4. AFFECTED ENVIRONMENT

4.1 Introduction

Chapter 4 describes the existing environment at the Idaho National Engineering and Environmental Laboratory (INEEL) and provides site-specific information for the Radioactive Waste Management Complex (RWMC), the proposed site for construction of the Advanced Mixed Waste Treatment Project (AMWTP) under the Proposed Action. Central to the tiered environmental impact statement (EIS) concept, INEEL-wide information was obtained and referenced primarily from the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE INEL EIS) (DOE 1995). Where necessary, updated environmental baseline information is presented and documented accordingly. Individual sections within Chapter 4 focus predominantly upon RWMC site-specific resources (e.g., water resources) and project-specific resources (e.g., socioeconomics) most likely to be impacted by implementing the Proposed Action.

Chapter 4 summarizes the existing data and technical literature in each discipline where pertinent to the Proposed Action. Chapter 4 provides citations in each section to the supporting technical references that contain substantiating data and analysis.

4.2 Land Use

This section describes the existing and planned land use at the INEEL and surrounding area, and the proposed site of the AMWTP at the RWMC.

The INEEL encompasses 569,135 acres within Butte, Bingham, Bonneville, Jefferson, and Clark Counties. The eastern border is 22 miles west of downtown Idaho Falls in southeastern Idaho (see Figure 4.2-1). The land comprising the INEEL is used to support the U.S. Department of Energy (DOE) facility and program operations and as safety-and-security zones around facilities. About 2 percent of the total INEEL area (11,400 acres) is used for facilities and operations. INEEL operations are performed within the site's primary facility areas (i.e., Central Facilities Area [CFA], Test Reactor Area, Idaho Chemical Processing Plant, etc.) which occupy 2,032 acres (Figure 4.2-2). The remaining land (567,103 acres) is largely undeveloped and used for environmental research, ecological preservation, socio-cultural preservation, and livestock grazing. A detailed description of the INEEL's land use and land use plans and policies applicable to the area is contained in Volume 2, Section 4.2 of the DOE INEL EIS and the *Idaho National Engineering Laboratory Comprehensive Facility and Land Use Plan* (LMITCO 1997a).

4.2.1 Existing and Planned Land Use at the Advanced Mixed Waste Treatment Project Site

Facilities at the RWMC, where the AMWTP is proposed to be located, provide waste management support for various processing, storage, and disposal of radioactive waste. One of the missions at the RWMC is preparing waste for shipment to the Waste Isolation Pilot Plant (WIPP). The 187-acre RWMC is divided into four zones: the Administrative Area, located in the northeast section of the facility; the Operation Zone, located west of the Administrative Area; the Subsurface Disposal Area (SDA), located in the western section of the facility; and the Transuranic Storage Area (TSA), located in the southern section of the facility. The proposed AMWTP would be located within the TSA (see Figure 1.4-1).

4.2.2 Existing and Planned Land Use at the Idaho National Engineering and Environmental Laboratory and in Surrounding Areas

INEEL facility operations include industrial and support operations associated with energy research and waste management activities. Land is also used for environmental research associated with the DOE designation of the INEEL as a National Environmental Research Park. A summary of the land use within the primary facility areas of the INEEL is shown in Table 4.2-1.

Only 2 percent of the land within the INEEL has been developed for the operating areas and facilities. INEEL facilities are sited within a central core area of approximately 230,000 acres (see Figure 4.2-2). The missions of the INEEL are moving toward management of radiological and hazardous waste, restoration of the environment, development of environmental cleanup technologies, national security, U.S. economic competitiveness, and development of nuclear energy and non-nuclear technologies and applications.

The INEEL was formed through a series of land withdrawals from the public domain called public land orders (PLOs) (i.e., PLOs 318, 545, 637, and 1770) and the acquisition of State-owned and private land parcels. The DOE and Bureau of Land Management (BLM) share administrative responsibilities, through Memorandums of Understandings (MOUs) for grazing permits on the INEEL; granting of utility rights-of-way across the INEEL; extracting materials; and controlling wildfires, noxious weeds, insects, and predators. The DOE owns INEEL, acquired from the State and private parties.

