-hour time weighted average)]	Percentage	1.9	0.09	0.37	0.08	0.26	0.08	0.23	0.12	0.23	0.12

Table C.10-4. Existing facility disposition data (continued).

		Alternatives									
		Clean Closure		Performance based Closure		Closure to landfill standards		Performance based closure with Class A grout disposal		Performance based closure with Class C grout disposal	
	Units	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets
Health and Safety											
Estimated latent cancer fatalities in involved worker population	Latent cancer fatalities	***0.76***	***0.15***	***0.042***	***0.12***	***0.020***	***0.057***	***0.026***	***0.080***	***0.026***	***0.080***
Total recordable cases	Cases	***280***	***56***	***16***	***43***	***7.5***	***21***	***9.8***	***30***	***9.8***	***30***
Total lost workdays	Days	***2.1×10^{3}***	***430***	***120***	***330***	***58***	***160***	***75***	***230***	***75***	***230***
Utilities and Energy											
Potable water use	Million gallons per year	2.0	0.32	0.11	0.31	0.06	0.15	0.13	0.52	0.14	***0.55***
Nonpotable (process) water use	Million gallons per year	0.05	3.9×10^{-3}	0.06	0.01	0.09	***0.011***	0.05	0.03	0.05	0.03
Electricity use	Megawatt-hours per year	7.3×10^{3}	3.2×10^{3}	4.4×10^{3}	6.0×10^{3}	1.2×10^{3}	990	4.6×10^{3}	1.5×10^{3}	4.6×10^{3}	1.5×10^{3}
Sanitary wastewater	Million gallons per year	2.0	0.32	0.13	0.32	0.10	0.16	0.14	0.52	0.15	0.56
Fossil fuel use	Million gallons per year	0.08	3.9×10^{-3}	0.02	6.6×10^{-3}	***0.011***	5.2×10^{-3}	***0.010***	5.2×10^{-3}	***0.010***	5.0×10^{-3}
Waste and Materials											
Mixed low-level waste	Cubic meters	1.1×10^{4}	180	120	85	480	33	120	540	120	540
Low-level waste	Cubic meters	1.1×10^{3}	4.6×10^{3}	0	150	0	150	0	0	0	0
Hazardous waste	Cubic meters	0	130	79	100	0	100	27	28	27	28
Industrial waste	Cubic meters	1.6×10^{5}	2.4×10^{4}	1.9×10^{3}	3.6×10^{3}	1.7×10^{3}	3.6×10^{3}	1.5×10^{3}	1.5×10^{4}	1.5×10^{3}	1.5×10^{4}

Table C.10-5. Lifetime radiation dose (millirem) for Tc-99 and I-129 by receptor and facility disposition scenario.

Facility	Maximally exposed resident	Future industrial worker	Intruder	Recreational user
No Action				
Tank Farm	84	4.4	5.1×10^{4}	0.64
Bin sets	490	25	2.3×10^{-4}	3.7
Performance-Based Closure or Closure to Landfill Standards				
Tank Farm	4.4	0.36	1.9×10^{4}	0.057
Bin sets	1.3	0.070	6.6×10^{-9}	0.010
New Waste Calcining Facility	0.034	1.7×10^{-3}	9.1×10^{-11}[a]	2.4×10^{-4}
Process Equipment Waste Evaporator	0.036	1.8×10^{-3}	9.6×10^{-11}[a]	2.6×10^{-4}
Performance-Based Closure with Class A Grout Disposal				
Tank Farm[b]	5.0	0.44	2.0×10^{4}	0.070
Bin sets[b]	2.2	0.19	6.7×10^{-9}	0.030
Performance-Based Closure with Class C Grout Disposal				
Tank Farm[c]	4.6	0.38	2.5×10^{5}	0.061
Bin sets[c]	2.1	0.16	2.4×10^{-7}	0.025
Class A or C Grout Disposal in a New Low-Activity Waste Disposal Facility				
Class A disposal facility	6.9	0.95	2.8×10^{-6}	0.16
Class C disposal facility	5.8	0.72	4.4×10^{-3}	0.12

a. Direct radiation dose to intruder from exposure to residual activity in closed New Waste Calcining Facility and Process Equipment Waste Evaporator was not assessed. Doses shown for these facilities are from groundwater pathway.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

Table C.10-6. Noncarcinogenic health hazard quotients.

