U. S. DEPARTMENT OF ENERGY'S ENVIRONMENTAL REPORT SUPPLEMENT

ENVIRONMENTAL REPORT
SUPPLEMENT TO THE
INDEPENDENT SPENT
FUEL
STORAGE
INSTALLATION (ISFSI) LICENSE RENEWAL
APPLICATION

FOR THE
THREE MILE ISLAND UNIT TWO (TMI-2) Spent
Nuclear FUEL

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1. INTRODUCTION

Independent Spent Fuel Storage Installations (ISFSIs) for storing spent fuel and associated radioactive materials are licensed by the U.S. Nuclear Regulatory Commission (NRC) in accordance with the Atomic Energy Act of 1954 (42 United States Code [USC] 2011,et seq.) and NRC implementing regulations (10 Code of Federal Regulations [CFR] Part 72). The NRC issued a 20-year site-specific ISFSI operating license (U.S. Nuclear Regulatory Commission Docket No. 72-20) March 19, 1999 for the temporary storage of TMI Unit 2 (TMI) spent nuclear fuel (SNF) to the U.S. Department of Energy (DOE). The licensed storage location is the Idaho Nuclear Technology and Engineering Center (INTEC) located on the Idaho Site, formerly known as the Idaho National Environmental and Engineering Laboratory (INEEL).

1.1. PROPOSED ACTION

The proposed action is renewal of the site specific Materials License (SNM-2508) for the TMI ISFSI. The current operating license expires on March 19, 2019. By this application, DOE requests NRC to renew the operating license for an additional 20 years (i.e. until March 19, 2039).

The DOE, Department of the Navy, and the State of Idaho are party to a settlement agreement that was approved by the U.S. District Court on October 17, 1995 and incorporated into a consent order. The settlement agreement covers multiple DOE programs but specific to the TMI fuel, the parties agreed that all of the fuel would be removed from the State of Idaho by January 1, 2035. Therefore a 20 year renewal period is requested.

1.2. PURPOSE AND NEED

The purpose and need for the proposed action (renewal of an operating license) is to provide for continued temporary storage of spent nuclear fuel assemblies generated from the Three Mile Island Reactor accident.

This Environmental Report provides information for the Nuclear Regulatory Commission (NRC) to use in the analysis of the application for the renewal of the license to continue operations of DOE's Idaho site[1] TMI-2 Independent Spent Fuel Storage Installation (ISFSI) for a period of extended operation of 20 years through March 19, 3039.

1.3. BACKGROUND

The U.S. Department of Energy's Environmental Report for the Independent Spent Fuel Storage Installation to temporarily store TMI-2 spent fuel and core debris was submitted with the license application in April 1995. The final Environmental Impact Statement (NUREG-1626) for construction and Operation of an Independent Spent Fuel Storage Installation to store the Three Mile Island Unit 2 Spent Fuel at DOE's Idaho site was published in March 1998. The descriptions of ecology, geography, climate, hydrology, geology and historical and archaeological sites have not changed and therefore the references in the original application are still valid and appropriate.

The ISFSI has served the intended function for nearly 20 years and this supplemental report documents the continuous safe operations with no environmental impacts. This report identifies potential

[1] DOE's Idaho site was formerly known as the Idaho National Engineering Laboratory (INEL) and more recently the Idaho National Engineering and Environmental Laboratory (INEEL).

environmental impacts associated the continued operations of the ISFSI at the Idaho Nuclear Technology and Engineering Center (INTEC) and with subsequent decommissioning of the ISFSI.

This report has been prepared to meet the requirements of 10 CFR 51.45 and 10 CFR 51.61 as referenced in 10 CFR 72 and NUREG-1927, rev. 1. Additionally, guidance provided by Regulatory Guide 4.2, Rev 2, Preparation of Environmental Reports for Nuclear Power Stations (NRC 1976) was used to the extent applicable to a facility of this type based on the NEPA analysis prepared and decisions previously made by DOE.

Guidance from NUREG-1955, Environmental Standard Review Plan was considered in development of this document. Environmental Reports for the Idaho Spent Fuel Facility (ISFF), the Low-level Radioactive Waste Repository and the Idaho National Laboratory Comprehensive Land Use and Environmental Stewardship Report were utilized to update site data for climate, population distributions, transportation and records of sightings of fauna and flora within the potentially affected area.

The ISFSI is an aboveground dry storage system constructed to store the 341 TMI-2 canisters2 of spent nuclear fuel (SNF) core debris from the March 1979, Three Mile Island Unit 2 (TMI-2) reactor accident. These canisters were removed from wet storage at the Test Area North (TAN) pool and placed in 29 dry shielded canisters (DSCs). The DSCs were transported to INTEC in transport casks and placed in storage at the ISFSI. No additional material will be added to the ISFSI.

1.4. PREVIOUS DECISIONS

DOE constructed and operated the ISFSI within the boundaries of an existing facility; INTEC (FIGURE 1-1), located at DOE's Idaho site. DOE prepared extensive NEPA documentation analyzing the environmental impacts of this project, and completed a Final Environmental Impact Statement (FEIS) (DOE 1995) in April 1995 that analyzed two different, but related questions. The Volume 1 portion of that EIS evaluated reasonable programmatic alternatives to the management of DOE's inventory of spent nuclear fuel. Volume 2 of the EIS analyzed reasonable alternatives to the waste management and environmental restoration programs at DOE's Idaho site over the next ten years of the EIS. Impacts associated with the TAN Pool fuel transfer were analyzed in the FEIS at Volume 2, in both Part A, regarding the potential environmental impacts associated with this project and the site wide cumulative impacts perspective, and Part B, a project-specific analysis as one of DOE's Idaho site ongoing projects. The project's potential environmental impacts from removal of TMI-2 core debris from the pool, transportation, facility construction and facility operation were analyzed in the FEIS.

The FEIS Record of Decision (ROD) (DOE 1995a) was issued on May 30, 1995. The first decision made by the Department was to "Regionalize" the management of DOE's SNF, such that the production reactor fuel at the Hanford Site would remain at Hanford; the aluminum clad fuel would be moved to, and managed at the Savannah River Site; and all non-aluminum clad fuel would be moved to, and managed at DOE's Idaho site. By virtue of this decision, DOE decided that the SNF at TAN would be managed at DOE's Idaho site, rather than managed at some other site. As a result of the analysis in Volume 2, DOE decided to conduct its environmental restoration and waste management activities at DOE's Idaho site using one approach analyzed in the EIS known as the "Ten Year Plan." The Ten Year Plan

[2] A canister is a thin-walled, unshielded metal container used to hold fuel assemblies or debris. Canisters are used in combination with specialized "overpacks" (or casks) that provide shielding and structural support for transportation or storage purposes.

decision involved completing certain identified actions and initiating new projects to enhance cleanup, manage laboratory wastes, and spent nuclear fuel. The Appendix to the ROD states more specifically the decisions made by the Department. DOE decided, as part of the management of this SNF, to construct a dry storage system for the storage of the Three Mile Island, Unit 2 fuel upon receipt of any required approvals of the Nuclear Regulatory Commission.

The federal court case filed by the State of Idaho against DOE challenging the adequacy of the analyses in the FEIS was settled on October 16, 1995. The settlement agreement (DOE 1995b) among the Department of Energy, the Department of the Navy, and the State of Idaho was approved by the court on October 17, 1995 and incorporated into a consent order. In that Agreement, the parties agreed that all of the TMI fuel would be removed from the State of Idaho by January 1, 2035. In the Settlement Agreement/Consent Order, the parties agreed that DOE would complete construction of the Three Mile Island dry storage facility by December 31, 1998, commence moving fuel into the facility by March 31, 1999, and complete moving fuel into the facility by June 1, 2001.

On February 28, 1996, DOE published an amended ROD in the Federal Register reflecting the terms of the Settlement Agreement/Consent Order. No changes were made in DOE's decision to proceed with the TAN Pool Fuel Transfer Project or the construction of a dry storage facility for the TMI-2 fuels.

An Environmental Assessment (EA) (DOE 1996b) was prepared to analyze the potential impacts associated with stabilizing the pool at TAN. The scope of that impact analysis included an analysis of the potential environmental impacts associated with the proposed action of dewatering and removing the canisters of the TMI fuels from the TAN pool, draining and treating the water, construction of a dry storage facility at INTEC, transporting the fuels from TAN to INTEC, storage at INTEC, and stabilizing the TAN pool.

Because no significant environmental impacts were identified, DOE issued a Finding of No Significant Impact (FONSI) (DOE 1996c) and announced its decision to proceed with implementing this alternative.

The “Notice of Availability of the Final Environmental Impact Statement for the U.S. Department of Energy To Construct and Operate an Independent Spent Fuel Storage Installation To Store the Three Mile Island Unit 2 Spent Fuel at the Idaho National Engineering and Environmental Laboratory” NUREG-1626, was issued and noticed in the Federal Register (63 FR 13077) on March 17, 1998. The notice was made following independent review of the DOE NEPA documents. The NRC determined that its proposed action of issuing a license authorizing the construction and operation of the TMI–2 ISFSI was substantially the same as actions considered in DOE’s environmental documents and, therefore, elected to adopt the DOE documents.

The TMI facility construction, completed in 1999, fuel loading operations completed in 2001 and 18 years of fuel storage operation have confirmed that the original analysis was remain bounding.

1.5. DESCRIPTION OF THE TMI-2 DEBRIS

The TMI-2 core debris was shipped to DOE’s Idaho site from Pennsylvania between 1986 and 1990 and placed in the TAN Pool for examination as part of the TMI Core Offsite Examination Program. The objectives of this program were to: (a) provide the analytical data necessary to understand the accident sequence that occurred in the TMI-2 reactor, and (b) provide a data base for predicting nuclear fuel behavior during a degraded core cooling situation.

The damaged TMI-2 core material contained in the canisters does not consist of intact fuel assemblies or fuel rods typical of normal commercial fuels. The core material is an agglomerate of the various items that existed within the reactor vessel after the accident. Because of this, the TMI-2 core debris differs from normal commercial SNF and was placed in canisters in order to be shipped from the TMI-2 reactor to Idaho for examination. The debris was placed in three types of cylindrical stainless-steel canisters: fuel, knockout, and filter. The fuel canisters are receptacles for large pieces of core debris, the knockout canisters were designed to contain smaller debris, and the filter canisters contain stainless-steel filters and fines that were collected in the filters during defueling operations. Neutron absorbing materials (boron carbide poison in the form of plates or rods) were designed into each type of canister to prevent criticality events. The canisters in storage at the TMI-2 ISFSI were not repackaged following receipt in Idaho

Due to the characteristics of the damaged fuel, the TMI-2 canisters are designed to vent radiolytic generated hydrogen and oxygen. Venting is accomplished through a vent orifice located in the top of each canister. The canisters were received at TAN and placed in the TAN Pool. From March 1999 to April 2001 the TMI-2 debris was transferred from TAN to INTEC for storage at the ISFSI. The transfer process required the TMI-2 canisters to be dried loaded into a NUHOMS® DSC, and seal welded. The DSC was then loaded into the transport cask.

The fenced ISFSI site at INTEC has a series of concrete modular storage units called Horizontal Storage Modules (HSM) located on a concrete pad. The HSMs are a passive storage modular system designed to provide shielding and safe confinement of spent nuclear fuel. The HSM storage system has an installed High Efficiency Particulate Air (HEPA) filter through which the DSC atmosphere is vented.

1.6. FIGURES AND REFERENCES

1.6.1. FIGURES

FIGURE 1-1: Aerial Photo of INTEC and the TMI-2 ISFSI

1.6.2. REFERENCES

1-1 U.S. Nuclear Regulatory Commission, "License for Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste," License No. SNM-2508, Amendment No. 4, June 30, 2005, Docket No. 72-20, NRC Accession Number ML051810406.

1-2 DOE 1993, Report on Interim Storage of Spent Nuclear Fuel, the Midwestern Office of the Council of State Governments, DOE/CH/10402-22, April.

1-3 DOE 1995, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, April.

1-4 DOE 1995a, Record of Decision for the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, May 30.

1-5 DOE 1995b, "Settlement Agreement" between the State of Idaho, Department of the Navy, and the Department of Energy." Oct. 16.

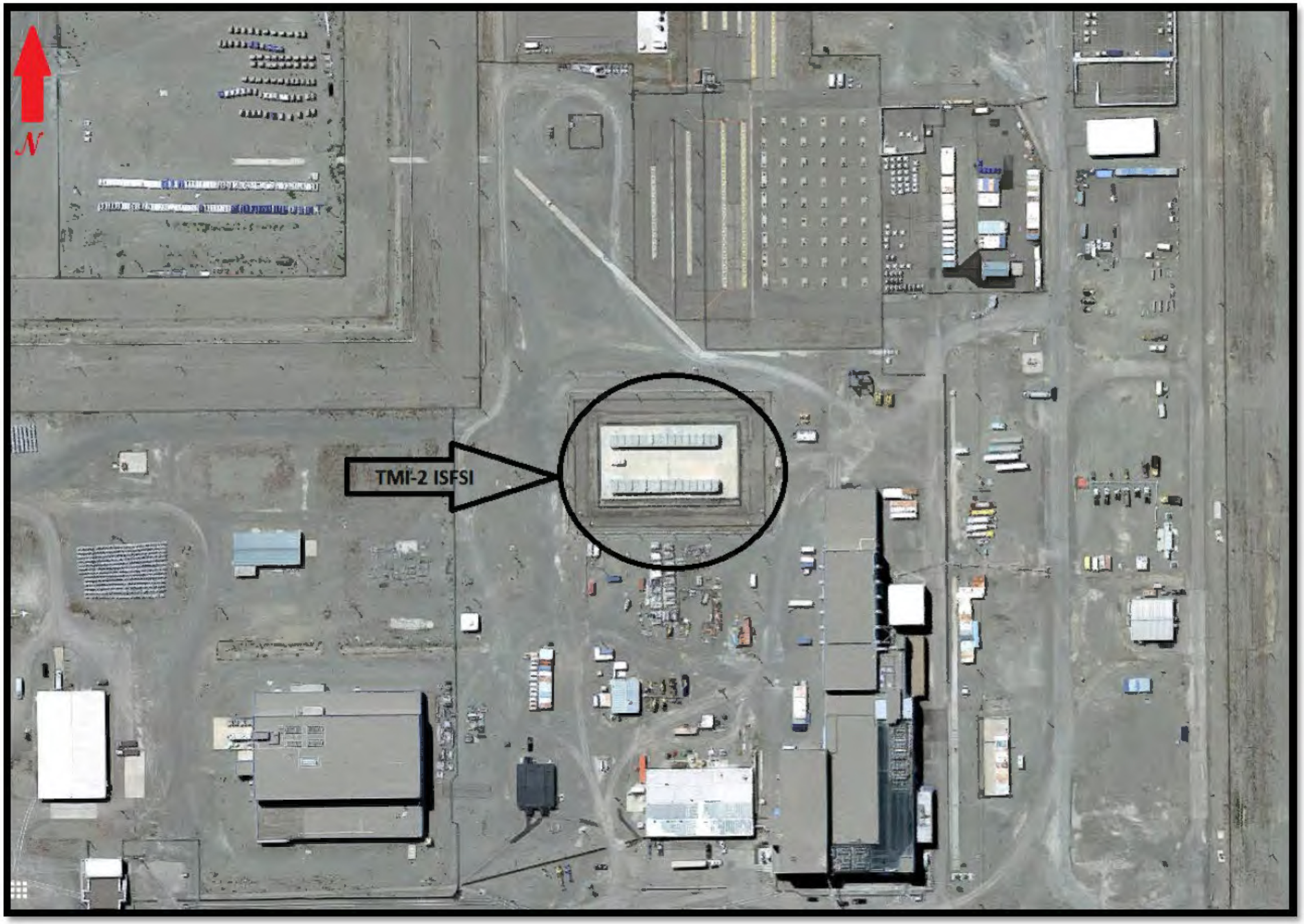
1-6 DOE 1996a, Amendment to Record of Decision on the Programmatic Spent Nuclear Fuel Management and Idaho National Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement. February 28.

1-7 DOE 1996b, Environmental Assessment of the Test Area North Pool Stabilization Project, DOE/EA-1050, May.

1-8 DOE 1996c, Finding of No Significant Impact for the Test Area North Pool Stabilization Project at the Idaho National Engineering Laboratory, May 6.

1-9 NRC 1976, U.S. Nuclear Regulatory Commission, Regulatory Guide 4.2, Revision 2, Preparation of Environmental Reports for Nuclear Power Stations.

FIGURE 1-1: AERIAL PHOTO OF INTEC WITH TMI-2 ISFSI SITE



2. THE SITE AND ENVIRONMENTAL INTERFACES

2.1. GEOGRAPHY AND DEMOGRAPHY

2.1.1. SITE LOCATION AND DESCRIPTION

The ISFSI is located at DOE's Idaho site and measures about 37.5 mi (60.3 km) north to south and about 34.8 mi (56.0 km) east to west. FIGURE 2-1 shows the location of DOE's Idaho site relative to surrounding cities. Most of DOE's Idaho site is located within Butte County, but portions are also within Bingham, Bonneville, Jefferson, and Clark counties. The INTEC is located totally within Butte County.

DOE's Idaho site primary facility areas are situated on an expanse of otherwise undeveloped, high-desert terrain. (FIGURE 2-2) The ISFSI is sited at the Idaho Nuclear Technology and Engineering Center (formerly the Idaho Chemical Processing Plant [ICPP]). The current mission for INTEC is to receive and temporarily store SNF and radioactive waste for future disposition, manage waste, and perform remedial actions. Other site facilities include Test Area North (TAN), Naval Reactors Facility (NRF), Advanced Test Reactor (ATR), Materials and Fuels Complex (MFC), Critical Infrastructure Test Range Complex, Central Facilities Area CFA), and the Radioactive Waste Management Complex (RWMC).

The geographic center of the INTEC is easting 43° 34' 13" latitude, northing 112° 55' 56" longitude. The Universal Transverse Mercator (UTM) coordinates of the ISFSI location within INTEC are 213.665 mi (343.867 km) east by 2998.424 mi (4825.583 km) north, Zone 12.

The ISFSI site is located in a flat-lying area near the Big Lost River in the south central part of DOE's Idaho site. The area is underlain by about 30 to 60 feet (9-18 m) of Big Lost River alluvial silts, sands, and gravels, which lie on an alternating sequence of basalt lava flows and interbedded sediments extending to a depth of about 2000 to 2300 ft (600 to 700 m). Landforms in the vicinity of the ISFSI consist of braided channels (some abandoned) of the Big Lost River to the west and north of the site, and irregular flow lobes of basalt lavas to the east of the site.

2.1.1.1. *Site Area*

DOE's Idaho site occupies about 890 square miles (2,300 km2). The ISFSI occupies approximately 2 acres (0.8 ha) within the INTEC complex such that a 100 meter radius includes current areas of the INTEC (FIGURE 2-3). The shortest distance from the ISFSI to the DOE's Idaho site boundary is to the south, (FIGURE 2-4) a distance of 8.5 mi (13.7 km). The next closest boundary to the ISFSI is 8.6 mi (13.8 km) to the northwest. DOE's Idaho site is remote from major population centers, waterways, and interstate transportation routes. It has no permanent residents, and ingress and egress of site personnel for performance of their duties and visiting personnel on official business are strictly controlled by the DOE. Visitor access to the site is restricted, except for persons driving through on one of four public highways and visitors to the Experimental Breeder Reactor-I (EBR-I), National Historical Monument, which is open to the public during the summer months.

Limited recreational activities and grazing are allowed within the site under special requirements.

DOE's Idaho site boundary (site boundary lines), establishes the exclusion area, defined in 10 CFR Part 100, for protection from exposure to airborne radioactivity.

2.1.1.2. *Population within 10 Miles*

There are no permanent residents, cities or towns within a 10-mile (16-km) radius of the ISFSI. However, several of DOE's Idaho site facilities, such as the CFA, ATR Complex, and the RWMC are within 10 miles of the ISFSI. Also, the Experimental Breeder Reactor I (EBR-1), a National Historic Land mark, is located southwest and within 10 miles of the ISFSI. Institutional control will continue to restrict access to DOE's Idaho site lands for the next 100 years (DOE 1996), thus population within 10 miles (16 km) of the INTEC is unlikely to change through 2035.

2.1.1.3. *Population within 10 and 50 Miles*

There are 16 counties within 80 km (50 mi) of DOE's Idaho site (TABLE 2-1). Fifteen of the counties are in the State of Idaho and one is in the State of Montana. This 16-county region has a low population density. In 2010, the population for this region was 390608 (Census Bureau 2011). Nearly 48% of this population resides in the two most populous counties: Bonneville and Bannock.

The largest regional cities are Idaho Falls (located in Bonneville County) with a 2010 estimated population of 56891 residents, and Pocatello (located in Bannock County) with a 2010 estimated population of 54,224 residents. These two cities represent approximately 28% of the regional population. The Fort Hall Indian Reservation is located south of DOE's Idaho site, with a 2010 estimated population of 3,201.

2.1.1.4. *Transient Population*

Year round differences in populations are caused by the daily influx of DOE's Idaho site's workforce. About 4000 workers are employed within 10 miles (16 km) of the ISFSI (TABLE 2-2). U.S. Highways 20 and 26 pass through the site and are within 10 miles (16 km) of INTEC. Highway traffic, other than the daily site traffic, is related to travel between cities surrounding the site and the many recreational opportunities in the area (see Section 2.1.2.1).

2.1.2. USES OF ADJACENT LANDS AND WATERS

DOE's Idaho site encompasses 571000 acres (230000 ha) within Butte, Bingham, Bonneville, Jefferson, and Clark counties. This section includes a brief description of existing land uses on and immediately surrounding the site, and applicable land use plans and policies.

2.1.2.1. *Existing and Planned Land Uses at DOE's Idaho Site*

Categories of land use at DOE's Idaho site include facility operations, grazing, general open space, and infrastructure, such as roads. Facility operations include industrial and support operations associated with energy research and waste management activities.

Land is also used for recreation and environmental research associated with the designation of as a National Environmental Research Park. Much of the site is open space that has not been designated for specific uses. Some of this space serves as a buffer zone between its facilities and other land uses. About 3 percent of the total site area (11400 acres or 4600 hectares) is used for facilities and operations.

Public access to most facility areas is restricted. Approximately 6 percent of DOE's Idaho site, or 34,260 acres (13870 ha), is devoted to public roads and utility rights-of-way that cross the site. Recreational uses include public tours of general facility areas and EBR-I and controlled hunting, which is generally restricted to half a mile (0.8 km) within the site boundary where the DOE's Idaho boundary is adjacent to agricultural lands. Between 300000 and 350000 acres (121000 and 142000 ha) are used for cattle and sheep grazing. A 900-acre (400-ha) portion of this land, located at the junction of Idaho State Highways 28 and 33, is used by the U.S. Sheep Experiment Station as a winter feed lot for approximately 6500 sheep. Grazing is not allowed within 2 miles (3 km) of any nuclear facility, and, to avoid the possibility of milk contamination by long-lived radionuclides, dairy cattle are not permitted. Rights-of-way and grazing permits are granted and administered by the U. S. Department of the Interior's Bureau of Land Management. Selected land uses at DOE's Idaho site and in the surrounding region are presented in FIGURE 2-5.