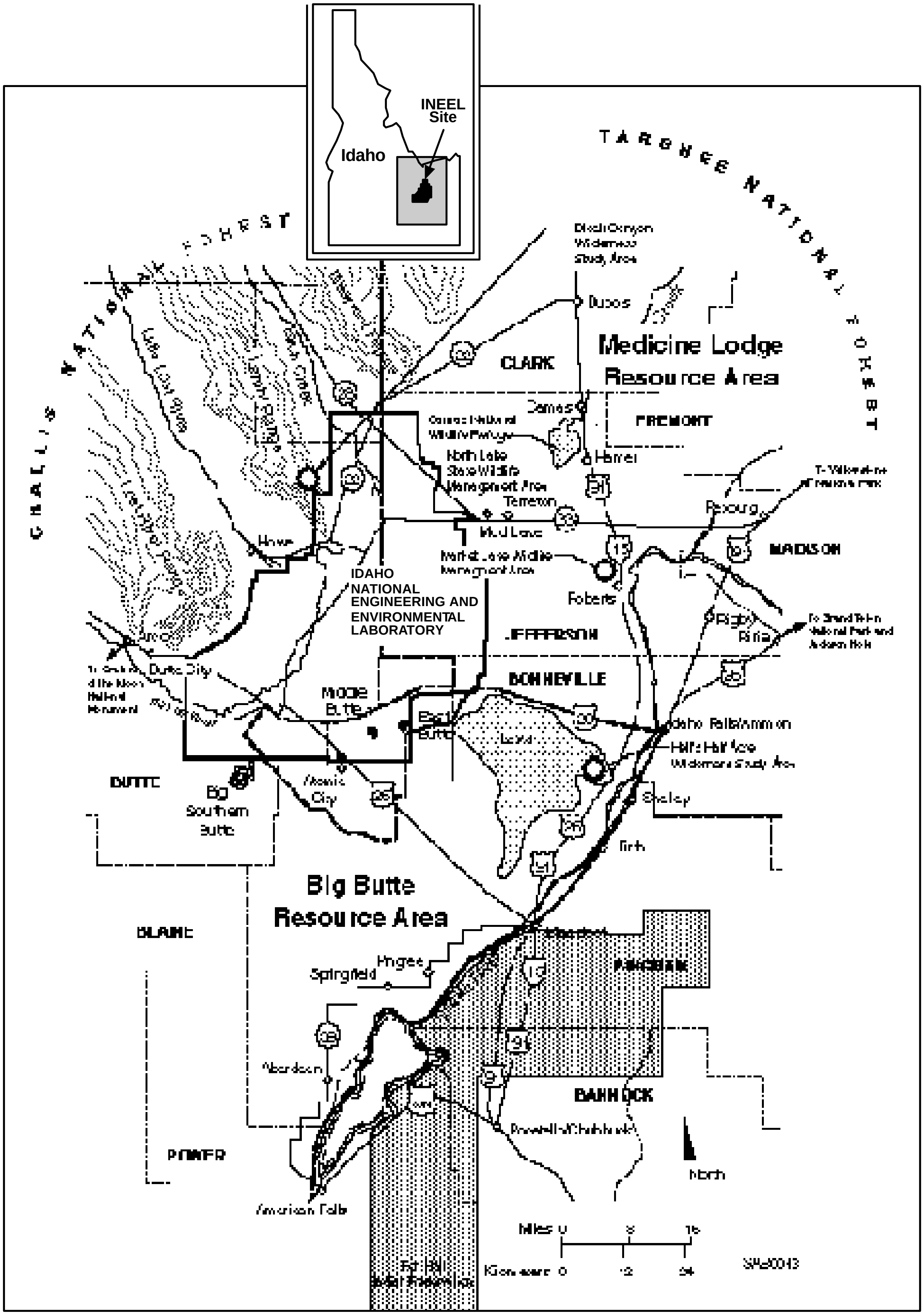


Figure 4.2-1 INEEL site vicinity map.

