4 ENVIRONMENTAL IMPACTS

This section presents the potential impacts of the construction and operation of the proposed Idaho Spent Fuel Facility. For the proposed action, the environmental impact statement (EIS) would consider impacts from construction activities, normal operational events, reasonably foreseeable accidents, and cumulative impacts. Cumulative impacts are discussed separately in Section 4.14. Impacts from the no-action alternative are presented in Section 4.15. The safety aspects of the proposed Idaho Spent Fuel Facility will be evaluated by the U.S. Nuclear Regulatory Commission (NRC) in more detail in the safety evaluation report to be prepared by NRC.

In constructing the proposed Idaho Spent Fuel Facility, Foster Wheeler Environmental Corporation (FWENC) would prepare the site adjacent to the Idaho Nuclear Technology and Engineering Center (INTEC). This preparation would include clearing and grading, extension and realignment of existing facilities, and addition of any necessary roads. After site preparation, there would be excavation for the foundations and below-grade facilities, erection of the buildings, connection of the INTEC utilities to the facility, and any final landscaping. Potential operational impacts would include emissions from routine operations, transfer from current storage locations, and credible accidents and external events. Because the current storage location for the spent nuclear fuel (SNF) is at the INTEC facility, the transfer distances would be short and conducted according to existing U.S. Department of Energy (DOE) procedures.

4.1 Land Use Impacts

If the FWENC construction authorization is approved, the proposed Idaho Spent Fuel Facility would be constructed on a previously disturbed site currently in use as a construction laydown area adjacent to the southeast corner of INTEC. This property is classified as least productive (FWENC, 2001a). Construction equipment would be used to grade the site and excavate the foundation for the facility. Explosives would not be used to establish below-grade areas. During construction, equipment delivering cement and other construction materials would access the site. In addition to the 3.2-ha [8-acre] site for the facility, a 4.1-ha [10-acre] plot northeast of the site would be used as a construction laydown area. Because it is not part of the proposed Idaho Spent Fuel Facility, the only construction activities here would be some grading and leveling, as for a parking lot. The construction laydown area would have similar restrictions and effects on land use as the proposed Idaho Spent Fuel Facility site itself.

NRC Environmental and Safety Reviews

The focus of an EIS is a presentation of the environmental impacts of the proposed action. In addition to meeting its responsibilities under the National Environmental Policy Act (NEPA), the NRC prepares a safety evaluation report to analyze the safety of the proposed action and assess its compliance with applicable NRC regulations.

The safety and environmental reviews are conducted in parallel. Although there is some overlap between the content of a safety evaluation report and the EIS, the intent of the documents is different. To aid in the decision process, the EIS provides a summary of the more detailed analyses included in the safety evaluation report. The EIS does not address accident scenarios, rather it addresses the environmental impacts which would result from the accident. Much of the information describing the affected environment in the EIS is also applicable to the safety evaluation report (e.g., demographics, geology, and meteorology).

The proposed Idaho Spent Fuel Facility does not have an independent electrical transmission corridor for power distribution. Electrical power for operations would be supplied from the INTEC distribution system. The INTEC distribution system would be connected to the proposed Idaho Spent Fuel Facility site boundary through a small substation. The final leg of the connection would route underground supply cables approximately 61 m [200 ft] to the proposed Idaho Spent Fuel Facility. Because the connection to the distribution system and routing path is on the proposed Idaho Spent Fuel Facility site, the impact of the transmission corridor on land use is negligible.

Once the proposed Idaho Spent Fuel Facility is completed, access to the site would be restricted, in accordance with 10 CFR Part 73, to activities in support of facility operations. By terms of this restricted access, the property would be unavailable for other uses such as exploration of mineral resources. No mineral resources have been found at the proposed site (Section 3.4.3). As described in Section 3.2, livestock grazing is already prohibited within 3.2 km [2 mi] of INTEC, so the impact on grazing and hunting would be negligible. Also, the nearest boundary of the Idaho National Engineering and Environmental Laboratory (INEEL) Sagebrush Steppe Ecosystem Reserve is located more than 17.6 km [11 mi] to the north of INTEC and would not be affected by the proposed facility.

Construction of the proposed Idaho Spent Fuel Facility would physically change the 3.2-ha [8-acre] tract. Because the proposed Idaho Spent Fuel Facility site (i) is only a small portion of the 2,580-km^2 [890-mi^2] INEEL and (ii) has been previously disturbed, the physical changes are minor. As outlined previously, these changes would restrict land use and would have a small impact during construction and operation of the proposed Idaho Spent Fuel Facility.

4.2 Transportation Impacts

Potential transportation-related impacts can be caused by construction activities, SNF transfer from interim storage to the proposed Idaho Spent Fuel Facility, and the eventual transfer of SNF to a geologic repository for final disposal. The peak workforce for construction of the proposed Idaho Spent Fuel Facility is estimated at 250 workers (FWENC, 2003). These additional workers would not increase the total INEEL workforce from previous levels when the facility had greater numbers of employees (FWENC, 2003). Given available road capacity (discussed in Section 3.3) and the relatively small number of additional construction workers, the impacts to local transportation infrastructure from construction are expected to be minor. Potential impacts from SNF transfer and geologic disposal are discussed in the following sections.

4.2.1 SNF Transfer from Interim Storage to the Proposed Idaho Spent Fuel Facility

Most SNF for the proposed Idaho Spent Fuel Facility is presently being stored at the adjacent INTEC, which is inside the boundary of the INEEL facility. The SNF for the proposed Idaho Spent Fuel Facility that remains to be shipped to INTEC consists of approximately 500 training, research, and isotope reactors built by General Atomics (TRIGA) elements. The environmental impacts of transporting these remaining TRIGA elements from their foreign sites of origin to United States ports of entry were previously assessed by DOE (1996a) and summarized in a record of decision (DOE, 1996b). The environmental impacts of shipping the same fuel from the United States ports of entry to INEEL were also previously assessed by DOE in a separate EIS (DOE, 1995). Both assessments found low environmental impacts from planned transportation

of TRIGA fuel. Because transportation impacts have been previously evaluated, no new assessment of impacts associated with SNF shipments is necessary for this EIS.

Details of proposed systems and operations for fuel transfer to the proposed Idaho Spent Fuel Facility from INTEC are provided in the applicant's Safety Analysis Report (FWENC, 2001b). Fuel transfer is expected to occur using the DOE-supplied casks (Peach Bottom PB–1 and PB–2 casks) loaded onto trailers (flatbed and lowboy depending on cask type) for a distance of about 460 m [1,500 ft] between the two facilities (FWENC, 2001b, Appendix A). The casks are expected to provide the necessary geometric control and configuration, confinement, and shielding of the SNF to ensure the radiation protection and criticality safety requirements are met at the proposed Idaho Spent Fuel Facility. Detailed descriptions of cask design, testing, and prior certification information are also provided in the applicant's Safety Analysis Report (FWENC, 2001b, Appendix A). A conservative shielding analysis using a Peach Bottom cask loaded with TRIGA fuel (highest photon flux of all fuel types included in the proposed action) estimated the dose rate at contact surface of the package to be less than 0.1 mSv/hr [10 mrem/hr] and 0.034 mSv/hr [3.4 mrem/hr] at 0.3 m [1 ft] (FWENC, 2001b, Appendix A). Dose estimates that include transfer operations are provided in the occupational health impacts section (4.12.1.2.2). That section indicates worker dose estimates are well below the annual occupational dose limit in 10 CFR Part 20 {50 mSv/yr [5,000 mrem/yr]}. Although dose estimates provide insight about potential radiation exposures during operations, all occupational radiation exposures will be maintained below the limits of 10 CFR Part 20 by implementing a compliant radiation protection program (FWENC, 2001b, Section 3.3)

The transporter is a tractor with administratively controlled petroleum fuel content and speed of travel to reduce the chance of fire or transport accidents (FWENC, 2001b, Appendix A). Scenarios and estimated consequences for potential off-normal events and accidents including those that could impact transfer operations are discussed in Sections 4.12.2 and 4.12.3. Because the transfer of fuel from INTEC to the proposed Idaho Spent Fuel Facility occurs completely within the boundaries of the site (i.e., INEEL), there are no significant off-site dose or transportation impacts from proposed normal transfer operations.

Factors such as the restricted access on-site location, limited speed and distance traveled, low dose rate from the shielded packages, and administrative controls (including a radiation protection program that addresses 10 CFR Part 20 requirements) provide confidence that transfer operations can be conducted safely with minimal adverse environmental impacts.

4.2.2 Shipment of SNF to a Proposed Geologic Repository

In accordance with the 1995 Settlement Agreement among DOE, the State of Idaho, and the U.S. Navy, it is anticipated that SNF would be transferred from the proposed Idaho Spent Fuel Facility to a geologic repository by 2035. The specific timing of the removal would depend on DOE having a repository constructed and ready to receive SNF and on the schedules developed by DOE to ship SNF from current storage locations around the United States to a repository.

General aspects of the removal would require transfer of the SNF from its interim storage at the Idaho Spent Fuel Facility and loading the SNF either onto trucks or specially designed railroad cars for transport to the geologic repository. As part of the DOE contract with FWENC, the storage containers for the proposed Idaho Spent Fuel Facility are to be designed for direct

shipment to a repository, and no intermediate fuel repackaging is anticipated. Generic environmental impacts of transporting SNF to a geologic repository are analyzed in a series of DOE EISs (DOE, 1999a, 2001a, 2002b) prepared for a proposed repository at Yucca Mountain, Nevada. As necessary, the EIS is to be updated by DOE to support a license application to NRC. As described by requirements in 10 CFR 51.109, NRC is required to adopt the DOE EIS to the extent practicable. At the time of publication of this EIS, there is no license application before NRC for a geologic repository.

4.3 Geological and Soils Impacts

Most of the waste processing activities for the proposed Idaho Spent Fuel Facility would take place inside the perimeter fence at INTEC, an area dedicated to industrial use at INEEL for more than 40 years. No mineral deposits or unique geologic resources have been found in or adjacent to the INTEC area. Thus, no impacts are expected to these resources during construction or normal facility operations. Most impacts to soils are expected to be associated with routine construction activities such as excavating, earthmoving, and grading. Waste management facilities would be designed with safeguards to minimize impacts (e.g., spills of toxic substances) to soils during normal facility operations. Because the facilities would be enclosed, no operational impacts to geologic resources are anticipated.

4.4 Water Resources Impacts

4.4.1 Water Quality Impacts

The proposed Idaho Spent Fuel Facility would be constructed on the edge of the Big Lost River flood plain southeast of the main channel. The nearest boundary of the proposed Idaho Spent Fuel Facility is about 1,200 m [4,000 ft] from the Big Lost River. Other nearby surface water bodies include sewage treatment lagoons in the INTEC area and two percolation ponds south of INTEC. Because the treatment lagoons and percolation ponds are artificial and not intended to support aquatic life, the impact on water quality is not examined for purposes of this section. The proposed Idaho Spent Fuel Facility site is 140 to 146 m [460 to 480 ft] above the Snake River Plain Aquifer.

Construction of the proposed Idaho Spent Fuel Facility would involve preparing the land, erecting buildings, and grading. These phases of construction would have minimal impact on the surface and subsurface hydrology. Site preparations include scraping and excavating to establish grade and foundations. Each of these phases creates different impacts (direct and indirect) for the surface and subsurface hydrology. Removal of surface material would typically establish conditions for erosion. However, the proposed Idaho Spent Fuel Facility site is in a high, cool desert environment with aeolian, alluvial, and lacustrine sediments overlying basaltic lava flows. Therefore, rainwater is unlikely to erode subsurface soil. The surface soils removed would be staged onsite for use in establishing the final grade. This soil stockpile could erode and be carried to the Big Lost River or into the Snake River Plain Aquifer. Migration of soils into the aquifer is not likely because the loose soil would fill in the natural pathway through the alluvium and underlying rock.

Migration of loose soils to the Big Lost River could add to existing sediments and affect the natural flow of the river. This is unlikely, however, because the river is approximately 1,200 m

[4,000 ft] from the proposed Idaho Spent Fuel Facility boundary, and the soil would settle on the surface before reaching the river. During construction, water would be distributed to control fugitive dust. This water, like other small amounts of water on the site, would evaporate or seep into the ground, probably not reaching the Big Lost River, and would have minimal effect on the aquifer.

During construction, there would be occasions in which the physical changes of the land could affect the nearby water bodies and the subsurface aquifer. These effects, however, would be mitigated for construction activities through the implementation of a generic storm water pollution prevention plan (DOE, 1998), and a site-specific plan, written in accordance with U.S. Environmental Protection Agency (EPA) Administered Permit Programs, The National Pollutant Discharge Elimination System (40 CFR Part 122), and site-specific requirements. The generic storm water pollution prevention plan (DOE, 1998) includes an assessment of drainage and runoff, an evaluation of the Endangered Species Act and the National Historic Preservation Act impacts, identification of erosion and sediment controls during construction, assessment of permanent storm water management controls, and identification and control of other potential sources of pollution. Once construction is complete, unpaved areas of the property would be covered with gravel or similar material to minimize erosion and the need for excess pesticides and fertilizers to maintain adequate erosion control and minimize combustible vegetation buildup. The industrial operations at the proposed Idaho Spent Fuel Facility are exempt from storm water permit requirements because the proposed facility is not included in sectors or subsectors identified by EPA as requiring a permit (FWENC, 2001a).

The proposed Idaho Spent Fuel Facility does not require construction of any new groundwater wells or percolation ponds. During operation, the facility would use water from existing INEEL wells. There are no planned process discharges, and storm water discharge from industrial operations would be regulated by the existing INEEL storm water pollution prevention plan (DOE, 2001b). Accordingly, there would be no discharge of radionuclides into the planned process discharge. It is anticipated that impacts on surface and groundwater resources would be negligible.

4.4.2 Water Use impacts

Construction activities at the proposed Idaho Spent Fuel Facility site would require a supply of water for making concrete, controlling fugitive dust, and potable water for consumption and sanitary facilities. For dust suppression, one water truck is estimated to use an average of one full tank every 2 days to maintain the 3.2-ha [8-acre] site and 4.1-ha [10-acre] construction laydown area grounds sufficiently wet to minimize fugitive emissions. Average water truck capacity is 15,000 L [4,000 gal]. Assuming that water would be needed for approximately 200 work days per year, construction of the proposed Idaho Spent Fuel Facility is estimated to require 1.5 million L [396,300 gal] of water during the first year. It is also estimated that during the second year of construction, this water usage will be reduced by half because the building foundation and principal structures will have been erected, and need for the entire construction laydown area will diminish.

The estimated concrete needed for the proposed Idaho Spent Fuel Facility is approximately 9,260 m^3 [12,115 yd^3]. Adding 5 percent for discarded concrete results in an estimated concrete quantity of 9,725 m^3 [12,720 yd^3]. Based on a typical concrete mix design, 136 L [36 gal] of water is required for 0.8 m^3 [1 yd^3] of concrete. Given these assumptions, the estimated water

needed for concrete is about 1.74 million L [460,000 gal]. Adding 10 percent for cleaning equipment, waste, and such, results in an estimated water quantity of 1.91 million L [502,000 gal]. The average INEEL annual site water consumption from 1987 to 1991 was 7.4 billion L/yr [1.95 billion gal/yr] (DOE, 1995, Volume 1, Appendix B, Section 4.13.1). A Water Rights Agreement between DOE and the State of Idaho allows up to 43 billion L/yr [11.4 billion gal/yr] (FWENC, 2003). This means that the estimated water usage for constructing the proposed Idaho Spent Fuel Facility is less than 0.05 percent of the average annual INEEL water consumption and approximately 0.008 percent of the allowed water use limits.

During operations, the proposed Idaho Spent Fuel Facility would consume approximately 142,028 L [37,520 gal] of potable water each month (FWENC, 2001a). Because this water consumption is limited to drinking water, hygiene, and sewage disposal, the quantity would remain relatively constant during the year. This quantity represents a small amount (0.1 percent) of the water consumption relative to the more than 6 billion L [1.6 billion gal] used each year at the INEEL facility, and the water use impacts are expected to be small.

4.5 Ecological Impacts

Construction and operation of the proposed facility are not expected to have a significant adverse impact on the immediate and surrounding ecological resources. There are no known wetlands, endangered species, or critical habitats at the proposed facility location, so, no important or unique species habitats, both terrestrial and aquatic, would be lost or impacted by construction or operation of the proposed facility (FWENC, 2001a, Appendix B). Secondary impacts on wildlife would be minimal, including those from noise, heat release, radionuclide release, construction traffic, human activity, and the presence of new buildings. A discussion of the potential environmental impacts is included as part of the license application in FWENC (2001a).

The proposed activities are not expected to disturb any benthic communities or habitats. Potential increases in surface runoff would be mitigated through good construction practices. The proposed action does not involve dewatering any wetlands or using dredge spoils as fill material, so, guidelines for appropriate actions associated with such activities are not applicable. No wetlands and streams or associated vegetation would be disturbed by construction or operation of the proposed facility.

It is anticipated that normal construction practices to minimize soil erosion would be followed. The proposed facility would potentially impact 7.3 total ha [18 acres]; 3.2 ha [8 acres] at the proposed site and 4.1 ha [10 acres] at the nearby construction laydown area. Both the proposed facility site and construction laydown area would use previously disturbed lands that do not presently support native vegetation (FWENC, 2001a).

4.6 Air Quality Impacts

The description of impacts to air quality from the construction and operation of the facility is found in several documents. One source for this information is the applicant’s Environmental Report (FWENC, 2001a). Other sources include the DOE programmatic SNF EIS (DOE, 1995) and Belanger, et al. (1995). Frequently, the impact of the proposed Idaho Spent Fuel Facility was not examined individually, but as part of Alternative B of the DOE SNF management activities at INEEL (DOE, 1995). The proposed Idaho Spent Fuel Facility is one of eight projects that compose Alternative B. The equivalent name for the proposed Idaho Spent Fuel

Facility in the DOE programmatic SNF EIS (DOE, 1995, Volume 2, Part B, Appendix C) is the Dry Fuel Storage Facility, Fuel Receiving, Canning/Characterization, and Shipping Facility.

Any impacts to air quality from the construction and operation of the proposed facility are expected to be below regulatory limits. This proposed facility is exempt from the need for a National Emissions Standard for Hazardous Air Pollutants application because the State of Idaho regulations do not classify the proposed facility as a major facility for nonradioactive pollutants, and expected radionuclide emissions represent less than 1 percent of the site boundary dose limit and would not exceed regulatory constraints (FWENC, 2001a, Section 12.2). FWENC would submit a Permit to Construct Categorical Exemption request for Idaho Division of Environmental Quality approval before beginning construction (FWENC, 2001a, Section 12.2).

4.6.1 Construction

4.6.1.1 Nonradiological Impacts

Potential impacts to nonradiological air quality from construction activities would include fugitive dust and exhaust emissions from support equipment. Modeling assessments from the DOE programmatic SNF EIS (DOE, 1995, Volume 2, Part A) showed that the construction-related air quality impact should be temporary and highly localized.