2.1.2.2. ***Existing and Planned Land Use in Surrounding Areas***

Lands surrounding DOE's Idaho site are owned by the Federal government, the State of Idaho, and private parties. Land uses on federally owned land consist of grazing, wildlife management, range land, mineral and energy production, and recreation. State-owned lands are used for grazing, wildlife management, and recreation. Privately owned lands are used primarily for grazing, crop production, and range land.

Small communities and towns located near DOE's Idaho site boundaries include Mud Lake to the east; Arco, Butte City, and Howe to the west; and Atomic City to the south. The larger communities of Idaho Falls/Ammon, Rexburg, Blackfoot, and Pocatello/Chubbuck are located to the east and southeast of DOE's Idaho site. The Fort Hall Indian Reservation is located southeast of DOE's Idaho site. Recreation and tourist attractions in the region surrounding DOE's Idaho site include Craters of the Moon National Monument, Hell's Half Acre Wilderness Study Area, Black Canyon Wilderness Study Area, Camas National Wildlife Refuge, Market Lake State Wildlife Management Area, Mud Lake Wildlife Management Area, North Lake State Wildlife Management Area, Yellowstone National Park, Targhee and Challis National Forests, Sawtooth National Recreation Area, Sawtooth Wilderness Area, Sawtooth National Forest, Grand Teton National Park, Jackson Hole recreation complex, and the Snake River (see FIGURE 2-6).

All county plans and policies encourage development adjacent to previously developed areas in order to minimize the need to extend infrastructure improvements and to avoid urban sprawl (DOE-ID 1993d). Because DOE's Idaho site is remotely located from most developed areas, its lands and adjacent areas are not likely to experience residential and commercial development, and no new development is planned near the DOE's Idaho site (DOE-ID 1993d). However, recreational and agricultural uses continue to increase in the surrounding area in response to greater demand for recreational areas and the conversion of range land to crop land.

2.2. ECOLOGY

This section describes the biotic resources on DOE's Idaho site, which are typical of the Great Basin and Columbia Plateau. Threatened and endangered species, wetlands, and the extent of human-caused radionuclides in plants and animals are discussed. Only those biotic resources in the immediate vicinity of the ISFSI are expected to be affected by this action. However, because other resources such as more mobile species like pronghorn could be affected, biotic resources for the entire site have been evaluated are briefly described.

2.2.1. FLORA

The natural vegetation at DOE's Idaho site primarily consists of a shrub overstory with an understory of perennial grasses and forbs. Most vegetation communities within the site boundaries are dominated by various species or subspecies of sagebrush, although some communities that are dominated by saltbush, juniper, crested wheatgrass, and Indian rice grass are present and distributed throughout the site. The DOE's Idaho site supports over 420 species of flowering plants. (Anderson, 1991)

DOE's Idaho site occupies one of the largest tracts of relatively undisturbed sagebrush-steppe rangeland in the United States, with the most common shrub being Wyoming big sagebrush, although basin big sagebrush may dominate or be codominant with Wyoming big sagebrush on sites having deep soils or sand accumulations. Wyoming big sagebrush communities occupy most of the central portions of the site. Green rabbitbrush is the next most abundant shrub, and other common shrubs include winterfat, spiny hopsage, gray rabbitbrush, broom snakeweed, and horsebrush. Communities dominated by Utah juniper and three-tipped sagebrush, black sagebrush, or both are limited to areas along the DOE's Idaho site periphery, specifically on the slope of the buttes and on the foothills of adjacent mountain ranges to the northwest. Salt-desert shrub communities may be found on the sediment in the sinks and playas associated with the Big Lost River and Birch Creek. These communities are dominated by shadescale, Nuttall saltbush, or winterfat.

The understory grasses include natives such as thick-spiked wheatgrass, bottlebrush squirreltail, Indian rice grass, needle-and-thread grass, and Nevada bluegrass. Creeping wild rye and western wheatgrass may be locally abundant. Communities dominated by basin wild rye are common in depressions between lava ridges and in other areas having deep soils. Bluebunch wheatgrass is common at slightly higher elevations southwest and east of DOE's Idaho site.

Vegetation communities within DOE's Idaho site boundaries contain an unusually high diversity of forbs largely due to the exclusion of livestock grazing common throughout the sagebrush-steppe region. Forb species are numerous, but not abundant in many areas. Common forbs include tapertip hawksbeard, Hood's phlox, prickly phlox, hoary false yarrow, globe-mallow, evening primrose, bastard toadflax and various paintbrushes, buckwheats, lupines, milkvetches, and mustards.

A system of sinks and playas of the Big and Little Lost Rivers and Birch Creek are believed to have once supported an extensive, diverse, and unique wetland system. However, only minimal surveys of the presence and abundance of plant species have ever been conducted in this area, including two surveys in 1995 and 1997 conducted by a team inventorying plants and aquatic invertebrates in the area. (Lobdell. 1995)

A total of 11 Idaho noxious weeds have been identified on DOE's Idaho site and several other non-native species also are present. Non-native species are quick to colonize new disturbance and successfully compete with native species, making them difficult to eradicate once present. Exotic plant species (such as cheatgrass and Russian thistle) that are well established, particularly within disturbed areas, may be altering the overall structure of the plant communities in the region, and, in the case of cheatgrass, also may be dramatically altering the fire regime. Crested wheatgrass, a European bunchgrass seeded in the late 1950s, dominates many disturbed areas where it was used to provide cover and to hold soils.

2.2.2. FAUNA

Estimates of the total number of species of vertebrate fauna found on DOE's Idaho site vary. Perhaps the most reliable information on vertebrate fauna on the site is provided by the Idaho National Laboratory (INL) Environmental Surveillance, Education, and Research Program, which describes some 211 vertebrate species (i.e., 5 fish, 1 amphibian, 9 reptile, 37 mammal, and 159 bird species) as having been documented on site. Of these species, 56 are considered to be year-round residents, whereas the rest are partial-year residents that were observed during specific seasons or during migration. Most of the migratory species are birds. An additional nine fish, five amphibian, five reptile, 13 bird, and 14 mammal species are considered as possibly occurring at the site, because portions of their range overlap DOE's Idaho site area or they have been reported within 30 km (18 miles) of the Site. However, no verified observations of these species have been reported on DOE's Idaho site.

Fish species reported on DOE's Idaho site are limited to the Big Lost River during years when water flow is sufficient (Reynolds et al. 1986). However, periods of drought and upstream water diversion for agricultural and flood-prevention purposes has severely restricted the flow of the Big Lost River on the site, thereby restricting the presence of native fish species. Similarly, the Great Basin spadefoot toad, DOE's Idaho site only reported resident amphibian, is limited by water flow in the Big Lost River. Reptiles include five species of snake, three species of lizards, and the western skink.

Birds represent the largest group of vertebrates found on DOE's Idaho site, although as pointed out above, many bird species are seasonal residents. Raptors, songbirds, and waterfowl are all well represented and comprise important ecological components of the sagebrush-steppe community. DOE's Idaho site is inhabited by 14 species of sparrows and allies, six species of swallows, 20 species of ducks and geese, and 24 species of raptors (Idaho Department of Fish and Game 2015). Among these species is the bald eagle, which is seen on or near the site during winter. Sage-grouse is another species of importance that is present on DOE's Idaho site.

Although most of the 37 mammal species reported on DOE's Idaho site are small mammals, several important large mammals (such as mule deer) are present. Approximately 30% of Idaho's pronghorn populations use DOE's Idaho site and surrounding areas for winter range (DOE 1997). In addition, a small population of elk has become resident on DOE's Idaho site. Some small mammal species (such as the black-tailed jackrabbit) exhibit large population fluctuations and influence the abundance, reproduction, and migration of predators such as the coyote, bobcat, and raptors. Other observed predators include mountain lions and badgers. Several vertebrate species are considered to be sagebrush obligates (i.e., they live only in sagebrush communities). These sagebrush obligates include sage-grouse, sage sparrow, and the pygmy rabbit. Rock outcroppings associated with these communities also provide habitat for species such as bats and wood rats. Grasslands serve as habitat for species that include the western meadowlark and mule deer. Facility structures at DOE's Idaho site also provide important wildlife habitat. Buildings, lawns, ornamental vegetation, and ponds are used by a number of species such as waterfowl, raptors, rabbits, and bats. Aquatic vertebrates are supported year-round by habitat provided by facility treatment ponds, waste ponds, and facility drainages (Cieminski 1993).

In 1995 and 1997, DOE funded a team to conduct surveys in the area of the site that contains a system of sinks and playas of the Big and Little Lost Rivers and Birch Creek. Although by no means comprehensive, the field team observed 18 species of waterfowl and shorebirds (including over 500 ducks, some with broods) and several other bird species, including two peregrine falcons. Thousands of ephemeral Great Basin

spadefoot toads were observed, as were invertebrates representing many different orders. Although remnants of these systems remain, the long-term impact of the various water diversion systems on the aquatic communities is uncertain.

The biological diversity of invertebrate fauna at DOE's Idaho site has not been investigated extensively; however, 740 insect species have been collected and identified at DOE's Idaho site. The harvester ant, in particular, has received attention during the past decade because of its general importance in desert ecosystem nutrient cycling and energy flow (Clark and Blom 1988, 1992). At the nearby Craters of the Moon National Monument, where a thorough inventory of invertebrates has been obtained, 2064 species were found; therefore, many more insect species may be present at DOE's Idaho site.

2.2.3. THREATENED AND ENDANGERED SPECIES

The USFWS provides a list, by county, of threatened and endangered species of plants and animals and species of concern for the State of Idaho. The most recent USFWS list includes one threatened plant species that may occur within the five counties that encompass the site: Ute ladies'-tresses (*Spiranthese diluvialis*) and several sensitive plant species that may be present on DOE's Idaho site (Idaho Department of Fish and Game 2015).

The USFWS list (October, 2011) also includes two threatened and endangered animal species and two candidate species that may occur within the five counties that encompass DOE's Idaho site (USFWS 2015). The Canada lynx (*Lynx canadensis*) and the grizzly bear (*Ursus arctos horribilus*) are threatened species. Neither is expected to be present on DOE's Idaho site. The gray wolf (*Canis lupus*) was delisted on May 5, 2011, and is no longer afforded protection under the Endangered Species Act in Idaho; wolf populations in Idaho are managed by the State. The yellow-billed cuckoo (*Coccyzus americanus*), and the wolverine (*Gulo gulo*) are candidate species. The yellow-billed cuckoo is a riparian-obligate species and is primarily associated with willow-cottonwood riparian forest.

DOE's Idaho site is a refuge for the beleaguered sage-grouse since the site's 890 mi^2 are mostly wide-open and wild; roads and buildings, such as DOE's Idaho site the ATR Complex, occupy only 3% of the land. DOE's Idaho site consists of good sagebrush habitat surrounded by wheat fields, potato fields, and degraded rangelands. In the last 100 years, the sage-grouse population has fallen by at least 67% to just a few hundred thousand birds. The sage-grouse is in trouble because its habitat, the sagebrush steppe, is in trouble from development of aggressive non-native species such as cheat grass. Recently, USFWS reported in 80 FR 59857-59942, that the Columbia Basin population does not qualify as a distinct population segment and that listing sage grouse is not warranted at this time.

In 2014, DOE-ID voluntarily entered into a Candidate Conservation Agreement with USFWS to protect greater sage-grouse and its habitats on DOE's Idaho site, while allowing DOE flexibility in conducting its current and future missions. This was the first such agreement signed in Idaho for sage-grouse. The Candidate Conservation Agreement complements Idaho's State Alternative, developed in 2012 by Governor C. L. "Butch" Otter's task force, and other efforts to preclude the need for sage-grouse to be listed under the Endangered Species Act. The DOE's Idaho site conservation framework protects lands within a 1- km (0.6-mi) radius of all known active leks (i.e., traditional breeding grounds) on the DOE's Idaho site and establishes a sage-grouse conservation area that limits infrastructure development and human disturbance in approximately 68% of remaining sagebrush-dominated communities. Leks protected by the sage- grouse conservation area support an estimated 74% of the sage-grouse that breed on DOE's Idaho site. In addition

to establishing a conservation framework, the Candidate Conservation Agreement identifies primary threats to sage-grouse and its habitats on DOE's Idaho site and introduces a set of new conservation measures that DOE commits to implement to minimize those threats. Successful implementation will promote preservation of sagebrush habitat, reduce or eliminate threats to sage-grouse, and increase understanding of habitat and population trends through long-term research and monitoring.

Several other animal species were designated as sensitive that may be present on DOE's Idaho site. The bald eagle *(Haliaeetus leucocephalus*) was delisted in 2007, but is still protected under the Bald and Golden Eagle Protection Act. This species often winters in the Little Lost River Valley just north of DOE's Idaho site and several have been known to winter on the site. The American peregrine falcon (*Falco peregrinus*) (delisted, but being monitored) has been observed infrequently on the northern portion of DOE's Idaho site.

Among the mammal species recognized by other agencies that might be found on DOE's Idaho site are Merriam's shrew (*Sorex merriami*), pygmy rabbit (*Brachylagus idahoensis*), bobcat (*Lynx rufus*), Townsend's big-eared bat (*Corynorhinus townsendii*), long-eared myotis (*Myotis evotis*), and small-footed myotis (*Myotis subulatus*). Bird species of concern include ferruginous hawk (*Buteo regalis*), long-billed curlew (*Numenius americanus*), northern goshawk (*Accipiter gentilis*), osprey (*Pandion haliaetus*), gyrfalcon (*Falco rusticolus*), merlin (*Falco columbarius*), white-faced ibis (*Plegadis chihi*), long-billed curlew (*Numenius americanus*), burrowing owl (*Athene cunicularia*), prairie falcon (*Falco mexicanus*), and loggerhead shrike (*Lanius ludovicianus*). The northern sagebrush lizard (*Sceloporous graciosus*) is the single reptile on the USFWS list (USFWS 2015).

TABLE 2-3 is a categorized list of threatened and endangered species of special concern, and sensitive species that may be found on DOE's Idaho site.

2.2.4. WETLANDS

The Environmental Protection Agency defines wetlands as "areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions" (40 CFR 230.3(t)).

The USFWS, as part of a 1992 preliminary survey, conducted an evaluation of aquatic habitats at DOE's Idaho site for the National Wetlands Inventory. This inventory identified and mapped approximately 135 areas within the boundaries of the DOE's Idaho site. Of these areas, 121 DOE's Idaho site wetlands were surveyed, grouped into five wetland categories (i.e., palustrine and lacustrine, riverine, manmade, unmapped, and unclassified). Jurisdictional wetlands, governed by the Clean Water Act, are those wetlands that exhibit the following, (1) a prevalence of hydrophytic plants, (2) hydrological conditions suited to such plants, and (3) the presence of hydric soils. The only area of DOE's Idaho site identified as potential jurisdictional wetlands is the Big Lost River Sinks. Additional information concerning this mapping can be obtained in *A Preliminary Survey of the National Wetlands Inventory as Mapped for the Idaho National Engineering Laboratory* (Hampton et al. 1995).

2.2.5. RADIOECOLOGY

Potential radiological effects on plants and animals are measured at the population, community, or ecosystem level. However, for threatened and endangered species, harm to individuals is important. Radionuclides are found above background levels in individuals belonging to some plant and animal species

on and surrounding DOE's Idaho site (Morris 1993a). Measurable effects of radionuclides on plants and animals, however, have only been observed in individuals on areas adjacent to DOE's Idaho site facilities, and not at the population, community, or ecosystem levels. The following is information on doses, concentrations, and effects reported for animals on the site.

Halford and Markham (1984) and Arthur et al. (1986) studied maximally exposed small mammals at the TRA radioactive waste percolation pond and at the RWMC SDA (Subsurface Disposal Area). These studies concluded that the small mammals received doses similar to those shown to reduce life expectancies in other small mammals at other locations. Statistically significant differences in several physiological parameters were found between deer mice inhabiting the TRA radioactive waste percolation pond, the SDA, and control areas (Evenson 1981). However, radiation exposures were too small to cause cellular changes in the mice. A comparison between barn swallow nestlings exposed to sediments from the TRA pond and control birds revealed a statistically significant difference in growth rates (Millard et al. 1990). However, this difference could not definitely be attributed to exposure. All studies reported that doses to individual organisms were too low to cause any effects at the population level. Doses and exposures to animals from 1992 at both the SDA and TRA are probably lower than the doses reported in the above studies because 2 feet (0.6 meter) of additional soil cover the contaminated pits and trenches (Wilhelmsen and Wright 1992), and the percolation pond is now less attractive to animals (Morris 1993b).

Elevated radionuclide concentrations have also been observed in some individual animals and plants outside the boundaries of DOE's Idaho site facilities and off the site. Iodine-129 concentrations in vegetation and in rabbit thyroids have been reported in excess of background up to 18.6 miles (30 km) from the INTEC fence (Markham 1974). Iodine-129 has also been detected above background in pronghorn tissue collected from the site (Markham 1974) and from pronghorn collected as far away as Craters of the Moon National Monument and Monida Pass (Markham et al. 1982). In a study of raptor nesting, Craig et al. (1979) concluded that detectable radionuclide levels would only be observed within 2.2 miles (3.5 km) from the RWMC. In these examples, the dose from internal consumption of radionuclides was less than is thought to be required for observable effects to occur to individual animals (IAEA 1992). Also, on the basis of limited data and the infrequent and few bald eagles and Ferruginous hawks observed near contaminated areas, these species probably are not consuming harmful concentrations of radioactive contaminants in their prey (Morris 1993b). A similar conclusion can be made for peregrine falcons because they have rarely been seen on or near the DOE's Idaho site, and have never been seen near contaminated ponds on site.

2.3. CLIMATOLOGY AND METEOROLOGY

The Eastern Snake River Plain climate exhibits low relative humidity, wide daily temperature swings, and large variations in annual precipitation. TABLE 2-4 lists the Average temperature and snowfall totals per month for periods from 1950 to 2014. Average seasonal temperatures measured onsite range from 20°F (Fahrenheit) (-7.8°C [Celsius]) in winter to 83°F (27°C) in summer, with an annual average temperature of about 42°F (5.6°C). Temperature extremes range from a summertime maximum of 105°F (40°C) to a wintertime minimum of -47°F (-45°C). Large year-to-year variations in average monthly and seasonal temperatures are common, as are large variations in temperature in different locations. Annual precipitation is light, averaging 8.71 inches (22.1 centimeters), with monthly extremes of zero to 5 inches (12.8 centimeters). The maximum 24-hour precipitation rate is 1.8 inches (4.6 centimeters). The greatest short-term precipitation rates are primarily attributable to thunderstorms, which occur approximately two or three days per month during the summer. The average annual snowfall is 25.7 inches (69.1 centimeters), with

extremes of 59.7 inches (151.6 centimeters) and 6.8 inches (17.3 centimeters). Relative humidity ranges from an average minimum of 27 percent to a maximum of 79 percent on an annual basis.

DOE's Idaho site is in the belt of prevailing westerlies; however, these winds are normally channeled by the mountain ranges bordering the Eastern Snake River Plain into a southwest wind. Most offsite locations experience the predominant southwest/northeast wind flow of the Eastern Snake River Plain, although subtle terrain features near some locations cause considerable variations from this flow regime. The highest hourly average near-ground wind speed measured onsite is 51 miles per hour (22.8 meters per second) from the west-southwest, with a maximum instantaneous gust of 78 miles per hour (34.9 meters per second) (Clawson et al. 1989). Other than thunderstorms, severe weather is uncommon. Five funnel clouds (tornadoes not touching the ground) and no tornadoes have been reported onsite from 1950 to 1988 (TABLE 2-5). Visibility in the region is good because of the low moisture content of the air and minimal sources of visibility-reducing pollutants. At Craters of the Moon Wilderness Area [approximately 12.4 miles (20 km) southwest of DOE's Idaho site], the seasonal visual range is from 81 to 97 miles (130 to 156 km) (Notar 1993). TABLE 2-5 shows representative wind speed means and extremes for the 10 meter tower level at GRI.

Air pollutant dispersion is a result of the processes of transport and diffusion of airborne contaminants in the atmosphere. Transport is the movement of a pollutant in the wind field, while diffusion refers to the process whereby a pollutant plume is diluted by turbulent eddies. Vertical diffusion of pollutants may be restricted or enhanced by the temperature gradient of the atmosphere (that is, the change in temperature with altitude). Lapse conditions, which tend to enhance vertical diffusion, occur slightly less than 50 percent of the time. Conversely, thermal stratification or inversion conditions, which inhibit vertical diffusion, occur slightly more than 50 percent of the time. The height to which the pollutants can freely diffuse is known as the mixing depth, while the layer of air from the ground up to the mixing depth is known as the mixed layer. Estimates of the monthly average depth of the mixed layer range from 400 feet (120 meters) in December to 3000 feet (900 meters) in July. Nocturnal (nighttime) inversions form at approximately sunset and dissipate about one to two hours after sunrise. These inversions are often ground-based, meaning that the temperature increases with height from the ground (Clawson et al. 1989).

The U.S. Weather Bureau, subsequently the Environmental Sciences Service Administration, and presently the NOAA, has maintained a meteorological observation program at DOE's Idaho site since 1949. The Environmental Research Laboratories (the NOAA facility at DOE's Idaho site) is a permanent installation and continues to update all meteorological data. FIGURE 2-7 shows the locations of the present site stations.

2.4. HYDROLOGY

This section describes existing regional and DOE's Idaho site hydrologic conditions and discusses existing water quality for surface and subsurface water, water use, and water rights. The subsurface water section also describes the saturated zone below the water table and the vadose zone (or unsaturated zone and perched water bodies) located between the land surface and the water table.

2.4.1. SURFACE WATER

Using the United States Geological Survey's surface water classification scheme, DOE's Idaho site straddles portions of six (possibly seven) watersheds. FIGURE 2-8 shows the locations of surface water monitoring stations. The watersheds include American Falls, Big Lost River, Birch Creek, Idaho Falls, Little

Lost River, Medicine Lodge, and possibly a small portion of Lake Walcott. Of these watersheds, only four contain significant surface water bodies that flow onto or near DOE's Idaho site, including the Big Lost River, Birch Creek, Little Lost River, and Medicine Lodge watersheds. All surface water within them is lost to evapotranspiration or via infiltration to their local aquifers and the regional Eastern Snake River Plain Aquifer near or beneath the site.