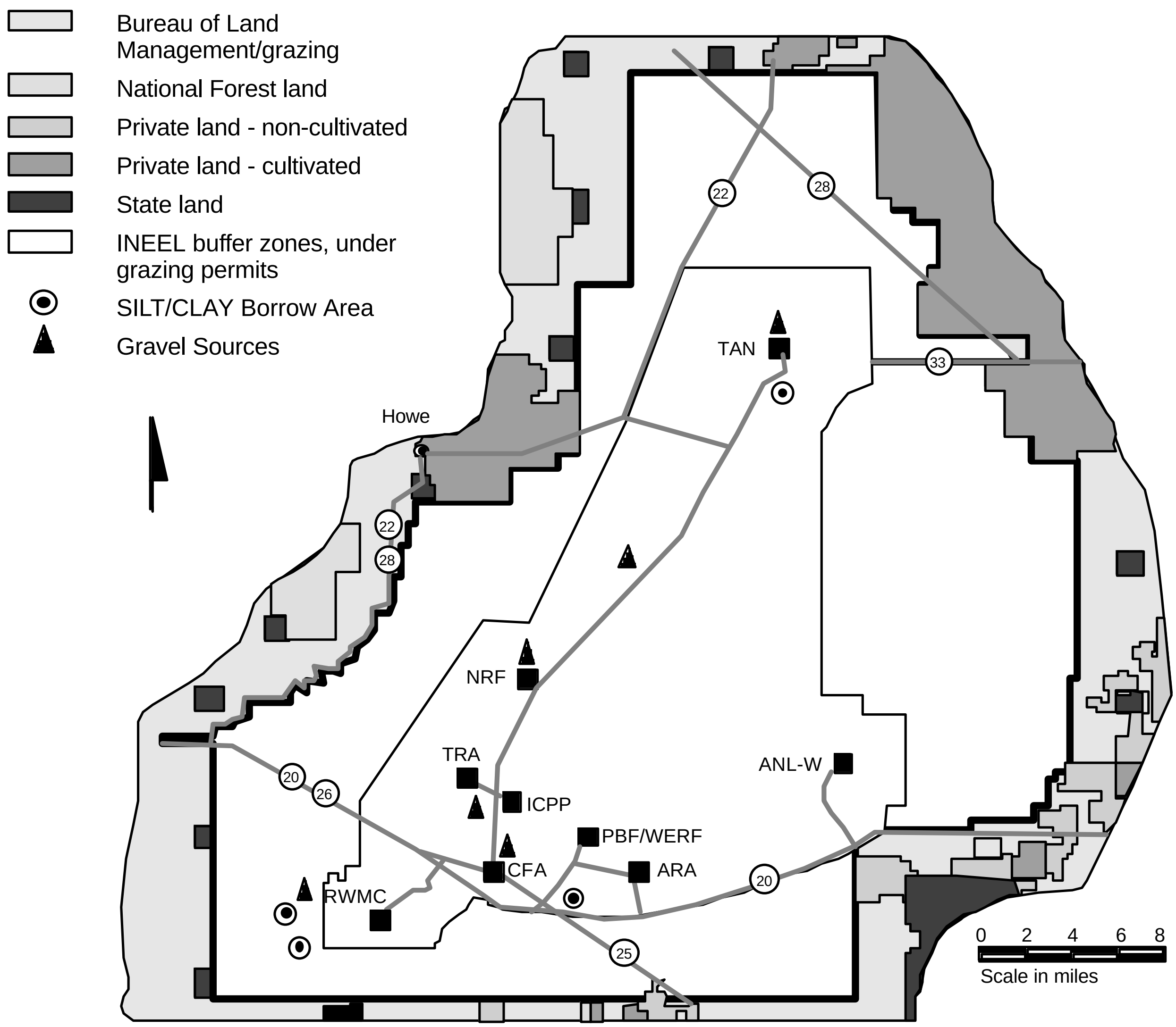


Figure 4.2-2. Selected land uses at the INEEL and in the surrounding region

Table 4.2-1. Summary of land use within the primary facility areas of the INEEL.