Estimates from FWENC (2001a, Section 4.1) are that 13.6 metric tons [15 tons] of dust and particulates would be generated during the construction phase. Watering, routinely and effectively used in construction projects to reduce fugitive dust generation, would mitigate construction dust. Watering is expected to reduce the estimated 13.6 metric tons [15 tons] of fugitive dust and particulates to approximately 8.2 metric tons [9 tons] (FWENC, 2001a, Section 4.1).

Fugitive dust estimates for Alternative B of the projects described in the DOE programmatic SNF EIS (DOE, 1995, Volume 2, Part A) can be used to demonstrate that fugitive dust emissions from the proposed Idaho Spent Fuel Facility would be less than the appropriate standards. Table 4-1 contains the estimated particulate concentration emission levels for all eight projects that coonstitute Alternative B. The annual average concentrations of both PM_{10} and total particulates are below the applicable standard at the INEEL site boundary and public road locations. Similarly, the 24-hour average concentrations of both PM_{10} and total particulates are below the applicable standard at the INEEL site boundary and public road locations (Belanger, et al., 1995, Section 7-2).

Construction vehicle emissions estimates for Alternative B can be used to demonstrate that construction vehicle emissions from the proposed Idaho Spent Fuel Facility would be less than the appropriate standards. Table 4-2 contains the estimated construction vehicle emissions for all eight projects that compose Alternative B. All the average concentrations for carbon dioxide, nitrogen dioxide, and sulfur dioxide are below the applicable standards at the INEEL site boundary and public road locations (Belanger, et al., 1995, Section 7-2).

Mobile source impacts, including the INEEL fleet light- and heavy-duty vehicles, privately owned vehicles, heavy-duty commercial vehicles, and the INEEL bus fleet operations were also evaluated by DOE. It was concluded that increased vehicular traffic due to any of the

Table 4-1. Impacts at Public Access Locations from Projected Construction Fugitive Dust Emissions for Alternative B Spent Nuclear Fuel Program, Including the Proposed Idaho Spent Fuel Facility[a]

Pollutant	Averaging Time	Construction Fugitive Dust Emissions ($\mu g/m^3$)		Applicable Standard ($\mu g/m^3$)
		Site Boundary	Public Roads	
PM_{10}	24 hours	3.5	49	150
PM_{10}	Annual	0.007	0.09	50
Total Particulates	24 hours	5.4	77	150
Total Particulates	Annual	0.1	0.1	50

DOE = U.S. Department of Energy

[a] Belanger, R., J. Raudsep, and D.A. Ryan. DOE/ID–10497, "Technical Support Document for Air Resources Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs." Section 7-2. Idaho Falls, Idaho: Science Applications International Corporation. 1995.

NOTE: To convert $\mu g/m^3$ to oz/ft^3, multiply by 1×10^{-9}.

Table 4-2. Impacts at Public Access Locations from Projected Construction Vehicle Emissions for Alternative B Spent Nuclear Fuel Program, Including the Proposed Idaho Spent Fuel Facility[a]

Pollutant	Averaging Time	Construction Fugitive Dust Emissions ($\mu g/m^3$)		Applicable Standard[b] ($\mu g/m^3$)
		Site Boundary	Public Roads	
Carbon Monoxide	1 hour	10	125	40,000
Carbon Monoxide	8 hours	7.3	88	10,000
Nitrogen Dioxide	Annual	0.003	0.03	100
Sulfur Dioxide	24 hours	4.1	50	365
Sulfur Dioxide	3 hours	9.3	113	1,300
Sulfur Dioxide	Annual	0.0002	0.003	80

DOE = U.S. Department of Energy

[a] Belanger, R., J. Raudsep, and D.A. Ryan. DOE/ID–10497, "Technical Support Document for Air Resources Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs." Section 7-2. Idaho Falls, Idaho: Science Applications International Corporation. 1995.

[b] Applicable Standards based on National Air Quality Standards, except 3-hour sulfur dioxide standard, which is a secondary standard.

NOTE: To convert $\mu g/m^3$ to oz/ft^3, multiply by 1×10^{-9}.

alternatives for SNF management at INEEL would be negligible compared to existing traffic. The peak cumulative impacts from any alternative, which includes existing conditions plus alternative impacts, were predicted to occur at the INEEL gate. These maximum impacts were estimated to be about 5–30 percent of the applicable standards and are due almost entirely to existing traffic conditions (DOE, 1995, Volume 2, Part A, Section 5.7).

4.6.1.2 Radiological Impacts

No impacts to radiological air quality from construction activities are expected. The soil at the site is not considered radiologically contaminated (see Section 3.4). Therefore, no resuspension of radioactivity would occur from construction activities that would disturb the soil. Sources of radiation exposure during construction are limited to background radiation and potential accidents or abnormal operations exposure from other facilities at INEEL (FWENC, 2001a, Section 4.5).

4.6.2 Operations

4.6.2.1 Nonradiological Impacts

The proposed Idaho Spent Fuel Facility would have only trace chemical air discharges, with no discernible environmental effects (FWENC, 2001b, Section 5.3). Sources for incidental nonradiological airborne emissions include testing or operation of the emergency diesel generator, emissions from vehicles, and use of herbicides and pesticides.

The only stationary nonradiological emission source at the facility would be a standby diesel generator for use during loss of normal electrical power (FWENC, 2001b, Section 3.1). This generator would be located outside the facility, so combustion products produced during generator operation would be discharged directly to the atmosphere. This generator is classified as an exempt source (FWENC, 2001a, Section 12.2) and would not require a permit.

During transport operations, vehicular traffic would increase between the INTEC and the proposed Idaho Spent Fuel Facility. This activity would add to the cumulative amount of exhaust at the INEEL. The vehicular exhaust is within regulatory limitations (FWENC, 2001a, Section 5.6). Mobile source impacts, including the INEEL fleet light- and heavy-duty vehicles, privately owned vehicles, heavy-duty commercial vehicles, and the INEEL bus fleet operations were evaluated. It was concluded that increased vehicular traffic due to any of the alternatives would be negligible compared to existing traffic. The peak cumulative impacts from any alternative, which include existing conditions plus alternative impacts, were predicted to occur at the INEEL gate. These maximum impacts were estimated to be approximately 5–30 percent of the applicable standards and are due almost entirely to existing traffic conditions (DOE, 1995, Volume 2, Part A, Section 5.7).

4.6.2.2 Radiological Impacts

Facility operations are not expected to result in significant amounts of gaseous radioactive effluents. Because of the nature and condition of the SNF to be packaged at this proposed facility, most radioactive gases from the SNF are expected to have been released already and concentrations reduced through radioactive decay (FWENC, 2001b, Section 6.2). Therefore, the volume of releasable fission gases remaining is not expected to be significant. It is possible,

however, that initial SNF handling and repackaging operations could result in the release of small amounts of radioactive gases. Initial SNF receipt and repackaging operations are scheduled to occur during the first 3 years of proposed facility operation. After the SNF is repackaged and placed into storage, it would be contained within redundant confinement boundaries. Subsequent to the initial receipt and repackaging of SNF, there would be minimal generation of gaseous radioactive waste (FWENC, 2001b, Section 6.1).

The proposed facility would be a fully enclosed building complex. Airborne contamination control zones throughout the facility would ensure that contamination is minimized and controlled. The proposed facility would be divided into four airborne contamination control zones based on varying degrees of potential contamination. The ventilation systems are designed to ensure that room pressures would establish airflow from areas of least expected contamination to most expected contamination. The ventilation system would serve to prevent accidental release of radioactive material to the environment and to help keep personnel exposure to radiological hazards as low as is reasonably achievable (ALARA). Gases released within the facility would be passed through high efficiency particulate air (HEPA) filters before being discharged through the facility ventilation exhaust stack to remove airborne particulates and provide monitoring of gaseous effluents. The HEPA filters, housed in metal enclosures, would be type B nuclear grade and meet the requirements of American National Standards Institute (ANSI) N509 and ANSI N510 (FWENC, 2001b, Section 3.3). The applicant's Safety Analysis Report (FWENC, 2001b, Section 4) provides a detailed description of the ventilation system and its components.

4.7 Noise Impacts

Because the proposed Idaho Spent Fuel Facility is to be located more than 13 km [8 mi] from the nearest INEEL boundary and more than 16 km [10 mi] from the nearest community, noise generated during its construction is not likely to travel off the site at levels that would affect the general population. Noise impacts would be limited to those resulting from the transportation of personnel and materials to and from the site that would affect nearby communities and from on-site sources that could affect wildlife near those sources. The vehicles that transport employees, personnel, and materials on roads and rails would represent only a small portion of the current noise levels of traffic (FWENC, 2001a; DOE, 2002a). In addition, noise generated during construction of the facility would be temporary.

Most potential impacts on noise would occur during construction of the facility. Because the proposed Idaho Spent Fuel Facility is enclosed, the potential impacts of noise from operations would be substantially the same as or less than those for construction of the facility.

As described in Section 3.8, INEEL complies with Occupational Safety and Health Administration regulations (29 CFR 1910.95) in conducting industrial operations and construction activities. Any INEEL personnel exposed to an 8-hour time-weighted average of 85 dBA or greater must be issued hearing protection (DOE, 2002a). The regulations also require that any exposure to impulse or impact noise should be limited to 140 dBA peak sound pressure level. Studies of the effects of noise on wildlife indicate that intermittent noise levels over 100 dBA do not affect wildlife productivity [Bureau of Land Management (BLM), 1986; Lehto, 1993]. Therefore, the impacts of noise on both humans and wildlife would be minor.

4.8 Cultural, Historical, Archaeological, Ethnographical, and Paleontological Resources

The proposed Idaho Spent Fuel Facility would be located within INEEL boundaries, adjacent to the INTEC. Types of resources analyzed in the area include archaeological and historic resources, as well as paleontological sites. Ethnographic concerns focused on resources significant to the Shoshone–Bannock Tribes, who have long inhabited the area. Cultural resources in the area related to the Tribes are mainly archaeological. The Shoshone–Bannock Tribes place cultural and religious significance on all components of the natural setting, and this philosophy must be respected in the analysis of impacts. Nontraditional uses of the area have an impact on the natural and cultural settings traditionally used by the Shoshone–Bannock Tribes for cultural and religious purposes. Because these settings continue to be important to the Tribes, nontraditional uses of the land/area affect the purity of the natural and sacred environment.

Impacts to the cultural resources within the project area were assessed by identifying known and potential cultural resources in the areas that would be affected by the actions of the alternative. Furthermore, construction-related activities that could directly or indirectly affect cultural resources were evaluated to determine if these activities would have an adverse impact. There are no known cultural resources identified within the proposed Idaho Spent Fuel Facility site and its associated construction laydown area. However, the adjacent INTEC facility contains 38 buildings and structures that are potentially eligible for listing on the National Register of Historic Places. The construction activities at the proposed Idaho Spent Fuel Facility site may have some impacts, and the subsequent relocation of the SNF from locations within INTEC could also have impacts to some cultural resources.

4.8.1 Impacts to Historical Resources

There are no historic resources within the boundaries of the proposed Idaho Spent Fuel Facility and its associated construction laydown area that would be affected by the construction of the support buildings and the associated road system. Thus, because there are no historic resources, there would be no direct or indirect impacts within the area of construction for the proposed Idaho Spent Fuel Facility.

The adjacent INTEC site contains 38 buildings and structures that have been evaluated as potentially eligible for listing on the National Register of Historic Places. The construction activities of the proposed Idaho Spent Fuel Facility and the subsequent transfer of SNF from the current INTEC storage location will not affect these potentially historic structures, with the exception of one, which currently stores some of the SNF that will be transferred to the proposed Idaho Spent Fuel Facility. The Fuel Receiving and Storage building (CPP–603) was constructed in 1951 to receive and store SNF and waste fission products. Construction of the proposed facility will provide updated and safer storage for the SNF, so the existing Fuel Receiving and Storage building will be in a more ready state for decontamination and removal once transfer of the SNF has been completed. A Memorandum of Agreement between the Idaho Field Office of DOE, Idaho State Historic Preservation Office, and Advisory Council on Historic Preservation (signed in 1998), pursuant to 36 CFR Part 800, stipulated the procedures required to meet compliance requirements in Section 106 of the National Historic Preservation Act (16 USC §47 OF) for removal of the Fuel Receiving and Storage building.

4.8.2 Impacts to Archaeological Resources

Extensive archaeological surveys and investigations have been conducted in the area for the proposed Idaho Spent Fuel Facility. Three sites in the vicinity have been identified and recorded, one of which is eligible for listing on the National Register of Historic Places. All three sites, however, are located outside areas that would be affected by construction activities for the proposed Idaho Spent Fuel Facility. Ground disturbance associated with the proposed Idaho Spent Fuel Facility and other temporary support facilities would be extensive but localized. The proposed construction sites have had a high degree of previous ground disturbance and no known archaeological sites have been identified in the proposed Idaho Spent Fuel Facility location or its associated construction laydown area. Thus, there would not be any impacts to archaeological resources at the proposed construction site and associated laydown area because of construction activities. Furthermore, because the area has been subject to intensive archaeological survey with negative results, it is highly unlikely that archaeological resources would be discovered during construction activities. Within the boundaries of INTEC, the ground has been subject to intensive disturbance during the past 50 years. It is unlikely that any archaeological sites exist in the heavily disturbed areas that would be used during the transfer of SNF to the proposed Idaho Spent Fuel Facility, so there would not be any impacts to archaeological resources caused by activities related to the proposed facility.

All ground disturbing activities would be monitored. If archaeological resources were discovered, work would cease until the site could be evaluated and mitigation measures applied, which would include notification of and consultation with the State Historic Preservation Officer, the Advisory Council on Historic Preservation (if necessary), and the Shoshone–Bannock Tribes. In the unlikely event that human remains were found, provisions would apply as outlined in the Native American Graves Protection and Repatriation Act (Pace, 2001).

4.8.3 Impacts to Ethnographical Resources

The Shoshone–Bannock Tribes believe the resources of the natural world have a spiritual and sacred significance in the traditional and contemporary ways that land is used and respected. The Tribes view all elements of the environment such as earth, water, air, plants, and animals, to be one entity as they relate to the protection of Native American cultural resources and land. Nontraditional uses of the area are considered to be infractions of the natural and cultural settings when these uses can be seen or heard from sacred or traditional-use areas. The open topographic nature of the Eastern Snake River Plain permits uninterrupted viewsheds, providing the potential for visual impacts to many sacred and traditional use areas. The location of the proposed Idaho Spent Fuel Facility and its associated construction laydown area is adjacent to INTEC, a highly developed area constructed 50 years ago. Hence, placement of the proposed Idaho Spent Fuel Facility would not introduce a built environment into a pristine natural setting. The tallest structures {24 m [80 ft]} would be similar to existing structures at INTEC, so the effects on the viewshed will be minimal.

The area has been subject to intensive ground disturbance throughout the past 50 years. The lack of archaeological resources and the highly disturbed nature of the areas indicate that no sensitive tribal resources are present. Vegetation is sparse and nonnative plant species are dominant. Also, no unique topographic features are present. These factors indicate the improbability that these areas contain resources significant to the Shoshone–Bannock Tribes.

Therefore, there would be no impacts to archaeological resources significant to the Shoshone–Bannock Tribes.

Access to this area by Tribal members would continue to be restricted. Construction of the proposed Idaho Spent Fuel Facility would not change the status of restricted access, so there would not be any new impacts that would occur from the proposed action. The construction of the proposed Idaho Spent Fuel Facility and the subsequent transfer of SNF would occur on restricted and secure property that currently facilitates the same type of land use. For this reason, and because the activities would be performed by trained and certified staff, it is improbable that any ethnographic resource other than the Shoshone–Bannock Tribes would continue to be affected by restricted access.

4.8.4 Impacts to Paleontological Resources

The area closest to the proposed Idaho Spent Fuel Facility site where paleontological remains were discovered was in the alluvial gravels of the Big Lost River. This site, however, is some distance from the proposed Idaho Spent Fuel Facility construction areas. The likelihood of the existence of paleontological resources at the proposed Idaho Spent Fuel Facility location is extremely low, because this area has had a high level of ground disturbance. Furthermore, no paleontological resources have been discovered within the areas of INTEC that are associated with the proposed action. There has been a high level of ground disturbance within the INTEC boundaries during the past 50 years, and it is unlikely any paleontological resources are present. However, in the unlikely event that resources are discovered during the construction phase of the proposed Idaho Spent Fuel Facility or in the course of loading and transporting SNF at these areas, work would cease until consultations with the appropriate entities and proper mitigation measures are complete. Because there are no known paleontological resources at the proposed Idaho Spent Fuel Facility site and its associated construction laydown area, or within the areas of INTEC relevant to this project, there would not be any impacts to paleonotological resources.

4.9 Visual/Scenic Impacts

Most of the proposed action would take place inside a perimeter security fence adjacent to INTEC, an area that has been highly altered by development and dedicated to industrial use for almost 50 years. Two potential impacts to aesthetic and scenic resources include the addition of buildings and construction and process emissions that could alter the view.

The industrialized area of INTEC has a BLM Visual Resource Management rating of Class IV (DOE, 2002a, Section 5.2.4). The tallest structure planned for the proposed Idaho Spent Fuel Facility would be the exhaust emissions stack at about 24 m [80 ft] (FWENC, 2001b). The height of this stack is of the same order or less than existing stacks at INTEC (FWENC, 2001a).

Construction activities at the proposed Idaho Spent Fuel Facility would produce fugitive dust and exhaust emissions from construction equipment that could affect visibility temporarily in localized areas; however, these emissions would not be visible from lands adjacent to INEEL or beyond and would not exceed the Class III objectives. Construction activities would be limited in duration, and FWENC would use water to minimize both erosion and dust. After construction, roads would be graded and disturbed land would be landscaped to further reduce dust (FWENC, 2001a). Fuel-handling and storage operations would be contained in an enclosed

building and are not anticipated to produce dust particulate emissions. For this reason, operations are likely to have less of a visual impact than are construction activities. In addition, the proposed facility would be constructed next to INTEC, an existing industrial complex. DOE previously evaluated visual and aesthetic impacts for planned waste management activities at INTEC and determined they would not be significant (DOE, 2002a, Section 5.2). The proposed Idaho Spent Fuel Facility is approximately 13.7 km [8.5 mi] from the nearest INEEL boundary. The proposed facility is also much smaller than INTEC, so it is unlikely there would be significant visual impacts.

4.10 Socioeconomical Impacts

No permanent residents or communities are within 16 km [10 mi] of the proposed Idaho Spent Fuel Facility site, but several INEEL facilities are within this distance (Figure 4-1). Institutional control would continue to restrict access to INEEL lands, thus, the population within 16 km [10 mi] of the proposed Idaho Spent Fuel Facility site is unlikely to change throughout the life of the facility.

The DOE programmatic SNF EIS (1995) presented the environmental impacts of implementing the SNF management approach, including a generic analysis of the activities associated with a facility similar to the proposed Idaho Spent Fuel Facility. This environmental analysis indicates the impacts of a dry fuel storage facility, fuel receiving, canning/characterization, and shipping facility would be minimal or negligible in most areas, including impacts to land use, socioeconomics, water and air resources, ecology, cultural and historical resources, and cumulative impacts.

The 2-year construction phase would employ a maximum of 250 workers. These employees constitute approximately 3 percent of the current INEEL workforce of about 8,100. Thus, proposed Idaho Spent Fuel Facility construction would not have significant economic or social impacts, because most workers would likely come from the existing INEEL workforce.