2.4.1.1. ***Regional Drainage***

DOE's Idaho site is in the Pioneer Basin, a closed topographic depression on the Eastern Snake River Plain that receives intermittent runoff from the Big Lost River, Little Lost River, and Birch Creek drainage basins. No known perennial streams cross the Pioneer Basin, because the permeability of alluvium and underlying rock of the basin causes the water to infiltrate into the ground. In addition, much of the water from the tributary drainage basins is diverted for irrigation upstream of DOE's Idaho site. The largest stream, the Big Lost River, enters the southern end of DOE's Idaho site from the west and, during exceptionally wet years, flows in a large arc north to the foot of the Lemhi Mountain Range, where it ends in a series of playas (sinks). Birch Creek has been diverted to a hydropower plant north east of DOE's Idaho site. In the summer all flows out of the power plant are used for irrigation. In the winter, those outflows are diverted back to the Birch Creek stream bed at a location approximately 6 miles northeast of the TAN Facility. The Little Lost River approaches DOE's Idaho site from the northwest through Howe and ends in a playa on the DOE's Idaho site.

Other than these intermittent streams, playas, and manmade percolation, infiltration, and evaporation ponds, there is little surface water at DOE's Idaho site. Surface water that reaches the site is not used for consumption (e.g., irrigation, manufacturing, or drinking). No future uses of surface water that reaches DOE's Idaho site have been identified.

In the Final Environmental Impact Statement (NUREG-1626) it was stated that flooding onto the site from the Big Lost River coupled with a failure of the Mackay Dam was possible if there was a subsequent topping of the Diversion Dam before the water enters DOE's Idaho site.

INTEC is located on an alluvial plain approximately 200 feet (16 m) from the Big Lost River Channel. The TMI-2 ISFSI site is located in the southern portion of INTEC, about 2800 feet (850 m) from the main river channel. The probable maximum flood event would result in flood water within INTEC controlled area up to about 4917 feet (1498.7 m) above mean seal level[3] (Koslow and Van Haaften, 1986). The elevation of the ISFSI pad is 4917 feet (1489.7 m). The DSCs within the HSMs are slightly above 4922 feet (1500.2 m) elevation. In the unlikely event of flooding of the ISFSI Facility structures (due to coincident failure of flood control strategies and the probable maximum load), such flooding would not cause structural damage or create significant offsite radiological consequences.

2.4.1.2. ***Surface Water Quality***

[3] The design basis maximum flood elevation for the TMI-2 ISFSI reported in Section 3.2.2 of the TMI-2 ISFSI FSAR is 4917 feet. A Bureau of Reclamation (BOR) study performed in 2005 (Big Lost River Hazard Study) includes information that could change the ISFSI flood elevation previously analyzed in the TMI-2 ISFSI design and licensing basis. The flood elevation reported in the 2005 BOR study for a DOE regulated facility near the TMI-2 ISFSI is 4917.48 feet. This calculated maximum flood level is approximately six inches higher than that reported in the TMI-2 ISFSI SAR and the original TMI-2 ISFSI Environmental Report. A Deficiency Report has been initiated to identify the discrepancy in the corrective action program to 1) determine the purpose of the 2005 BOR report and 2) evaluate the need for actions pertaining to the TMI-2 ISFSI design and licensing basis. Any resulting impacts on the LRA and/or ER Supplement will be evaluated and communicated to the NRC, as appropriate.

Water quality in the Big and Little Lost Rivers and Birch Creek is similar and has not varied a great deal over the period of record. Measured physical, chemical, and radioactive parameters have not exceeded applicable drinking water quality standards (USGS 1982-1993). The chemical composition is determined primarily by the carbonate mineral composition of the rocks in surrounding mountain ranges northwest of DOE's Idaho site, and by the chemical composition of irrigation water returns flow to the surface water (Robertson et al. 1974).

The discharge of wastewater to the land surface and evaporation ponds at DOE's Idaho site is regulated by the State of Idaho wastewater rules (Idaho Administrative Procedures [IDAPA] 58.01.16 and 17) and requires wastewater reuse permits. INTEC, the area that contains the ISFSI, is sampled according to the permit and no permit limits have been exceeded. In addition, samples collected from drinking water systems within INTEC have been well below the drinking water limits for all relevant regulatory parameters.

2.4.2. SUBSURFACE WATER

Drinking water for INTEC is supplied by two wells, CPP-04 and ICPP-POT-A-012, located north of the facility. A disinfectant residual (chlorine) is maintained throughout the distribution system. In 2013, drinking water samples were collected from the point of entry to the distribution system (CPP-614) and from various buildings throughout the distribution system (FIGURE 2-8). Twenty compliance samples and 48 surveillance samples were collected from various buildings throughout the distribution system at INTEC and analyzed for total coliform and E. coli. The results for all 68 samples were reported as absent. One compliance sample was collected at CPP-614 and analyzed for nitrate. The result was 0.7 mg/L and below the nitrate Maximum Contamination Level (MCL) of 10 mg/L. One surveillance sample was collected at CPP-614 and analyzed for gross alpha, gross beta, tritium, and strontium-90. Gross alpha was detected at 5.55 pCi/L, but below its MCL of 15 pCi/L. Gross beta, tritium, and strontium-90 were all reported as non-detects.

2.5. GEOLOGY

This section describes the geological, seismic, and volcanic characteristics of DOE's Idaho site and surrounding region.

2.5.1. GENERAL GEOLOGY

The Eastern Snake River Plain is a broad low-relief basin floored with basaltic lava flows and terrigenous sediments extending in a broad arc from the Idaho-Oregon border on the west to the Yellowstone Plateau on the east. It transects and sharply contrasts with the mountainous northern Basin-and-Range Province and the Idaho Batholith (FIGURE 2-9). Eastern Snake River Plain surface elevations decrease continually and gradually from about 6560 feet near Yellowstone to about 2130 feet (197.9 m) near the Idaho-Oregon border.

The northern Basin-and-Range Province, which bounds the Eastern Snake River Plain on the south, consists of north-to northwest-trending mountain ranges separated by intervening basins filled with terrestrial sediments and volcanic rocks. The Yellowstone Plateau, at the northeastern end of the Eastern Snake River Plain, is a high volcanic plateau underlain by Pleistocene rhyolitic volcanic rocks. At an elevation of 6889 feet, it is significantly higher than the Eastern Snake River Plain but not as high as the mountain summits of the northern Basin-and-Range Province, which borders the southern boundary of the Eastern Snake River Plain. A large area of irregular mountainous terrain characterizes the Idaho Batholith, which joins the northern margin of the Snake River Plain, with peaks from 7874 feet (2400 m) to 12139 feet (3700 m).

The axial ridge (axial volcanic zone) constrains the Snake River to the southeastern edge of the plain and causes rivers from the mountains north of the plain to drain into the playas. The most prominent example is the Big Lost River, which flows onto the plain near Arco, turns northeast in the southwestern part of DOE's Idaho site, and flows north to the Big Lost River Sinks in the northern part of the site. The Little Lost River and Birch Creek also empty into playas in the northern part of the site.

In detail, much of the Eastern Snake River Plain exhibits rough, uneven topography due to the character of the numerous basalt flows that make up the surface. The topography is characterized by lobate forms, numerous steep-walled closed depressions and mounds, and anastomosing fissures. Erosion processes have established classic drainage patterns; streams tend to be intermittent, wandering, and blind as they follow lava flow contacts and lava channels, commonly ending in closed depressions.

In many areas, the lava flow topography is softened by deposition of windblown silt into fissures and depressions. In some areas, silt deposition has been so great that the topography is dominated by dune forms and rolling terrain with little or no basalt at the surface. Development of intermittent lakes and ponds in many depressions in the lava flow surface has resulted in deposition of fine silts and clays, producing small flat-floored playas.

During the past 4 million years, the Eastern Snake River Plain has experienced volcanic activity, mostly as mild outpourings of basaltic lava flows. Vents for the basaltic volcanism are concentrated in northwest-trending volcanic rift zones and along the axial volcanic zone. Sediments deposited by wind action, streams, and lakes have also accumulated in the Eastern Snake River Plain, concurrent with the basaltic lava flows. Lithologic logs of four of DOE's Idaho site's deep holes and hundreds of shallower borings show an interlayered sequence of basalt lava flows and poorly consolidated sedimentary interbeds (the Snake River Group) occurring to depths of up to 6560 feet (1999.5 m) beneath the site. This sequence is underlain by a large, but unknown thickness of Late Tertiary rhyolitic volcanic rock.

The ISFSI is located approximately 2800 feet (853.4 m) southeast of the channel of the Big Lost River in the south central part of DOE's Idaho site, on Late Pleistocene alluvial gravels above the Holocene floodplain.

Numerous abandoned channels and perhaps braided channels of the Big Lost River characterize the Holocene floodplain. The presently active channel, which is dry most of the time, is incised into the Holocene floodplain deposits by about 5 to 7 feet (1.5 – 2.1 m), and is floored by sands and fine gravels.

Surficial sediments (Big Lost River alluvium) at the ISFSI consist mostly of gravel, gravelly sands, and sands. In some locations, a thin layer of clay and silt underlies the gravelly alluvium, forming a discontinuous low-permeability layer just above the basalt bedrock. Sedimentary interbeds in the Snake River Group beneath the ISFSI consist mostly of silts, clayey silts, and sandy silts. The interbed occurs at about 197 feet (60.0 m) below the surface. Several more interbeds occur at depths of up to 590 feet (197.8 m).

2.5.2. SEISMIC HAZARDS

The distribution of earthquakes at and near DOE's Idaho site from 1884 to 1999 clearly shows that the Plain has a remarkably low rate of seismicity, whereas the surrounding Basin and Range has a fairly high rate of seismicity (FIGURE 2-10). The mechanism for faulting and generation of earthquakes in the Basin and Range is attributed to northeast- southwest directed crustal extension.

Several investigators have suggested hypotheses for the low rate of seismic activity within the Plain compared to the Centennial Tectonic Belt (Stickney and Bartholomew 1987) and Intermountain Seismic Belt (Smith and Arabasz 1991):

- Smith and Sbar (1974) and Brott et al. (1981) suggested that high crustal temperatures beneath the Plain and adjacent region inside the seismic parabola resulted in ductile deformation (aseismic creep), in contrast to the brittle deformation (rock fracture) that occurs in the Basin and Range.

- Anders et al. (1989) suggested that the Plain and the adjacent region inside the seismic parabola have increased integrated lithospheric strength. They proposed that the presence of mid-crustal mafic intrusive rock strengthens the crust so that it is too strong to fracture (see also Smith and Arabasz 1991).

- Parsons and Thompson (1991) proposed that magmatic dike injection suppresses normal faulting and associated seismicity by altering the local tectonic stress field. As dikes are injected in volcanic rift zones, they push apart the surrounding rocks and decrease differential stress, thereby preventing earthquakes from occurring.

- Anders and Sleep (1992) proposed that introduction of mantle-derived magma into the midcrust beneath the Plain has decreased faulting and earthquakes by lowering the rate of deformation.

The markedly different late-Tertiary and Quaternary tectonic and seismic histories of the Plain and Basin and Range Province reflect the dissimilar deformational processes acting in each region. Both regions are being subjected to the same extensional stress field (Weaver et al. 1979, Zoback and Zoback 1989, Pierce and Morgan 1992, Jackson et al. 1993); however, crustal deformation within the Plain occurs through dike injection and, in the Basin and Range, through large-scale normal faulting (Rodgers et al. 1990, Parsons and Thompson 1991, Hackett and Smith 1992).

Major seismic hazards include the effects from ground shaking and surface deformation (surface faulting, tilting). Other potential seismic hazards (for example, avalanches, landslides, mudslides, soil settlement, and soil liquefaction) are not likely to occur at DOE’s Idaho site because the local geologic conditions are not conducive to them. Based on the seismic history and the geologic conditions, earthquakes greater than magnitude 5.5 (and associated strong ground shaking and surface fault rupture) are not likely to be generated within the Plain. However, moderate to strong ground shaking can affect DOE’s Idaho site from earthquakes in the Basin and Range. Patterns of seismicity and locations of mapped faults are used to assess potential sources of future earthquakes and to estimate levels of ground motion at the DOE’s Idaho site. The sources and maximum magnitudes of earthquakes that could produce the maximum levels of ground motions at all DOE’s Idaho site facilities include (WCC 1990, 1992):

- A moment magnitude 7.15 earthquake at the southern end of the Lemhi fault along the Howe and Fallert Springs segments

- A moment magnitude 7.25 earthquake at the southern end of the Lost River fault along the Arco segment

- A moment magnitude 5.5 earthquake associated with dike injection in either the Arco or Lava Ridge-Hell's Half Acre Volcanic Rift Zones and the Axial Volcanic Zone

- A "random" moment magnitude 5.5 earthquake occurring within the Eastern Snake River Plain
- A background earthquake with magnitude up to 6.75 in the northern Basin and Range Province

Results of this seismic hazard evaluation significant to the ISFSI include:

- The ISFSI is located within the ESRP, which is characterized by a very low rate of seismicity and small magnitude earthquakes. Thus, the background earthquakes within the ESRP contribute very little to the hazard at the ISFSI.
- There is very little contribution from the volcanic rift zones because the volcanic episodes have long recurrence intervals (>15000 yrs.) and any associated seismicity is characterized by small magnitude (< 5.5) earthquakes
- In general, the stochastic relationship results in lower motions at short periods than the empirical relationships because of the interbedded volcanic stratigraphy which has a lower velocity gradient in the upper 1 km than homogeneous rock and the alternating high and low velocities which tend to dampen out high frequency ground motions.
- At shorter return periods (<2000 yrs.) the hazard is dominated by the northern Basin and Range background seismicity due in part to the extremely low level of seismicity in the ESRP and the long recurrence intervals of the Basin and Range faults.
- The Basin and Range faults contribute more to the hazard at 10000 years because this return period approaches the average recurrence interval of the faults.

In addition to the above probabilistic evaluation, a deterministic analysis was also performed for the ISFSI site. This analysis was based in part on the results of a 1990 deterministic evaluation for DOE’s Idaho site (WCC 1990) and more recent fault-trenching studies conducted along the Lemhi and Lost River faults (WCC 1992, WCFS 1995). The Lemhi fault is the closest basin-and-range normal fault to the ISFSI site and controls the deterministic seismic hazard. The paleo seismic characteristics and geometry of this fault indicate that it has the potential for a moment-magnitude 7.1 earthquake at a distance of 22 km from the ISFSI site. The same attenuation relationships from the probabilistic study were used in the deterministic analysis and were weighted the same as in the probabilistic evaluation.

2.5.3. VOLCANIC HAZARDS

Volcanic hazards at DOE’s Idaho site can come from sources inside or outside the Plain's boundaries. Volcanic hazards include the effects of lava flows, ground deformation (fissures, uplift, subsidence), volcanic earthquakes (associated with magmatic processes as distinct from earthquakes associated with tectonics), and ash flows or airborne ash deposits (Bowman 1995). Most of the basalt volcanic activity occurred from 4 million to 2100 years ago in DOE’s Idaho site area. The most recent and closest volcanic eruption occurred 2100 years ago at the Craters of the Moon National Monument 15 miles (25 km) southwest of DOE’s Idaho site (Kuntz et al. 1992). The rhyolite domes along the Axial Volcanic Zone formed between 1.2 and 0.3 million years ago and have a recurrence interval of about 200000 years. Therefore, the probability of future dome formation affecting site facilities is very low.

Catastrophic Yellowstone eruptions have occurred three times in the past 2 million years, but DOE's Idaho site lies more than 70 miles (160 km) from the Yellowstone Caldera rim, and high-altitude winds would not disperse Yellowstone ash in the direction of the DOE's Idaho site.

2.6. REGIONAL HISTORIC, ARCHAEOLOGICAL SITES, HISTORIC STRUCTURES, CULTURAL, SCENIC, AND NATURAL FEATURES

This section discusses all cultural resources DOE's Idaho site, including prehistoric and historic archaeological sites, historic sites and structures, and traditional resources that are of cultural or religious importance to local Native Americans. Paleontological localities on the site are also discussed.

2.6.1. ARCHAEOLOGICAL SITES, HISTORIC STRUCTURES, AND CULTURAL RESOURCES

The *Idaho National Laboratory Management Plan for Cultural Resources, Final Draft* (DOE/ID-10997, Rev 6, February 2016) identifies cultural resources found at the DOE's Idaho site. This inventory includes fossil localities that provide important paleo ecological background for the region and the numerous prehistoric archaeological sites preserved in it. These latter sites, including campsites, lithic workshops, cairns, and hunting blinds, are also an important part of DOE's Idaho site inventory. These sites provide information about aboriginal hunting and gathering groups who inhabited the area for approximately 12000 years. Archaeological sites, pictographs, caves, and other features of DOE's Idaho site landscape are important to contemporary Native American groups for historical, religious, and traditional reasons. Historic sites document use of the area during the late 1800s and 1900s. These sites include the abandoned town of Powell/Pioneer; Goodale's Cutoff, a northern spur of the Oregon Trail; and many small homesteads, irrigation canals, sheep/cattle camps, and stage/wagon trails. Finally, important information on the development of nuclear science in America is preserved in the many scientific and technical facilities within DOE's Idaho site.

2.6.2. NATIVE AMERICAN CULTURAL RESOURCES

Because Native American people hold the land sacred, in their terms the entirety of DOE's Idaho site reserve is culturally important. Cultural resources, to the Shoshone-Bannock Tribes, include all forms of traditional lifeways and usage of all natural resources. This includes not only prehistoric archaeological sites, which are important in a religious or cultural heritage context, but also features of the natural landscape and air, plant, water, or animal resources that have special significance. These resources may be affected by changes in the visual environment (construction, ground disturbance, or introduction of a foreign element into the setting), dust particles, or by contamination. Geographically, the site is included within a large territory once inhabited by and still of importance to the Shoshone-Bannock. Plant resources used by the Shoshone-Bannock that are located on or near the site are listed in FIGURE 2-7. Areas significant to the Shoshone-Bannock would include the buttes, wetlands, sinks, grasslands, juniper woodlands, Birch Creek, and the Big Lost River. Five Federal laws prompt consultation between Federal agencies and Native American tribes: the National Environmental Policy Act (NEPA), the National Historic Preservation Act, as amended (NHPA), the American Indian Religious Freedom Act (AIRFA), the Archaeological Resources Protection Act (ARPA), and the Native American Graves Protection and Repatriation Act (NAGPRA). In accordance with these directives and in consideration of DOE's written Native American policy (DOE 1990b, 1992), DOE has committed to additional interaction and exchange of information with the Shoshone-Bannock Tribes of the nearby Fort Hall Indian Reservation and has developed procedures for consultation and coordination. This relationship is outlined in a formal Working

Agreement between the Shoshone-Bannock and DOE (DOE-ID 2012), the Idaho National Laboratory Cultural Resources Management Plan for DOE's Idaho site (DOE/ID-10997, Rev. 62016), and the Curation Agreement (1996) for permanent storage of archaeological materials. The Cultural Resources Management Plan defines procedures for involving the Shoshone-Bannock during the planning stages of project development. The Curation Agreement provides for the repatriation of burial goods in accordance with the Native American Graves Protection and Repatriation Act.

2.6.3. PALEONTOLOGICAL RESOURCES

There are 31 known fossil localities at the site, and available information suggests that the region has relatively abundant and varied Paleontological resources. Preliminary analyses suggest that these materials are most likely to be found in association with archaeological sites; in areas of basalt flows; in deposits of the Big Lost River, Little Lost River, and Birch Creek; in deposits of Lake Terreton and playas; in some wind and sand deposits; and in sedimentary interbeds or lava tubes within local lava flows (Miller 1992).

2.6.4. VISUAL AND SCENIC RESOURCES

2.6.4.1. *Visual Resources*

DOE's Idaho site is bordered on the north and west by the Bitterroot, Lemhi, and Lost River mountain ranges. Volcanic buttes near the southern boundary can be seen from most locations on the site and the Fort Hall Indian Reservation. Most of the DOE's Idaho sit consists of open, undeveloped land, predominantly covered by Big Sagebrush and grasslands (see Section 2.2, Ecology). Pasture and irrigated farmland border much of the site (see Section 2.1.3, Uses of Adjacent Lands and Waters).

Nine facility areas are located on DOE's Idaho site. Although the site has a master plan, no specific visual resource standards have been established. The generally low density facilities look like commercial/industrial complexes and are dispersed throughout the site. The structures range in height from 10 feet (3 m) to approximately 100 feet (30 m), with a few stacks and towers that reach up to 250 feet (76 m). Although many site facilities are visible from highways, most facilities are located over half a mile (0.8 km) from public roads. The facility closest to a public road, 0.4 mile (0.6 km) is the Water Reactor Research Test Facility about 60 feet in height (18 m), located off State Highway 33. This section of Highway 33 is used primarily by the DOE's Idaho site workforce at TAN.

About 90 miles (144 km) of paved public highway run through the DOE's Idaho site. U.S. Highway 20 runs east and west across the southern portion, and has one rest stop within the site boundaries next to the highway. This is the highway most heavily used by DOE's Idaho site workforce. It is a direct route from the Idaho Falls area to Boise, Idaho, and recreational areas such as Sun Valley and Craters of the Moon National Monument. The Experimental Breeder Reactor-I, just off Highway 20, is a National Historic Landmark. It has approximately 9000 visitors a season (Memorial Day to Labor Day). State Highways 22, 28, and 33 cross the northeastern part of the site.

The ISFSI is well within the boundaries and not visible from the public roads. It blends in with existing structures at the INTEC and therefore has no visual impact.

2.6.4.2. ***Scenic Areas***

The Craters of the Moon National Monument is located about 15 miles (24.1 km) southwest of DOE's Idaho site's western boundary. The seasonal visual range from Craters of the Moon is from 81 to 97 miles (130 to 156 km) (Notar 1993). The Monument is located in a designated Wilderness Area, for which Class I (very high) air quality standards, or minimal degradation, must be maintained, as defined by the Clean Air Act (CFR 1977, 1990). Under the Clean Air Act, air quality is defined to include visibility and scenic view considerations.

Lands adjacent to DOE's Idaho site, under Bureau of Land Management jurisdiction, are designated as Visual Resource Management Class II areas (BLM 1984, 1986). This designation urges preservation and retention of the existing character of the landscape. Lands within site boundaries are designated as Class III and IV, the most lenient classes in terms of modification. The Bureau of Land Management is considering the Black Canyon Wilderness Study Area, located adjacent to the Wilderness Area designation (BLM 1986), which, if approved, would result in an upgrade of its Visual Resource Management class from Class II to Class I.

Features of the natural landscape have special significance to the Shoshone-Bannock tribes. The visual environment of DOE's Idaho site is within the visual range of the Fort Hall Indian Reservation.