Facility area	Land area (acres)	Total gross square feet of facilities	Land use
Argonne National Laboratory–West	84	600,000	Industrial uses associated with nuclear power research. Other land uses include support facilities, tank areas, spent fuel storage, and wastewater treatment and disposal.
Central Facilities Area	968	683,379	Centralized support facilities for site-wide operations (e.g., security, warehousing, transportation, and food service facilities). Other uses include laboratories and other administrative offices (e.g., the National Oceanic and Atmospheric Administration and the U.S. Geologic Survey).
Idaho Chemical Processing Plant	265	1,152,073	Spent fuels storage, high-level waste treatment and storage, and analytical laboratory facilities. Other uses include a coal-fired steam-generating plant, a wastewater treatment facility, office facilities, and warehouse facilities.
Naval Reactors Facility	187	673,000	Industrial uses associated with receipt and examination of Navy spent nuclear fuel and examination of expended core components and irradiated material test specimens. Other land uses include support facilities such as offices, storage areas, and wastewater treatment and disposal.
Power Burst Facility	19	112,481	Industrial uses associated with research and development of radioactive and mixed waste management technologies and waste-reduction activities.
Radioactive Waste Management Complex	187	738,859	Industrial uses associated with disposal and transfer of hazardous and radioactive waste. Other land uses include support-related facilities such as offices and maintenance shops.
Site-Wide Area	567,103	92,502	Composed of the land outside the boundaries of the primary facility areas. Most of the buildings and structures in the site-wide area are old, abandoned, and scheduled for, or in the process of, demolition. Land uses include communication, utility, and transportation systems and open land that serves as a safety-and-security buffer and a livestock grazing zone. The site-wide area constitutes most of the Idaho National Environmental Research Park, which serves as an outdoor laboratory for ecological research by university, contractor, and Government scientists.
Test Area North	220	693,559	Industrial facilities primarily involved in researching, engineering, and remote handling of radioactive materials. This area is also home to facilities used for activities that are considered hazardous and to facilities used for research, development, and manufacturing for the Department of the Army.
Test Reactor Area	102	610,000	Industrial land use supporting nuclear reactor research. Other uses include support facilities (storage tanks, maintenance buildings, warehouses); laboratories; and sanitary and radioactive waste treatment facilities.

The BLM has entered into a MOU with DOE to permit livestock operators to graze livestock in designated areas outside the central core area. A summary of selected land use at the INEEL and in the surrounding region is shown in Figure 4.2-2.

The Federal government manages approximately 75 percent of the land bordering INEEL; this land is administered by the BLM and U.S. Forest Service. Twenty-four percent of adjacent land is privately owned, with one percent held by the State of Idaho. Land uses on Federal–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 and crop production. Small communities and towns located near the INEEL boundaries are shown in Figure 4.2-1.

No onsite land use restrictions due to Native American treaty rights would exist for any of the alternatives described in the EIS. The INEEL does not lie within any of the land boundaries established by the Fort Bridger Treaty. Furthermore, the entire INEEL is land occupied by the DOE, and therefore the provision in the Fort Bridger Treaty that allows the Shoshone and Bannock Indians the right to hunt on the unoccupied lands of the United States does not presently apply to any land upon which the INEEL is located. Potential impacts of the alternatives upon Native American and other cultural resources, and potential mitigation measures, are discussed in Section 5.20, Environmental Justice, and Section 5.4, Cultural Resources.

Because the INEEL is remotely located from most developed areas, the INEEL and adjacent areas are not likely to experience large-scale residential and commercial development (DOE-ID 1995c). However, recreational and agricultural uses are expected to increase in the surrounding area in response to greater demand for these types of land uses (DOE-ID 1995c). One proposed new development that could affect the use of the INEEL in the vicinity of the RWMC is a quartzite mining and processing operation in the Arco Canyon area 3 miles east of Arco, Idaho (BLM 1997).

4.3 Socioeconomics

This section presents an overview of current socioeconomic conditions within a region of influence (ROI) where more than 95 percent of the INEEL workforce reside. The INEEL ROI is a seven-county area comprised of Bannock, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison Counties. Cities located in the ROI are shown in Figure 4.2-1. During 1996, INEEL employees and their families accounted for 20 percent of Bonneville County's population and composed almost 30 percent of Idaho Falls' population. INEEL employees and their families represent only 2 percent of the population of Bannock and Madison Counties (DOE/INEEL 1996).