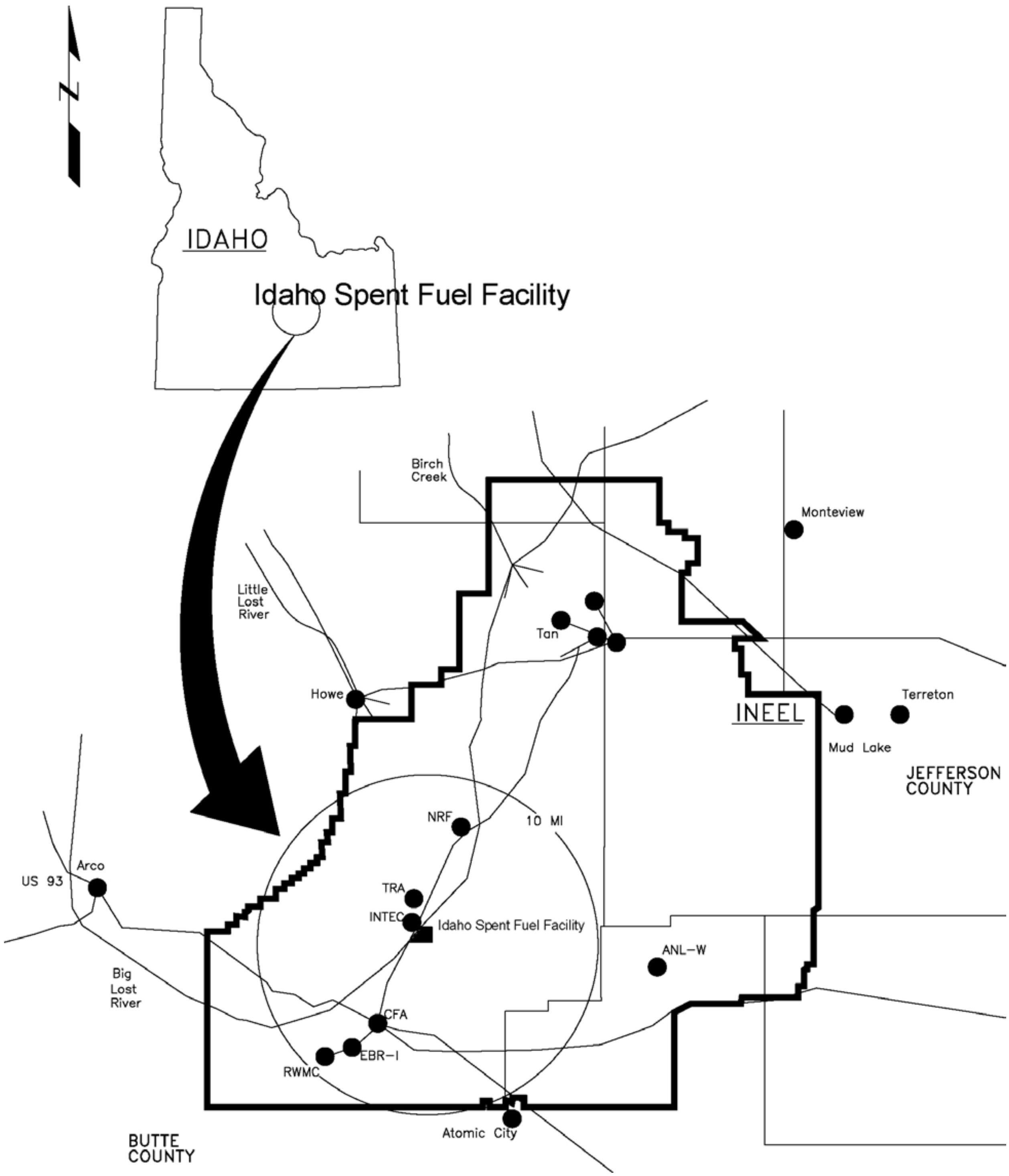
Operation of the proposed Idaho Spent Fuel Facility would require nearly 60 employees for the first 4 years—when fuel receipt and packaging occur. Once this phase of operations is completed, storage operations would likely require fewer staff. Most operations personnel would come from the local workforce.

Impacts on small and isolated communities will vary in socioeconomic and demographic characteristics and future connection to the proposed Idaho Spent Fuel Facility. In the case of employment opportunities, the facility would be but one of many employers, implying a lack of dependence on any one facility within the region of influence.

4.11 Environmental Justice Impacts

As addressed in Section 3.12 of this EIS, Executive Order 12898 (The White House, 1998) directs federal agencies to make achieving environmental justice part of their mission and to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

The minority population near INEEL is predominately Hispanic, American Indian, and Asian. On the basis of 2000 census data for blocks wholly contained within the region of influence, these



1 **Figure 4-1. INEEL Facilities and Surrounding Communities (Modified from FWENC, 2001a, Section 8)**

groups constitute 12 percent of the population. The low-income population composes 11 percent of the total population within the 80-km [50-mi] radius, based on analysis at the tract level (U.S. Bureau of the Census, 2000).

The earlier 1995 DOE programmatic SNF EIS regarding the agency SNF management and environmental restoration and waste management programs assessed the environmental justice issue for the area surrounding INEEL (DOE, 1995). The DOE EIS Project Office reviewed concerns expressed by the Shoshone–Bannock Tribes on the Fort Hall Reservation and engaged in consultations with Tribal officials and INEEL officials "... to fully understand, evaluate, and consider these comments" (DOE, 1995, volume 2, Part B, Section 5.20). The concerns included

- Tribal values as they relate to nature, ties to the land, and religious beliefs; and

- Potential impacts not only to such resources on INEEL (once inhabited by the Shoshone–Bannock Tribes) as Native American archaeological sites important to religious and cultural heritages, but also features of the natural landscape, air, water, or animal resources that remain of special significance.

Impacts could occur from disturbing the land or changing the environmental setting of sacred or traditional-use areas, pollution, noise, and contamination. Potential mitigation measures discussed in the DOE programmatic SNF EIS (DOE, 1995) included

- Involving Tribal representatives in project planning to avoid sensitive areas;

- Locating new facilities in areas with similar visual settings;

- Avoiding Native American archaeological sites and traditional-use and sacred areas;

- Monitoring gathering areas and game animals for operational effects; and

- Restoring native vegetation to areas of ground disturbance.

In the event that avoidance was "... not feasible, data recovery at archaeological sites (for example, archiving artifacts) and restoration of alternative hunting or gathering areas may be substituted after consultation with the Tribes" (DOE, 1995, Section 5.20).

Another initiative included DOE and the U.S. Navy working with the Shoshone–Bannock Tribes to impart clearer understanding of potential impacts of various alternatives, including postulated facility and transportation accidents and those from normal operations. A management agreement among the DOE Idaho Operations Office, the Federal Advisory Council on Historic Preservation, the State of Idaho, and the Tribes with respect to cultural resources at INEEL was an outgrowth of the consultations.

The conclusion of the DOE programmatic SNF EIS was "… the potential impacts calculated for each discipline under each of the proposed INEEL environmental restoration and waste management alternatives, including spent nuclear management, are small and do not constitute a disproportionately high and adverse impact on any particular segment of the population, minorities or low-income communities included; thus, they do not present an environmental

justice concern" (DOE, 1995, Section 5.20). Noted elsewhere in the report are environmental justice implications of low-probability accident scenarios. "Whether or not such [accident] impacts would have disproportionately high and adverse effects with respect to any particular segment of the population, minority and low-income populations included, would be subject to natural motive forces including random meteorological factors" (DOE, 1995, Volume 2, Part A, Section 5.20). In the case of the Fort Hall Reservation, both weather and geologic features favor low probability of receipt of adverse effects, though higher probability when compared with more distant locations.

The summary of DOE (2002a) cites recognition of concerns of the Shoshone–Bannock Tribes and consequently reports early and frequent involvement of the Tribes with DOE during preparation of the EIS. This involvement included ensuring that Tribal issues and concerns were considered in hearings before and during the scoping period, briefings and open discussions at Tribal facilities, and a public hearing on the Fort Hall Reservation. DOE entered into an Agreement in Principle with the Tribes that provided a consultation process under NEPA auspices. The agreement also included a commitment for the Tribes to obtain resources and expertise to enable effective review or involvement in DOE activities.

Construction and operation of the proposed Idaho Spent Fuel Facility would have some local and regional economic benefits, such as using regional workers for construction of the proposed facility and increasing sales of materials for regional suppliers throughout construction. Minorities and low-income populations would benefit to the extent they are linked to this economy. Because the construction and operation of the proposed Idaho Spent Fuel Facility would be consistent with current and anticipated activities at the INEEL, the social and economic impacts associated with the proposed facility are not significant.

DOE determined that facility operations and foreseeable accidents associated with a dry fuel storage facility (proposed Idaho Spent Fuel Facility) present no significant risk or impact to any surrounding population, including minority and low-income populations (DOE, 1995, Volume 1, Appendix L). In a larger context, the proposed facility would be a step in the process of preparing the SNF for removal from Idaho. If the SNF is placed in dry storage, it would be in a more stable environment independent of support systems needed to maintain storage. This would benefit all people in the region of influence by ensuring that the SNF would not harm the environment and people in the area. For these reasons, it is unlikely there will be any disproportionately high adverse human health or environmental effects on low-income or minority populations.

4.12 Public and Occupational Health and Safety Impacts

Potential impacts to radiological air quality were examined for normal, off-normal, and accident conditions. For off-normal operations and accidents, the various structures, systems, and components (SSCs) of the facility were evaluated for postulated internal accidents or natural phenomena associated with the facility for both the repackaging and storage phases. Table 4-3 summarizes the criteria for radiological protection design for normal, off-normal, and accident conditions applicable for the restricted area (area enclosed by the facility peripheral fence), the controlled area (INEEL site), and outside the controlled area (outside INEEL) (FWENC, 2001b, Section 3.3). A summary of the results of the public and occupational health and safety impacts of the proposed Idaho Spent Fuel Facility is provided in this EIS. The impacts are described in more detail and evaluated against the NRC regulatory limits in the safety evaluation report being prepared by NRC as part of its evaluation of the FWENC license application.

Table 4-3. Radiological Protection Design Criteria[a]

Location	Normal and Off-Normal Conditions	Accident Conditions
Restricted Area	ALARA in accordance with 10 CFR 72.126(d) 50 mSv/yr [5,000 mrem/yr] TEDE in accordance with 10 CFR 20.1201 10 mSv/yr [1,000 mrem/yr] TEDE in accordance with proposed Idaho Spent Fuel Facility administrative control limits	ALARA in accordance with 10 CFR 72.126(d)
Controlled Area	1 mSv/yr [100 mrem/yr] TEDE in accordance with 10 CFR 20.1301	50 mSv [5,000 mrem] TEDE for any design basis accident in accordance with 10 CFR 72.106(b)
Outside of Controlled Area	0.25 mSv/yr [25 mrem/yr] TEDE in accordance with 10 CFR 72.104(a)	50 mSv [5,000 mrem] TEDE for any design basis accident in accordance with 10 CFR 72.106(b)

ALARA = as low as is reasonably achievable
FWENC = Foster Wheeler Environmental Corporation
TEDE = total effective dose equivalent

[a] FWENC. "Safety Analysis Report, Idaho Spent Fuel Facility." Section 3.3. NRC Docket No. 72-25. ISF–FW–RPT–0033. Morris Plains, New Jersey: FWENC. 2001.

There are potential hazards that may affect safe operation of the proposed facility because of the transport, handling, storage, and disposal of radioactive materials. These hazards are classified into off-normal events and accidents based on frequency of occurrence (NRC, 2000a). Off-normal events are expected to occur with moderate frequency or once per calendar year [Design Event II, according to ANSI/American Nuclear Society (ANS) 57.9 (ANSI/ANS, 1984)]. Accidents occur more infrequently, if ever, during the lifetime of the facility. Effects of natural events, such as, earthquakes, tornadoes, floods, and such. are considered to be accidents.

Off-normal operations and accidents potentially could expose members of the general public to additional levels of radiation or radiological effluents beyond those associated with routine operations. The analyses presented in this EIS are not intended to substitute for the detailed evaluation of safety issues that will be presented in the NRC safety evaluation report. The NRC staff, as documented in the safety evaluation report, is currently evaluating the effects of natural phenomena and human-induced hazards on the proposed Idaho Spent Fuel Facility. Natural phenomena being considered include earthquake, flood, volcanic hazards, wildfire, high wind, tornado, and tornado-generated missiles of the maximum severity expected at the proposed site

during the lifetime of the proposed facility. These events bound the natural phenomena expected to occur at the proposed facility. Similarly, human-induced events include a potential aircraft crash and explosion at the proposed site and are considered bounding for the proposed facility during its lifetime.

The probability that the natural phenomena would be more severe than those events evaluated in the safety evaluation report and in this EIS is extremely low. Such events at the proposed facility are not credible during its lifetime. Because these events are not credible, they are not considered in this EIS or the safety evaluation report. Information evaluated in this section is based on data provided by the applicant. The analyses summarized in this EIS are intended only to identify and bound the types of environmental impacts that could result from off-normal events or credible accidents.

4.12.1 Normal Operations

4.12.1.1 Nonradiological Impacts

Worker safety for nonradiological exposures would be maintained at the proposed Idaho Spent Fuel Facility through implementation of a health and safety program in accordance with applicable Occupational Safety and Health Administration Standards in 29 CFR Part 1910 and 29 CFR Part 1926. The health and safety program includes an integrated safety management system (conforming to 48 CFR 970.5204-2) that provides a graded approach to environmental safety and worker health and safety. The program would include review, approval, and control measures for all chemicals introduced into the proposed Idaho Spent Fuel Facility.

Chemical usage at the Idaho Spent Fuel Facility is shown in Table 4-4. Herbicides and pesticides will be present in small volumes and applied in accordance with manufacturer's recommendations (FWENC, 2001a, Section 5.3). The chemicals listed can be used safely by applying standard chemical safety practices, and, therefore, no significant environmental impacts are expected. For normal operating conditions, no chemical discharges are planned from the proposed Idaho Spent Fuel Facility (FWENC, 2001a). Therefore, no public chemical exposures are expected from the proposed Idaho Spent Fuel Facility, and no additional chemical monitoring programs are necessary to ensure safety and protect the environment. Chemical wastes associated with the proposed Idaho Spent Fuel Facility are discussed in Section 4.13 on waste management impacts.

4.12.1.2 Normal Operations—Radiological Impacts

In general, radiation can deliver a dose through external or internal pathways. Direct radiation from a radioactive source, irradiation from radioactive fallout on the ground surface, and immersion in a passing airborne radioactive material are external radiation pathways. Inhalation of airborne radioactive material and ingestion of contaminated food and water are internal radiation pathways. The radiological dose assessments consider these external and internal pathways.

Mitigation measures for radiological impacts would be in place during facility operations. Areas where loose radioactive contamination can be generated would be maintained at a negative pressure relative to other areas of the proposed Idaho Spent Fuel Facility. In these areas, air would flow from clean areas into areas of potential contamination in order to confine any

Table 4-4. Proposed Chemical Uses and Quantities for the Proposed Idaho Spent Fuel Facility[a]

Chemical	Use at Idaho Spent Fuel Facility	Annual Quantity
Propylene glycol	Chilled water anti-freeze	568 L
Refrigerant (R–22)	HVAC systems	147 kg
Sodium nitrite	Chilled water corrosion inhibitor	95 L
Herbicides and pesticides	Weed and pest control	Indeterminate
Liquid nitrogen	Laboratory	95 L

FWENC = Foster Wheeler Environmental Corporation
HVAC = heating, ventilation, and air conditioning

[a] FWENC. "Safety Analysis Report, Idaho Spent Fuel Facility." NRC Docket No. 72-25. ISF–FW–RPT–0033. Morris Plains, New Jersey: FWENC. 2001.

NOTE: To convert liters (L) to gallons (gal), multiply by 0.244; to convert kiligrams (kg) to pounds (lb), multiply by 2.205.

radioactive contamination. In addition, ventilation airflow would be channeled through HEPA filters to remove radioactive particulates from the air stream before it is exhausted into the atmosphere through the stack. An atmospheric release of radioactivity diffuses as it is moves with the wind. This natural process of diffusion reduces the radioactive concentration in air as it travels downwind. The applicant's Safety Analysis Report (FWENC, 2001b, Section 2.3.4) provides a more detailed discussion of the local and regional diffusion estimates.

Radiological impacts are addressed separately for the public and workers in the next two subsections.

4.12.1.2.1 Public Health and Safety Impacts

The primary pathway for off-site exposure to radiation is from air emissions during operations of the proposed Idaho Spent Fuel Facility. The INEEL site boundary serves as the controlled area boundary per 10 CFR Part 20 and 10 CFR Part 72. Using the EPA CAP–88 model for atmospheric dispersion, the highest off-site dose was calculated to be 3×10^{-7} mSv/yr [3×10^{-5} mrem/yr] at the southern boundary of the INEEL site (FWENC, 2001a, Section 5.2.2).

Tables 4-5 and 4-6 present the estimated doses to the maximally exposed individual (MEI), based on the applicant's safety analysis report (FWENC, 2001b, Section 7.4.2). The estimated dose to the hypothetical MEI is an insignificant fraction (less than 0.00063 percent) of the 0.1-mSv/yr [10-mrem/yr] regulatory dose limits and natural background of about 3.6 mSv/yr [360 mrem/yr].

After transfer operations are complete, direct radiation from the storage vault is the primary source of radiation dose to the public. By neglecting the attenuation of the external radiation,

Table 4-5. Comparison of the Estimated Annual Dose to the Public with the Relevant Regulatory Limits and Natural Background

Quantity	Dose[a] (mSv)	Dose[a] (mrem)
Estimated annual dose to maximally exposed individual from Idaho Spent Fuel Facility operations[b]	Less than 0.00000063	Less than 0.000063
Total estimated annual dose to maximally exposed individuals from all nearby facility operations (including Idaho Spent Fuel Facility)	Less than 0.0032	Less than 0.32
EPA individual radiation protection limit (40 CFR 61.92)	0.10	10
NRC annual limit for air emissions to individual members of the public (10 CFR 20.1101)	0.10	10
NRC annual limit to a real member of the public (10 CFR 72.104)	0.25	25
NRC annual limit for individual members of the public (10 CFR 20.1301)	1.0	100
Regional annual natural background to an individual resident[c]	3.6	360

DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
NRC = U.S. Nuclear Regulatory Commission

[a] The doses presented represent the total effective dose equivalents, which correspond to the dose equivalent to the whole body. In general, organ dose limits also apply. Organ dose limits can only be exceeded when the whole-body dose limit is exceeded or, in limited circumstances, when doses are close to but just less than the whole-body dose limit.

[b] Including ingestion of contaminated animal products.

[c] DOE. DOE/ID–12082(96), “Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1996.” Idaho Falls, Idaho: DOE, Idaho Operations Office. 1997.

the annual dose during the storage period is conservatively estimated to be 6×10^{-7} mSv [6×10^{-5} mrem] at the INEEL site boundary.