2.7. NOISE

Noise levels at DOE's Idaho site range from 10 decibels adjusted (dBA) for the rustling of grass to 115 dBA, the upper limit for unprotected hearing established by the Occupational Safety and Health Administration (OSHA), from industrial operations, construction activities, and vehicular traffic combined. In accordance with site procedures, workers on site use hearing protection. Workplace noise limits are established in accordance with OSHA standards (Ref. 2-22). OSHA requires site workers to wear hearing protection devices when exposed to noise levels above 85 dBA on an 8-hour time-weighted average.

There are no hearing protection requirements within the boundaries of the ISFSI.

2.8. FIGURES, TABLES, AND REFERENCES

2.8.1. FIGURES LIST

2.8.2. TABLES LIST

FIGURE 2-1: LOCATION OF THE INL, aka DOE's IDAHO SITE IN SOUTHEASTERN IDAHO

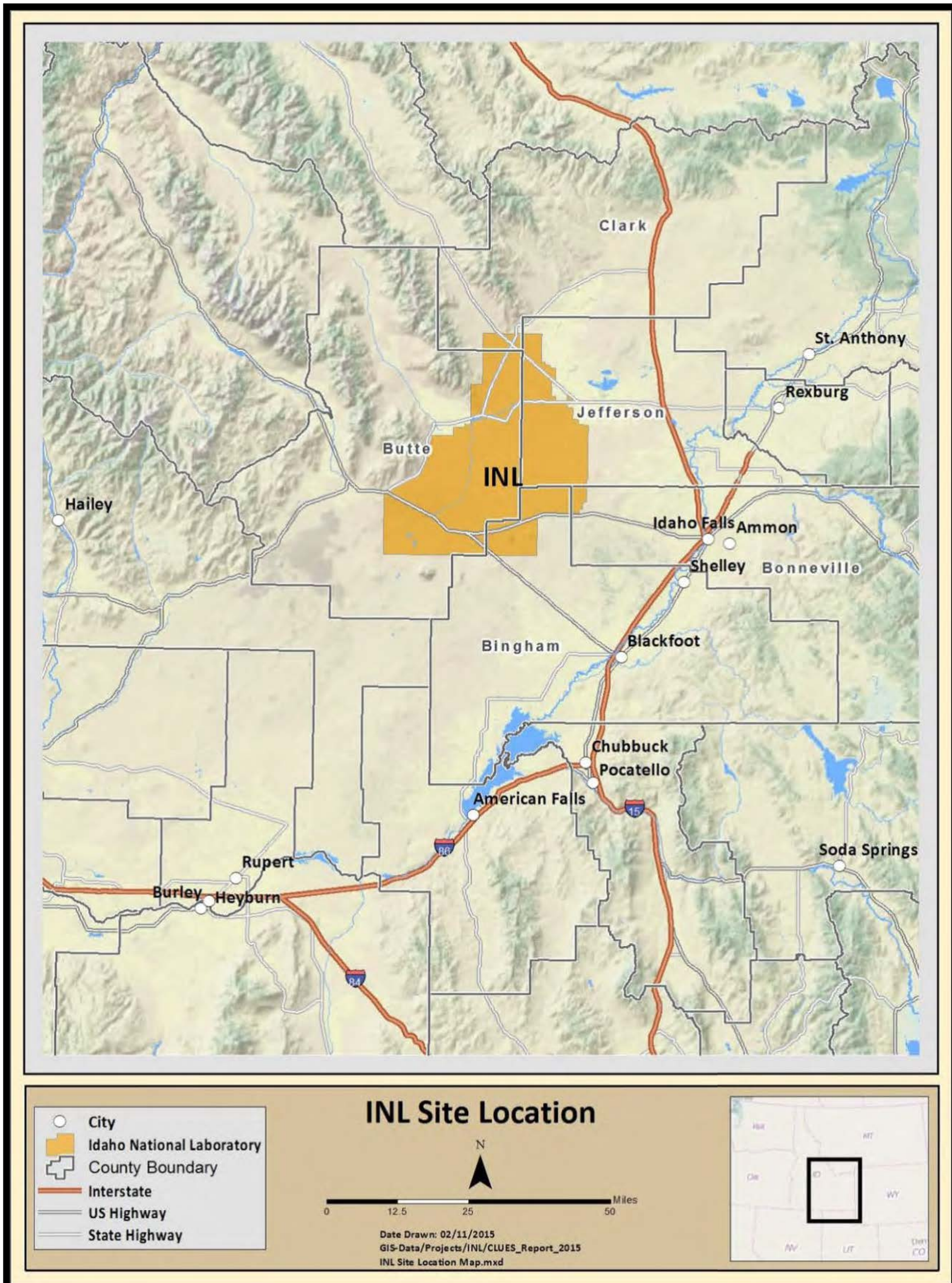


FIGURE 2-2: IDAHO NATIONAL LABORATORY'S PRIMARY FACILITY AREAS

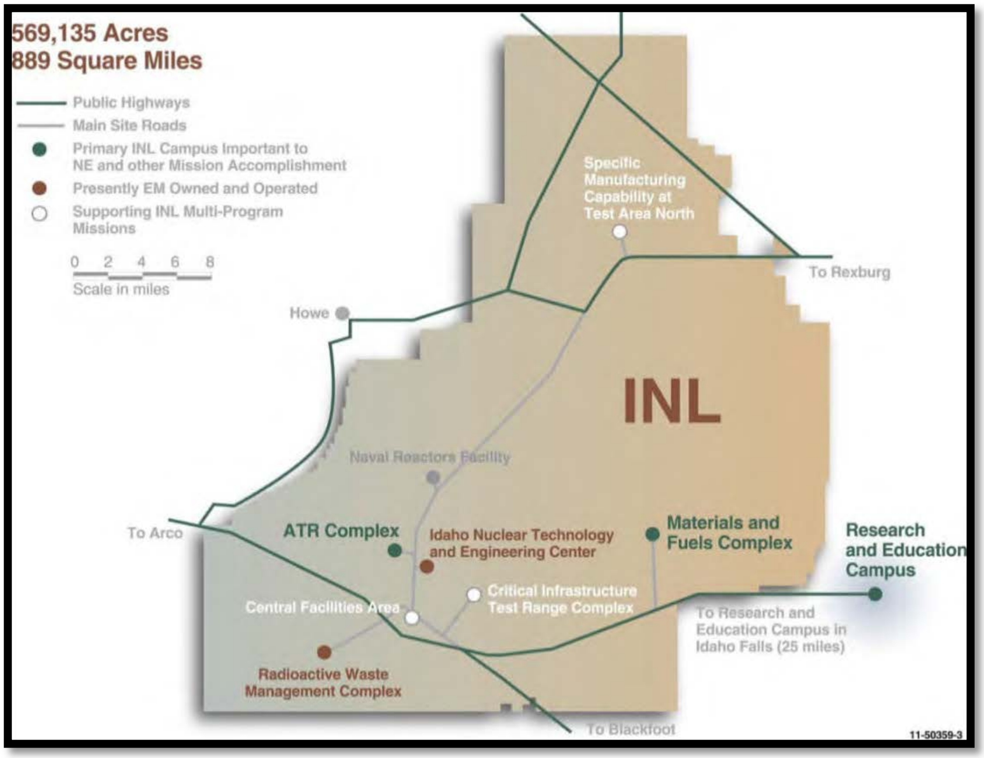


FIGURE 2-3: TMI-2 ISFSI WITHIN INTEC

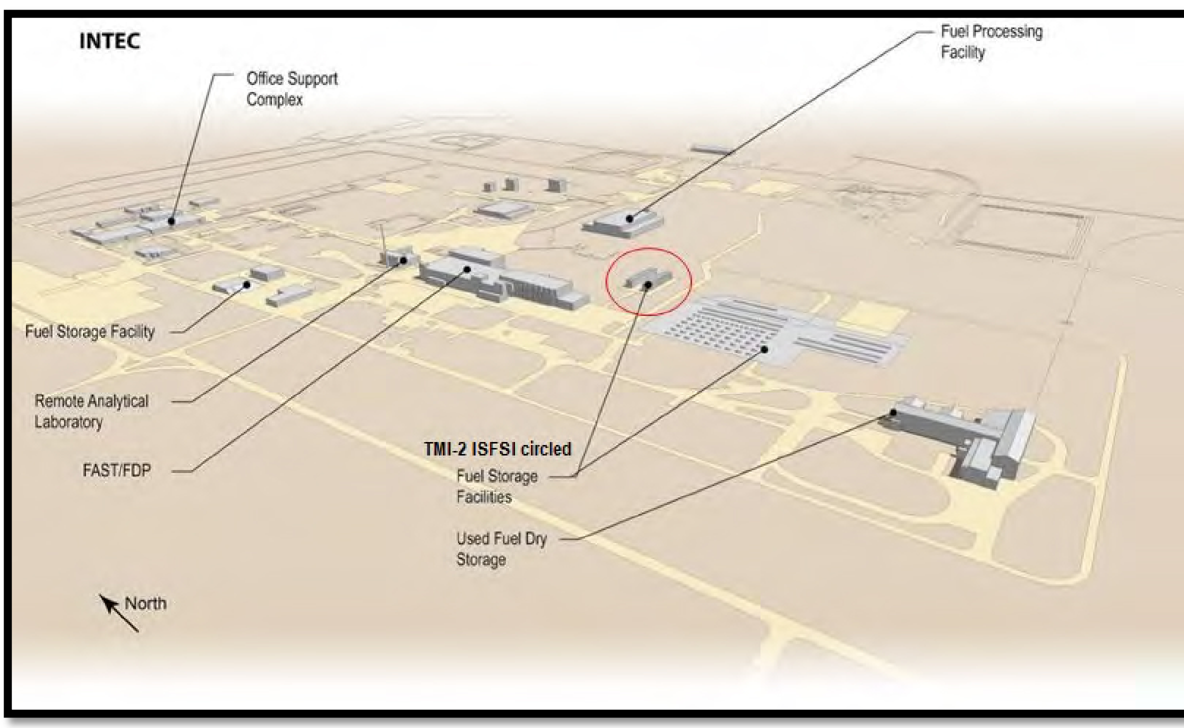


FIGURE 2-4: DISTANCE FROM THE INTEC TO THE SITE BOUNDARY

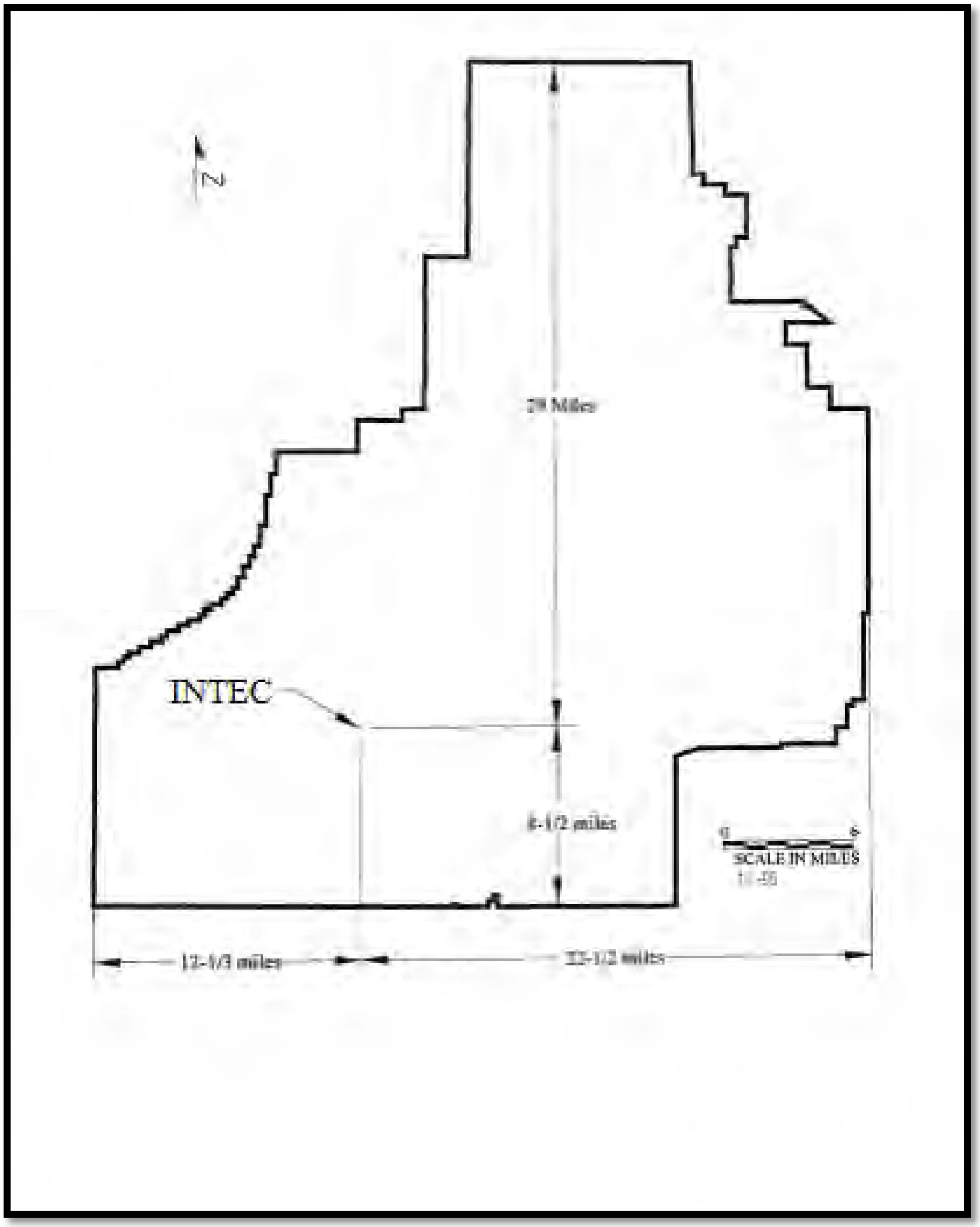


FIGURE 2-5: LAND USE SCENARIO

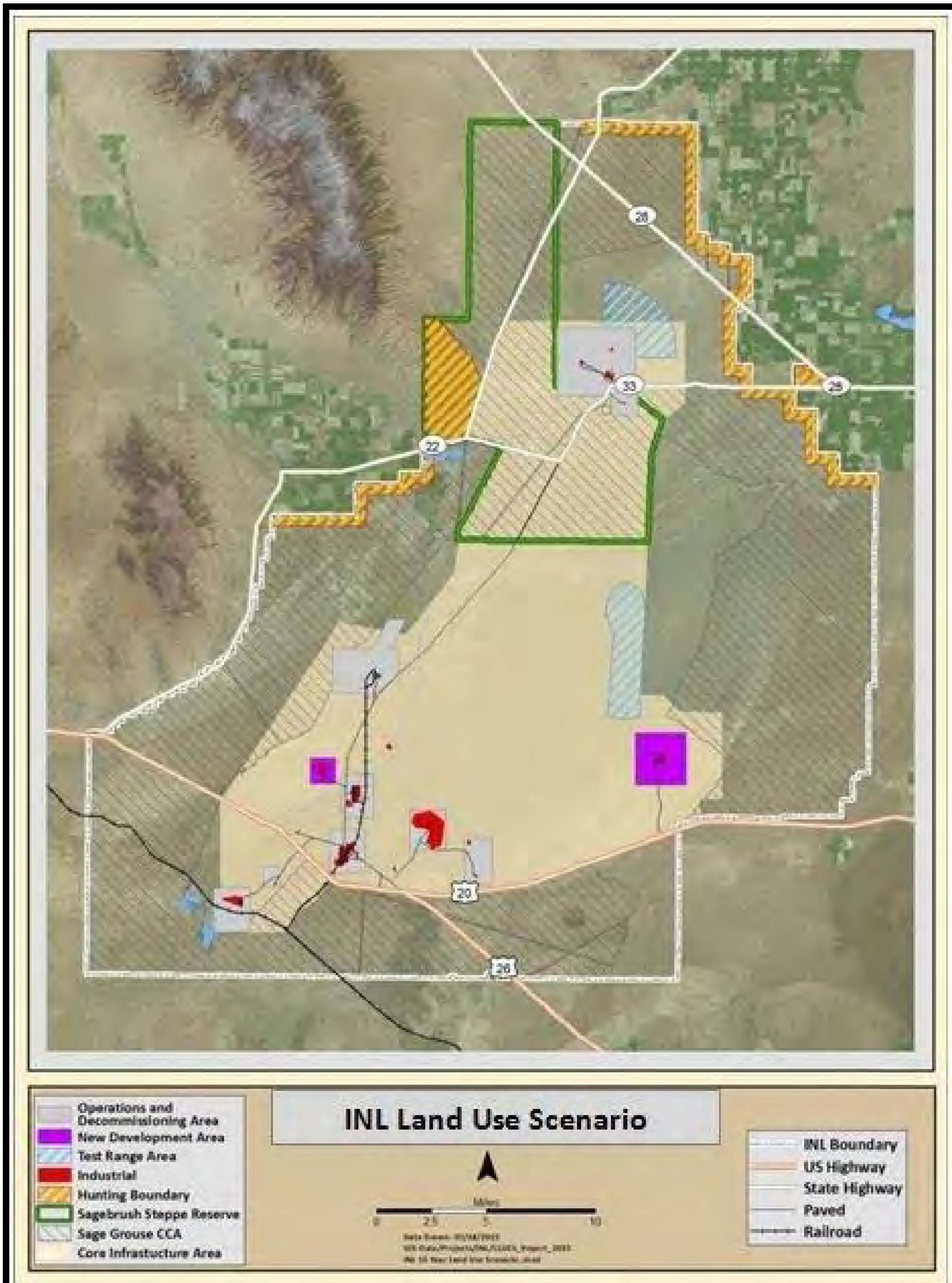


FIGURE 2-6: SITE VICINITY MAP

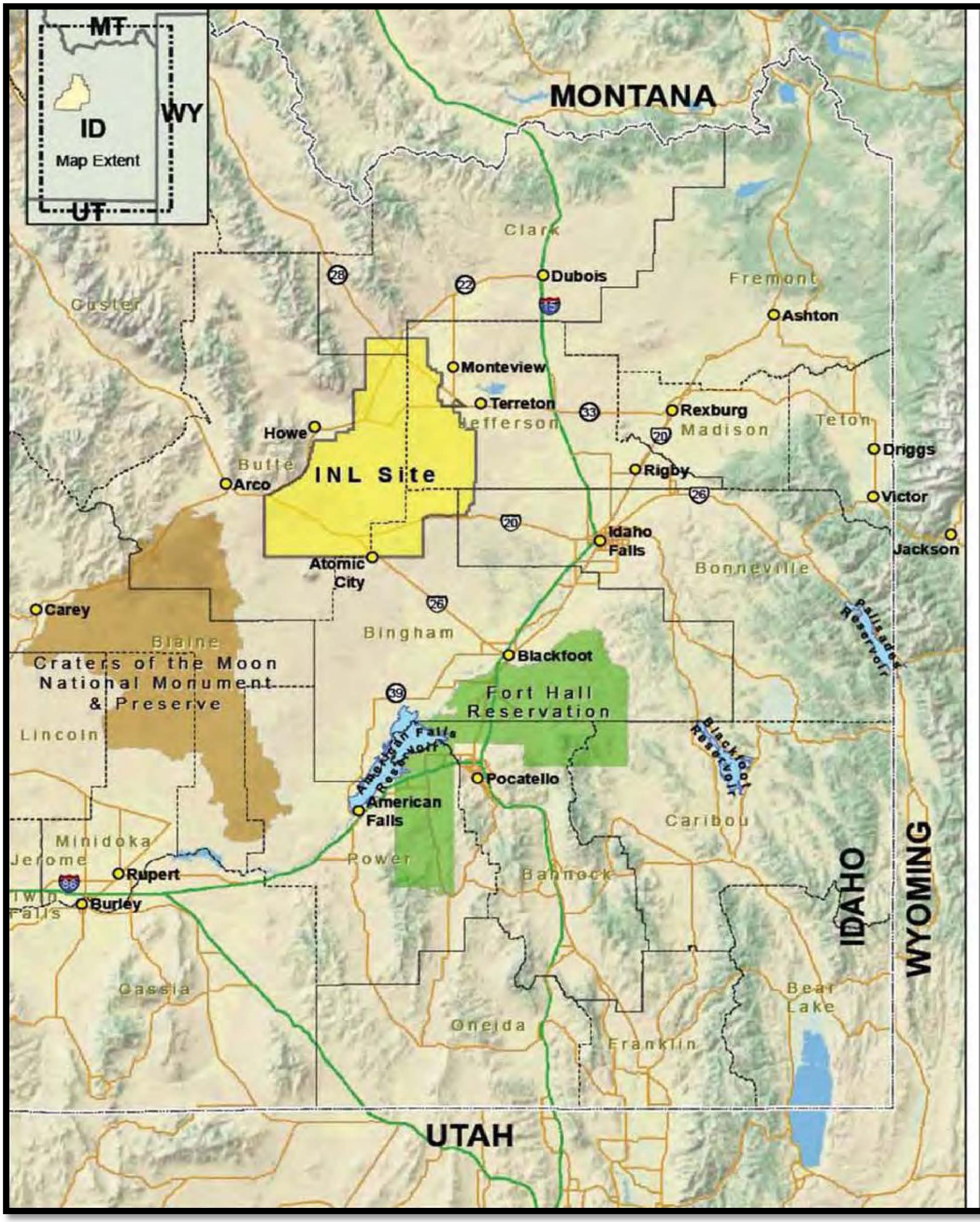


FIGURE 2-7: SURVEILLANCE AIR SAMPLING LOCATIONS

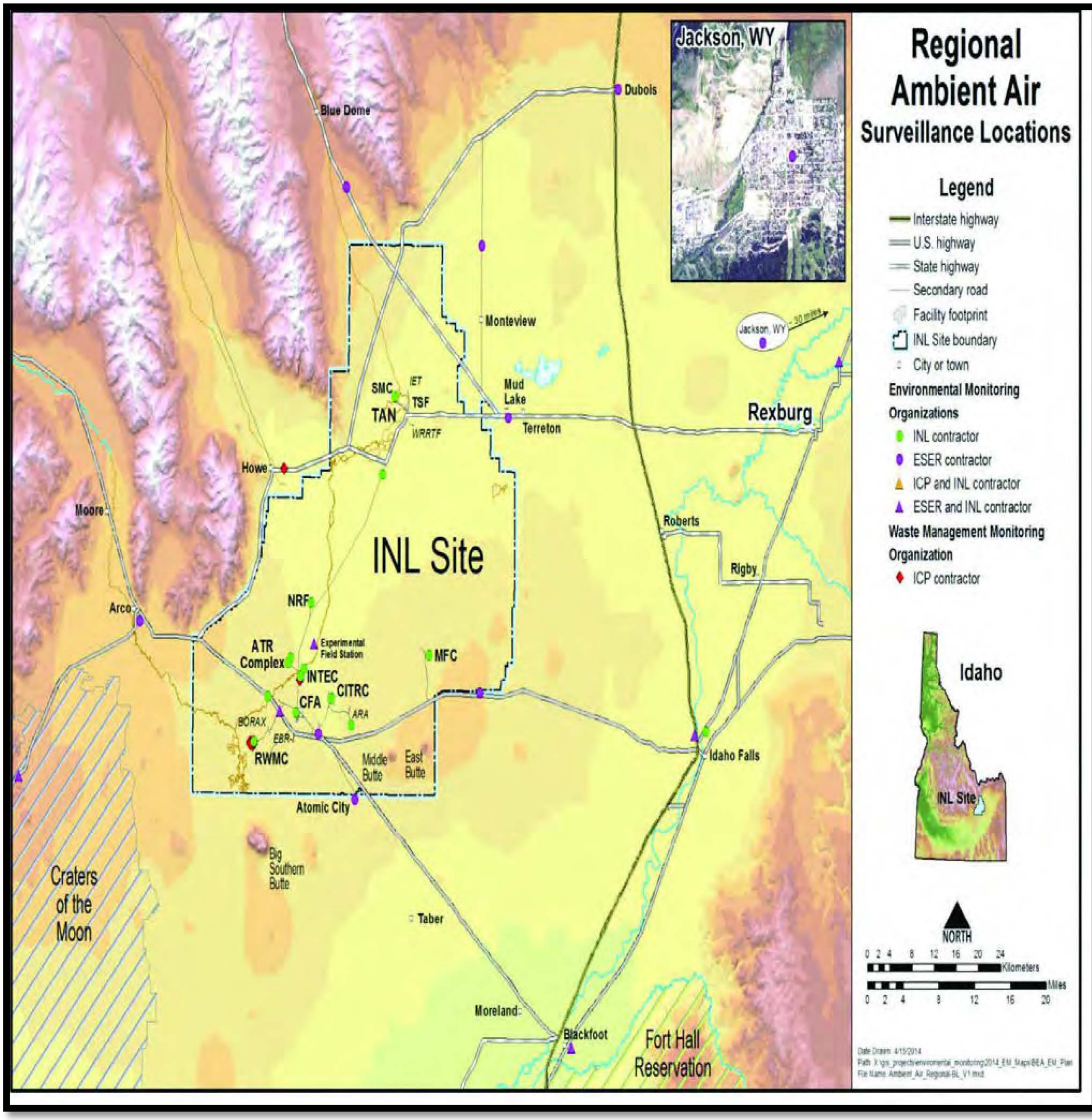


FIGURE 2-8: SURFACE WATER MONITORING LOCATIONS

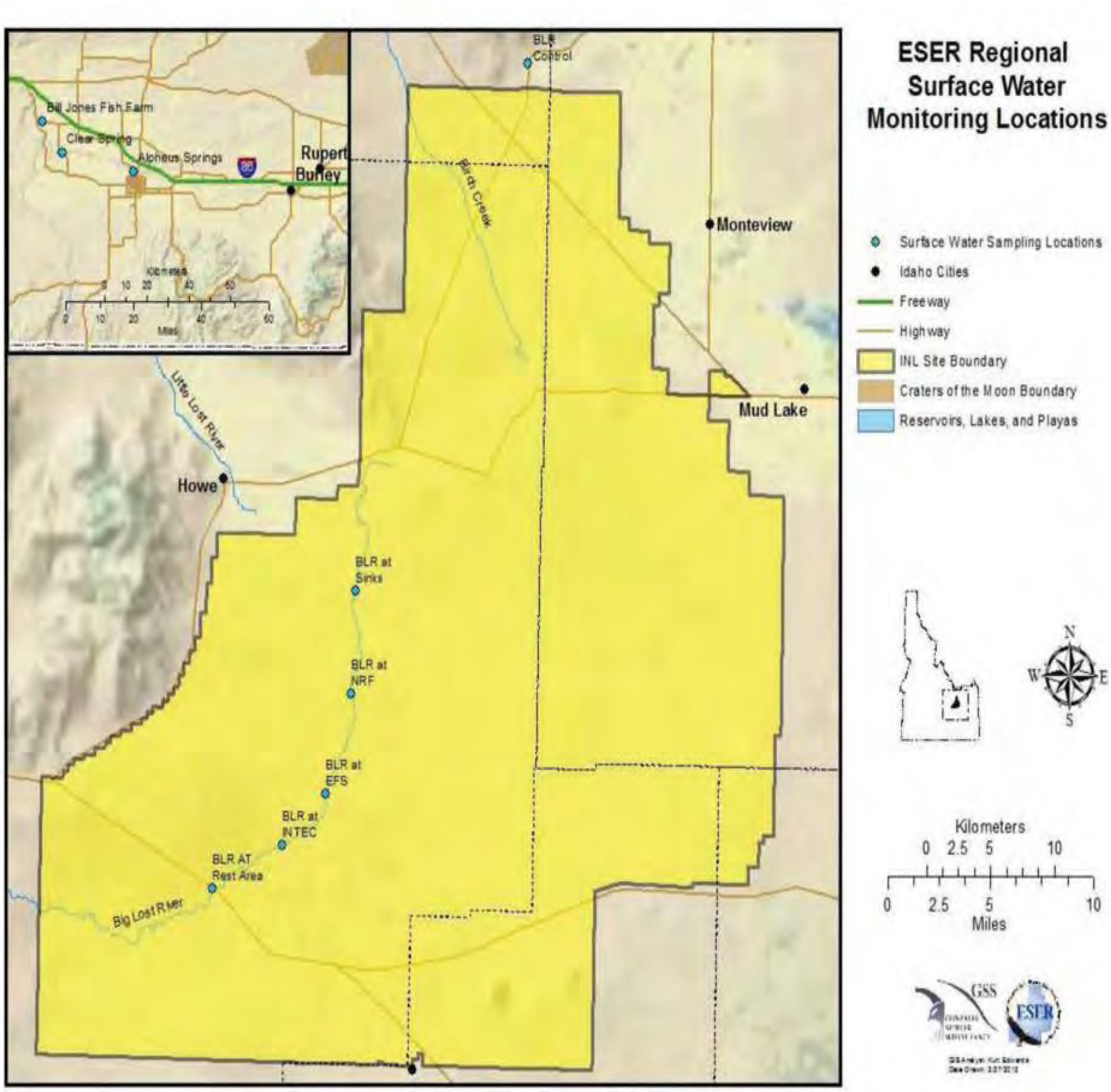


FIGURE 2-9: GEOGRAPHICAL FEATURES IN THE REGION OF THE SITE

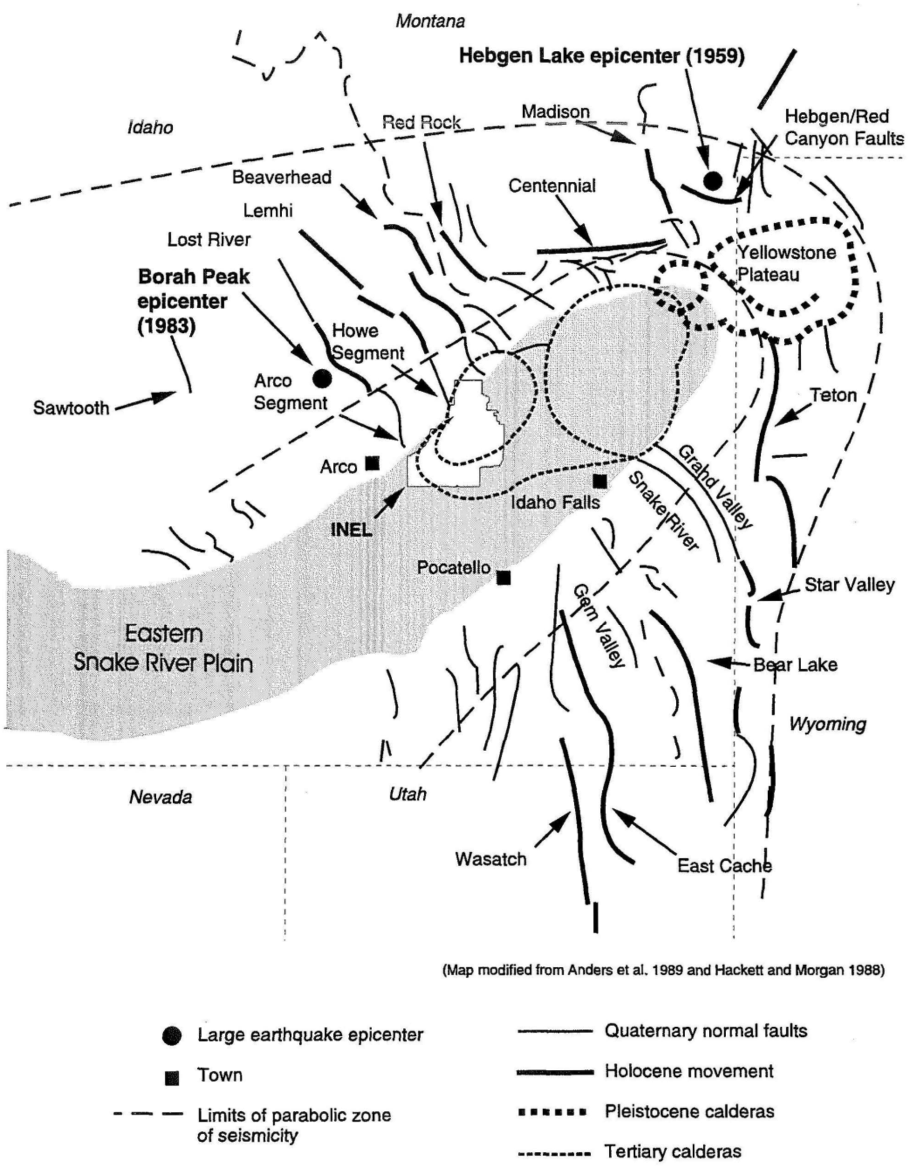


FIGURE 2-10: HISTORIC EARTHQUAKES IN THE REGION WITH MAGNITUDES GREATER THAN 2.54 (1884 TO 1989) (WCC 1992)

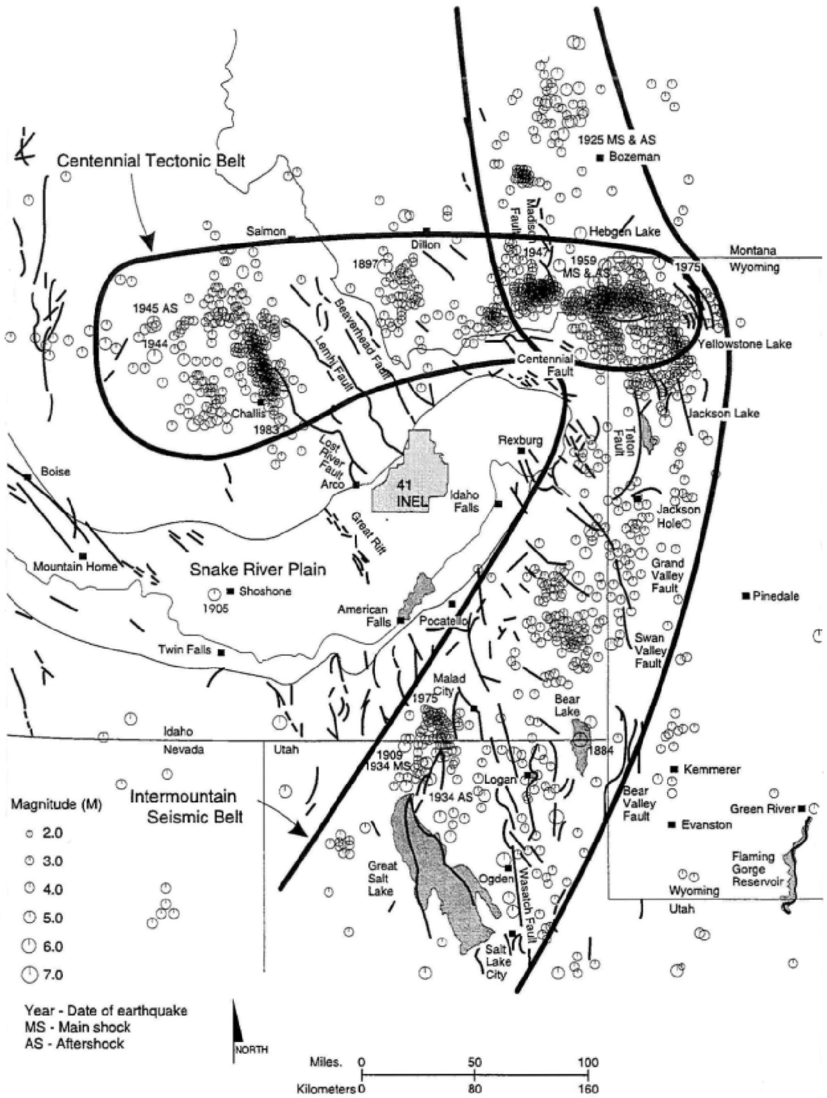


TABLE 2-1: POPULATION RECORDS FROM 1990, AND THE 2010 CENSUS (Census Bureau 2011)

CITY	YEAR 1990	YEAR 2010
ARCO	1,016	995
ATOMIC CITY	17	29
BLACKFOOT	9,646	11,899
HOWE	381	358
IDAHO FALLS	43,929	56,813
MACKAY	566	517
MUD LAKE	270	358
POCATELLO	46,080	54,255
RIGBY	2681	3,945
TOTAL	**104,586**	**129,169**

TABLE 2-2: WORKFORCE AT FACILITIES ON THE SITE

FACILITY	DOE's Idaho site WORKFORCE
CFA	854
ICPP	1,157
PBF	116
NRF	1,022
TAN	335
TRA	430
WMF (RWMC)	196
TOTAL	**4,110**

Note: Source LITCO Monthly Headcount Report – MARCH 1996

TABLE 2-3: THREATENED & ENDANGERED SPECIES, SPECIES OF SPECIAL CONCERN, AND SENSITIVE SPECIES THAT MAY BE FOUND ON THE SITE

(Idaho Fish and Game 2011)

	NAME	COMMON NAME	STATUS (see KEY)	COMMENTS
BIRDS	*Accipiter gentilis*	Northern Goshawk	C2, SSC, FS, BLM	The ferruginous hawk nests on and migrates through the INL. This species is found throughout the INL but is observed frequently in juniper woodlands. Peregrine falcons have been observed rarely in the winter and not observed at all during other seasons. The last sighting was 1993. It is not known to nest on the INL. The bald eagle is a winter resident and common in the far north end and the western edge of the INL near Howe. It is not known to nest, nor commonly observed near the INL. The white face ibis uses aquatic, riparian, nearby upland habitats, and some man-made ponds, but is an uncommon migrant at the INL. The long-billed curlew is known to nest in the north end of the INL. The northern goshawk is a casual migrant through the INL.
	Athene cunicularia	Burrowing Owl	C2, BLM	
	Buteo regalis	Ferruginous Hawk	C2, BLM	
	Buteo swainsoni	Swainson's Hawk	BLM	
	Casmerodius albus	Great Egret	SSC	
	Falco columbarius	Merlin	SSC, BLM	
	Falco peregrinus	Peregrine	E	
	Falco rusticolus	Gyrfalcon	BLM	
	Gavia immer	Common Loon	SSC, FS	
	Haliaeetus leucocephalus	Bald Eagle	E	
	Numenius americanus	Long-billed Curlew	SPS, BLM	
	Pelecanus erythrorhynchos	American White Pelican	SSC	
	Plegadis chihi	White-faced Ibis	C2	
MAMMALS	*Sorex merriami*	Merriam's shrew	SPS	The pygmy rabbit is common on the INL, but its distribution is patchy. Roosts and hibernation caves for Townsend's big-eared bat occur on the INL. About six caves are known to be used by the species. All are over 3 miles from facilities. No brood caves have been located on the site
	Brachylagus sylvilagus idahoensis	Pygmy rabbit	C2, BLM, SSC	
	Myotis californicus	California myotis	SSC	
	Myotis thysanodes	Fringed myotis	SSC	
	Pipistrellus hesperus	Western pipistrelle	SSC, BLM	
	Plecotus townsendii	Townsend's western big-eared bat	C2, SSC, FS, BLM	
	Myotis evotis	Long-eared myotis	C2	
	Myotis subulatus	Small-footed myotis	C2	
PLANTS	*Astragalus aquilonius*	Lemhi milkvetch	BLM, FS, INPS-S	The species identified as sensitive, rare, or unique are uncommon on the INL because they require unique microhabitat conditions. The plant species are distant from disturbed facilities.
	Astragalus ceramicus var. apus	Painted milkvetch	3C, INPS-M	
	Camissonia pterosperma	Wing-seed evening primrose	BLM, INPS-S	
	Coryphantha missouriensis	Nipple cactus	INPS-M	
	Cuscuta denticulata	Sepal-tooth dodder	INPS-1	
	Ipomopsis (gilia) polycladon	Spreading gilia	BLM, INPS-2	
	Lesquerella kingii var. cobrensis	King's bladderpod	INPS-M	
	Oxytheca dendroidea	Tree-like oxytheca	INPS-S	
INSECTS	*Acrolophitus pulchellus*	Idaho point-headed grasshopper	C2, BLM	Occurs just north of the INL

KEY

C2	Federal category 2 species	FS	U.S. Forest Service monitored
3c	No longer considered for Federal listing	INPS-S	Idaho Native Plant Society sensitive