4.3.1 Employment and Income

The INEEL ROI is rural in character, and the economy has historically been based on natural resources. Consistent with most regions of the country, economic growth over the past several decades has been in nonagricultural sectors. Although farming and agricultural services remain important to the ROI economy, these sectors provide less than 8 percent of the total number of jobs in the ROI. The service, wholesale and retail trade, and public sectors are now the major sources of ROI employment. Together, these sectors generate approximately 70 percent of the jobs in the ROI. Manufacturing and construction jobs are also important sectors and accounted for about 13 percent of the ROI's employment in 1995 (BEA 1997a). Table 4.3-1 presents employment levels for the major sectors for the ROI.

The ROI experienced stable growth during the 1990s. The labor force grew from 105,837 in 1990 to 122,725 in 1996, an annual growth rate of almost 2.7 percent. Total ROI employment grew from 100,074 in 1990 to 117,009 in 1996, an annual growth rate of approximately 2.8 percent (BLS 1997). This growth rate was considerably higher than during the 1980s when ROI employment grew at approximately 1.2 percent annually.

The ROI unemployment rate was 4.7 percent in 1996, the lowest level in over a decade. Unemployment rates within the ROI ranged from a low of 3.0 percent in Madison County to a high of 5.4 percent in Bingham County. The unemployment rate for Idaho during 1996 was 5.2 percent (BLS 1997).

Table 4.3-1. Employment by sector in 1995.

Sector	Percentage
Services	29.6
Wholesale and retail	24.8
Government (including Federal, State, local, and military)	16.0
Manufacturing	7.1
Farm	5.9
Construction	5.9
Finance, insurance, and real estate	5.0
Transportation and public utilities	3.9
Agricultural service, forestry, and other	1.7

Source: BEA 1997a.

Per capita income for the ROI was $16,550 in 1995, a 17-percent increase over the 1990 level of $14,136. Per capita income levels within the ROI ranged from a low of $11,758 for Madison County to a high of $22,444 in Clark County. The per capita income for Idaho was $18,895 in 1995 (BEA 1997a).

The INEEL exerts a major influence on the ROI economy. During 1996, INEEL provided an average of 8,134 jobs, almost 7 percent of the total jobs in the ROI (DOE/INEEL 1996). The INEEL is the largest employer in Southeast Idaho and the second largest employer in Idaho (second to State government). The current workforce, however, is significantly lower than the peak of approximately 11,600 employees that worked at INEEL during 1992. Much of the employment loss was due to consolidation of contracts and reduction in defense-related activities. Employment projections indicate a stabilization of the job force at about 7,250 in Fiscal Year 2004.

4.3.2 Population and Housing

4.3.2.1 Population. From 1960 to 1990, population growth in the ROI paralleled Statewide growth. During this period, the ROI's population increased an average rate of approximately 1.3 percent, while the annual growth rate for the State was 1.4 percent. From 1990 to 1995, State population growth accelerated to over 3 percent per year, while ROI growth remained under 2 percent. Population growth rates for both the ROI and the State are projected to slow after the year 2000. Table 4.3-2 presents population estimates for the ROI through 1995 and projections for 2000 through 2025. Based on population trends, the ROI population will reach more than 339,000 persons by 2025.

Bannock and Bonneville are the two largest counties in the ROI; together, they accounted for almost 64 percent of the total ROI population in 1995. Butte and Clark are the most sparsely populated counties; together, they contain only 1.6 percent of the total ROI population. The largest cities in the ROI are Pocatello (in Bannock County) and Idaho Falls (in Bonneville County), with 1995 populations of approximately 51,132 and 48,411, respectively (DOC 1996).

Table 4.3-2. Population estimates for the INEEL ROI.