4.12.1.2.2 Occupational Health and Safety Impacts

The proposed Idaho Spent Fuel Facility fence serves as the restricted area boundary, within which external and internal occupational doses to personnel are monitored per 10 CFR Part 20. Based on the applicant’s safety analysis report (FWENC, 2001b, Section 7.6.1.4), Table 4-7 shows that anticipated annual occupational dose during construction is less than 0.0032 mSv [0.32 mrem]. Construction activities would occur before receipt of SNF and involve only potential preexisting contaminants. Therefore, the anticipated annual occupational doses would be far less than the occupational limit and the regional natural background. The total collective

Table 4-6. Radionuclides That Contribute to Calculated Dose at Frenchman's Cabin[a,b]		
Radionuclide	**mSv/yr [mrem/yr]**	**Percent of Total**
Tritium	1.43×10^{-3} [1.43×10^{-5}]	51.6
Iodine-129	7.74×10^{-4} [7.74×10^{-6}]	27.9
Barium-137m	2.32×10^{-4} [2.32×10^{-6}]	8.4
Plutonium-238	1.61×10^{-4} [1.61×10^{-6}]	5.8
Krypton-85	1.53×10^{-4} [1.53×10^{-6}]	5.5
Americium-241	7.91×10^{-6} [7.91×10^{-8}]	0.3
Others	1.2×10^{-5} [1.2×10^{-7}]	0.5

FWENC = Foster Wheeler Environmental Corporation

[a] Frenchman's Cabin is located outside the Idaho National Engineering and Environmental Laboratory boundary approximately 19.6 km [12.3 mi] southwest of the proposed Idaho Spent Fuel Facility.
[b] FWENC. "Safety Analysis Report, Idaho Spent Fuel Facility." Section 5.2. NRC Docket No. 72-25. ISF–FW–RPT–0033. Morris Plains, New Jersey: FWENC. 2001.

Table 4-7. Comparison of the Anticipated Annual Occupational Dose during Construction with the Relevant Regulatory Limits and Natural Background		
Quantity	**Dose[a] (mSv)**	**Dose[a] (mrem)**
Anticipated annual occupational dose during construction	less than 0.0032	less than 0.32
NRC annual occupational limit (10 CFR 20.1201)	50	5000
Regional annual natural background to an individual resident[b]	3.6	360

DOE = U.S. Department of Energy
NRC = U.S. Nuclear Regulatory Commission

[a] The doses presented represent the total effective dose equivalents, which correspond to the dose equivalent to the whole body. In general, organ dose limits also apply. Organ dose limits can only be exceeded when the whole-body dose limit is exceeded or, in limited circumstances, when doses are close to but just less than the whole-body dose limit.
[b] DOE. DOE/ID–12082(96), "Idaho National Engineering and Environmental Laboratory Site Environmental Report for Calendar Year 1996." Idaho Falls, Idaho: DOE, Idaho Operations Office. 1997.

dose during the entire construction period is conservatively estimated at 1.6 person-mSv [160 person-mrem].

The occupational dose estimates for workers involved with the proposed fuel-handling operations are presented in FWENC (2001b, Table 7.4-2). When necessary, temporary shielding is used to keep the occupational doses ALARA. The maximum total annual dose to the whole body of an individual worker would be 9.1 mSv [910 mrem], which is less than the 50 mSv [5,000 mrem] occupational limit stipulated in 10 CFR Part 20. For the same conditions, the maximum organ dose received by an individual worker would not exceed the occupational organ dose limit stipulated in 10 CFR Part 20. When the fuel-handling operations are complete, the occupational doses from long-term monitoring activities would be reduced considerably during the storage period. The total occupational dose from all inspections that require workers to enter Radiological Control Areas sums to less than 9.1 mSv [910 mrem] annually during the storage period.

For noninvolved workers present at the INEEL site during proposed fuel-handling operations, the annual dose from stack emissions would be 6.6×10^{-6} mSv [6.6×10^{-4} mrem] at the boundary of the proposed Idaho Spent Fuel Facility boundary. By neglecting the attenuation of external radiation, the annual dose due to direct radiation is conservatively estimated as 0.012 mSv [1.2 mrem] at the site boundary for an entire year. These doses are a small percentage of the 1.0-mSv [100-mrem] annual limits to a member of the public. The annual collective dose to noninvolved workers within a radius of 8 km [5 mi] was calculated as 6.68×10^{-5} person-mSv [6.68×10^{-3} person-mrem] from stack effluent (FWENC, 2001b, Table 7.6-2). Collective dose represents the summation of the dose for an entire population, whereas the dose to an individual is typically a small fraction of the collective dose. Even if all the collective doses were to be received by a single noninvolved worker located at the INEEL site, the dose would still be much less than the limits for individual workers or members of the public (see Tables 4-5 and 4-3, respectively).

4.12.2 Off-Normal Operations

Off-normal and accident design events identified by the ANSI/ANS 57.9, as applicable to facility operations at the proposed Idaho Spent Fuel Facility, were considered in the applicant's safety analysis report (FWENC, 2001b). NRC Regulatory Guide 3.48 (NRC, 1989) specifies that the four event types in ANSI/ANS 57.9 be addressed. Of these design events, Design Events II consist of off-normal events expected to occur routinely or to occur approximately once per year.

Five categories of Design Events II (off-normal events) are evaluated in FWENC (2001b, Section 8.1):

- Transfer cask events (Section 8.1.1,);
- Fuel packaging events (Section 8.1.2);
- Fuel storage events (Section 8.1.3);
- Waste handling events (Section 8.1.4); and
- Other events (Section 8.1.5).

The off-normal events identified were selected as the bounding cases for the larger population of credible events identified during design of the facility. The analyses include the cause of the

postulated event, the method of detection of the event, an analysis of the impacts of the event, and the corrective actions to be taken to recover from the event. The results of the safety analysis for these off-normal events are summarized in Table 4-8. The table shows evaluation of 18 postulated events under the five categories of off-normal events previously listed. Related sections in FWENC (2001b) where the events have been addressed are also listed in the table. Of these potential events, only misventing the transfer cask was found to result in a dose to the workers. No significant radiological consequences to the public at the confinement area boundary resulted from the postulated off-normal events. In the event of misventing of the transfer cask, a worker near the cask could receive a dose by inhaling contaminated atmosphere (FWENC, 2001b, Section 8.1.1). The dose was evaluated to be less than 0.1 mSv [10 mrem]. This value is well below the 10 CFR Part 20 occupational dose limit of 50 mSv/yr [5,000 mrem/yr]. Workers might also receive a dose from the exterior surface of a storage container contaminated in the Fuel Processing Area or during transfer of SNF to the Canister Closure Area (FWENC, 2001b, Section 8.1.3), breach of a waste package in the solid waste area (FWENC, 2001b, Section 8.1.4), transfer of a high dose rate object into the solid waste area (FWENC, 2001b, Section 8.1.4), and failure of the ventilation system (FWENC, 2001b, Section 8.1.5). Worker exposures to these events are estimated to be negligible. Any decontamination efforts required would result in low air concentration (0.1 derived air concentration) for the workers.

In the safety evaluation report being prepared for this license application, NRC is developing a more detailed evaluation of the impacts to he public and occupational health and safety because of off-normal operations. The safety evaluation report will provide an evaluation of the ability of the proposed Idaho Spent Fuel Facility to meet the NRC standards for protection against radiation (10 CFR Part 20) and licensing requirements for an independent spent fuel storage installation (ISFSI) (10 CFR Part 72).

4.12.3 Accident Analysis

FWENC (2001b) provides an evaluation of the radiological impacts of Design Events III and IV (NRC, 1989) that could potentially result from the proposed facility operations. Design Events III are infrequent events that could be expected to occur during the lifetime of the facility. Design Events IV are the events postulated to establish a conservative design basis for SSCs important to safety. Accidents evaluated in FWENC (2001b) are the same general categories as those assessed for off-normal operations:

- Transfer cask events (Section 8.2.1);
- Fuel packaging events (Section 8.2.2);
- Fuel storage accidents (Section 8.2.3); and
- Other Events (Section 8.2.4).

In the safety evaluation report that is being prepared for this license application, NRC is developing a more detailed evaluation of the impacts to the public and occupational health and safety because of operational accidents. The safety evaluation report will provide an evaluation of the ability of the proposed Idaho Spent Fuel Facility to meet the NRC standards for protection against radiation (10 CFR Part 20) and licensing requirements for ISFSI (10 CFR Part 72).

The applicant ‘s evaluation of Design Events III and IV under the four accident categories previously listed is summarized in Table 4-9. The table provides a description of the accidents,

Table 4-8. Off-Normal Event Evaluated[a]				
Safety Analysis Report Section Number	**Description**	**Effects and Consequences**	**Estimated Dose (mrem)**	**Corrective Action**
8.1.1.1	Misventing of Transfer Cask	Increased dose inside Transfer Tunnel	Less than 0.1 mSv [10 mrem] to operator; negligible at controlled area boundary	Decontaminate area, determine cause, and implement corrective action
8.1.1.2	Cask Drop Less Than Design Allowable Height	NA	No radiological consequences	NA
8.1.2.1	Attempt to Lower Fuel Container into Occupied Fuel Station	No adverse consequences	No radiological consequences	Determine cause and implement corrective action
8.1.2.2	Attempt to Load Fuel Element into Full Idaho Spent Fuel Basket	No adverse consequences	No radiological consequences	Determine cause and implement corrective action
8.1.2.3	Failure of Fuel Element During Handling	Delay in operations while fuel recovery is performed	No radiological consequences outside FPA area	Cease operations, recovery actions, determine cause, and implement corrective action
8.1.2.4	Drop of Fuel Element During Handling	Delay in operations while fuel recovery is performed	No radiological consequences outside FPA area	Cease operations, recovery actions, determine cause, and implement corrective action
8.1.2.5	Fuel Container Binding of Impact During Handling	Delay in operations to replace Idaho spent fuel storage container	No radiological consequences	Cease operations, recovery actions, determine cause, and implement corrective actions
8.1.2.6	Malfunction of Idaho Spent Fuel Canister Heating System	Increase in fuel temperature, no adverse consequences	No radiological consequence	Repair heater
8.1.2.7	Malfunction of Idaho Spent Fuel Canister Vacuum Drying/ Helium Fill System	Delay in operations, possible increase in fuel temperatures, no adverse consequences	No radiological consequences	Repair equipment, determine cause, and implement corrective action
8.1.2.8	Loss of Confinement Barrier	Increased radiation dose to on-site personnel due to decontamination efforts	Potential spread of particulate into adjacent areas of FPA; nonmechanistic dose at the controlled area boundary is 0.0002 mSv [0.02 mrem]	Repair equipment, determine cause, and implement corrective action

Table 4-8. Off-Normal Event Evaluated[a] (continued)				
Safety Analysis Report Section Number	**Description**	**Effects and Consequences**	**Estimated Dose (mrem)**	**Corrective Action**
8.1.3.1	Binding or Impact of Idaho Spent Fuel Canister During Hoisting/Lowering Operations	No adverse consequences	No radiological consequences	Determine cause and implement corrective action
8.1.3.3	Extended Operation with Idaho Spent Fuel Canister in CHM	Increase in fuel temperature	No radiological consequences	Repair equipment, determine cause, and implement corrective action
8.1.3.4	Malfunction of Storage Area Vacuum Drying/Helium Fill System	Increase in fuel temperature	No radiological consequences	Repair equipment, determine cause, and implement corrective action
8.1.3.5	Partial Air Inlet/Outlet Vent Blockage	Increase in fuel temperature	No radiological consequences	Clear obstructions from inlet/outlet
8.1.4.1	Breach of Waste Package in the Solid Waste Area	Increased radiation dose to on-site personnel due to decontamination efforts	Minimal dose consequences from decontamination efforts: 0.1 DAC	Repair equipment, determine cause, and implement corrective action
8.1.4.2	High Dose Rate to Solid Waste Area	Increased radiation level in unoccupied waste enclosure, negligible worker exposure	Negligible worker exposure, no off-site consequences	Return material to FPA, determine cause, and implement corrective action
8.1.5.1	Ventilation System Failures	Increased fuel temperatures, no significant release, negligible worker exposure, no off-site exposure	No significant release or exposure, no off-site radiological consequences	Repair equipment or determine cause, implement corrective action
8.1.5.2	Loss of External Power Supply for a Limited Duration	Increased fuel temperatures	No radiological consequences	Restore power source; manual and backup power available but not required

Table 4-8. Off-Normal Event Evaluated[a] (continued)				
Safety Analysis Report Section Number	**Description**	**Effects and Consequences**	**Estimated Dose (mrem)**	**Corrective Action**
8.1.5.3	Off-Normal Ambient Temperatures	No adverse consequences	No radiological consequences	None required; HVAC designed for extremes

CHM = Canister Handling Machine
DAC = derived air concentration-hour
HVAC = heating, ventilation, and air conditioning
FPA = Fuel Processing Area
FWENC = Foster Wheeler Environmental Corporation
NA = not applicable

[a] FWENC. "Safety Analysis Report, Idaho Spent Fuel Facility." NRC Docket No. 72-25. ISF–FW–RPT–0032. Morris Plains, New Jersey: FWENC. 2001.

NOTE: To convert millirems (mrem) to millisieverts (mSv), multiply by 0.01.

Table 4-9. Accident Analysis for the Proposed Idaho Spent Fuel Facility[a]				
Safety Analysis Report Section No.	**Description**	**Effects and Consequences**	**Estimated Dose (mrem)**	**Corrective Action**
8.2.1	**Transfer Cask Events**			
8.2.1.1	Vehicular Collision with Transporter	No adverse consequence	No radiological consequences	Event is bounded by transportation evaluation of Peach Bottom Cask
8.2.1.2	Transfer Cask Drop During Hoisting Operations	Staff requested for drop assessment for all fuel confinement structures and components in RAI for independent SNF facility application	No radiological consequences	Not a credible event; transfer cask will be handled with single-failure proof crane
8.2.1.3	Transfer Cask Tipover	Staff requested for tipover assessment for all fuel confinement structures and components in RAI for independent SNF facility application	No radiological consequences	Not a credible event; system designed to prevent the event
8.2.1.4	Cask Trolley Collision Events	No adverse consequence	No radiological consequences	Collision prevented by limit switches and cask designed to withstand impact
8.2.2	**Fuel Packaging Events**			
8.2.2.1	Drop of DOE Fuel Container During Handling	No adverse consequence	No radiological consequences	Not a credible event; DOE fuel container will be handled by FHM designed to the requirements of single-failure proof system
8.2.2.2	Drop of Idaho Spent Fuel Basket During Handling	No adverse consequence	No radiological consequences	Not a credible event; spent fuel basket will be handled by FHM designed to the requirements of single-failure proof system
8.2.2.3	Canister Trolley Movement in Raised Position	No adverse consequence	No radiological consequences	Not a credible event; trolley movement before lowering of storage container prevented by interlock
8.2.3	**Fuel Storage Accidents**			
8.2.3.1	Idaho Spent Fuel Canister Drop	Staff requested for drop assessment for all fuel confinement structures and components in RAI for independent SNF facility application	No radiological consequences	Not a credible event; drop events prevented by single-failure proof design of CHM and interlocks

Table 4-9. Accident Analysis for the Proposed Idaho Spent Fuel Facility[a] (continued)				
Safety Analysis Report Section No.	**Description**	**Effects and Consequences**	**Estimated Dose (mrem)**	**Corrective Action**
8.2.3.2	Transverse Movement of the CHM with an Idaho Spent Fuel Canister Partially Inserted	No adverse consequence	No radiological consequences	Not a credible event; CHM movement prevented by interlock and seismic design
8.2.4	**Other Postulated Accidents**			
8.2.4.1	Adiabatic Heatup	No adverse consequence	No radiological consequences	Periodically inspected to keep inlet and outlet vents free from blockages Applicant conducted nonmechanistic analysis considering 50-percent blockage, and the evaluated temperature of basket and vault storage is below maximum allowable Applicant should conduct an analysis with 100-percent blockage scenario
8.2.4.2	Loss of Shielding	No increase in exposure rate expected	No radiological consequences	No significant shielding concern; prevented by administrative control, design, and radiation monitoring
8.2.4.3	Building Structural Failure onto Structures, Systems, or Components	No adverse consequence	No radiological consequences	Not considered credible Building structures would be designed using regulatory guidance and codes Lifting devices would be designed as single-failure-proof devices or with added design margins

Table 4-9. Accident Analysis for the Proposed Idaho Spent Fuel Facility[a] (continued)

Safety Analysis Report Section No.	Description	Effects and Consequences	Estimated Dose (mrem)	Corrective Action
8.2.4.4	Fire and Explosion	Staff review of independent SNF Safety Analysis Report generated several RAIs on data, assumptions, and analysis with regard to fire and explosion; without this information, applicant's evaluation cannot be considered complete	No radiological consequences	Radiologically controlled areas are enveloped by fire-rated barriers to minimize potential for off-site release Impact of INTEC facility, storage yards, fuel storage tanks, and access roads to independent SNF facility was evaluated
8.2.4.5	Maximum Hypothetical Dose Accident	Dose well below the 5 mSv [5,000 mrem] limit	Nonmechanistic dose at the controlled area boundary: .00003 mSv [0.003 mrem] TEDE storage area container leakage release 0.0002 mSv [0.02 mrem] TEDE FPA HEPA filter release	Evaluated hypothetical events that result in nonmechanistic off-site dose for the purposes of demonstrating compliance with 10 CFR 72.106(b)

CHM = Canister Handling Machine
DOE = U.S. Department of Energy
FHM = Fuel Handling Machine
FWENC = Foster Wheeler Environmental Corporation
FPA = Fuel Packaging Area
HEPA = high efficiency particulate air
INTEC = Idaho Nuclear Technology and Engineering Center
RAI = request for additional information
SNF = spent nuclear fuel
TEDE = total effective dose equivalent

[a] FWENC. "Safety Analysis Report, Idaho Spent Fuel Facility." NRC Docket No. 72-25. ISF–FW–RPT–0032. Morris Plains, New Jersey: FWENC. 2001.

NOTE: To convert millirems (mrem) to millisieverts (mSv), multiply by 0.01.

estimated dose, postulated cause of the event, corrective actions taken, and effects and consequences, including related sections in FWENC (2001b) where the events have been addressed. The potential events analyzed include vehicular collision; storage cask drop and tipover; drop events for fuel container, fuel basket, and SNF canister; trolley collision; adiabatic heatup caused by blockage of inlet and outlet vents; fire and explosion; loss of radiation shielding; and building structural failure. None of the events is estimated to be likely, and no radiological consequences to the public and workers are expected because the SSCs associated with these events are designed to withstand the hypothetical events.