E	Federal and State endangered species	INPS-M	Idaho Native Plant Society monitored
SSC	State species of special interest	INPS-1	Idaho Native Plant Society State Priority 1
SPS	State protected species	INPS-2	Idaho Native Plant Society State Priority 2
BLM	Bureau of Land Management monitored		

TABLE 2-4: TEMPERATURE AND SNOWFALL REPORTS

	Highest Daily Max (deg. F)	Lowest Daily Max (deg. F)	Highest Daily Average (deg. F)	Lowest Daily Average (deg. F)
January	55	-40	44	-20
February	60	-36	45	-23
March	73	-28	55	-6
April	86	6	63	22
May	96	13	76	30
June	100	22	83	39
July	105	28	83	49
August	102	24	83	46
September	96	12	74	30
October	89	-6	64	10
November	67	-24	57	-9
December	57	-47	47	-28
ANNUAL	**105**	**-47**	**83**	**-28**

Daily air temperature extremes summarized by month for CFA (a)
(a) Data period of record spans January 1950 through December 2014

	Average	Maximum	Minimum	Largest Daily Maximum
January	6.2	18.1	0.0	9.0
February	4.6	16.1	0.0	7.5
March	2.8	10.2	0.0	8.6
April	1.8	16.5	0.0	6.7
May	0.4	8.3	0.0	4.4
June	0.0	0.0	0.0	0.0
July	0.0	0.0	0.0	0.0
August	0.0	0.0	0.0	0.0
September	0.0	1.0	0.0	1.0
October	0.5	7.2	0.0	4.5
November	3.0	12.3	0.0	6.5
December	6.4	22.3	0.0	8.0
ANNUAL	**25.7**	**59.7**	**6.8**	**9.0**

Monthly & annual snow fall totals and monthly & daily extreme totals for CFA (a)
(a) Data period of record spans March 1950 through December 2014

TABLE 2-5: WIND SPEED MEANS AND EXTREMES FOR 10 METER TOWER LEVEL AT GRI

Gust Direction (16th)	Monthly Mean	Greatest Hourly Mean			Greatest Peak	
	Speed (MPH)	Speed (MPH)	Direction (deg.)	Direction (16th)	Speed (MPH)	(deg.)
January WSW	6.9	46.2	240	WSW	63.2	240
February WSW	8.0	38.5	244	WSW	70.4	255
March WSW	10.0	43.5	243	WSW	62.5	237
April WSW	10.8	42.5	235	SW	76.5	247
May W	11.1	41.3	242	WSW	71.4	270
June SW	11.0	44.4	*MISSING*		77.2	223
July SW	10.1	40.4	243	WSW	81.6	232
August WSW	9.6	37.9	230	SW	66.6	256
September WSW	9.0	43.0	243	WSW	65.4	240
October SW	8.9	42.5	230	SW	65.2	224
November SW	8.3	39.2	243	WSW	58.4	226
December WSW	7.5	39.8	244	WSW	57.3	238
ANNUAL SW	9.4	46	240	WSW	81.6	232
a. Data period of record spans January 1994 through December 2014						

TABLE 2-6: PRODUCTION WELLS ON THE SITE

Well Name (1)	Depth of Well (ft. lbs.) (2)	Depth of Water (ft. lbs.) (2)	Annual Volume (gal)
ANP-01	360	208	2.561E+06
ANP-02	340	211	1.433E+06
ANP-08	309	218	3.908E+05
BADGING FACILITY WELL	644	489	5.76E+04
CFA-1	639	468	1.473E+07
CFA-2	681	471	1.448E+05
CPP-01	586	460	1.834E+08(3)
CPP-02	605	460	1.834E+08(3)
CPP-04	700	462	1.834E+08(3)
CPP-05	695	447	1.834E+08(3)
EBR-1	1075	596	4.491E+04
EBR II-1	745	632	2.767E+06(4)
EBR II-2	753	630	2.767E+06(4)
FET-1	330	199	1.427E+06
FET-2	455	200	5.067E+05
FIRE STATION WELL	516	420	1.057E+04
NRF-1	535	363	2.549E+06
NRF-2	529	362	9.368E+06
NRF-3	546	363	9.802E+04
NRF-4	597	363	1.649E+07
RIFLE RANGE WELL	620	508	9.115E+04
RWMC PRODUCTION	685	568	4.824E+05
SPERT-1	653	456	3.871E+05
SPERT-2	1217	463	3.450E+05
TRA-01	600	453	3.595E+07
TRA-03	602	456	2.074E+06
TRA-04	965	463	9.006E+07

(1) All wells withdraw water from the main body of the Snake River Plain Aquifer and are used as drinking water wells, with the exception of wells ANP-08, Fire Station Well, and NRF-4, which are production wells for facility operations.
(2) Feet below land surface
(3) Annual volume data is the total of wells CPP-1, CPP-2, CPP-4 and CPP-5.
(4) Annual volume data is the total for wells ERB II-1 and ERB II-2

TABLE 2-7: PLANTS USED BY THE SHOSHONE-BANNOK; LOCATED ON OR NEAR THE SITE

Plant Family	Type of Use							Location on INL Site	Abundance					
	Dye	Food	Fuel	Medicine	Rituals	Smoking	Tools		Abundant	Common	Common On Butte	Common Where Found	Scattered	Uncommon
Desert Parsley		☑		☑				Scattered		☑				
Milkweed		☑					☑	Roadsides					☑	☑
Sagebrush				☑			☑	Throughout	☑	☑				
Balsamroot		☑		☑				Around buttes		☑			☑	
Thistle		☑						Scattered		☑			☑	
Gumweed				☑				Disturbed Areas		☑				
Sunflower		☑		☑				Roadside		☑				
Dandelion		☑		☑				Throughout		☑				
Beggar's ticks		☑						Disturbed Areas	☑	☑				
Tansy mustard		☑		☑				Disturbed Areas	☑	☑				
Cactus		☑						Throughout	☑	☑				
Honeysuckle		☑					☑	Big Southern Butte			☑			
Goosefoot		☑						Throughout	☑	☑				
Russian thistle		☑						Disturbed Areas	☑	☑				
Dogwood		☑		☑			☑	Webb Springs, Birch Creek				☑		
Juniper		☑		☑			☑	Throughout	☑	☑				
Gooseberry		☑						Scattered	☑					
Wild mint				☑				Big Lost River						☑
Wild onion	☑	☑		☑				Throughout		☑				
Lilly		☑						Buttes		☑				
Fireweed		☑						Throughout		☑				
Pine		☑		☑			☑	Big Southern Butte			☑			
Douglas fir				☑				Big Southern Butte			☑			
Plantain		☑		☑				Throughout						☑
Wild rye		☑					☑	Throughout	☑	☑				
Indian rice grass		☑						Throughout	☑	☑				
Bluegrass		☑		☑				Throughout	☑	☑				
Serviceberry		☑		☑			☑	Buttes				☑		
Chokecherry		☑	☑	☑			☑	Buttes				☑		
Wood's rose		☑				☑		Big Lost River, Big Southern Butte	☑	☑				
Red raspberry		☑		☑				Big Southern Butte						☑
Willow				☑				Throughout in moist areas		☑				
Coyote tobacco				☑		☑		Big Lost River, Webb Springs						☑
Cattail		☑					☑	Sinks, outflow from facilities						☑

2.8.3. REFERENCES

2-1 Anders, M. H. and N. H. Sleep, 1992, Magmatism and Extension: The Thermal and Mechanical Effects of the Yellowstone Hotspot, Journal of Geophysical Research, 97, B ll, pp. 15379-15393.