County	1990	1995	2000	2005	2010	2015	2020	2025
Bannock	66,026	72,043	78,252	81,303	84,474	90,894	96,802	102,710
Bingham	37,583	40,950	44,479	46,214	48,016	51,666	55,024	58,382
Bonneville	72,207	79,230	86,059	89,415	92,902	99,963	106,460	112,958
Butte	2,918	3,097	3,364	3,495	3,631	3,907	4,161	4,415
Clark	762	841	913	948	985	1,060	1,129	1,198
Jefferson	16,543	18,429	20,017	20,798	21,609	23,251	24,763	26,274
Madison	23,674	23,651	25,690	26,692	27,733	29,841	31,780	33,720
ROI	219,713	238,241	258,774	268,865	279,350	300,582	320,119	339,657

Sources: DOC 1996; BEA 1997a.

4.3.2.2 Housing. There were a total of 77,660 housing units in the ROI during 1990; approximately 70 percent of these units were single-family units, 17 percent were multi-family units, and 13 percent were mobile homes. Approximately 7.7 percent of the housing units were vacant, although some vacant units were used for seasonal, recreational, or other occasional purposes. Rental vacancy rates ranged from 2.8 percent in Madison County to 16.2 percent in Butte County. About 29 percent of the occupied housing units in the ROI were rental units, and 71 percent were homeowner units. The majority of housing units in the ROI were located in Bonneville and Bannock Counties, which include the cities of Idaho Falls and Pocatello.

In 1990, the median value of the owner-occupied housing units ranged from $37,300 in Clark County to $63,700 in Madison County, while the median monthly contract rents ranged from $158 in Butte County to $293 in Bonneville County. Table 4.3-3 shows housing characteristics for the ROI.

Table 4.3-3. ROI housing characteristics (1990).

County	Total number of housing units	Number of owner-occupied units[a]	Owner occupied-vacancy rates	Median value	Number of rental units[a]	Rental vacancy Rates	Median monthly contract rent
Bannock	25,694	16,082	2.4%	$53,300	7,330	10.3	$237
Bingham	12,664	8,830	2.0%	$50,700	2,683	9.2	$207
Bonneville	26,049	17,371	1.9%	$63,700	6,918	6.2	$293
Butte	1,265	744	4.6%	$41,400	253	16.2	$158
Clark	502	174	1.7%	$37,300	103	9.6	$189
Jefferson	5,353	3,920	2.0%	$54,300	951	4.1	$221
Madison	6,133	3,476	1.3%	$68,700	2,325	2.8	$239
ROI	77,660	50,597	2.1%	[b]	20,563	4.6	[b]

Source: DOC 1992
[a.] Does not include housing used for seasonal, recreational, or other uses.
[b.] Not applicable.

4.3.3 Community Services

This assessment evaluates the following community services in the ROI: public schools, law enforcement, fire protection, and medical services.

Seventeen public school districts and three private schools provide educational services for the approximately 57,000 school-aged children in the ROI. Higher education in the ROI is provided by the University of Idaho, Idaho State University, Ricks College, and the Eastern Idaho Technical College.

Law enforcement is provided by 15 county and municipal police departments that employed 373 sworn officers and 149 civilians in 1995. Idaho Falls and Pocatello supported the largest departments, each employing 82 police officers. Clark County and the Firth police department were each staffed with only two officers (DOJ 1996).

The ROI is served by a total of 18 municipal fire districts staffed with about 500 firefighters, of which approximately 300 are volunteer. In addition, the INEEL fire department provides round-the-clock coverage for the site. The staff includes 50 firefighters with no less than 16 firefighters on each shift. Bingham, Bonneville, Butte, Clark, and Jefferson Counties, which surround the INEEL, have developed emergency plans to be implemented in the event of a radiological or hazardous materials emergency. Each emergency plan identifies facilities, including the INEEL, with extremely hazardous substances and defines transportation routes for these substances. The emergency plans also include procedures for notification and response, listings of emergency equipment and facilities, evacuation routes, and training programs.

The ROI contains seven hospitals with a capacity of 1,012 beds (AHA 1995). Over 65 percent of the hospital beds were in Bannock and Bonneville Counties. No hospitals are located in either Clark or Jefferson Counties.

4.4 Cultural Resources

This section discusses cultural resources located within, and surrounding, the RWMC. These resources include prehistoric and historic archaeological sites, historic sites and structures, traditional resources of cultural or religious importance to local Native Americans, and paleontological localities. A more detailed description of cultural resources at the INEEL is contained in Section 4.4, Volume 2 of the DOE INEL EIS.