Included in the various accident scenarios analyzed in FWENC (2001b, Section 8.2) is the maximum hypothetical dose accident for the purpose of demonstrating compliance with the

dose limits specified in 10 CFR 72.106(b). This hypothetical, beyond design basis accident was selected to serve as a worst-case scenario to bound the consequences of any credible accident at the facility involving the release, and subsequent atmospheric dispersion of radioactive material. For the proposed Idaho Spent Fuel Facility, two maximum hypothetical dose accidents were evaluated representing each of the two operational phases. For the repackaging phase of the operation, the maximum hypothetical dose accident involved a Fuel Packaging Area HEPA filter release. For the storage phase of the operation, the maximum hypothetical dose accident involved a storage area container leakage release. A detailed description of the conditions for each maximum hypothetical dose accident is presented in the applicant's safety analysis report (FWENC, 2001b, Section 8.2.4). A detailed evaluation of the maximum hypothetical dose estimates will be included in the safety evaluation report being developed by NRC. The resulting dose for the Fuel Packaging Area HEPA filter and the storage area container leakage release at the closest INEEL boundary is 2×10^{-4} mSv [2×10^{-2} mrem] and 3×10^{-5} mSv [3×10^{-3} mrem] total effective dose equivalent, respectively. These calculated dose results are well below the 50-mSv [5,000-mrem] accident dose limit of 10 CFR 72.106. Figures 4-2 and 4-3 provide dose estimates for distances closer to the proposed facility for the bounding Fuel Packaging Area HEPA filter release. The dose rates calculated for the nearer locations show the resulting dose rates for workers at nearby facilities would be well below accepted regulatory limits.

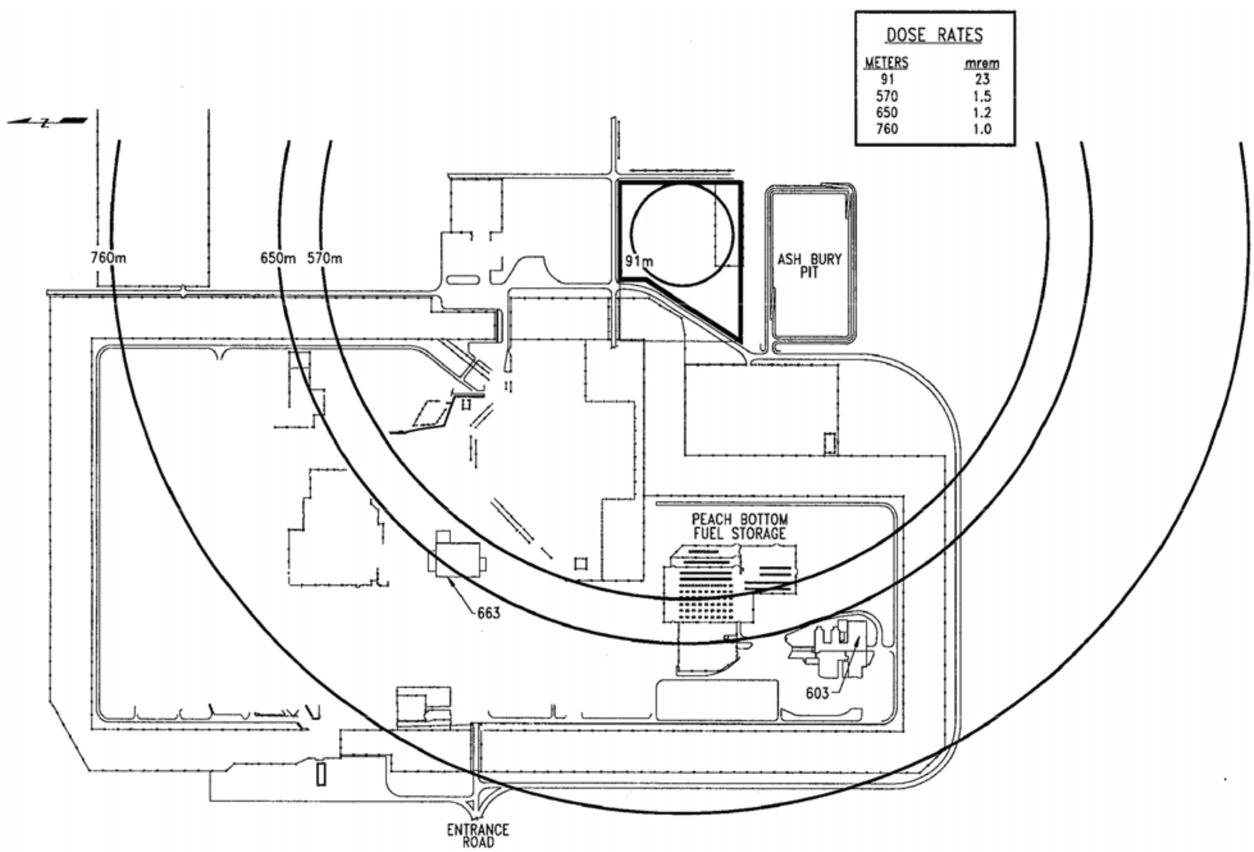
4.12.4 External Events

4.12.4.1 Flooding Hazards

The proposed Idaho Spent Fuel Facility would not discharge effluent as part of normal activities. The only potential impact to water resources at the site would be the result of the effects of a probable maximum flood (the largest flood likely to occur). The probable maximum flood at the site would occur from a failure of Mackay Dam on the Big Lost River (Koslow and Van Haaften, 1986). The potential impact on INEEL facilities by a maximum flood was assumed caused by a probable maximum flood resulting in the overtopping and rapid failure of Mackay Dam. The sequence of events that lead to a probable maximum flood includes a probable maximum precipitation event consisting of a 4-hour general storm, preceded 3 days earlier by an antecedent storm with a magnitude of 40 percent of the 4-hour storm. The postulated precipitation events would cause overtopping flow across the dam. The overtopping of the Mackay Dam is assumed to result in dam failure.

The probable maximum flood is considered conservative, because the last flood of similar magnitude occurred nearly 12,000 years ago during a wet climate cycle. The probable maximum flood scenario has flows estimated at 990 m^3/s [35,000 ft^3/s] with a water velocity ranging from 0.2 to 0.9 m/s [0.6 to 3.0 ft/s] on INEEL. This flood would result in shallow, slow-moving, flood water within the INTEC-controlled area with a flood elevation at the proposed Idaho Spent Fuel Facility site of approximately 1,500.0 m [4,921 ft], and water velocities of approximately 0.3 to 1 m/s [1 to 3 ft/s].

Debris bulking was not considered in the flow volumes for the probable maximum flood. Other than natural topography, the primary choke points for probable maximum flood flows are the diversion dam on INEEL and the culverts on Lincoln Boulevard to the west of INTEC. The probable maximum flood would quickly overtop and wash out the diversion dam; essentially, there would be no effect on flows downstream of the dam. The Lincoln Boulevard culverts are



1 **Figure 4-2. INTEC Area Maximum Radiological Dose for Maximum Hypothetical Dose Accident (from FWENC, 2001b, Section 8.3). To Convert Meters to Feet, Multiply by 0.3048; to Convert mrem to mSv, Multiply by 0.01.**

1

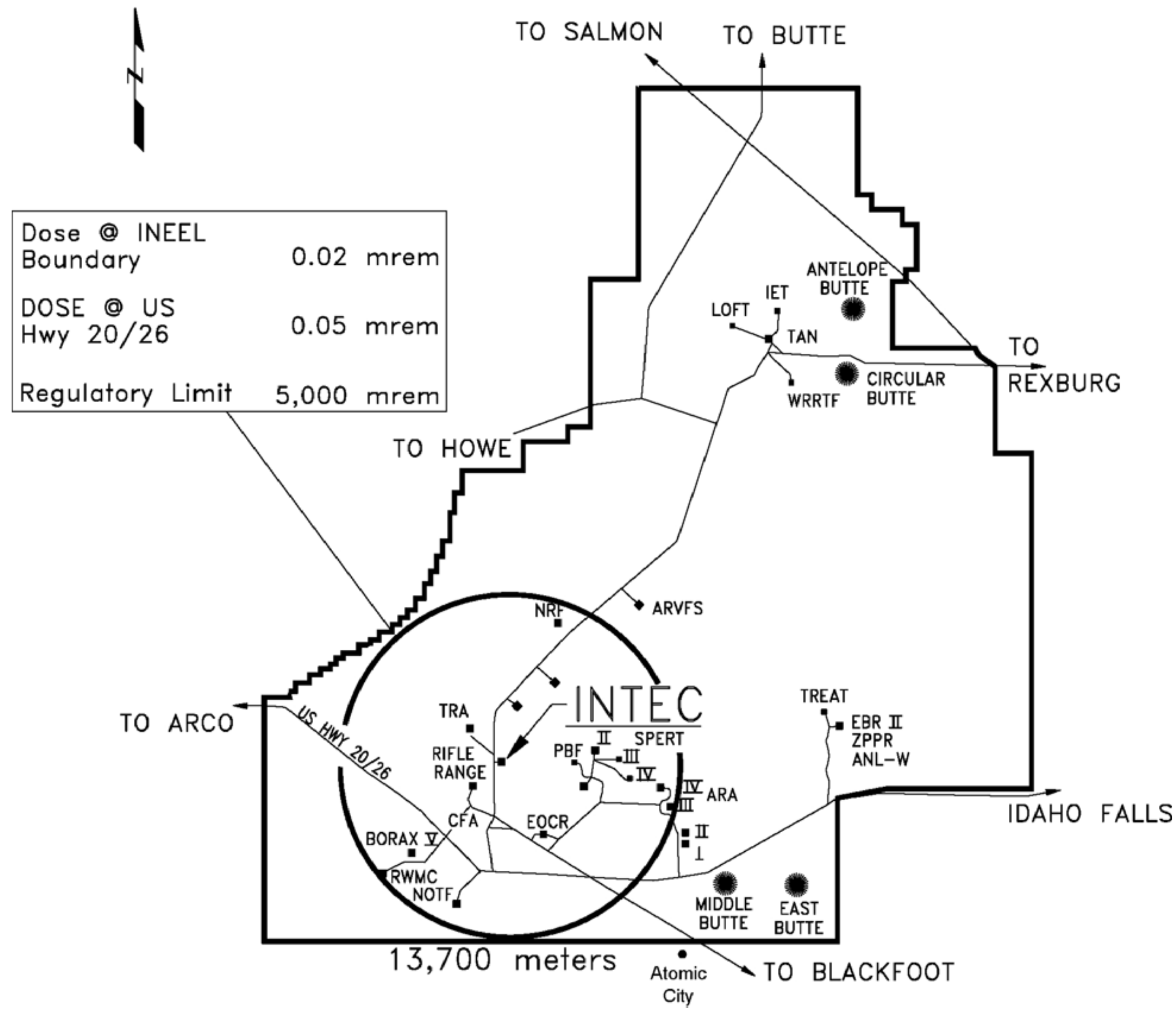


Figure 4-3. INEEL Area Maximum Radiological Dose for Maximum Hypothetical Dose Accident (Modified from FWENC, 2001b, Section 8.3). To Convert Meters to Feet, Multiply by 0.3048; to Convert mrem to mSv, Multiply by 0.01.

capable of passing about 42 m^3/s [1,500 ft^3/s] of waterflow (Berenbrock and Kjelstrom, 1998). Because of the relatively flat topography in the vicinity of INTEC, debris plugging at the culverts would have little effect on the probable maximum flood elevation at INTEC (DOE, 2002a, Section 4.8) or at the proposed Idaho Spent Fuel Facility.

The effects of hydrostatic and hydrodynamic forces on potentially affected SSCs have been considered in the proposed design (FWENC, 2001b). In general, these forces are insignificant compared with other normal, off-normal, or accident loads on the affected SSCs. This evaluation concludes that the structural integrity of the proposed Idaho Spent Fuel Facility confinement boundary would be maintained. The calculated time for the probable maximum flood wave to reach the proposed Idaho Spent Fuel Facility is at least 13.5 hours, providing sufficient time to implement preplanned flood control measures. These measures include putting any ongoing processing sequences into a secure configuration and securing waste containers. The Storage Area and the Fuel Processing Area are designed to prevent the ingress of floodwater. Penetrations and construction joints below the elevation of the probable maximum flood in these areas will be sealed to prevent leaks. The elevations of the various facility areas communicable with the floodwater and associated pathways are provided in Table 4-10.

Flooding hydrostatic forces have been considered in the equipment designs for these areas, therefore, any uplift would not damage equipment. Equipment such as the cask trolley, canister trolley, and liquid waste storage tank and the building structures include flooding loads in their design bases.

Table 4-10. Elevation[a] of the Proposed Idaho Spent Fuel Facility Relative to the Probable Maximum Flood[b]

Area	Elevation[a]	Outside Portal Elevation	PMF Elevations Above Area Floor
Cask Receipt Area	1,497.53	Below PMF	~2.31
Transfer Tunnel	1,497.33	Below PMF	~2.51
Solid Waste Storage/Solid Waste Processing Area	1,498.85	Below PMF	~0.99
Liquid Waste Storage Tank Area	1,498.09	Below PMF	~1.75
HVAC Exhaust Room	1,498.85	Below PMF	~0.99

FWENC = Foster Wheeler Environmental Corporation
HVAC = heating, ventilation, and air conditioning
PMF = maximum probable flood

[a] Meters above sea level
[b] FWENC. "Safety Analysis Report, Idaho Spent Fuel Facility." NRC Docket No. 72-25. ISF–FW–RPT–0033. Morris Plains, New Jersey: FWENC. 2001.

NOTE: To convert to meters (m) to feet (ft), multiply by 3.2808.

4.12.4.2 Aircraft Impact Hazards

Aircraft usually fly around the INEEL boundary. INEEL has in place a Federal Aviation Administration advisory prohibiting flights at altitudes below 1,800 m [6,000 ft] above mean sea level. Commercial airports near the INEEL facilities include (i) Idaho Falls Regional Airport, approximately 70 km [43 mi] away; (ii) Pocatello Regional Airport approximately 79 km [49 mi] away; (iii) Burley Municipal Airport, approximately 134 km [83 mi] away; and (iv) Joslin Field–Magic Valley Regional Airport, approximately at Twin Falls 176 km [109 mi] away. There are two small nearby airports that serve as a home base for aircraft. These two airports are usually used by general aviation aircraft. Twelve single-engine aircraft are based at Arco–Butte County Airport, approximately 32 km [20 mi] west of the proposed facility site. Howe Airport is located approximately 32 km [20 mi] north of the proposed site. Four single-engine aircraft are based there. In addition, there are several unpaved landing strips near the INEEL facilities, used primarily for recreational and emergency purposes by private and crop-dusting aircraft. The landing strips nearest the proposed site are located approximately 16 km [10 mi] south-southeast and 20 km [12 mi] south-southwest. These airports are all at significant distances from the INEEL facilities and, therefore, any flights near the INEEL facilities would be in a cruise mode at heights more than 305 m [1,000 ft] above the surface. Based on NUREG–0800 (NRC, 1997, Section 3.5.1.6), any landing and departure operations at these airports would have a negligible crash hazard to the proposed facility.

There are air taxi flights between Idaho Falls and Boise and between Idaho Falls and Salmon. The Idaho Falls Regional Airport has nearly 41,000 annual operations. Approximately 51,000 annual operations take place at the Pocatello Airport. Most traffic is either to Boise or Salt Lake City. Burley Municipal Airport has about 33,800 operations in a year. Approximately 36,800 annual operations take place at Joslin Field–Magic Valley Regional Airport at Twin Falls.

Approximately 98 percent of the traffic at Arco–Butte County airport is general aviation aircraft composed of private and crop-duster aircraft. This airport operates approximately 100 air taxi and commuter flights in a year. One hundred percent of traffic at Howe Airport is by general aviation aircraft mostly used for crop dusting.

Most aircraft used in crop dusting around the INEEL facilities do not cross the INEEL boundary. They use the boundary for turning the aircraft. However, aircraft need to be moved across the INEEL a few times a year. Approximately 60 to 100 overflights by crop dusting and other similar aircraft traditionally have been permitted by the INEEL Flight Department (Lee, et al., 1996).

Air taxi flights from Idaho Falls Regional Airport use Federal Aviation Administration-approved vector 269 while flying to Pocatello, Burley, and Twin Falls. Approximately six flights take place in a day. These flights approach approximately 30 km [19 mi] of the proposed facility (Lee, et al., 1996). On average, two to three air taxi flights are flown between Idaho Falls and Boise each day. The edge of this airway nearest the proposed facility site is approximately 15 km [9 mi] (FWENC, 2003).

General aviation aircraft while flying from Pocatello to Salmon come within approximately 15 km [9 mi] of the proposed facility. Only a small number of flights travel this route annually (Lee, et al., 1996).

Military training routes near the proposed facility (VR1300, IR302, and IR305) are used by the Idaho Air National Guard for terrain masking (FWENC, 2003). Hazardous activities such as practice bombing or laser firing are not conducted in these routes. Approximately 435 annual sorties are flown on these routes.

4.12.4.3 Volcanic Hazards

Lava flows from volcanoes located up topographic gradient from the INTEC site could present a hazard to the INTEC site if not mitigated. One proposed mitigation strategy for lava-flow hazards is the construction of 6.1-m- [20-ft-] high compacted earthen berms to divert potential lava flows away from the INTEC area. The berms would be constructed from 104,000 m^3 [136,000 yd^3] of soil from areas immediately adjacent to the INTEC area. Construction of these berms would occur only after the onset of a potentially hazardous volcanic eruption. Thus, in the unlikely event of a future lava-flow eruption, construction of a diversionary berm would adversely impact 104,000 m^3 [136,000 yd^3] of soils adjacent to the proposed Idaho Spent Fuel Facility. This potential soil impact appears minimal compared to the impact of a naturally occurring lava flow, which would bury significantly more soil if the flow extended to the vicinity of INTEC.

4.12.4.4 Seismic Hazards

One geologic hazards that must be considered in the safe design of nuclear facilities is the strong shaking of the ground during an earthquake. Earthquakes occur when energy stored within the earth, usually in the form of strain accumulated in rocks, is released suddenly. This energy is transmitted to the surface of the earth by earthquake waves. The accumulation of strain in the rocks results from plate tectonic forces deep in the earth. Because the INEEL site rests within an active tectonic province in the western United States, there is the possibility that the site could undergo ground shaking from an earthquake. The potential destructive force of an earthquake at any site on the earth depends on several factors including size of the earthquake (usually measured by earthquake magnitude), duration of shaking, and how far away the site is from the earthquake epicenter.

To ensure that critical facilities, including nuclear facilities, remain safe during and after an earthquake, the SSCs important to safety are designed to withstand vibratory ground motions from earthquakes. An important part of the design process is to accurately estimate the range of vibratory ground motions that could occur. Ground motion is most often expressed as ground acceleration in units of *g* (1*g* is the acceleration of gravitational attraction for standard conditions). Ground motions are determined for a range of spectral frequencies between 0.5 and 100 Hz (oscillations per second). These estimates of ground accelerations are based on observations of past earthquakes from the historical seismic record, inferences about the location and magnitude of prehistoric earthquakes based on the geologic record; and detailed models of how the energy from earthquakes is attenuated as it travels from the earthquake source to the site.

According to 10 CFR 72.122(b)(2), SSCs important to safety must be designed to withstand the effects of natural phenomena, including earthquakes. For sites west of the Rocky Mountains, such as the proposed Idaho Spent Fuel Facility, 10 CFR Part 72 requires that seismicity be evaluated by techniques described in Appendix A of 10 CFR Part 100. This appendix defines

the safe shutdown earthquake as the earthquake that produces the maximum vibratory ground motion at the site and requires the SSCs be designed to withstand these ground motions.