2-2 Anders, M. H., J. W. Geissman, L. A. Piety, J. T. Sullivan, 1989, Parabolic Distribution of Circumeastern Snake River Plain Seismicity and Latest Quaternary Faulting: Migratory Pattern and Association with the Yellowstone Hotspot, Journal of Geophysical Research, 94, B2, pp . 1589-1621.

2-3 Anderson, J. E., 1991, Final Report: Vegetation Studies to Support the NPR Environmental Impact Statement, Subcontract No. C34- 110421, Task Order No. 72, EG&G Idaho, Inc., Idaho Falls, Idaho.

2-4 Anderson, J. E., K. Rupple, J. M. Glennon, K. E. Holte, R. C. Rope, 1995, Vegetation, Flora, and Ethnoecology of the Idaho National Engineering Laboratory (in press), ESRF-005, Environmental Science and Research Foundation, Idaho Falls, Idaho.

2-5 Arthur, W. J., J. W. Connelly, D. K. Halford, T. D. Reynolds, 1984, Vertebrates of the Idaho National Engineering Laboratory, DOE/ID- 12099, U.S. Department of Energy, Idaho Falls, Idaho.

2-6 Arthur, W. J., 0. D. Markham, C. R. Groves, B. L. Keller, D. K. Halford, 1986, Radiation Dose to Small Mammals Inhabiting a Solid Radioactive Waste Disposal Area, Journal of Applied Ecology, 23, pp. 13-26.

2-7 Barraclough, J. T., B. D. Lewis, R. G. Jensen, 1981, Hydrologic Conditions at the Idaho National Engineering Laboratory, Idaho-Emphasis: 1974-1978, U.S. Geological Survey, Water Resources Investigations, Open-File Report 81-526, ID0-22060, U.S. Department of Energy, Idaho Falls, Idaho.

2-8 Bennett, C. M., 1990, Streamflow Losses and Ground-Water Level Changes Along the Big Lost River at the Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey Water-Resources Investigations Report 90-4067, DOE/ID-22091, U.S. Department of Energy, Idaho Falls, Idaho, 49 p.

2-9 Bishop, C. W., 1991, Hydraulic Properties of Vesicular Basalt, Master’s Thesis, University of Arizona, Tucson, Arizona.

2-10 Bishop, C. W., 1993, Water Resources, in Irving, J. S., 1993, Environmental Resource Document /or the Idaho National Engineering Laboratory, Volume 1, EGG-WM0- 10279, EG&G Idaho, Inc., Idaho Falls, Idaho, July.

2-11 Bowman, A. L., 1995, INEL Seismic and Volcanic Hazards Maps, Engineering Design File SNF-EIS-0001-95, Revision 2, Lockheed Idaho Technologies Company, Idaho Falls, Idaho, February 14.

2-12 BLM (Bureau of Land Management), 1984, Medicine Lodge Resource Management Plan Environmental Impact Statement, U.S. Department of Interior, Bureau of Land Management, Idaho Falls District, Idaho Falls, Idaho.

2-13 BLM (Bureau of Land Management), 1986, Final Environmental Impact Statement Eastern Idaho Wilderness Study, U.S. Department of Interior, Bureau of Land Management, Idaho Falls District, Idaho Falls, Idaho.

2-14 Braun, J., 1993, EG&G Idaho, Inc. Idaho Falls, Idaho, personal communication to M. Fikel, Science Applications International Corporation, Boise, Idaho, September 8.

2-15 Braun, J. B., S. J. Miller, and B. L. Ringe, 1993, Historically Significant Scientific and Technical Facilities at the , EGG-CS-10699, EG&G Idaho, Inc., Idaho Falls, Idaho.

2-16 Brott, C. A., D. D. Blackwell, J. P. Ziagos, 1981, Thermal and Tectonic Implications of Heat Flow in the Eastern Snake River Plain, Idaho, Journal of Geophysical Research, 86, B12, pp. 11709- 11734.

2-17 Case, J., W. House, P. Austin, 1990, Idaho National Engineering Laboratory Groundwater Protection Management Plan, DOE/ID-10274, U.S. Department of Energy, Idaho Falls, Idaho, May.

2-18 Cecil, D. L., T. M. Beasley, J. R. Pittman, R. L. Michel, P. W. Kubik, P. Sharma, U. Fehn, H. E. Gove, 1992, Water Infiltration Rates in the Unsaturated Zone at the Idaho National Engineering Laboratory Estimated from Chlorine-36 and Tritium Profiles, and Neutron Logging, Proceedings of the 7th International Symposium on Water-Rock Interaction, Park City, Utah, 13-18 July 1992.

2-19 CFR (Code of Federal Regulations), 1977, 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards, Office of the Federal Register, Washington, D.C., August.

2-20 CFR (Code of Federal Regulations), 1990, 40 CFR 51, Requirements for Preparation, Adoption, and Submittal of Implementation Plans, Office of the Federal Register, Washington, D.C., November.

2-21 CFR (Code of Federal Regulations), 1992, 29 CFR 1910.95, Occupational Noise Exposure, Office of the Federal Register, Washington, D.C.

2-22 CFR (Code of Federal Regulations), 1993, 40 CFR 100-149, "Title 40: Protection of Environment," Office of the Federal Register, July. Clawson, K. L., G. E. Start, M. R. Ricks, 1989, Climatography of the Idaho National Engineering Laboratory, 2nd Edition, DOE/ID-12118, U.S. Department of Commerce, National and Atmospheric Administration, Environmental Research Laboratories, Air Resources Laboratory, Field Research Division, Idaho Falls, Idaho, December.

2-23 Clark, W. H. & P.E. Blom, 1988 “Observations on the relationship between ants (Hymenoptera Formicidae: Myrmicinae, Dorylinae) and Arceoschizus (colepterra: Tenebrionidae), “Journal of the Idaho Academy of Science, pp. 34-37.

2-24 Clark, W. H. & P.E. Blom, 1992, “notes on Spider (Theridiidae, Salticidae) Predation of the Harvester Ants, Pogonomyamex salinus olsen (Hephymenopterra Formicidae Myrmicinae), and a Possible Parasiteoid Fly (Chloropidae), “Great Basin Naturalist, 52 (4): pp 385-386

2-25 Craig, T. H., D. K. Halford, 0. D. Markham, 1979, Radionuclide Concentrations in Nestling Raptors near Nuclear Facilities, Wilson Bulletin, 91, 1, pp. 71-77.

2-26 Dames & Moore, 1992, Revised Draft Flood Evaluation Study, Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho Falls, Idaho, July.

2-27 DOE 1990a, General Environmental Protection Program, DOE Order 5400.1, U.S. Department of Energy, Washington, D.C., and Jan. 7.

2-28 DOE 1990b, Memorandum EH-231, "Management of Cultural Resources at Department of Energy Facilities," Feb. 23.

2-29 DOE 1992, Working Agreement, Policy on Native American Consultation, Sept. 29.

2-30 DOE 1993, Radiation Protection of the Public and the Environment, DOE Order 5400.5, Change 2, U.S. Department of Energy, Washington, D.C., January 7.

2-31 DOE 1995, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, April

2-32 DOE 1996, The ISFSI Safety Analysis Report for the TMI-2 Independent Spent Fuel Storage Installation, October

2-33 DOE-ID 1991, INEL Nonradiological Waste Management Information System (NWIMS), DOE/ID-10057 (1991), U.S. Department of Energy, Idaho Falls, Idaho.

2-34 DOE-ID 1992, "Working Agreement Between the Shoshone-Bannock Tribes of the Fort Hall Indian Reservation and the Idaho Field Office of the United States Department of Energy Concerning Environment, Safety, Health, Cultural Resources and Economic Self-Sufficiency," U.S. Department of Energy, Idaho Falls, Idaho, September 29.

2-35 DOE-ID 1993a, Idaho National Engineering Laboratory Storm Water Pollution Prevention Plan for Construction Activities- Generic Plan, DOE/ID-10425, U.S. Department of Energy, Idaho Falls, Idaho, September.

2-36 DOE-ID 1993b, Memorandum of Agreement among the U.S. DOE-Idaho Field Office, the Idaho State Historic Preservation Office, and the Advisory Council on Historic Preservation, (for Test Area North 629 Hangar).

2-37 DOE-ID 1993c, Memorandum of Agreement among the U.S. DOE-Idaho Field Office, the Idaho State Historic Preservation Office, and the Advisory Council on Historic Preservation, (for Auxiliary Reactor Areas I, II, and III). Driscoll, F. G., 1986, Groundwater and Wells, Second Edition, St. Paul, Minnesota: Johnson Filtration Systems, Inc., p. 61.

2-38 DOE-ID 1993d, Idaho National Engineering Laboratory Long-Term Land Use Future Scenarios, DOE/ID-10440, Revision 1, U. S. Department of Energy, Idaho Falls, ID, June.

2-39 DOE-ID-10739 (2015), Annual Radiological Environmental Monitoring Program Report for the Three Mile Island, Unit 2 Independent Spent Fuel Storage Installation.

2-40 DOE-ID-10997, Rev 6 (2016) The Idaho National Laboratory Cultural Resource Management Plan for the INL.

2-41 DOE-ID (2012), ,Working Agreement between Shone-Bannock and DOE

2-42 DOE-ID (2016) Idaho National Laboratory Comprehensive Land Use and Environmental Stewardship Report, DOE-ID INL/EXT-05-00726 Revision 3.

2-43 Driscoll, F. G., 1986, Groundwater and Wells, Second Edition, St. Paul, Minnesota: Johnson Filtration Systems, Inc., p. 61.

2-44 Edwards, D. D., R. C. Bartholomay, C. M. Bennett, 1990, Nutrients, Pesticides, Surfactants, and Trace Metals in Groundwater from the Howe and Mud Areas Upgradient from the Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey Open File Report 90-565, DOE/ID-22093, U.S. Department of Energy, Idaho Falls, Idaho.

2-45 EG&G Idaho (EG&G Idaho, Inc.), 1984, INEL Environmental Characterization Report, EGG-NPR-6688, EG&G Idaho, Inc., Idaho Falls, Idaho.

2-46 EPA (U. S. Environmental Protection Agency), 1993, Drinking Water Regulations and Health Advisories, December.

2-47 Evenson, L. M., 1981, Systemic Effects of Radiation Exposure on Rodents Inhabiting Liquid and Solid Radioactive Waste Disposal Areas, Master's thesis, Colorado State University, Fort Collins, Colorado.

2-48 Federal Register, Volume 80, no. 191 page 59858, 2015.

2-49 Garabedian, S. P., 1986, Application of a Parameter Estimation Technique to Modeling the Regional Aquifer Underlying the Eastern Snake River Plain, Idaho, U.S. Geological Survey Water-Supply Paper 2278, 60 p.

2-50 Garabedian, S. P., 1992, Hydrology and Digital Simulation of the Regional Aquifer System, Eastern Snake River Plain, Idaho, Professional Paper 1408-F, U.S. Geological Survey, Idaho Falls, Idaho.

2-51 Gilbert, H. K. and B. L. Ringe, 1993, Inventory of Known Historical Cultural Resources on the JNEL and Preliminary Analysis of Historic Sensitivity, EGG-CS-10707, EG&G Idaho, Inc., Idaho Falls, Idaho.

2-52 Golder Associates, 1994, Assessment of Trends in Groundwater Quality at the Idaho National Engineering Laboratory, Report No. 933-1151, Golder Associates, Idaho Falls, Idaho, October 29.

2-53 Hackett, W. R. and R. P. Smith, 1992, Quaternary Volcanism, Tectonics, and Sedimentation in the Idaho National Engineering Laboratory Area, in Wilson, J. R. (editor), Field Guide to Geologic Excursions in Utah and Adjacent Areas of Nevada, Idaho, and Wyoming, Miscellaneous Publication 92-3, Geological Society of America, Rocky Mountain Section, Ogden, Utah, pp. 1-18.

2-54 Halford, D. K. and O. D. Markham, 1984, Iodine-129 in Waterfowl Muscle from a Radioactive Leaching Pond Complex in Southern Idaho, Health Physics, 46, 6, pp. 1259-1263.

2-55 Hampton, N. L., R. C. Rope, J. M. Glennon, K. S. Moor, 1995, A Preliminary Survey of National Wetland Inventory as Mapped for the Idaho National Engineering Laboratory, INEL-95/0101, Lockheed Idaho Technologies Company, Idaho Falls, Idaho, March.

2-56 Hoff, D. L., R. G. Mitchell, G. C. Bowman, R. Moore, 1990, The Idaho National Engineering Laboratory Site Environmental Report for Calendar Year 1989, DOE/ID- 12082(89), Environmental Sciences Branch, Radiological and Environmental Sciences Laboratory, U.S. Department of Energy, Idaho Falls, Idaho.

2-57 IAEA (International Atomic Energy Agency), 1992, Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards, Technical Report Series No. 332, Vienna, Austria.

2-58 Idaho Department of Fish and Game, Idaho Conservation Data Center, 2011, http://www.fishandgame.idaho.gov/cdc.

2-59 IDAPA 58.01.16, 2012, "Wastewater Rules," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality.

2-60 IDAPA 58.01.17, 2012, "Recycled Water Rule," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality.

2-61 Irving, J. S., 1993, Environmental Resource Document for the Idaho National Engineering Laboratory, Volumes 1 and 2, EGG-WM0-10279, EG&G Idaho, Inc., Idaho Falls, Idaho, July.

2-62 Jackson, S. M., 1985, Acceleration Data from the 1983 Borah Peak, Idaho, Earthquake Recorded at the Idaho National Engineering Laboratory, in Proceedings of Workshop XXVIII On the Borah Peak, Idaho, Earthquake, R. S. Stein and R. C. Bucknam (eds.), Open-File Report 85-290, U. S. Geological Survey, Idaho Falls, Idaho, pp. 385-400.

2-63 Jackson, S. M., I. G. Wong, G. S. Carpenter, D. M. Anderson, S. M. Martin, 1993, Contemporary Seismicity in the Eastern Snake River Plain, Idaho, Based on Microearthquake Monitoring, Bulletin of the Seismological Society of America, 83, 3, pp. 680-695.

2-64 Kaminsky, J. F., 1991, In Situ Characterization of Unsaturated Hydraulic Properties of Surficial Sediments Adjacent to the Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho, Master's Thesis, ISU-91-000, Idaho State University, Pocatello, Idaho.

2-65 King, J. J., T. E. Doyle, S. M. Jackson, 1987, Seismicity of the Eastern Snake River Plain Region, Idaho, Prior to the Borah Peak, Idaho Earthquake: October 1972 - October 1983, Bulletin of the Seismological Society of America, 77, 3, pp. 809-818.

2-66 Koslow, K. N. and D. H. Van Haaften, 1986, Flood Routing Analysis for a Failure of Mackay Dam, EGG-EP-7184, EG&G Idaho, Inc., Idaho Falls, Idaho, 78 p.

2-67 Kramber, W. L., R. C. Rope, J. Anderson, J. Glennon, A. Morse, 1992, Producing a Vegetation Map of the Idaho National Engineering Laboratory Using Landsat Thematic Mapper Data, in Proceedings of ASPRS 1992 Annual Meeting, Albuquerque, New Mexico, March, 1992.

2-68 Kuntz, M. A., B. Skipp, M. A. Lanphere, W. E. Scott, K. L. Pierce, G. B. Dalrymple, L. Morgan, D. E. Champion, G. F. Embree, R. P. Smith, W. R. Hackett, D. W. Rodgers, compiled by W. R. Page, 1990, Revised Geologic Map of the INEL site and Adjoining Areas, Eastern Idaho, Open- File Report 90-333, U.S. Geological Survey, Idaho Falls, Idaho.

2-69 Kuntz, M. A., H. R. Covington, L. J. Schorr, 1992, An Overview of Basaltic Volcanism of the Eastern Snake River Plain, Idaho, in Regional Geology of Eastern Idaho and Western Wyoming, P. K. Link, M. A. Kuntz, L. B. Platt (eds.), Memoir 179, Geological Society of America, Denver, Colorado, pp. 227-267.

2-70 Leenheer, J. A. and J. C. Bagby, 1982, Organic Solutes in Groundwater at the Idaho Engineering Laboratory, U.S. Geological Survey Open File Report 82-15, ID0-22061, U.S. Department of Energy, Idaho Falls, Idaho.

2-71 Leonard, P.R., 1993, Air Resources," Environmental Resource Document for the Idaho National Engineering Laboratory, J. S. Irving, Principal Investigator, Volume 1, WM0- 10279, EG&G Idaho, Inc., Idaho Falls, Idaho.

2-72 Liszewski, M. J. and L. J. Mann, 1992, Purgeable Organic Compounds in Groundwater at the Idaho National Engineering Laboratory, Idaho--1990 and 1991, U.S. Geological Survey Open .File Report 92-174, DOE/ID-22104, U.S. Department of Energy, Idaho Falls, Idaho.

2-73 Lobdell, C., 1995, U.S. Department of Interior, Fish and Wildlife Service, Boise Field Office, Boise, Idaho, letter to T. Reynolds, Environmental Science Research Foundation, Idaho Falls, Idaho, providing an updated list of endangered, threatened, proposed, and candidate species at the Idaho National Engineering Laboratory, FWS-1-4-95, January 24.

2-74 Mann, L. J. and L. D. Cecil, 1990, Tritium in Groundwater at the Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey Open File Report 90-4090, DOE/ID-22090.

2-75 Mann, L. J. and L. L. Knobel, 1987, Purgeable Organic Compounds in Groundwater at the Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey Open File Report 87-766, DOE/ID 22074, U.S. Department of Energy, Idaho Falls, Idaho.

2-76 Mann, L. J., 1990, Purgeable Organic Compounds in Groundwater at the Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey Open File Report 90- 387, DOE/ID-22089.

2-77 Mann, L. J., 1994, U.S. Geological Survey, INEL Field Office, Idaho Falls, Idaho, personal communication with A. L. Lundahl, Science Applications International Corporation, Idaho Falls, Idaho, January 17.

2-78 Mann, L. J., E. W. Chew, J. S. Morton, 1988, Iodine-129 in the Snake River Plain Aquifer at the Idaho National Engineering Laboratory, Idaho, U.S . Geological Survey Open File Report 88-4165, DOE/ID-22076, U.S. Department of Energy, Idaho Falls, Idaho.

2-79 Markham, O. D., 1974, Environmental and Radiological Monitoring at the National Reactor Testing Station during FY-1973 (July 1972-June 1973), Radiation Data Report, 15, pp. 227-246.

2-80 Markham, O. D., D. K. Halford, R. E. Autenrieth, R. L. Dickson, 1982, Radionuclides in Pronghorn Resulting from Nuclear Fuel Reprocessing and Worldwide Fallout, Journal of Wildlife Management, 46, pp. 30-42 .

2-81 Martin, S.B., 1996 U.S. Fish and Wildlife Service, letter to Reynolds, Environmental Science and Research Foundation, providing a list of endangered, threatened, proposed, and candidate species that may be present within the area of the INEL, SP #1-4-96-SP- 185, April 30.

2-82 Millard, J. B., F. W. Whicker, 0. D. Markham, 1990, Radionuclide Uptake and Growth of Barn Swallows Nesting by Radioactive Leaching Ponds, Health Physics, 58, 4, pp. 429-439.

2-83 Miller, S. J., 1992, Idaho National Engineering Laboratory Management Plan for Cultural Resources (Draft), DOE/ID-10361, U.S. Department of Energy, Idaho Falls, Idaho.

2-84 Miller, S. J., 1995, Idaho National Engineering Laboratory Management Plan for Cultural Resources, Final Draft, DOE/ID-10361, Rev. 1, Idaho Falls, Idaho, July 1995.

2-85 Mitchell, J. C., L. L. Johnson, J. E. Anderson, 1980, Geothermal Investigations in Idaho, Part 9, Potential for Direct Heat Application of Geothermal Resources, Water Information)3ulletin No. 30, Plate 1, Idaho Department of Water Resources, Boise, Idaho.

2-86 Mitchell, V. E., W. B. Strowd, G. S. Hustedde, E. H. Bennett , 1981, Mines and Prospects of the Dubois Quadrangle, Idaho, Mines and Prospects Map Series, Idaho Bureau of Mines and Geology, Moscow, Idaho, December.

2-87 Morris, R. C., 1993a, personal communication with T. Doerr, Science Applications International Corporation, August 16.

2-88 Morris, R. C., 1993b, Radioecology of the Idaho National Engineering Laboratory, Draft U.S. Department of Energy file report, August 16.

2-89 Notar, J., 1993, U. S. National Park Service, personal communication with D. A. Ryan, Science Applications International Corporation, Idaho Falls, Idaho, December 10.

2-90 NOAA 1984, Climatography of the Idaho National Engineering Laboratory, Site Specific Summary NPR Primary and Alternative Site (Draft), ID0-12048B, G.E. Start, Ed., November.