4.4.1 Archaeological Sites and Historic Structures

The INEEL contains a rich and varied inventory of cultural resources, including fossil localities, archaeological and historical remains, and military and Cold War era structures and features. Sites important to contemporary Native American groups are located throughout the INEEL. Historic sites document Anglo-European use of the area during the late 1800s and 1900s. These include the abandoned town of Powell/Pioneer, a northern spur of the Oregon Trail known as Goodale's Cutoff that crosses the southeastern edge of the INEEL approximately four miles southwest of the proposed AMWTP facility, many small homesteads, irrigation canals, sheep/cattle camps, and stage/wagon trails. Finally, important information on the historical development of nuclear science in America is also preserved in the many scientific and technical facilities within the INEEL's boundaries. Fifty-two nuclear reactors, many of which were "first-of-a-kind" facilities, were eventually built at the site (DOE 1998b). The Experimental Breeder Reactor I was the first reactor built onsite, was the first reactor in the world to generate electricity, and is the only property at INEEL to be formally nominated to the National Register of Historic Places (NRHP). The reactor is a designated National Historic Landmark located approximately four miles northeast of the proposed location of the AMWTP facility, as described in the DOE INEL EIS and the *Current INEEL Land Use* (DOE 1998c).

Archaeological sites are numerous on the INEEL, but have been relatively undisturbed by mission activities. As of January 1, 1998, approximately 6.6 percent (37,681 acres) of the INEEL have undergone systematic archaeological survey. These surveys have recorded 1,839 potentially significant archaeological sites. Over half of these sites are considered to be potentially eligible for nomination to the NRHP, and will require formal significance evaluations (Ringe-Pace 1998).

The Idaho State Historic Preservation Officer (SHPO) has determined that the portions of the RWMC within the perimeter fence have undergone extensive ground disturbance in the past that have likely destroyed any archaeological remains within that area. Based on this finding, the Idaho SHPO has found that no additional review of proposed projects within this area is necessary. However, if archaeological remains are discovered within the area, "stop work" stipulations must be followed, and the SHPO and DOE cultural resource personnel must be contacted as soon as possible (Yohe 1993).

A predictive model was developed to identify areas where densities of prehistoric sites are apparently highest (Ringe 1995). This information provides guidance for INEEL project managers in selecting appropriate areas for new construction. This model indicates prehistoric archaeological sites appear to be concentrated in association with certain definable physical features of the land, with dense concentrations projected along drainages, atop buttes, within craters and caves, and throughout a 1.75-mile-wide zone along the edge of local lava fields (Ringe 1995). The RWMC is located in a depression surrounded by basaltic and lava ridges (as discussed in Section 4.5.1), which according to the predictive model, have a high potential for archaeological sites.

Nine archaeological surveys have been conducted in the RWMC area. These surveys located 13 potentially significant prehistoric sites within a 656-foot-wide zone surrounding the outside of the perimeter fence. Test excavations have been conducted at three of the prehistoric sites that are in close proximity to the perimeter fence. One of these prehistoric sites has been determined to be ineligible for nomination to the NRHP. The site has since been destroyed by building construction; however, portions may still be present within the northern expansion of the RWMC (Ringe-Pace 1998, Yohe 1995).

The DOE Idaho Operations Officer (DOE-ID) has recently completed an historic buildings survey to assess the historic significance of all DOE-ID-managed buildings on the INEEL to determine their eligibility to the NRHP. Of the 509 buildings and structures inventoried, 213 are potentially eligible for nomination to the NRHP individually or as contributing elements of an historic district. Of these, 55 were located within the RWMC. Three of these Waste Management Facilities (WMF) buildings (WMF-601, WMF-610, and WMF-612) may be considered individually eligible for nomination to the NRHP or as contributing to a potential historic district (Ringe-Pace 1998). Memoranda of Agreement between DOE-ID, the Idaho SHPO, and the Advisory Council on Historic Preservation (ACHP) outline specific techniques for preserving the historic value of the properties in conformance with the requirements of the Historic American Building Survey and the Historic American Engineering Record (DOE-ID 1993). Facilities in the RWMC may require similar efforts in the future as they are scheduled for major modification or demolition.