Originally, this assessment of the safe shutdown earthquake was based on a deterministic approach assuming a 100-percent chance that the earthquake will occur. In recent years, however, geologists, seismologists, and engineers recognized that how frequently an earthquake occurs is also important to the definition of the safe shutdown earthquake. Thus, the NRC regulations were modified at 10 CFR 100.23(d)(1) to allow for the use of a probabilistic seismic hazard analysis (PSHA). In PSHA, the range of ground motions possible at a site is calculated as a function of how likely these ground motions are. This likelihood is expressed either as an annual probability that the ground motion would be exceeded or as its reciprocal, the ground motion return period. Geologic and seismologic inputs necessary to develop a PSHA include (i) interpretation of the seismic sources from which probability distribution functions of earthquake parameters (e.g., maximum magnitude and source-to-site distance) can be obtained, (ii) earthquake recurrence parameters (e.g., slip rate or activity rate), and (iii) ground motion attenuation. The NRC regulations in 10 CFR Part 72 have not yet been updated to incorporate the use of PSHA methods. Nevertheless, as part of the safety evaluation report prepared for the Three-Mile Island Unit 2 ISFSI at INTEC, NRC granted an exemption from the 10 CFR Part 72 regulations and allowed a PSHA approach, including facility design based on the 2,000-year return period mean ground motion (SECY–98–071).

Inputs to the original PSHA, used to assess earthquake ground motions at the Three-Mile Island Unit 2 ISFSI at the INTEC facility (Woodward-Clyde Federal Services, 1996), were also used for the hazard assessment at the proposed Idaho Spent Fuel Facility. For INTEC, the 2,000-year return period mean peak horizontal acceleration (ground acceleration at 100 Hz) was estimated at 0.13*g*. In 2000, the seismic hazards at five INEEL facility sites, including INTEC, were recalculated to account for new ground motion attenuation models. These new attenuation models were developed by URS Woodward-Clyde Federal Services for INEEL and first applied in the earthquake hazard assessment for the Naval Reactor Fuel ISFSI facility, 10.5 km [6.7 mi] northeast of the proposed Idaho Spent Fuel Facility (Stamatakos, et al., 2001). The new attenuation models predicted 12–23 percent lower ground motions compared with 1996 estimates.

In preparing a safety evaluation for the Three-Mile Island Unit 2 ISFSI at the INTEC facility and for the review of the Naval Reactor Fuel ISFSI site, NRC evaluated previous DOE seismic hazard analyses (Brach, 1999; Stamatakos, et al., 2001). These reviews concluded that the analyses and information provided reasonable assurance that adequate geologic and seismological data were used in developing seismic hazard analyses. Because the proposed Idaho Spent Fuel Facility is located within the same seismotectonic setting as the Three-Mile Island Unit 2 ISFSI and Naval Reactors Spent Fuel ISFSI site and because there have been no significant earthquakes since the Three-Mile Island Unit 2 ISFSI safety analysis report and Naval Fuel ISFSI evaluation were published, no additional update to the seismic hazard was deemed necessary. The design earthquake at the proposed Idaho Spent Fuel Facility is, therefore, based on the 2,000-year return period ground motions from the existing seismic hazard assessment for INEEL.

The primary structural steel members, concrete structures, and footings for the areas encompassed by the Cask Receipt Area, the Transfer Area, and the Storage Area are designed to withstand the forces and accelerations associated with the design earthquake. The storage

tube assemblies, including the container storage tubes, shield plugs, and lids, which provide the vault storage positions, have also been designed to withstand these forces. In addition, the primary structural steel members of the Cask Receipt Area, Transfer Area, and Storage Area have been designed using the same seismic criteria and load combinations as important to safety structures. These structures would not adversely impact the SNF container or the SNF after a seismic event. The wall and roof panels and secondary support structures are not designed to withstand the design earthquake and may require repair or replacement after the event. These building components are not, however, required to remain intact during the event and do not provide configuration control, confinement, support or structural protection for the SNF. Failure of these systems would not result in damage to the SNF container or the SNF, and would not adversely impact public health and safety.

The Fujita or F scale, is commonly used to classify tornadoes. In this scale, intensity of the tornadoes ranges from F0–F5 in order of increasing intensities. Each intensity class has a range of wind speed associated with it, as shown below.

F Scale	Wind Speed km/h [mph]
F0	64–116 [40–72]
F1	117 and 180 [73 and 112]
F2	181 and 253 [113 and 157]
F3	254–332 [158–206]
F4	333–418 [207–260]
F5	Higher than 419 [260]

Based on the analyses provided in the safety analysis report (FWENC, 2001b), the systems important to safety for the proposed Idaho Spent Fuel Facility systems would withstand the accident loads with no unacceptable consequences and no significant release of radioactive material. The design basis ground motions are not expected to breach confinement or damage in-process or stored fuel or fuel containers. There are no postulated radiological releases or adverse radiological consequences from these design basis ground motions. These design basis ground motions do not involve a change to the fuel or structural integrity configuration. Therefore, no changes to the criticality, confinement, or retrievability of SNF are expected, and the impacts of the design basis ground motions are minimal.

4.12.4.5 Extreme Wind and Wind-Generated Missiles

The proposed facility is to be constructed at the INEEL site, approximately 43° 34' north latitude and 112° 55' west longitude. Based on the analysis presented in Ramsdell and Andrews (1986), the geographic region encompassing the INEEL site is one of the areas in the United States with a low tornado hazard occurrence. NRC Guidance (1997) specifies that any event with an annual probability of occurrence less than 1×10^{-7} need not be considered.

The applicant, based on Ramsdell and Andrews (1986), estimated the characteristics of potential tornadoes at the proposed site. The average probability of any tornado striking this region is approximately 6×10^{-7} per year. The probability of a tornado with intensity F2 or higher {wind speed higher than 180 km/h [113 mph]} is approximately 1.69×10^{-7} per year. The estimated maximum wind speed at INEEL is 187 km/h [117 mph] (tornado category F2) with a probability of 1×10^{-7}.

Lawrence Livermore National Laboratory developed a probabilistic tornado wind hazard model for the continental United States (Boissonnade, et al., 2000) on behalf of DOE. This model formed the basis of the tornado missile criteria in DOE (2002d). Based on Boissonnade, et al. (2000,), the estimated tornado wind speed at INEEL at an annual probability of exceedence of 10^{-7} (one chance in 10 million) is 459 km/h [285 mph], assuming tornado intensity distribution based on the contiguous United States; however, the estimated tornado wind speed reduces to 330 km/h [205 mph] when assuming the tornado intensity distribution applicable to the NRC Region III, which encompasses the proposed facility. The NRC and Center for Nuclear Waste Regulatory Analyses (CNWRA) staffs have requested additional information from FWENC on the design-basis tornado for the proposed facility, based on site-specific hazard information.

The applicant considered Spectrum II missiles, as defined in Section 3.5.1.4, Missiles Generated by Natural Phenomena, NUREG–0800 (NRC, 1997) as the representative tornado-generated missiles for the proposed site. These missiles include

- 52-kg [115-lb] wooden plank traveling at 58 m/s [190 ft/s];

- 130-kg [287 lb] 15-cm [6-in.] diameter Schedule 40 steel pipe traveling at 10 m/s [33 ft/s];

- 4-kg [9-lb] 2.54-cm [1-in] diameter steel rod traveling at 8 m/s [26 ft/s];

- 510-kg [1,124-lb] utility pole traveling at 26 m/s [85 ft/s];

- 340-kg [750-lb] 0.3-m [12-in] diameter Schedule 40 steel pipe traveling at 7 m/s [23 ft/s]; and

- 1,810-kg [4,000-lb] automobile traveling at 41 m/s [134 ft/s].

The applicant concluded, however, that the utility pole and the 0.3-m [12-in] diameter steel pipe are not credible missiles, citing DOE Standard DOE/STD–1020–1994 (1994), because heavier missiles will not be generated by a wind speed less than 322 km/h [200 mph]. Similarly, the applicant has excluded an automobile as a potential tornado-generated missile for the proposed facility, citing Coats and Murray (1985), because automobiles will not be picked up or sustained aloft by tornado events with wind speeds less than or equal to 322 km/h [200 mph]. The NRC and CNWRA staffs have requested additional information from FWENC on tornado-generated missiles.

FWENC (2001b) analyzed the potential for a tornado missile to strike a safety-related structure causing radiological release at different locations of the proposed facility: (i) Outside Cask Receipt Area, (ii) Inside Cask Receipt Area, (iii) Inside Transfer Tunnel, (iv) Fuel Packaging Area, (v) Canister Closure Area, (vi) Canister Handling Machine on the Second Floor of the Storage Area, (vii) Storage Area, and (viii) Solid/Liquid Waste Area. Outside the Cask Receipt Area, the DOE transfer cask provides protection against tornado missiles. Inside the Canister Receipt Area, the DOE transfer cask provides the protection. SNF would be handled in the proposed facility approximately 15 percent of the time each year. Additionally, as an added precaution, any handling of SNF would be suspended when tornado watches or tornado warnings are in effect (FWENC, 2001b). The Transfer Tunnel would be constructed with a minimum 0.9-m [3-ft] thick reinforced concrete that would be able to provide the necessary protection from tornado missiles, based on NRC (1997). Similarly, within the Transfer Area, the Fuel Packaging Area and Canister Closure Area are isolated and enclosed by 1.2- and 0.9-m

[4- and 3-ft] thick reinforced concrete walls. Therefore, it is anticipated the tornado missiles would not be a credible hazard for these locations. The Canister Handling Machine has been designed to withstand the effects of tornados. The Storage Area is enclosed by reinforced concrete walls up to 9.1 m [30 ft] around the perimeter, with a thickness of 0.9 m [3 ft]. Therefore, it is anticipated tornado missiles would not be a credible hazard there either. The Solid/Liquid Waste Storage Areas are vulnerable to tornado missiles and wind pressure at some locations. FWENC (2001b) stated the off-site dose would remain below the regulatory limit even if there are gross failures of the protective barriers.

4.12.4.6 Wildfires

The INEEL site has a desert ecosystem with shrub-steppe vegetation. Wildfires occur within the INEEL property boundary. Large fires in 1994, 1995, 1996, 1999, 2000, as shown in Figure 3-9, burned approximately 56,700 ha [140,000 acres] (DOE, 2002a). DOE has an active program to monitor the affected areas and the recovery of desert vegetation. Although evacuating personnel from the INEEL facilities when a fire approached too closely was necessary on some occasions, the INEEL Fire Department, with assistance from other area fire departments such as BLM, successfully fought the fire on every occasion so that none of the INEEL facilities was affected. The proposed Idaho Spent Fuel Facility would be constructed adjacent to INTEC on a previously disturbed site. Vegetation covers less than 5 percent of the surface area of this site. Therefore, potential for wildfires fueled by this vegetation is low (FWENC, 2001a).

Outside the controlled boundary of the proposed Idaho Spent Fuel Facility, the INEEL Fire Department would provide fire response in accordance with the emergency plan (FWENC, 2001b, Section 4.3). A qualified fire protection engineer would develop the overall fire protection program and also would design and select necessary equipment. The INEEL Fire Department would provide periodic site-specific training and fire drills. Personnel at the Idaho Spent Fuel Facility would be provided with general training; however, emergency response staff would have specialized training in accordance with FWENC (2001d). Therefore, based on the small amount of available fuel and the rapid response of the fire fighting team, it is anticipated that wildfires would not be a credible hazard to the proposed facility.

4.13 Waste Management Impacts

Generation of gaseous, liquid, and solid low-level radioactive waste is expected during the SNF receipt and repackaging operations the first 3 years of the proposed Idaho Spent Fuel Facility operation (FWENC, 2001b, Section 6).

SNF that would be stored at the proposed Idaho Spent Fuel Facility is predominantly from the Peach Bottom and Shippingport reactors that ceased operations in 1974 and 1983. The nature and condition of the SNF have provided a means for radioactive gases to escape. Furthermore, the storage time has allowed for some decay of radioactive gases. Nonetheless, some release of radioactive gas is possible during handling and repackaging in areas such as the Transfer Tunnel, Fuel Packaging Area, and Canister Closure Area. Based on the expected radionuclide inventory of SNF to be received at the proposed Idaho Spent Fuel Facility, the primary gaseous radionuclides of concern are iodine-129, krypton-85, and tritium (FWENC, 2001b, Chapter 6).

The proposed heating, ventilation, and air-conditioning system (HVAC) would serve to prevent accidental release of radioactive material into the environment and maintain personnel exposures ALARA. Any gases released within the proposed Idaho Spent Fuel Facility would be passed through HEPA air filters to remove particulates and allow monitoring of radioactive gases before discharge through the exhaust stack. Evaluation of potential radiological impacts from normal heating ventilation and air-conditioning system discharges of gaseous effluents to the MEI at the controlled area boundary {approximately 3×10^{-7} mSv/yr [3×10^{-5} mrem/yr]} (FWENC, 2001b, Chapter 6) would be well below the regulatory constraint in 10 CFR Part 20 for members of the public {0.1 mSv/yr [10 mrem/yr]}.

Once repackaged, no further gaseous releases are expected from the SNF because packages would be sealed and monitored for integrity during storage. Hydrogen gas also may be produced by radiolytic decomposition of aqueous solutions. Release of hydrogen gas is possible in the liquid radioactive waste storage tank or in the SNF transfer cask where small amounts of moisture may be present with the SNF. Conservative FWENC estimates of the rate of hydrogen generation in the liquid waste storage tank (with no ventilation) indicate passive ventilation of the tank would be sufficient to maintain hydrogen concentrations below the 4 percent flammable concentration level (FWENC, 2001b, Section 6). Regarding the transfer casks, the internal atmospheric concentration of hydrogen would be sampled to ensure gas concentrations are within acceptable limits prior to removal of the cask lid (FWENC, 2001b, Section 6).

Liquid radioactive waste would not be generated during normal operations of the proposed Idaho Spent Fuel Facility, however, such waste may be generated during nonroutine decontamination activities or as a result of sprinkler or firefighting water (Table 4-11). FWENC estimates no more than 17,800 L [4,700 gal] of liquid radioactive waste would be generated

Table 4-11. Estimated Concentrations of Principal Radionuclides in Liquid Waste[a]

Radionuclide[b]	Concentration (Ci/g)
Tritium	1.11×10^{-9}
Krypton-85	7.75×10^{-9}
Strontium-90	1.33×10^{-10}
Yttrium-90	1.33×10^{-10}
Cesium-137	1.41×10^{-10}
Barium-137	1.33×10^{-10}
Plutonium-238	1.57×10^{-12}

FWENC = Foster Wheeler Environmental Corporation

[a] FWENC. "Safety Analysis Report, Idaho Spent Fuel Facility." Section 6. NRC Docket No. 72-25. ISF–FW–RPT–0033. Section 6. Morris Plains, New Jersey: FWENC. 2001.
[b] Other radionuclide concentrations estimated at < 1 pCi/g.

NOTE: To convert grams (g) to ounces (oz), multiply by 0.03527.

each year from decontamination activities (2001b, Section 6). A liquid waste processing system would collect and store such liquid wastes temporarily in a 18,900-L [5,000-gal] tank prior to transfer to a licensed treatment facility by a mobile service contractor. The tank would be located below grade with an effective containment volume of 41,650 L [11,000 gal] in the event of a tank failure or spill (FWENC, 2001b, Section 6). Liquid waste collection would be available in the personnel safety shower and eye wash, the solid waste processing area where water may be used for decontamination, the Transfer Tunnel where decontamination water or fire sprinkler water could be generated, the Canister Closure Area where decontamination or container weld test water may be generated, the workshop where decontamination water may be generated, and the liquid waste storage area where a sump would filter and collect spilled or wash water to be transferred to the liquid waste storage tank. Normal decontamination activities would involve only small amounts of water for wiping with cloth or paper (no free liquid wastes would be generated).

Solid waste generated at the proposed Idaho Spent Fuel Facility would be from repackaging of SNF and other process-related activities. Solid waste is classified as large canister waste, small canister waste, and process level waste. The canister waste includes large and small containers used to deliver SNF to the proposed Idaho Spent Fuel Facility. Process waste includes paper, rubber, plastic, rags, machinery parts, tools, vacuum cleaner debris, welding materials, and HEPA filters. Estimated volumes of solid waste are provided in Table 4-12.

Solid waste from the proposed Idaho Spent Fuel Facility would be characterized for disposal as low-level radioactive waste (FWENC, 2001b, Section 6) and would be handled through the solid waste processing system located in the solid waste processing area. This solid waste processing system would handle, package, and temporarily store solid waste pending transportation to the (onsite) INEEL Radioactive Waste Management Complex or available off-site locations, including the Nevada Test Site and Hanford, for disposal (DOE, 2000). Waste would be characterized, analyzed, and disposed of in accordance with existing DOE/INEEL reuse, recycle, and waste acceptance criteria (DOE, 1999b). The Radioactive Waste Management Complex would accept packages with radiation limited to 500 mR/hr at 1 m [3.3 ft]; however, the general practice is to limit waste container surface radiation to below 100 mR/hr. Canister waste would be processed by surveying containers and cleaning and sectioning in the fuel processing area using specially designed saws to ensure canister waste meets a radiation

Table 4-12. Estimated Volumes of Solid Low-Level Radioactive Waste[a]

Waste Type (m^3)	Year 1	Year 2	Year 3	Total
Canister Waste	81	81	138	300
Process Generated	37	37	28	102
Total Volume	118	118	166	402

FWENC = Foster Wheeler Environmental Corporation

[a] FWENC. "Safety Analysis Report, Idaho Spent Fuel Facility." Section 6. NRC Docket No. 72-25. ISF–FW–RPT–0033. Morris Plains, New Jersey: FWENC. 2001.

NOTE: To convert meters cubed (m^3) to yards cubed (yd^3), multiply by 1.3079.

limit of 50 mR/hr prior to transfer to the Radioactive Waste Management Complex for further sectioning and packaging for disposal (FWENC, 2001b, Section 6). No mixed waste is expected to be generated by the proposed Idaho Spent Fuel Facility.

The Radioactive Waste Management Complex Subsurface Disposal Area has a total capacity of approximately 50,000 m^3 [70,000 yd^3] (FWENC, 2003). For the past 3 years, DOE has disposed of low-level radioactive waste at a rate of approximately 4,000 m^3 [5,000 yd^3] per year (FWENC, 2003). The aforementioned estimated total volume of solid waste during proposed fuel receipt and repackaging operations in Table 4-12 is approximately 400 m^3 [500 yd^3], representing a 3-percent annual increase in low-level waste generation. Therefore, the increase in the waste generation rate and estimated total volume of waste for the proposed action is small compared with the current waste generation rate and existing disposal capacity.

In summary, no chemical effluents or wastes are planned to be generated from the proposed Idaho Spent Fuel Facility. Small amounts of gaseous, particulate, and dilute liquid radioactive wastes are planned to be generated by the proposed Idaho Spent Fuel Facility. Control systems planned for gaseous, particulate, and liquid radioactive wastes would contain releases and limit exposures to workers and the public well below regulatory limits. Solid radioactive wastes generated at the proposed Idaho Spent Fuel Facility would consist of used waste containers and process wastes, both classified as low-level radioactive waste. The INEEL site includes a low-level radioactive waste disposal facility with the capacity to dispose of the waste generated by the proposed Idaho Spent Fuel Facility. Volumes of low-level solid waste estimated to be generated by the proposed Idaho Spent Fuel Facility are a small fraction of the annual INEEL site low-level waste generation and existing disposal capacity. INEEL and other applicable low-level radioactive waste sites have been previously assessed for environmental impacts; therefore, no significant environmental impacts are expected from solid wastes. Overall, waste management activities associated with the proposed Idaho Spent Fuel Facility are designed to limit waste volumes and maintain exposures ALARA. No significant environmental impacts are expected to result from waste management activities.