2-91 NRC 1976, U.S. Nuclear Regulatory Commission, Regulatory Guide 4.2, Revision 2,

2-92 Preparation of Environmental Reports /or Nuclear Power Stations, NUREG-0099, July

2-93 Orr, B. R. and L. D. Cecil, 1991, Hydrologic Conditions and Distribution of Selected Chemical Constituents in Water, Snake River Plain Aquifer, Idaho National Engineering Laboratory, Idaho, 1986 to 1988, U.S. Geological Survey Open File Report 91-4047, DOE/ID-22096, U.S. Department of Energy, Idaho Falls, Idaho.

2-94 Orr, B. R., L. D. Cecil, L. L. Knobel, 1991, Background Concentrations of Selected Radionuclides, Organic Compounds, and Chemical Constituents in Groundwater in the Vicinity of the Idaho National Engineering Laboratory, U.S. Geological Survey Open File Report 91-4015, DOE/ID- 22094, U.S. Department of Energy, Idaho Falls, Idaho.

2-95 Parsons, T. and G. A. Thompson, 1991, The Role of Magma Overpressure in Suppressing Earthquakes and Topography: Worldwide Examples, Science, 253, pp. 1399-1402.

2-96 Pelton, J. R., R. J. Vincent, N. J. Anderson, 1990, Microearthquakes in the Middle Butte/East Butte Area, Eastern Snake River Plain, Idaho, Bulletin of the Seismological Society of America, 80, 1, pp. 209-212.

2-97 Pierce, K. L. and L. A. Morgan, 1992, The Track of the Yellowstone Hotspot: Volcanism, Faulting, and Uplift, in Regional Geology of Eastern Idaho and Western Wyoming, P. K. Link, M. A. Kuntz, and L. B. Platt (eds.), Memoir 179, Geological Society of America, Denver, Colorado, pp. 1-53.

2-98 Pittman, J. R., R. G. Jensen, P. R. Fischer, 1988, Hydrologic Conditions at the Idaho National Engineering Laboratory, 1982 to 1985. U.S. Geological Survey Water- Resources Investigation Report 89-4008, DOE/ID-22078, U.S. Department of Energy, Idaho Falls, Idaho.

2-99 Reynolds, T. D., 1993, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, Idaho, personal communication with T. Doerr, Science Applications International Corporation.

2-100 Reynolds, T. D., J. W. Connelly, D. K. Halford, W. J. Arthur, 1986, Vertebrate Fauna of the Idaho National Environmental Research Park, Great Basin Naturalist 46, 3, pp. 513- 527.

2-101 Ringe, B. L., 1993, Locational Analysis and Preliminary Predictive Model for Prehistoric Cultural Resources on the INEL (Draft), EGG-CS-10706.

2-102 Robertson, J. B., R. Schoen, J. T. Barraclough, 1974, The Influence of Liquid Waste Disposal on the Geochemistry of Water at the National Reactor Testing Station, Idaho: 1952-1970, ID0-22053, U.S. Department of Energy, Idaho Falls, Idaho.

2-103 Rodgers, D. W., W. R. Hackett, H. T. Ore, 1990, Extension of the Yellowstone Plateau, Eastern Snake River Plain, and Owyhee Plateau, Geology, 18, pp. 1138-1141.

2-104 Rope, R. C., N. L. Hampton, K. A. Finley, 1993, Ecological Resources, in Irving, J. S., Environmental Resource Document for the Idaho National Engineering Laboratory, Volumes 1 and 2, EGG-WM0-10279, EG&G Idaho, Inc., Idaho Falls, Idaho, July.

2-105 Sehlke, G. and F. E. Bickford, 1993, Idaho National Engineering Laboratory Groundwater Monitoring Plan, Volume 1, DOE/ID-10441, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID, June.

2-106 Smith, R. B. and W. J. Arabasz, 1991, Seismicity of the Intermountain Seismic Belt, in Neotectonics of North America, D. B. Slemmons, E. R. Engdahl, M. D. Zoback, D. D. Blackwell (eds.), Decade Map Volume 1, Geological Society of America, Boulder, Colorado, pp. 185-221.

2-107 Smith, R. B. and M. L. Sbar, 1974, Contemporary Tectonics and Seismicity of the Western United States with Emphasis on the Intermountain Seismic Belt, Geological Society of America Bulletin, 85, pp. 1205-1218.

2-108 Stickney, M. C. and M. J. Bartholomew, 1987, Seismicity and Late Quaternary Faulting of the Northern Basin and Range Province, Montana and Idaho, Bulletin of the Seismological Society of America, 77, 5, pp. 1602-1625.

2-109 Strowd, W. B., V. E. Mitchell, G. S. Hustedde, E. H. Bennett, 1981, Mines and Prospects of the Idaho Falls Quadrangle, Idaho, Mines and Prospects Map Series, Idaho Bureau of Mines and Geology, Boise, Idaho.

2-110 USGS (U.S. Geological Survey), 1982-1993, Water Data Storage Retrieval System (WATSTORE), water quality file.

2-111 VWG (Volcanism Working Group), 1990, Assessment of Potential Volcanic Hazards for the New Production Reactor Site at the Idaho National Engineering Laboratory, EGG- NPR-10624, EG&G Idaho, Inc., Idaho Falls, Idaho, October.

2-112 WCC (Woodward-Clyde Consultants), 1990, Earthquake Strong Ground Motion Estimates for the Idaho National Engineering Laboratory: Final Report; Volume I: Summary; Volume II: Methodology and Analyses; and Volume III: Appendices, EGG- BG-9350, EG&G Idaho, Inc., Idaho Falls, Idaho, November.

2-113 WCC (Woodward-Clyde Consultants), 1992, Earthquake Ground Motion Evaluations for the Proposed New Production Reactor at the Idaho National Engineering Laboratory: Final Report; Volume I: Deterministic Evaluation; Volume II: Probabilistic Evaluation, EGG-GEO-10304, EG&G Idaho, Inc., Idaho Falls, Idaho, June.

2-114 WCFS (Woodward-Clyde Federal Services), 1993, Site-Specific Probabilistic Seismic Hazard Analysis for the Idaho National Engineering Laboratory (Draft), prepared by Woodward-Clyde Federal Services for EG&G Idaho, Inc., Idaho Falls, Idaho, June.

2-115 WCFS (Woodward-Clyde Federal Services), 1995, Paleo seismic investigations of the southern Lost River fault zone, Idaho; Lockheed-Martin Idaho Technologies Company, Technical Report INEL-95-058.

2-116 WCFS (Woodward-Clyde Federal Services), 1996, Site-Specific Probabilistic Seismic Hazard Analysis for the INEL, prepared by Woodward-Clyde Federal Services for Lockheed-Martin Idaho Technologies Company, Final Report INEL -95-0536, two volumes.

2-117 Weaver, C. S., A. M. Pitt, D. P. Hill, 1979, Crustal Spreading Direction of the Snake River Plain-Yellowstone system, EOS, 60, p. 946.

2-118 Whitehead, R. L., 1982, Geohydrologic Framework of the Snake River Plain Regional Aquifer System, Idaho and Eastern Oregon, U.S. Geological Survey, Professional Paper 1408-B.

2-119 Whitehead, R. L., 1987, Geohydrologic Framework of the Snake River Plain Regional Aquifer System, Idaho and Eastern Oregon, Professional Paper 1408-B, U.S. Geological Survey, Idaho Falls, Idaho.

2-120 Wilhelmsen, R. N. and K. C. Wright, 1992, Annual Report-1991, Environmental Surveillance for EG&G Idaho Waste Management Facilities at the Idaho National Engineering Laboratory, EGG-2679(91), Idaho Falls, Idaho.

2-121 Wilhelmsen, R. N., K. C. Wright, D. W. McBride, 1993, Annual Report-1992 Environmental Surveillance for EG&G Idaho Waste Management Facilities at the Idaho National Engineering Laboratory, EGG-2679(92), EG&G Idaho, Inc., Idaho Falls, Idaho, August.

2-122 Wood, W. W. and W. H. Low, 1986, Aqueous Geochemistry and Digenesis in the Eastern Snake River Plain Aquifer System, Idaho, Geological Society of America Bulletin, 97 (12), pp. 1456- 1466.

2-123 Wood, W. W. and W. H. Low, 1988, Solute Geochemistry of the Snake River Plain Regional Aquifer System, Idaho and Eastern Oregon, U.S. Geological Survey Professional Paper 1408-D.

2-124 Yohe, R., 1993, Idaho State Historical Preservation Office, Boise, Idaho, personal communication to T. Rudolph, Science Applications International Corporation, Boise, Idaho.

2-125 Zoback, M. L., and M. D. Zoback, 1989, Tectonic Stress Field of the Continental United States, in Geophysical Framework of the Continental United States, L. C. Pakiser and W.D. Mooney (eds.), Memoir 172, Geological Society of America, Boulder, Colorado, pp. 523-539.

3. THE DRY STORAGE SYSTEM

3.1. EXTERNAL APPEARANCE

The ISFSI storage area resembles a light industrial park. The immediate area in the vicinity of the ISFSI, consisting of approximately 2 acres (0.8 ha), is fenced for security purposes (FIGURE 3-1). The fenced area is sufficiently sized for the storage of the DSCs. Construction of administrative offices and equipment storage areas was not required for this project as these functions are provided by the existing INTEC complex. The ISFSI site at INTEC is not readily visible by the public due to its remoteness from the nearest public route; Highway 20/26 located approximately 4 miles (6.4 km) to the south.

The external appearance of the ISFSI is consistent in scale and general appearance as other structures located at INTEC. Inside the fenced boundary is a large load-bearing pad approximately 110 ft by 200 ft (34 m by 61 m) in size for placement of the horizontal storage modules (HSM) are placed on. The HSMs are rectangular precast reinforced concrete modules with 2-3 ft (0.6-0.9 m) thick walls, roof, floor and end walls, and are approximately 18 ft (5.5 m) long and 14 ft (4.3 m) high. The HSM's design and use of construction materials protect the DSC from missiles, earthquakes, tornado, or other natural phenomena and provide principle biological (radiation) shielding during fuel storage.

3.2. REACTOR AND STEAM-ELECTRIC SYSTEM

The ISFSI does not require the use of any reactor or steam electric systems.

3.3. WATER USE

The ISFSI does not require a water system for operation.

3.4. HEAT DISSIPATION SYSTEM

The heat dissipation system is fully passive using natural air flow cooling medium over the HSM. The TMI-2 fuel, knockout, and filter canisters had a maximum heat load of 80 W and an average of 20 W at the time of loading. The TMI-2 DSC was designed for a maximum of 860 W heat load per storage module, which is the total heat-load of the 12 hottest TMI-2 canisters. This heat load is sufficiently low that the DSC and HSM are fully capable of expelling the heat and keeping all internal and external temperatures within the recommended temperature limits of the materials used without the need for HSM air vents. The heat loads have substantially decreased over the first 20 years of storage due to the radioactive decay of the contents. The environmental effects of the operation of this system are provided in Section 5. 1.

3.5. RADWASTE SYSTEMS SOURCE TERM

3.5.1. SOURCE TERM

In the original Environmental Report submitted in October, 1996 and the Final Environmental Impact Statement published in March, 1998, there was an expectation that “Radionuclides may be emitted due to the venting of the TMI-2 canisters during dry storage” (DOE, 1996). Each TMI-2 canister is vented through a HEPA filter to the atmosphere. EPA regulations limit the amount of airborne radionuclides released from any nuclear facility such that a maximum release would produce a dose of 10 mrem/yr to any member of the public. These regulations, known as the *National Emission Standards for Hazardous Air Pollutants* (NESHAPs), are found in 40 CFR Part 61, Subpart H. The

EPA specified that the CAP-88 computer code be used to demonstrate compliance unless an alternative method has been approved by the Administrator of EPA.

The operating team at the TMI-2 ISFSI developed a Radiological Environmental Monitoring Program (REMP) in accordance with 10 CFR 72.44 to monitor two predominant radiation exposure pathways inherent with the facility design; potential airborne radioactivity releases and direct radiation using a combination of loose surface radioactive contamination surveys, dosimetry and periodic airborne radioactivity sampling. The results are published each year in the "Annual Radiological Environmental Program Report for the Three Mile Island, Unit 2 Independent Spent Fuel Storage Installation."

In summary of those reports, the radiation dosimetry results indicate there has been no measurable increase in the ambient background radiation levels outside the TMI-2 ISFSI perimeter fence attributed to storage of TMI-2 core debris. Furthermore, it can be concluded that airborne radioactivity and direct radiation exposure from the facility has not contributed to any increase in the estimate of maximum potential dose commitment to the general public; characterized as $2.7E^{-3}$ mrem/yr. These results are consistent with the conclusion of the EIS (NUREG-1626).

3.5.2. LIQUID RADWASTE SYSTEM

No liquid radioactive wastes would be generated during the operation of the ISFSI.

3.5.3. GASEOUS RADWASTE SYSTEM

Prior to venting, the air from a DSC is filtered through a HEPA filter with a decontamination factor of 3E-04 (Staley, 1996a). Under NESHAPs, a project with the potential to release radioactivity must be evaluated to determine its impact to the public. There are two doses to a MEI for two separate purposes to be calculated for NESHAPs: (1) a dose from releases using release fractions and emission factors from Appendix D, 40 CFR 61; and (2) a dose assuming no pollution control equipment is present to clean up emissions. These doses are for purposes of determining permitting and monitoring requirements, respectively, and need to be at or below 0.1 mrem/yr for a project to be exempt from these two requirements. (Staley, 1996c) identifies that these two doses to the MEI would be below 0.1 mrem/yr (0.00303 mrem/yr and 0.0161 mrem/yr respectively). Therefore, a NESHAPs application to construct and perform continuous monitoring was not required for the TMI-2 ISFSI.

3.5.4. SOLID RADWASTE SYSTEMS

The solid radioactive waste at ISFSI is classified as process generated waste and consists of paper, rubber, plastic, rags, tools, vacuum cleaner debris and HEPA filters utilized in monitoring and sampling according to the Technical Specifications. The process-generated waste is taken to the Solid Waste Processing Area, where it is consolidated, segregated, and as applicable, compacted to 55-gallon drums and prepared for shipment and disposal.

3.5.5. PROCESS AND EFFLUENT MONITORING

While NESHAPs does not require the continuous monitoring of the HEPA-filtered DSC emissions since the unabated emissions are less than 0.1 mrem/yr emissions are calculated on an annual basis and reported in DOE's Idaho site annual NESHAPs report. As identified in Section 6.2, site operational radiological monitoring programs are continued through the life of the TMI-2 ISFSI. These programs also serve as the operational monitoring program for the ISFSI.

3.6. CHEMICAL AND BIOCIDE WASTES

The ISFSI does not require use of any chemicals or biocide.

3.7. SANITARY AND OTHER WASTE SYSTEMS

There are no sanitary or other waste systems required for the operation of the ISFSI since, during operation, personnel would use existing INTEC sanitary facilities. During construction, portable toilets were available for use by the construction workers as discussed in Chapter 4.0.

3.8. REPORTING OF RADIOACTIVE MATERIAL MOVEMENT

The TMI-2 canisters were transported from TAN to ISFSI, and have remained in the HSM as described in Section 3.1. Environmental effects from transportation were bounded by the analysis conducted for the FEIS (DOE 1995) including the occupational and general population collective doses and accident analysis.

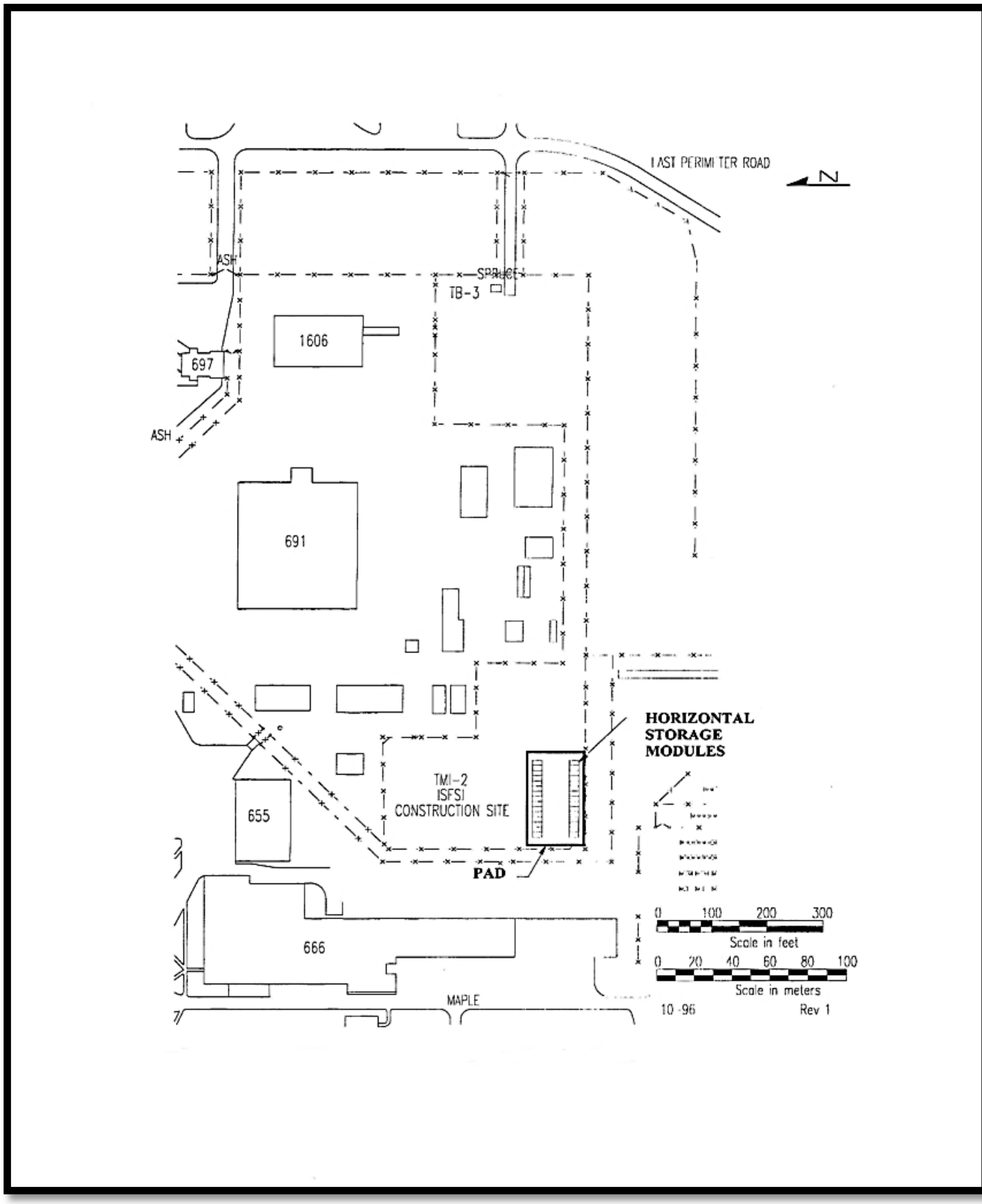
3.9. TRANSMISSION FACILITIES

During construction, existing retail electrical transmission lines in the immediate vicinity of the site provided electrical power for construction activities. This system also supplied power for external lighting, canister emission sampling, and security systems.

3.10. FIGURES, TABLES, AND REFERENCES

3.10.1. FIGURES LIST

FIGURE 3-1: THE TMI-2 ISFSI SITE, PAD AND HSMS WITHIN THE INTEC.



3.10.2. TABLES LIST

TABLE 3-1: CALCULATED RADIONUCLIDE INVENTORY AND RELEASES

TABLE 3-1: CALCULATED RADIONUCLIDE INVENTORY AND RELEASES

Nuclide	Ci in fuel	INTEC storage Release (Ci/yr.)
H-3	7.68E +02	7.68E +01
Co-60	1.13E +04	6.16E -06
Kr-85	1.52E +04	1.52E +03
Sr-90	4.83E +05	2.63E -04
Y-90	4.83E +05	2.63E -04
I-129	1.15E -01	1.15E -02
Cs,.134	2.43E +02	1.27E -07
Cs-137	2.82E +05	1.54E -04
Ba-137m	2.67E +05	1.45E -04
Eu-154	2.29E +03	1.25E -06
Pu-238	9.48E +02	5.16E -07
Pu-239	9.34E +03	5.09E -06
Pu-240	2.86E +03	1.56E -06
Pu-241	1.03E +05	5.61E -05
Am-241	4.67E +03	2.54E -06

3.10.3. REFERENCES

3-1 DOE 1996, Environmental Report-Independent Spent Fuel Storage Installation (ISFSI) License for the Three Mile Island Unit Two (TMI-2) Fuel

3-2 DOE 1993, NESHAPs Permit to Construct Application for the INEL Test Area North Dry Cask Storage Project, Appendix A, DOE/ID-10452(93)

3-3 DOE 1995, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, April

3-4 DOE 1996, The Safety Analysis Report for the TMI-2 Independent Spent Fuel Storage Installation, October.

3-5 ‘‘Final Environmental Impact Statement (FEIS) Related to the Construction and Operation of the TMI–2 Independent Spent Fuel Storage Installation,’’ NUREG–1626,

3-6 Sheffield, J., 1996, TMI-2 Fuel Storage Project Input for Environmental Report, VECTRA, 219-02-96-045, May 24.

3-7 Staley, C.S., 1996a, Dose to Maximally Exposed Individuals due to Potential Airborne Releases from the INEL Storage of the TMI-2 Fuel Project, Engineering Design File EMA-96-001, LITCO, February

3-8 Staley, C.S., 1996b, Letter to L. C. Tuott, Letter #CSS-08-96, September

3-9 Staley, C.S., 1996c, Letter to L. C. Tuott, Letter #CSS-10-96, September

4. ENVIRONMENTAL EFFECTS OF SITE OPERATIONS

4.1. SITE OPERATIONS

4.1.1. EFFECTS ON LAND USE

ISFSI operations are within the controlled access area at INTEC and the continuing operations have no impact to the area. Site preparation and construction for the ISFSI occurred in previously disturbed areas at INTEC and therefore did not impact the offsite land use. The ISFSI was previously used as an access road and construction staging and parking area for the construction of CPP 691. Operations of the ISFSI does not affect any wetland areas.

Access is controlled between the ISFSI and the rest of INTEC with the installation of fencing and the use of existing East Perimeter Road and gate provides access to maintenance and operations personnel. At the onset of operations, a perimeter security fence for the ISFSI was installed.

4.1.2. EFFECTS ON WATER BODIES USE

Operation of the ISFSI has no impact to the groundwater used to supply the INTEC water system. Construction is complete and no additional SNF will be placed in this ISFSI.