Contaminant	Cadmium			Fluoride			Nitrate		
Facility	Maximally exposed resident	Future industrial worker	Recreational user	Maximally exposed resident	Future industrial worker	Recreational user	Maximally exposed resident	Future industrial worker	Recreational user
No Action									
Tank Farm	0.040	8.5×10^{-3}	9.7×10^{-4}	1.6×10^{-4}	1.9×10^{-5}	3.8×10^{-6}	0.047	3.8×10^{-3}	6.5×10^{-4}
Bin sets	0.81	0.17	0.020	7.1×10^{-3}	8.3×10^{-4}	1.7×10^{-4}	3.6×10^{-3}	2.9×10^{-4}	5.0×10^{-5}
Performance-Based Closure or Closure To Landfill Standards									
Tank Farm	5.3×10^{-3}	1.0×10^{-3}	1.2×10^{-4}	1.1×10^{-6}	1.3×10^{-7}	2.7×10^{-8}	1.7×10^{-4}	1.4×10^{-5}	2.4×10^{-6}
Bin sets	6.1×10^{-3}	1.3×10^{-3}	2.8×10^{-3}	6.0×10^{-5}	7.1×10^{-6}	1.4×10^{-6}	5.6×10^{-5}	4.6×10^{-6}	7.8×10^{-7}
NWCF	-[a]	-	-	3.8×10^{-6}	4.5×10^{-7}	9.2×10^{-8}	8.9×10^{-7}	7.2×10^{-8}	1.2×10^{-8}
PEW Evaporator	-	-	-	1.1×10^{-5}	1.3×10^{-6}	2.7×10^{-7}	9.2×10^{-7}	7.5×10^{-8}	1.3×10^{-8}
Performance-Based Closure with Class A Grout Disposal									
Tank Farm[b]	0.088	0.019	2.1×10^{-3}	7.2×10^{-4}	8.5×10^{-5}	1.7×10^{-5}	6.9×10^{-3}	5.6×10^{-4}	9.6×10^{-5}
Bin sets[b]	0.12	0.026	5.5×10^{-3}	1.0×10^{-3}	1.2×10^{-4}	2.5×10^{-5}	0.035	2.9×10^{-3}	4.9×10^{-4}
Performance-Based Closure with Class C Grout Disposal									
Tank Farm[c]	0.040	8.4×10^{-3}	9.6×10^{-4}	3.8×10^{-4}	4.5×10^{-5}	9.3×10^{-6}	9.1×10^{-4}	7.5×10^{-5}	1.3×10^{-5}
Bin sets[c]	0.14	0.031	6.1×10^{-3}	1.2×10^{-3}	1.5×10^{-4}	3.0×10^{-5}	0.028	2.3×10^{-3}	1.4×10^{-4}
Class A or C Grout Disposal In a New Low-Activity Waste Disposal Facility									
Class A disposal facility	0.96	0.20	0.023	9.1×10^{-3}	1.1×10^{-3}	2.2×10^{-4}	9.8×10^{-3}	8.0×10^{-4}	1.4×10^{-4}
Class C disposal facility	1.1	0.23	0.026	0.011	1.3×10^{-3}	2.6×10^{-4}	2.8×10^{-3}	2.3×10^{-4}	3.9×10^{-5}

a. A dash indicates that there is no quantifiable exposure to this toxicant.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

NWCF = New Waste Calcining Facility; PEW = Process Equipment Waste.

Utilities and Energy - The values presented are for water use (potable and non-potable), electricity use, sanitary wastewater, and fossil fuel use. They represent the utility and energy requirements for disposition (clean ***closure***) ***of*** new facilities built to support the various waste processing alternatives and disposition ***of*** existing facilities, depending on the facility disposition alternative selected. Water use, electricity use, sanitary wastewater, and fossil fuel use and related consequences are discussed in Section 5.2.12.

Waste and Materials - The data presented represent the total generation of mixed low-level, low-level, hazardous, and industrial nonhazardous and nonradiological wastes (in cubic meters) from the disposition activities over the entire disposition period. The waste volumes are discussed in Section 5.3.11.

- New Information -

Appendix D

Comment Documents on Draft EIS

Appendix D

Comment Documents on Draft EIS

D.1 Introduction

This appendix provides scanned copies of all the original comment documents received by DOE or transcribed by the hearing recorder at the public meetings on the Draft Idaho High Level Waste and Facilities Disposition EIS.

The Appendix D index lists comment documents alphabetically in four categories: Individuals, Government Agencies/Tribes, Organizations, and Public Hearings. As in the Chapter 11 Table 11-2, comment document numbers appear opposite each commentor's name. The index for this appendix also identifies the page number where the scanned document appears. A specific page may contain more than one comment document. The comment document number appears above the document on each page. There may be more than one comment document for an individual, agency or organization (e.g. Craig, Larry, U.S. Senate, Document 6, page 12, and Document 35, pages 46-47).

Each comment document may contain a number of comments on different topics. The Roman Numerals handwritten in the margins of the comment documents correspond to the comment summary topics shown in Table 11-1, Chapter 11, Comment Responses.

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