4.14 Cumulative Impacts

Cumulative impacts (effects) refer to the impacts on the environment that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place during a period of time (40 CFR 1508.7). This definition encompasses the following relative to this section:

- The action refers to the construction and operation of the proposed Idaho Spent Fuel Facility to be located adjacent to INTEC at INEEL.

- The direct and indirect incremental impacts of the proposed action are a key criterion in determining if cumulative effects on localized and regional environmental and natural resources, ecosystems, and human communities need to be addressed (e.g., if the proposed action has no effects on a given resource, it is not necessary to address the existing cumulative effects that have occurred on the resource).

- For those cumulative effects that need to be addressed, it is necessary to consider the direct and indirect effects of past, present, and reasonably foreseeable future actions on the affected resources, ecosystems, and human communities (past actions can include those prior to INEEL, as well as INEEL actions since 1949; present actions include those in detailed planning, being constructed, and recently initiated; and reasonably foreseeable future actions include those beyond mere speculation, but within the timeframe for analysis).

- Direct effects are those effects caused by the proposed action, past actions, present actions, or reasonably foreseeable future actions, that occur at the same time and place as the respective actions (40 CFR 1508.8a); indirect effects are caused by the respective actions and are later in time or farther removed in distance, but are still reasonably foreseeable (indirect effects may include growth-inducing effects; other effects related to induced changes in the pattern of land use, population density; or growth rate; and related effects on air, water, and other natural systems, including ecosystems) (40 CFR 1508.8b).

- The respective actions may have been, or would be, the result of decisions made by various governmental levels (federal, state, or local) or the private sector; further, such actions may be on INEEL lands or offsite (the key is that common resources, ecosystems, or human communities are affected).

- Cumulative effects need to be analyzed relative to a place-based perspective (the situation at INEEL) on the specific resources, ecosystems, and human communities affected.

- Each affected resource, ecosystem, and human community must be analyzed for its sustainability and capacity to accommodate additional effects, based on its own time and space parameters (Council on Environmental Quality, 1997).

A detailed methodology based on Council on Environmental Quality guidance (1997) is included in Appendix C.

4.14.1 Incremental Impacts of the Proposed Idaho Spent Fuel Facility

Section 8.1 and Table 2-1 contain a summary of the potential environmental impacts identified for construction and operation of the proposed Idaho Spent Fuel Facility. These impacts were abstracted from Sections 4.1–4.13. Detailed information on the assumptions, calculations, and qualitative descriptions of the impacts is presented in the respective earlier sections.

Based on the impact analysis, all incremental impacts of the proposed Idaho Spent Fuel Facility would be small in the context of historical, current, and planned operations at INEEL. No significant impacts have been identified from the construction and operation of the proposed Idaho Spent Fuel Facility; however, cumulative effects are addressed for most of the impact categories summarized previously. Cumulative effects on noise and visual/scenic qualities are not addressed because of the temporary and localized nature of the noise impacts from the facility, and the lack of visual intrusions from the facility in relation to its adjoining location to INTEC.

4.14.2 Past, Present, and Reasonably Foreseeable Future Actions

Cumulative effects assessment entails consideration of the incremental impacts of the proposed Idaho Spent Fuel Facility when added to the effects of past, present, and reasonably foreseeable future actions. Past actions can include those prior to the establishment of INEEL (or its precursor names) in 1949 and other actions implemented at INEEL prior to the current time. Examples of these past actions on INEEL lands include

- Agricultural practices and cattle and sheep grazing from 1860 through the 1940s;

- Bombing practice in the Central Facilities Area in the 1940s;

- Usage by the Shoshone–Bannock Tribes for subsistence and religious practices for many decades prior to the 1940s; and

- Development of the infrastructure and facilities at nine multiprogram areas within INEEL by the DOE (or its precursor agencies); these program areas include INTEC, Test Area North, Naval Reactors Facility, Test Reactor Area, Central Facilities Area, Power Burst Facility, Auxiliary Reactor Area, Argonne National Laboratory–West, and the Radioactive Waste Management Complex (see Figure 3-2 for the location of these areas).

The cumulative effects of past actions are summarized in Table 4-13 and described in more detail in Appendix C. Cumulative effects concerns are divided into four groups—major, modest, minor, and none. No cumulative effects concerns exist for noise because of the localized and transient nature of noise impacts. There are no cumulative effects concerns for visual and scenic issues because of INEEL's compliance with current guidelines. Additional information on the rationale for the grouping of each remaining affected environment is presented in Section 4.14.3.

Current actions and reasonably foreseeable future actions include those identified in the DOE programmatic SNF EIS (DOE, 1995), the Idaho High-Level Waste (HLW) and Facilities Disposition EIS (DOE, 2002a), and the EIS on the ISFSI for Three-Mile Island Unit 2 Spent Fuel (NRC, 1998). Table 4-14 includes the projects considered to be within the current actions and reasonably foreseeable future actions based on the earlier DOE analysis (DOE, 1995). These actions are part of the projected baseline (i.e., the future without the proposed action conditions). The project Dry Fuel Storage, Fuel Receiving, Canning/Characterization, and Shipping includes the proposed Idaho Spent Fuel Facility (DOE, 1995, Volume 2, Part B, Appendix C).

Additional onsite reasonably foreseeable future actions included in this cumulative effects assessment are listed in Table 4-15. Information related to the closure of various INTEC facilities identified in Table 4-15, including a list of facilities and their closure actions, deactivation activity period, and demolition activity period is provided in the Idaho HLW and Facilities Disposition EIS (DOE, 2002a, Section 5.4).

As part of the preparation of the Idaho HLW and Facilities Disposition EIS (DOE, 2002a), discussions were held with the City of Idaho Falls, the State of Idaho Department of Environmental Quality, and the BLM regarding anticipated future activities that could contribute to a cumulative impact on a particular resource or through a particular pathway within the

Table 4-13. Summary of the Cumulative Effects Concerns Related to Past Actions[a]

Affected Environment	Category	Cumulative Effects Concerns
Land Use	E	Modest concerns because small land use changes can impact many other environmental features
Transportation	HC	Minor concerns because adequate highways and on-site roads exist, along with a rail system in the region
Geology and Soils	R	Some soil contamination exists in and around INTEC facility, thus a minor concern exists
Water Resources–Surface Water	R	Minor concerns because surface water is not used as a water supply, the quality meets applicable standards, and wastewater treatment systems exist at INEEL
Water Resources–Groundwater	R	Groundwater usage is well within INEEL water rights; however, contaminated soils in the vadose zone and groundwater underlying the INTEC facilities suggest a major cumulative effects concern
Ecology	E	Minor concerns because the large majority of the INEEL area supports a diversity of flora, fauna, threatened or endangered species, and wetlands
Air Quality	R	Modest concerns because atmospheric transport can be a major cumulative effects pathway; however, current radiological and nonradiological air qualities are in compliance with applicable federal and state standards
Noise	R	No concerns due to localized and transient nature of noise sources at INEEL and in the region
Historic and Cultural	HC	Minor concern with regard to eligible historic structures; major concerns due to cumulative effects of continued restricted access on the Shoshone and Bannock Tribes
Visual and Scenic	HC	No concerns because the land uses both onsite at INEEL and on the adjacent lands are compatible with the Bureau of Land Management Visual Resource Management Guidelines
Socioeconomic	HC	Major beneficial cumulative effect because the overall operations of INEEL represent a significant contribution to the regional economy
Environmental Justice	HC	Minor concern because three recent impact studies indicated no disproportionately high adverse human health or environmental effects on minority or low-income populations
Public and Occupational Health	HC	Modest concerns due to cumulative exposures to INEEL workers and to the general public living nearby; both radiological and nonradiological stressors exist
Waste Management	R	Major concerns due to the quantities of radioactive wastes and spent nuclear fuel stored at INEEL

E = ecosystems
HC = human communities
INEEL = Idaho National Engineering and Environmental Laboratory
INTEC = Idaho Nuclear Technology and Engineering Center
R = resources

[a] See Appendix C of this report.

Table 4-14. Current Actions and Reasonably Foreseeable Future Actions Identified in the DOE Programmatic EIS on SNF and Included in the Projected Baseline Conditions[a]

Borrow Source Silt Clay
Calcine Transfer Project
Central Liquid Waste Processing Facility Decontamination and Decommissioning
Dry Fuels Storage Facility, Fuel Receiving, Canning/Characterization, and Shipping
Environmental Assessment Determination for CPP–627
Experimental Breeder Reactor-II Blanket Treatment
Experimental Breeder Reactor-II Plant Closure
Expended Core Facility Dry Cell Project
Engineering Test Reactor Decontamination and Decommissioning
Fuel Processing Complex (CPP–601) Decontamination and Decommissioning
Gravel Pit Expansions (New Borrow Source)
Greater-Than-Class C Dedicated Storage
Headend Processing Plant (CPP–640) Decontamination and Decommissioning
Heath Physics Instrument Lab
High-Level Tank Farm Replacement (upgrade phase)
Increased Rack Capacity for CPP–666
Industrial/Commercial Landfill Expansion
Material Test Reactor Decontamination and Decommissioning
Mixed Low-Level Waste Disposal Facility
Nonincinerable Mixed Waste Treatment
Partnership Natural Disaster Reduction Test Station
Pit 9 Retrieval
Private Sector Alpha-Mixed Low-Level Waste Treatment
Radioactive Scrap/Waste Facility
Remediation of Groundwater Facilities
Remote Mixed Waste Treatment Facility
Radiological and Environmental Sciences Laboratory Replacement
Radioactive Waste Management Complex Modifications for Private Sector Treatment of Alpha-Mixed Low-Level Waste
Sodium Processing Plant
Test Area North Pool Fuel Transfer
Tank Farm Heel Removal Project
Treatment of Alpha-Mixed Low-Level Waste
Technical Support Annex Enclosure and Storage Project

Table 4-14. Current Actions and Reasonably Foreseeable Future Actions Identified in the DOE Programmatic EIS on SNF and Included in the Projected Baseline Conditions[a] (continued)
Vadose Zone Remediation
Waste Calcine Facility (CPP–633) Decontamination and Decommissioning
Waste Characterization Facility
Waste Handling Facility
Waste Immobilization Facility
Waste Experimental Reduction Facility Incineration

DOE = U.S. Department of Energy
EIS = Environmental Impact Statement
SNF = spent nuclear fuel

[a] DOE. DOE/EIS–0203–F, "Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement." Idaho Falls, Idaho: DOE, Idaho Operations Office. 1995.

geographical boundaries of the study. No specific off-site reasonably foreseeable future actions were identified for inclusion in the analysis.

4.14.3 Magnitude and Significance of Cumulative Effects

The magnitude of cumulative effects resulting from past, present, and reasonably foreseeable future actions is addressed using a three-step process: (i) the cumulative effects of past actions on selected resources, ecosystems, and human communities are discussed in Section 4.14.2 and summarized in Appendix C and Table 4-13; (ii) the cumulative effects of current actions and reasonably foreseeable future actions are included in Table 4-16; and (iii) the incremental impacts of the construction and operation of the proposed Idaho Spent Fuel Facility are summarized in Section 8.1. A discussion of the magnitude of the additive cumulative effects and their significances, is presented in this section. Prior to the discussion, however, some clarifying comments regarding Table 4-16 are in order.

- The data and information in Table 4-16 were extracted from the comprehensive systems model described in DOE (1995). The systems model included all SNF, HLW, transuranic waste, low-level waste, mixed low-level waste, hazardous waste, and industrial waste activities. The model was based on planned treatment, storage, and disposal activities at INEEL, EIS project summaries, and operating parameters of existing facilities, and was updated to reflect projects included in the DOE programmatic SNF EIS record of decision and other projects that occurred subsequent to that EIS.

- The data and information listed for the Idaho HLW and Facilities Disposition EIS (DOE, 2002a) represent the maximum impact from the alternatives analysis contained in that EIS.

- In Table 4-16, column New Silt/Clay Source was included as a separate reasonably foreseeable future action because excavation of silt and clay for use in INEEL operations and remedial activities would be needed; further, these materials may be required to support facility disposition activities at INTEC (DOE, 2002a, Section 5.4).

Table 4-15. Summary of Current Actions and Reasonably Foreseeable Future Actions Identified in the Idaho HLW and Facilities Disposition[a]

Project	Description
Programmatic SNF EIS[b]	DOE[b] provided the scope and timetable for SNF and environmental restoration activities to be included in the cumulative impact analysis of DOE.[a]
Advanced Mixed Waste Treatment Project[c]	Retrieve, sort, characterize, and treat mixed low-level waste and approximately 65,000 m^3 [85,000 yd^3] of alpha-contaminated mixed low-level waste and transuranic waste currently stored at the INEEL Radioactive Waste Management Complex. Package the treated waste for shipment offsite for disposal.
Waste Area Group 3 Remediation[c]	Ongoing activities addressing remediation of past releases of contaminants at INTEC.
New silt/clay source development and use at INEEL	INEEL activities require silt/clay for construction of soil caps over contaminated sites, research sites, and landfills; replacement of radioactivity contaminated soil with topsoil for revegetation and backfill; sealing of sewage lagoons; and other uses. Silt/clay will be mined from three onsite sources (ryegrass flats, Spreading Area A, and Water Reactor Research Test Facility).
Closure of various INTEC facilities unrelated to Idaho HLW and Facilities Disposition EIS Alternatives[a]	Reduce the risk of radioactive exposure and release of hazardous constituents and eliminate the need for extensive long-term surveillance and maintenance for obsolete facilities at INTEC.
Percolation Pond Replacement	DOE intends to replace existing percolation ponds at INTEC with replacement ponds approximately 3,110 m [10,200 ft] southwest of the existing percolation ponds.

DOE = U.S. Department of Energy
EIS = Environmental Impact Statement
HLW = high-level waste
INEEL = Idaho National Engineering and Environmental Laboratory
INTEC = Idaho Nuclear Technology and Engineering Center
SNF = spent nuclear fuel

[a] DOE. DOE/EIS–0250, “Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement.” Idaho Falls, Idaho: DOE, Idaho Operations Office. 2002.
[b] ———. DOE/EIS–0203–F, “Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement.” Idaho Falls, Idaho: DOE, Idaho Operations Office. 1995.
[c] Included in the baseline conditions identified in DOE[b].

Table 4-16. Maximum Impact from Other Past, Present, and Reasonably Foreseeable Projects[a,b]

Resource Area	Waste Processing[a]	Facility Disposition[a]	SNF Management[b]	New Silt/Clay Source Development and Use at INEEL[a]	Disposition of Unrelated INTEC Facilities[a]	Percolation Pond Replacement[a]	Proposed Idaho Spent Fuel Facility[c]
Land Resources/ Acres Disturbed	8.9 ha	None	545.1 ha	8.5 ha/yr and 9.7 ha/yr	None	6.9 ha	7.3 ha
Socioeconomics	Direct employment of 870 during construction, 530 during operations	Direct peak year employment of 790	Overall decrease in employment	None/use of existing workforce	Small numbers of workers drawn from existing labor pool	None/use of existing workforce	Direct employment of 250 during construction; 60 during first 4 years of operation
Air Resources	Consumption up to 40 percent of prevention of significant deterioration increment/no health-based standards exceeded	No health-based standards exceeded	Below applicable standards	Short-term elevated levels of fugitive dust and exhaust emissions	Emissions of fugitive dust/vehicle exhaust during demolition activities	Temporary emissions of fugitive dust and vehicular exhaust during construction activities	Temporary emissions of fugitive dust and vehicular exhaust during construction activities; no chemical air discharges during operations, radiological emissions are controlled by filtration and monitoring
Water Resources/ Groundwater Withdrawal and Contamination	352 million L/yr; negligible latent cancer fatality risk	Increase of 41.6 million L/yr; latent cancer fatality risk of 2.9×10^{-4} from facility disposition	Increase of 314.2 million L/yr; latent cancer fatality risk of 5×10^{-5}	Negligible	Within existing water use; latent cancer fatality risk of 2×10^{-6} from closure of CPP–633	Relocation of ponds reduces potential for contaminant migration	3.41 million L during first year of construction, 1.7 million L/yr during operations; no planned liquid discharges from the facility
Ecological Resources/ Acreage Loss	8.9 ha	None	545.1 ha	8.5 ha and 9.7 ha/yr	None	1.5 ha	7.3 ha

Table 4-16. Maximum Impact from Other Past, Present, and Reasonably Foreseeable Projects[a,b] (continued)

Resource Area	Waste Processing[a]	Facility Disposition[a]	SNF Management[b]	New Silt/Clay Source Development and Use at the INEEL[a]	Disposition of Unrelated INTEC Facilities[a]	Percolation Pond Replacement[a]	Proposed Idaho Spent Fuel Facility[c]
Geology and Soils	Negligible (use of existing on-site sources)	Negligible (use of existing on-site sources)	1,355,000 m^3	3,517,000 m^3 as a silt/clay source	Materials obtained from existing INEEL sources	Soil disturbance on 6.9 ha	Soil disturbance on 7.3 ha; materials obtained from existing INEEL sources
Cultural Resources	Negligible	Potential for loss of historic data on nuclear facilities	70 structures and 23 sites affected	No significant resources identified in survey of 40-acre plots at each on-site location	Potential for loss of historic data on nuclear facilities	Surveys will be conducted/ resources avoided	Two structures potentially eligible for the National Register of Historic Places are near current storage locations or proposed transfer routes; no identified cultural resources

DOE = U.S. Department of Energy
EIS = Environmental Impact Statement
HLW = high-level waste
INEEL = Idaho National Engineering and Environmental Laboratory
INTEC = Idaho Nuclear Technology and Engineering Center
SNF = spent nuclear fuel

[a] DOE. DOE/EIS–0250, "Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement." Idaho Falls, Idaho: DOE, Idaho Operations Office. 2002.
[b] ———. DOE/EIS–0203–F, "Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement." Idaho Falls, Idaho: DOE, Idaho Operations Office. 1995.
[c] See Table 2-1 of this report for a detailed summary.

NOTE: To convert hectares (ha) to acres, multiply by 2.471; meters cubed (m^3) to yards cubed (yd^3), multiply by 1.3079; liters (L) to gallons (gal), multiply by 0.2642.

- In Table 4-16, column Disposition of Unrelated INTEC Facilities addresses impacts of the disposition of the facilities listed in DOE (2002a, Section 5.4).

- In Table 4-16, column Percolation Pond Replacement is included because residual contamination left in place from Waste Area Group 3 activities would contribute to the source for long-term risks associated with INTEC. DOE has chosen to remediate contaminated perched water at Waste Area Group 3 using institutional controls with aquifer recharge control. This choice would entail restricting future use of contaminated perched water and future recharge to contaminated perched water and taking the existing INTEC percolation ponds out of service and replacing them with new ponds built outside the zone influencing perched water contaminant transport (DOE, 2002a, Section 5.4).