4.1.3. IMPACT OF WORK FORCE

The staff at the ISFSI consists of sharing security, operations, maintenance and engineering personnel and radiation protection/health physics personnel with the labor force at the INTEC. For the PEO, there would be no adverse impact to the workforce, associated local housing or site office accommodations.

4.1.4. IMPACT OF CONSTRUCTION GENERATED FUGITIVE DUST

The ISFSI is not a construction site and all fuel has been placed in storage; therefore there will be no generation of fugitive dust.

4.1.5. IMPACT ON WILDLIFE

TMI-2 ISFSI was selected as a previously disturbed and developed area within the INTEC therefore impact to threatened or endangered species of plants and animals as a result of construction and operation was determined to be negligible and will not change for the PEO. (Reynolds, 1993)

4.1.6. NOISE

Activities associated with ISFSI maintenance such as concrete repairs and monitoring (vacuum pumps) can generate noise. This noise is intermittent and does not adversely impact threatened or endangered species (Reynolds, 1993). Visual examination of the interior of the HSM was conducted. The minimal noise generated was within that of the intermittent maintenance activities. The noise generated at DOE's Idaho site is not propagated at detectable levels offsite, since all public areas are at least 5 miles (8 km) away from site areas. Previous studies of the effects of noise on wildlife indicate that even very high intermittent noise levels at DOE's Idaho site (over 100 dBA) would have no deleterious effect on wildlife productivity (Section 4.10, Vol. 2, Part A, DOE 1995). Impacts should not change during the PEO.

4.2. TRANSMISSION FACILITIES CONSTRUCTION

New transmission facilities are not required for continued operation of the TMI-2 ISFSI.

4.3. RESOURCES COMMITTED

Following removal of the TMI-2 material, the components of the ISFSI would be surveyed, decontaminated if necessary, and disposed of or reused using methods available at the time of decommissioning (See Section 5.7). It is anticipated that the continuing operations and future decontamination and decommissioning (D&D) will not cause an irreversible commitment of resources. The site would be decontaminated and made available for alternative future uses consistent with future disposition of INTEC. Energy resources such as diesel fuel used for (D&D) and retrieval of DSCs from storage and electricity for continued operations would be irreversibly used and committed.

4.3.1. LAND

The construction support area for the ISFSI encumbers approximately 5 acres (2 ha) or approximately 2% of the INTEC area. The ramp and storage pad are within this area. No expansion is expected during the PEO.

4.3.2. WATER

There are no irretrievable or irreversible commitments of water or waterways for the proposed continued operations of the ISFSI.

4.3.3. AIR

No local or site air resources would be irretrievably committed to the proposed continued operations of the ISFSI.

4.3.4. BIOTA

Due to the limited area of disturbance and the disturbance being within previously developed (and disturbed) areas, the effects of the proposed continuing operations on the biota are expected to be minimal, not change from the past 20 year license period.

4.3.5. MATERIALS

Only a small quantity of materials (e. g. epoxy, air sampling supplies) will be required for the proposed ongoing operations.

4.3.6. SUMMARY OF RESOURCES COMMITTED

As identified in the previous sections, relatively small amounts of resources would be required for the operations of the ISFSI. This commitment of resources would not alter or affect their availability either locally or regionally.

4.4. RADIOACTIVITY

Recorded exposure in excess of normal background to workers at the ISFSI during operations including HSM loading, 18 years of operation and the initial remote visual examination of a loaded

DSC in storage has been well below regulatory limits. Exposure to personnel is expected to remain as low as reasonably achievable and is not expected to increase during the proposed PEO.

4.5. CONSTRUCTION IMPACT CONTROL PROGRAM

The ISFSI is an operating site and no construction activities are planned during the proposed license period.

4.6. REFERENCES

4-1 DOE 1995, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, DOE/EIS-0203-F, April

4-2 DOE, 1996, Department of Energy Environmental Assessment of the Test Area North Pool Stabilization Project, DOE/EA-1050, May

4-3 DOE-ID 1996, INEL Stormwater Pollution Prevention Plan for Construction Activities. DOE/ID-10425

4-4 Reynolds, T. L., 1993, Memorandum to S. K. Gray, Subject: "Pool Stabilization Project" July 9

5. ENVIRONMENTAL AFFECTS OF ISFSI OPERATION

5.1. EFFECTS OF OPERATION OF HEAT DISSIPATION SYSTEM

The operation of the TMI-2 ISFSI requires no active heat dissipation system. Decay heat is removed from the DSC by convection, conduction, and thermal radiation to the atmosphere in the immediate vicinity of the ISFSI. The maximum HSM outer surface temperature, based on initial design heat load and analysis, was calculated to be less than 150°F (65.6°C) during normal operations and less than 200°F (93.3°C) during potential off-normal and accident conditions (Section 8, DOE 1996a). Due to the low heat loads of the TMI-2 debris and the system's design to remove heat by natural convection in the air, there is no release of heat to water and no impacts on water quality or biological growth.

5.2. RADIOLOGICAL IMPACT FROM ROUTINE OPERATION

5.2.1. ANALYSIS OF ISFSI CONTRIBUTION

The ISFSI design incorporates multiple confinement barriers to ensure that during normal operations there would be no releases to the environment of radioactive material and airborne releases would be controlled through the use of the HEPA filtration system. Sections 7.4 and 7.5 of the Safety Analysis Report (SAR) (DOE 1996a) have analyzed the radiological impact of the operation of the TMI-2 ISFSI. Based on the conservative assumptions used in the SAR, the radiological doses attributable to the ISFSI are well below regulatory limits of 10 CFR 72.104.

The REMP was implemented in 1999. Results of the loose surface radioactive contamination surveys indicated no increase in either gross beta or Cs-137 radioactivity attributed to the facility operation. The results of the airborne radioactivity sampling did not indicate releases of airborne particulate radioactivity from the loaded Horizontal Storage Modules (HSM) that would contribute to an increase in the estimated maximum potential dose commitment to the general public. The results of the thermoluminescent dosimetry network did not indicate an increase in radiation levels above ambient background attributed to the facility operation." (STI-NLF-RPT-016)

5.2.2. ANALYSIS OF MULTIPLE CONTRIBUTION

Because the doses to the public from DOE's Idaho site operations are generally too small to be measured, computer models are used to estimate annual radiation doses from the site. Using the EPA approved CAP-88 model, the hypothetical maximum dose from DOE's Idaho site activities in 1995 was 0.018 mrem/yr for the MEI located at "Frenchman's Cabin" located at the foot of Big Southern Butte (DOE-ID 1996b). This dose estimate can be compared to the average annual dose of 360 mrem/yr in southeast Idaho.

The maximum annual dose to the nearest permanent resident, i.e., the MEI, and the site worker resulting from DOE's Idaho site activities from 1995 to 2005, has been calculated (Section 5.7.3, Vol. 2, Part A, DOE 1995). This estimate projects that the MEI would receive an incremental ten-year dose of 5.8 mrem (0.58 mrem/yr) for this period that would result in a cumulative ten-year dose of 6.3 mrem (0.63 mrem/yr). On an annual basis, this dose rate is well below the 25 mrem/yr limit specified in 10 CFR 72.104. A DOE's Idaho site worker at a location of highest dose from airborne emissions is estimated to receive an incremental ten-year dose of 1.4 mrem (0.14 mrem/yr) for this period that would result in a cumulative ten-year dose of 4.6 mrem (0.46 mrem/yr) . This is a small fraction of the occupational dose limit of 5000 mrem/yr. (Note: the offsite dose can be higher than the worker dose since the workers may not receive any dose by the Food ingestion pathway.)

5.3. EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

As discussed in Section 3.6, the ISFSI operation does not generate any chemical or biocide wastes. Commercially available herbicides (weed-killers) or ground sterilants may be used to control vegetation at the ISFSI site. The use of these products would be in accordance with manufacturer's guidelines and site procedures with any potential runoff being controlled in accordance with the INTEC Industrial Stormwater Pollution Prevention Plan. Therefore, there are no chemical and biocide discharges.

5.4. EFFECTS OF OPERATION AND MAINTENANCE OF THE TRANSMISSION SYSTEM

The INTEC is supplied with electrical power from two separate feeds and includes standby emergency systems. Power requirements during construction were supplied by tapping the electrical supply system's feeder transmission lines located adjacent to the ISFSI site. This system also supplies power for operation and maintenance.

Further operation and maintenance of this type would result in minimal environmental effects due to the short distance from the point of origin to the ISFSI site, previously disturbed nature of the site, and relatively low voltage demands of the equipment.

5.5. OTHER EFFECTS

5.5.1. NOISE IMPACT

Noise would result from the DSC transfer to transport vehicles from the ISFSI, if required. Noise from this activity is expected to be within the range of that typically produced by ongoing activities at INTEC and no adverse impacts would be anticipated.

5.5.2. CLIMATOLOGICAL IMPACT

Radioactive decay would cause heat to be generated within the canisters. The temperature inside the HSM would be below well 200° F (93.3° C) using bounding assumptions. The HSM contains no air vents as they are not required to remove the decay heat generated by the TMI-2 canisters. The cooling air flows around the DSC to the top of the HSM. This passive system provides an effective means for spent fuel decay heat removal. Precipitation does not vaporize at the HSM surface. There is no adverse climatological impact due to the operation of the ISFSI.

5.5.3. IMPACT ON LOCAL WILDLIFE

Due to the location of the TMI-2 ISFSI (existing highly disturbed site and the presence of ISFSI and INTEC fencing), no area local wildlife or any threatened or endangered wildlife or plant species are adversely affected by the operation of the TMI-2 ISFSI.

5.5.4. IMPACT FROM RUNOFF

Rainfall runoff from the ISFSI is not contaminated since the HSM protects the DSC from direct contact

5.6. RESOURCES COMMITTED

The operation of the ISFSI does not cause the irreversible and irretrievable commitment of resources. Subject to the use of decontamination technologies as identified in Section 5.7, it is anticipated that

the site will be restored to pre-license condition and made available for alternative use consistent with future uses of INTEC.

5.7. DECOMMISSONING AND DISMANTLING

Decommissioning and dismantlement of the ISFSI will be performed in a manner consistent with the *Conceptual Plan for Decommissioning TMI-2 Independent Spent Fuel Storage Installation* and site procedures that will be in place at that time.

5.8. REFERENCES

5-1 DOE 1995, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, DOE/EIS-0203-F, April

5-2 DOE 1995a, “Settlement Agreement” between the State of Idaho, Department of the Navy, and the Department of Energy." Oct. 16

5-3 DOE 1996, Department of Energy Environmental Assessment of the Test Area North Pool Stabilization Project, DOEIEA-1050, May

5-4 DOE 1996a, the Safety Analysis Report for the TMI-2 Independent Spent Fuel Storage Installation, October

5-5 DOE-ID 1996a, In Summary: Idaho National Engineering Laboratory Site Environmental Report /or Calendar Year 1995, ESRF-015, September

5-6 DOE-ID 1996b, 1995 INEL National Emission Standard /or Hazardous Air Pollutants - Radionuclides, Annual Report, DOE/ID-10342(95), June

5-7 STI-NLF-RPT-016, (2016), Published February 2017, Annual Radiological Environmental Monitoring Program Report for the Three Mile Island, Unit 2, Independent Spent Fuel Storage Installation

5-8 Staley, C.S., 1996, Dose to Maximally Exposed Individuals due to Potential Airborne Releases from the INEL Storage of the TMI-2 Fuel Project, Engineering Design File EMA-96-001, LITCO, February

6. EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1. APPLICANT'S PREOPERATIONAL ENVIRONMENTAL MONITORING PROGRAMS

As identified in Section 2.0 of this document, DOE's Idaho site has a comprehensive environmental monitoring program conducted on and around the site. Environmental monitoring associated with the TMI-2 ISFSI is not a separate program but conducted as part of the overall site monitoring program. The Environmental Surveillance Program has the following organizations charged with the responsibility for environmental monitoring: National Oceanic and Atmospheric Administration (NOAA) - onsite and offsite meteorological monitoring; BEA onsite environmental surveillance; Environmental Science and Research Foundation - offsite environmental surveillance; and the U.S. Geological Survey (USGS) - onsite and offsite groundwater surveillance. These programs provide a comprehensive and timely base for the environmental impact evaluations of the ISFSI. The results of this environmental surveillance and monitoring are reported to the public and DOE Headquarters in an annual site environmental report.

As the operation of the ISFSI does not involve the discharge of liquid effluent, chemical, or sanitary wastes, the existing DOE's Idaho site monitoring programs for surface water, groundwater, air, meteorological conditions, and land (including threatened and endangered flora and fauna) has not been modified.

To conduct radiological monitoring, the Environmental Surveillance Program includes a network of approximately 20 continuous air samplers that measure ambient radiation exposure rates and airborne radioactivity levels. The Environmental Surveillance Program also includes direct measurements of ambient (environmental) radiation levels. These devices measure ionizing radiation exposure rates due to the combined sources of natural radioactivity in the air and soil, cosmic rays, residual fallout from nuclear weapons tests, and radioactivity from site operations. Devices are also placed at seven distant community locations and six DOE's Idaho site boundary locations.

6.2. APPLICANT'S PROPOSED OPERATIONAL MONITORING PROGRAMS

DOE's Idaho site operational meteorological and radiological monitoring programs will be continued through the life of the TMI-2 ISFSI. These programs will also serve as the operational monitoring program of the ISFSI. Periodic and confirmatory measurements of radiological emissions will be conducted, as necessary, for NESHAPs compliance purposes. In addition to the onsite and offsite sampling and monitoring conducted in support of DOE's Idaho site annual NESHAPs and environmental reporting, sampling of the DSC internal gases will be made on a frequency sufficient to ensure that hydrogen concentrations are maintained at safe levels. Portable radiological monitoring equipment is used to detect potential releases from the DSC system.

6.3. RELATED ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

In January 1994, the State of Idaho's Oversight Program took over the independent verification program operated by the Idaho State University since 1989. The University continues to perform radiological analyses for the State program. Results of this monitoring are made available to the public in the Oversight Program's quarterly progress reports.

7. ENVIRONMENTAL EFFECTS OF ACCIDENTS

7.1. FACILITY ACCIDENTS INVOLVING RADIOACTIVITY

An evaluation of the safety of the ISFSI with respect to postulated accidents is presented in Chapter 8 of the Safety Analysis Report for the TMI-2 Independent Spent Fuel Storage Installation (U.S. Department of Energy, March 31, 1999). For each postulated condition, the accident cause, the structural, thermal, and radiological consequences, and the recovery measures required to mitigate the accident are presented. Calculated doses resulting from these postulated accidents would not exceed the exposure limits identified in 10 CFR 72.104 and 10 CFR 72.106.

7.2. TRANSPORTATION ACCIDENTS INVOLVING RADIOACTIVITY

The TMI-2 transfer cask (TC) is required to provide retrieval of the DSC from an HSM for recovery and decommissioning operations. While outside the HSM and still within the ISFSI limits, the TC provides radiological shielding for the DSC during such operations. In accordance with the UFSAR the two TC cask types permitted are the OS-197 and MP-187. The OS-197 cask was used to transfer the DSC to the ISFSI at INTEC for loading in the HSM. DOE-ID does not possess a TC (either an MP-187 or OS-197 as authorized by the design basis) associated with the TMI-2 ISFSI license at DOE's Idaho Site. DOE-ID will acquire access to a TC when one is needed at the TMI-2 ISFSI via an important-to safety purchase order. A determination will be made at that time as to the method of obtaining access, but in all cases, it will be developed under a procurement process using the DOE-ID QA program. Suitable procurement documents will specify the design, operating, and maintenance requirements for the TC for use in retrieving the TMI-2 DSCs from the HSM, consistent with applicable license requirements and commitments. DOE-ID will ensure compliance with these procurement requirements under the DOE-ID QA program.

7.3. OTHER ACCIDENTS

Due to the limited volume (or lack of) chemicals and toxic materials associated with the operation of the ISFSI, there are no credible nonradioactive accident scenarios that could be postulated.

7.4. REFERENCES

7-1 DOE 1995, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, DOE/EIS-0203-F, April

7-2 U.S. Department of Energy, "Safety Analysis Report for INEEL Three Mile Island Unit 2 Independent Spent Fuel Storage Installation, Revision 1," March 31, 1999, NRC Accession Number 9903260243.

8. ECONOMIC AND SOCIAL EFFECTS OF SYSTEM CONSTRUCTION AND OPERATION

Since the ISFSI is operated by existing DOE's Idaho site employees, there should be no long-term change to the area employment, population, housing, public services, demographics, or income.

8.1. ENVIRONMENTAL JUSTICE

Environmental justice impacts associated with waste management, environmental restoration, and the programmatic management of SNF at DOE's Idaho site including construction and operation of INTEC dry storage for the TMI-2 debris was evaluated (Section 5.20, Vol. 2, Part A, DOE 1995). This environmental justice analysis was based on a qualitative assessment of proposed projects and impacts to determine if there was identifiable disproportionately high and adverse human health or environmental impacts on minority populations, or low-income populations, within a 50 mile (80 km) radius around the site.

The racial and ethnic composition of the minority population residing near the site is predominantly Hispanic, American Indian, and Asian and consists of approximately 6% (10570 persons) of the population within the 50 mile (80 km) radius (U.S. Census, 2015). The low-income population characteristics within this same area are approximately 14% (23416 persons). (U.S. Census, 2015)

Because the impacts due to facility operations and reasonably foreseeable accidents present no significant risk and do not constitute a reasonably foreseeable adverse impact to surrounding population, no disproportionately high and adverse impact would be expected for any particular segment of the surrounding population, minority and low income populations included (Section 5.20.3. 1, Vol. 2, Part A, DOE 1995).

The review of other technical disciplines did not indicate any significant adverse impacts because of land use, socioeconomics, water and air resources, ecology, cultural resources, or cumulative impacts (Section 5.20.3.5, Vol. 2, Part A, DOE 1995).

In summary, based on the analysis of the impacts for each of the disciplines analyzed in the FEIS (DOE 1995), along with the impact of other past, present, and reasonably foreseeable future activities at DOE's Idaho site, no reasonably foreseeable cumulative adverse impacts are expected to the surrounding populations, minority populations and low-income populations included (Section 5.20.3.5.3, Vol. 2, Part A, DOE 1995).

8.2. TABLES AND REFERENCES

8.2.1. TABLES LIST

TABLE 8-1: 2015 POPULATION ESTIMATES

	Bingham	Bonneville	Butte	Clark	Jefferson	All 5 Counties
County Totals	44,990	110,089	2,501	880	27,157	185,617
Racial/Ethnic Composition						
American Indian	760	120	90	240	140	1,350
Asian	70	100	40	100	50	360
Hispanic	1,780	1,280	520	4,240	1,040	8,860
	2,610	1,500	650	4,580	1,230	10,570

TABLE 8-2: 2015 PERSONS IN POVERTY ESTIMATES

	Bingham	Bonneville	Butte	Clark	Jefferson	All 5 Counties
County Totals	44,990	110,089	2,501	880	27,157	185,617
Percent	14.8%	15.5%	14.8%	17.3%	11.5%	8%
Persons	6,720	16,643	385	150	3,093	26,991

8.2.2. REFERENCES

8-1 DOE 1995, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, DOE/EIS-0203-F, April

8-2 U.S. Census Bureau Report for Idaho, 2015

9. ALTERNATIVE STORAGE METHODS, SITES, AND SYSTEM DESIGNS

Section 1.2 of this document identifies the DOE documentation of the NEPA analysis and decisions concerning alternative storage methods, sites, and system designs.

10. ENVIRONMENTAL APPROVALS AND CONSULTATION

The TMI-2 ISFSI is subject to NRC approval and licensing (10 CFR 72). The transportation of the TMI-2 debris from TAN to INTEC was subject to NRC approval and compliance with the Atomic Energy Act of 1954 as amended (42 USC § 2011 et seq.) including 10 CFR Part 71 "Packaging and Transportation of Radioactive Material."

The U.S. Fish and Wildlife Service (USFWS) published a list of threatened and endangered species at the site. After review of the proposed action and species list, it was determined that it was unlikely that the proposed activity would impact any threatened or endangered species. DOE-ID consultation with USFWS is ongoing.

Ongoing consultation with the Governor of Idaho regarding the Idaho Settlement Agreement, the State of Idaho State Historic Preservation Office (SHPO) and Shoshone-Bannock Tribes will be conducted by DOE-ID. No county construction or zoning permits are *required* for operations at DOE's Idaho site.

10.1. REFERENCES

10-1 Reynolds, T. L., 1993, Memorandum to S. K. Gray, Subject: "Pool Stabilization Project" July 9

APPENDIX A: ACRONYMS & ABBREVIATIONS

A	
ALASA	As Low As Reasonable Achievable
ANL-W	Argonne National Laboratory-West
ARA	Auxiliary Reactor Area
ATR	Advanced Test Reactor
B	
BNCT	Boron Neutron Capture Therapy
C	
C	Centigrade
CFA	Central Facilities Area
CFR	Code of Federal regulations
Ci	Curies
Co	Cobalt
Cs	Cesium
CWA	Clean Water Act
D	
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy – Idaho Operations Office
DOT	U.S. Department of Transportation
DSC	Dry Shielded Canister
E	
EA	Environmental Assessment
EBR-1	Experimental Breeder Reactor-1
EDE	Effective Dose Equivalent
EPA	U.S. Environmental Protection Agency
F	
F	Fahrenheit
FEIS	Final Environmental Impact Statement
FONSI	Finding of No Significant Impact
FR	Federal Register
G	
g	Acceleration due to gravity at sea level
H	
H-3	Tritium
ha	Hectares
HEPA	High Efficiency
HSM	Horizontal Storage Module
I	
I	Iodine
ICPP	Idaho Chemical Processing Plant
INTEC	Idaho Nuclear Technology and Engineering Center
INL	Idaho National Laboratories
ISFSI	Independent Spent Fuel Storage Installation (10 CFR Part 72)
K	
Kr	Krypton
L	
LITCO	Lockheed Idaho Technologies Company
LMITCO	Lockheed Martin Idaho Technologies Company
M	
MEI	Maximally Exposed Individual
mrem	Millirem
N	
NEPA	National Environmental Protection Agency
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	National Regulatory Commission
NRF	Naval Reactors Facility
O	
OSHA	Occupational Safety and Health Administration
P	
PBF	Power Burst Facility
PTC	Permit to Construct
R	
ROD	Record of Decision
RSAC	Radiological Safety Analysis Computer Program
RWMC	Radioactive Waste Management Complex
S	
SAR	Safety Analysis Report
SDA	Subsurface Disposal Area
SIS	Special Isotope Separation
SNF	Spent Nuclear Fuel
SRPA	Snake River Plain Aquifer
T	
TAN	Test Area North
TLD	Thermoluminescent Dosimeter
TMI-2	Three Mile Island Unit 2
TRA	Test Area Reactor
U	
UTM	Universal Traverse Mercator
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Services
W	
W	Watts
WERF	Waste Experimental Reduction Facility