- Table 4-16 does not include summary information on impacts to transportation, noise, visual/scenic, environmental justice, public and occupational health and safety, and waste management. Noise and visual/scenic impacts are excluded because of minimal existing concerns and the minimal incremental impacts of the proposed Idaho Spent Fuel Facility. The other impacts are addressed in the following paragraphs.

For land use, existing industrial development at INEEL occupies 4,600 ha [11,400 acres] of a total resource of 230,850 ha [570,000 acres] (nearly 2 percent). Modest cumulative effects concerns are related to these past and present actions because it is recognized that even though the percentage of land use is small, such land use changes can affect other resources, ecosystems, and human communities. Implementation of all current and future actions, as shown in Table 4-16 (for the period 2000–2095), would lead to the conversion of an additional approximately 650 ha [1,600 acres] to industrial use. The total industrial land use would increase to 2.3 percent. Finally, the incremental impact of the proposed Idaho Spent Fuel Facility would be an additional 3.2 ha [8 acres] of land permanently converted to industrial use. Total industrial land use would increase to approximately 5,270 ha [13,008 acres] (still about 2.3 percent). As a result, modest cumulative effects concerns would persist; however, these can be minimized via careful land use planning that involves land use conversions to industrial development in or near areas that have been previously used for such purposes.

For transportation and infrastructure, existing conditions include six highways and one rail line providing access to INEEL. Further, 140 km [87 mi] of paved roads are located within INEEL. These transportation components have been previously analyzed for cumulative radiological impacts because of shipments of radioactive materials to INEEL (DOE, 2002a). Another perspective is to consider the adequacy of the capacity (levels-of-service) of the transportation system for the volume of worker and shipment ingress to INEEL and egress from INEEL. From this perspective, only minor cumulative effects concerns exist, and no level-of-service changes are currently needed. Further, even with the implementation of all current and planned or proposed future actions at INEEL, traffic volumes are not expected to increase. Incremental impacts of the proposed Idaho Spent Fuel Facility on traffic volume would be small; however, the transfer of currently stored SNF from INTEC to the proposed Idaho Spent Fuel Facility would be required for planned operations. The traffic volume would be low, and the transfers would be made in accordance with the requirements of the DOE orders and procedures for on-site SNF transfer. As a result, no changes are anticipated in the minor cumulative effects concerns for transportation.

For geology and soils, the primary issue from past and present actions is that soils have been disturbed in areas where the land use has been converted to industrial activities. Soil losses have occurred via erosion, and some soils at specific locations have become radiologically contaminated. More specifically, some soil contamination exists in and around the INTEC facility, thus, a minor cumulative effects concern exists. Surveys do not show any existing soil contamination at the proposed site for the Idaho Spent Fuel Facility. The remediation focus of many current and future actions listed in Table 4-16 would require some additional land disturbance for the extraction of silt and clay for use as borrow material and the replacement of the percolation pond at INTEC. The proposed Idaho Spent Fuel Facility would affect the soil at the 3.2-ha [8-acre] site, and to some extent, at the adjacent construction laydown area (a temporary impact). Therefore, the incremental impact of the proposed facility is almost negligible within the overall geological and soil resources at INEEL. Further, because of the planned remediation projects at INEEL, the current minor cumulative effects concern would be reduced.

Regarding surface water resources, only minor cumulative effects concerns exist from past and present actions. Surface water is not used as a water supply at INEEL, and its quality meets applicable standards. Current and planned actions would also not require surface water use, nor would the proposed Idaho Spent Fuel Facility. Storm water control plans would be used for current and planned actions and for the proposed Idaho Spent Fuel Facility. Wastewaters generated at INEEL are currently handled via planned treatment systems, as would such wastewater that may be generated by all current and future actions.

Past and current INEEL operations use groundwater as the water supply source. Current annual water withdrawals from the Eastern Snake River Plain Aquifer total 6.4 to 7.2 billion L [1.7 to 1.9 billion gal], and these withdrawals are well within the allocated INEEL water rights that permit a maximum consumption of 43.2 billion L [11.4 billion gal] per year. Table 4-16 indicates that current and future actions would require a maximum total of 707 million L [187 million gal] on an annual basis (an approximate 10-percent increase from current use, however, not on a continuing basis, and still well within the water rights). The incremental water use from the proposed Idaho Spent Fuel Facility is an increase of only 0.1 percent of the current water use. Thus, the cumulative effects on groundwater use would not be significant.

A major cumulative effects concern related to past and present actions is the contaminated soils in the vadose zone and the contaminated groundwater underlying the INTEC facilities and surrounding area. Planned and future actions are focused on remediation effects, thus, the contamination would be reduced and more appropriately managed. No soil and groundwater impacts are anticipated from construction and operation of the proposed Idaho Spent Fuel Facility located adjacent to the southeastern boundary of INTEC.

Ecological resources associated with the undisturbed land at INEEL are diverse and include 15 vegetation associations and 280 different vertebrate species (46 mammal, 204 bird, 10 reptile, 2 amphibian, and 9 fish). Seven bird species, six mammals, one reptile, and six plant species are listed as threatened or endangered, or species of concern, or other unique species. Some wetland characteristics are exhibited by approximately 130 areas within the INEEL boundaries. There are minor cumulative effects concerns from past and present actions because nearly 98 percent of INEEL lands still supports the diversity noted previously. Land use required for current and future actions totals 650 ha [1,600 acres] (Table 4-16), and the land requirement for the proposed Idaho Spent Fuel Facility is 3.2 ha [8 acres]. These current and

future actions would cumulatively affect 651 ha [1,608 acres] and increase the disturbed land area total to 2.3 percent (the past and present actions total is nearly 2 percent). Therefore, the ecological diversity at INEEL should be maintained, and cumulative effects concerns would continue to be minor.

Regarding ambient air quality, the current radiological and nonradiological air quality at INEEL is in compliance with applicable federal and state standards. Modest cumulative effects concerns currently exist, however, because atmospheric transport of radioactivity releases can be a major pathway for the occurrence of cumulative health effects. Table 4-16 indicates that no health-based air quality standards would be exceeded by the current and future actions, although short-term elevated levels of fugitive dust and exhaust emissions would occur in localized areas. Consumption up to 40 percent of prevention of significant deterioration increments may occur from future waste processing. The incremental effects of the construction and operation of the proposed Idaho Spent Fuel Facility would be essentially negligible when considered in relation to current and future radiological and nonradiological emission inventories at INEEL.

Regarding historical and cultural resources at INEEL, no known resources would be lost as a result of the construction and operation of the proposed Idaho Spent Fuel Facility. Past and present actions at INEEL probably have caused the loss or damage to historic buildings and cultural sites; further, the major current concern is associated with the cumulative effects of continued restricted access of the Shoshone–Bannock Tribes. As summarized in Table 4-16, some historic structures and cultural resources sites may be impacted by current and future actions. Moreover, the requirements of the National Historic Preservation Act and related federal and state laws would be followed for all current and future actions, including the construction and operation of the proposed Idaho Spent Fuel Facility.

The 2001 INEEL workforce was approximately 8,100 workers; this represents approximately 6 percent of the total work force in the region of influence. Thus, the operations at INEEL provide a major beneficial cumulative effect on the socioeconomic characteristics of the region. Table 4-16 indicates that waste processing activities would sustain a maximum of 870 direct jobs during the peak year (2013) of the construction phase and a maximum of 530 direct jobs during the peak year (2015) of the operations phase (DOE, 2002a). Facility disposition activities would require direct employment of up to 790 workers. Further, DOE anticipates these workers would be drawn from the existing workforce through retraining and reassignment. When the workforce of the proposed Idaho Spent Fuel Facility is considered (a construction force of 250 for 4 years and an operational force of up to 60 for the next several decades), it is seen that the incremental impacts are small in relation to the current total and anticipated workforce. Accordingly, the cumulative effects of the proposed facility on the workforce, when added to the effects of other reasonably foreseeable future actions on the workforce, will be small and within normal INEEL workforce fluctuations.

Regarding cumulative environmental justice impacts, the two recent programmatic impact studies (DOE, 1995, 2002a), along with NRC (1998), all concluded there were no disproportionate impacts. Table 4-13 lists minor cumulative impact concerns, primarily because of the potential for such impacts occurring over time. Regarding disproportionate impacts, none were noted for the proposed Idaho Spent Fuel Facility; thus, there are no significant cumulative environmental justice impacts.

Current annual individual exposures to airborne releases of radioactivity from past and present actions are well below the 0.1 mSv/yr [10 mrem/yr] limit in 40 CFR Part 61 for onsite workers and the MEI and considerably below the natural background level of 3.6 mSv/yr [360 mrem/yr]. Occupational doses for INEEL workers are also considerably below the annual occupational dose limit of 50 mSv [5,000 mrem] in 10 CFR Part 20. Although the exposure levels are well below the regulatory limits, however, there are modest cumulative effects concerns because of the human health nature of these effects. A detailed discussion of such effects from current and future actions is found in DOE (2002a). The anticipated annual exposures from current and future actions are still well below regulatory limits for INEEL workers and the MEI. Further, because many current and future actions are related to remediation, annual public exposure levels would be expected to decrease. Finally, the incremental impacts from the construction and operation of the proposed Idaho Spent Fuel Facility are also well below regulatory limits for INEEL workers and the MEI.

A variety of radioactive wastes are currently stored, generated, or both at INEEL. These wastes, resulting from past and present actions, represent a major cumulative effects concern. Many current and future actions are focused on better management and control of existing stored wastes, including reducing the potential for contamination of INEEL groundwater and air quality. The purpose of the proposed ISFSI facility is to accomplish better management and control of a portion of the SNF currently stored at INEEL (from the Peach Bottom reactor, Shippingport reactor, and TRIGA reactors). Relative to the quantities of waste materials currently stored and generated annually at INEEL, only small quantities of gaseous, liquid, and solid low-level radioactive waste would be generated during SNF receipt and repackaging operations planned for the first 3 years of the proposed Idaho Spent Fuel Facility. After the SNF is repackaged and stored, no gaseous releases, or liquid or solid radioactive wastes are anticipated to be generated on a regular basis from the proposed Idaho Spent Fuel Facility.

4.15 Impacts of the No-Action Alternative

For the no-action alternative, NRC would not grant the license and the proposed facility would not be constructed. In this case, DOE would maintain current storage activities as described in the DOE programmatic SNF EIS (DOE, 1995, Volume 2, Part A, Section 5). Specific information related to the no-action alternative for a generic dry fuel storage facility is provided in the DOE programmatic SNF EIS (DOE, 1995, Volume 2, Part A, Appendix C). Under the no-action alternative, SNF stored at INEEL would be transferred and consolidated at existing facilities at INTEC, including CPP–603 Irradiated Fuel Storage Facility, CPP–749, and CPP–666. During a 3-year transition period, U.S. Navy SNF would continue to be received and stored at INTEC (CPP–666) according to the terms of the 1995 Settlement Agreement. Existing procedures and site-wide plans such as the Storm Water Pollution Protection Plan (DOE, 2001b) and the INEEL Long-Term Stewardship Strategic Plan (DOE, 2002c) would continue to be implemented by DOE and its contractors.

In the short term, no major upgrades or new facilities would be installed, and minor fuel conditioning would be necessary for maintaining safe operation. Because there would be no construction of new facilities, short-term impacts to geologic resources, land use, water resources, and ecological, visual/scenic, and cultural resources would be the same as those discussed in DOE (1995). Transportation and storage of the remaining TRIGA reactor fuel would continue per an existing DOE record of decision (DOE, 1996a,b). Cumulative impacts of the no-action alternative are addressed in the DOE programmatic SNF EIS (DOE, 1995). In the

longer term, current storage and fuel-handling facilities at INTEC will be open and operational longer than planned. Ultimately, existing facilities will need to be modified or facilities similar to those described in the proposed action will need to be built. For example, the current storage location of Shippingport SNF at the INTEC Irradiated Spent Fuel Storage Facility (CPP–603) will be modified to expand the hot cell and add a load-out facility in lieu of the availability of the proposed Idaho Spent Fuel Facility. Long-term impacts would be similar to the proposed Idaho Spent Fuel Facility, because SNF must be repackaged before shipment can occur from INEEL to a national HLW geologic repository.

4.16 Decontamination and Decommissioning

In accordance with the 1995 Settlement Agreement among DOE, the State of Idaho, and the U.S. Navy, SNF must be removed from Idaho by 2035. It is anticipated that SNF would be transferred from the proposed Idaho Spent Fuel Facility to a geologic repository. The proposed facility would need to be decontaminated and decommissioned in accordance with the NRC license termination criteria after the fuel is removed. According to the terms of its contract with FWENC to construct and operate the proposed Idaho Spent Fuel Faculty, DOE is obligated to provide funding for decommissioning the proposed facility.

Decontamination and decommissioning of the proposed ISFSI is anticipated to occur many years in the future, and details of the activities are uncertain at this time. FWENC provided a conceptual plan for decommissioning the proposed Idaho Spent Fuel Facility as an appendix to its license application (FWENC, 2001c, Appendix C). The objective of the plan is to demonstrate that the facility can be decommissioned in a manner both economical and safe. The plan describes the costs and activities required for safely removing the proposed Idaho Spent Fuel Facility from service and reducing residual radioactivity through remediation to a level that permits release of the property and termination of the NRC license. Prior to beginning decontamination and decommissioning of the site, FWENC would be required to submit a detailed plan to NRC for review and approval.

The primary areas of anticipated radioactive contamination at the proposed Idaho Spent Fuel Facility are the Transfer Area, Solid Waste Processing Area, HVACs, and those portions of systems that contained radioactive fluids. Because the exterior of the storage canisters would not contact the radioactive materials, the canisters should not become contaminated. After the canisters are removed from the proposed Idaho Spent Fuel Facility Site, the Storage Area should require little or no remediation.

The decision concerning how to proceed with decontamination and decommissioning would be made during the decommissioning planning phase (FWENC, 2001c, Appendix C). The decision would be based on numerous factors, including

- Physical condition of equipment and structures during a long-term period;
- Optimization of radiological aspects to minimize dose to workers and the public;
- Environmental impacts of the project;
- Existence of technical resources;
- Availability of waste management and disposal facilities;
- Costs; and
- Public opinion.

In its preliminary plan (FWENC, 2001c, Appendix C), FWENC assumed an approach to decommissioning the proposed Idaho Spent Fuel Facility that included decontaminating equipment and building surfaces, demolishing and completely removing contaminated buildings, and free release of as many items as possible for recycling/salvage in accordance with the NRC release criteria.

FWENC intends to select construction materials and use preventive and protective methods (ALARA principles) during operations to minimize the amount of actual decontamination required during decommissioning. Based on this approach, FWENC assumes that a majority of building surfaces and some equipment should be uncontaminated and released for unrestricted use. Equipment and surface decontamination methods would also be chosen to minimize secondary wastes and ensure the maximum amount of free-releasable items without unnecessarily inflating costs.

Decommissioning activities would likely begin with the decontamination and removal of equipment from the Transfer Area. Systems would be vacuumed or flushed, as appropriate, to remove any residual materials, and contaminated filters would be removed from equipment for safe disposal. As required by facility operation procedures, a complete history of materials processed through the Transfer Area and facility maintenance activities would be maintained along with accounts of spills and clean-up actions. This historical record would be available for making needed revisions to the decommissioning plan before final decommissioning operations begin. Based on the preliminary plan, decommissioning of the proposed Idaho Spent Fuel Facility would be divided into two broad phases: (i) decontamination and dismantling and (ii) site restoration.

The decontamination and dismantling phase would begin after all SNF has been transferred from the proposed Idaho Spent Fuel Facility to a geologic repository. Major activities during this phase include removing contaminated systems and components, decontaminating structures, and performing a final radiation survey. The intent of this phase would be to reduce radioactivity to acceptable levels, allowing termination of the NRC license. As noted previously, based on the current design for the proposed facility, the anticipated areas of radioactive contamination would be the Transfer Area, Solid Waste Processing Area, HVACs, and those portions of systems that contained radioactive liquids. During this phase, contaminated systems and components would be handled in one of two ways: (i) they would be decontaminated and removed or (ii) they would be removed, packaged, and shipped either to an off-site processing facility or to a low-level radioactive waste disposal facility.

The site-restoration phase would begin immediately after the decontamination and dismantling phase is completed, although some site-restoration activities may occur during the decontamination and dismantling phase. The site restoration phase would involve the final disposition of SSCs. SSCs required to contain and control radioactive materials during decommissioning activities would be identified and excluded from any restoration until no longer required. These excluded systems then would be decontaminated and removed for the performance of the final site survey. Site-restoration activities not involving radioactive materials may be completed following termination of the NRC license.

FWENC developed a 24-month schedule for decommissioning (FWENC, 2001c, Appendix C) to support the preliminary decommissioning plan. During the decommissioning planning phase, a final decommissioning schedule would be created. The sequence of decommissioning activities

would depend on access and material-handling restrictions or by personnel exposure considerations. All activities would be planned to minimize the spread of contamination. In most parts of the facility, uncontaminated or only slightly contaminated items would be removed first to avoid contamination or further contaminating them when more highly contaminated equipment is removed. When uncontaminated equipment cannot be removed first, covers or other protection would be used to minimize the spread of contamination. The proposed Idaho Spent Fuel Facility would be equipped with cranes, hoists, forklifts, and lifting and transport systems. These systems would be used to lift and transport components and equipment to support decommissioning activities. Installed cranes, hoists, and other lifting devices would be decontaminated and dismantled when they are no longer needed to support decommissioning activities.

A final radiological survey would be performed to determine the condition of the proposed Idaho Spent Fuel Facility site after decontamination activities have been completed. This survey is to demonstrate that radiological conditions at the site meet the NRC license termination criteria. A detailed plan for the survey would be submitted to the NRC for approval prior to the final survey and submittal of the application for license termination. NRC has provided guidance for developing the final radiological survey plan (NRC, 1992, 2000b). The final survey results would be provided to NRC to support license termination. The final survey would be designed so that NRC can verify procedures, results, and interpretations.

Release of the site, facility, and materials would be based on release criteria for surface contamination, direct exposure, and soil and water concentrations consistent with the NRC requirements in 10 CFR Part 20, Subpart E. NRC provided additional guidance for site-release criteria (NRC, 1994)

FWENC (2001c, Appendix C) provides a preliminary estimate of the decommissioning costs for the proposed Idaho Spent Fuel Facility. The costs of activities involved in radiological decommissioning as well as expenditures necessary to complete nonradiological site restoration activities are included in the cost estimate. The costs (in 2001 dollars) for the selected decommissioning alternative have been estimated at $22,600,000 for radiological decommissioning activities and $13,200,000 for nonradiological decommissioning activities (site restoration).

The NRC requirements in 10 CFR 72.30(c) provide financial assurance methods acceptable for decommissioning. Decommissioning of the facility would remain the responsibility of DOE in accordance with its contract with FWENC. Under the terms of the contract, DOE would work to give the contract a high priority and obligate additional funds as necessary to pay the costs of decontamination and decommissioning (FWENC, 2001c, Appendix C).

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