Whenever possible, locations with a high likelihood of archaeological or Native American resources are avoided when siting new facilities or planning land use actions. Historically significant architectural structures are carefully considered prior to activities that may affect their historic integrity. Prior to ground-disturbing activities or facility modifications at INEEL, project managers are required to follow an environmental checklist that includes direct consultation with the INEEL Cultural Resources Management Office to avoid damage to any sensitive archaeological or historic resources. If avoidance is not possible, mitigation plans are developed in consultation with the Idaho SHPO, the ACHP, and the Shoshone-Bannock Tribes (DOE 1998c).

A draft management plan for cultural resources on the INEEL (DOE-ID 1995a) contains procedures for management of all cultural resources, based on Federal laws in combination with DOE policy. Cultural resource sites are further protected by the INEEL security force. Excavation, collection, and curation of artifacts is strictly controlled, and locational information on the sites is protected by law from public disclosure. The management plan also outlines responsibilities and consultation procedures with the Shoshone-Bannock Tribes, State and Federal agencies, and other INEEL stakeholders (DOE-ID 1995a, DOE 1998c).

4.4.2 Native American Cultural Resources

Native American people hold the land sacred. In their terms, the entire INEEL reserve is culturally important and, in fact, is located within the aboriginal territory of the Shoshone peoples (USGS 1978). The Shoshone and Bannock Tribes, linguistically distinct groups, were in the INEEL area at the time of European exploration. These tribes used the area as a natural corridor for hunting, gathering, and collecting important natural resources.

Cultural resources, to the Shoshone-Bannock Tribes as well as other Native Americans, include all forms of traditional lifeways and usages 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, mineral, or animal resources that have special historic and/or contemporary significance. A complete ethnobotanical survey has been conducted for the INEEL, including the RWMC area, which describes traditional Native American cultural uses of plants found on the INEEL (Anderson et al. 1996a).

Areas significant to the Shoshone-Bannock Tribes would include the buttes, wetlands, sinks, grasslands, juniper woodlands, Birch Creek, Big Southern Butte, Middle Butte, and the Big Lost River and the Little Lost River. None of these areas are located within the proposed project area; however, Middle Butte, the Big Lost River, and grasslands are found outside of the RWMC (Figure 4.2-1).

Five Federal laws (discussed in Section 4.4, Cultural Resources, of the DOE INEL EIS) prompt consultation between Federal agencies and Native American tribes. DOE-ID has established an INEEL Cultural Resources Management Team that is comprised of tribal cultural resource management staff, contractor staff, and DOE-ID staff who meet periodically to address cultural resource management issues. This Team has worked with the Shoshone-Bannock Tribes to develop guidelines for conducting consultations with the Tribes (DOE-ID 1995a). INEEL's cultural resources management plan defines procedures for involving the Shoshone-Bannock Tribes during the planning stages of project development. As a comprehensive inventory of Native American resources has not been completed at INEEL, direct consultation with interested tribal governments is critical for successful implementation of INEEL projects. DOE-ID also has a curation agreement with the Idaho Museum of Natural History in Pocatello specifying how non-*Native American Grave Protection and Repatriation Act* (NAGPRA) artifacts from the INEEL (such as unassociated arrowheads or historical artifacts from the Anglo-European settlement era) are submitted to and stored at the museum (DOE-ID 1996a). DOE-ID does not send NAGPRA cultural items or human remains to the museum; rather, DOE-ID consults with the Tribes and the Idaho State Archaeologist on the appropriate management of such items.

4.4.3 Paleontological Resources

Documentation suggests that the region has relatively abundant and varied paleontological resources, including fossils of marine invertebrates, an extinct species of horse, mammoth, and camel representing different geologic eras (DOE-ID 1995a: Table 3-1). Although no formal paleontological surveys have been conducted at the RWMC, several fossil remains from this location have been recovered and are curated at the Idaho Museum of Natural History. These items include a horse metapodial, an unidentified horse megafaunal element, a mammoth tusk and bone, and wood and plant concretions. These fossils were recovered from alluvium strata at 3 to 16 feet below the surface (DOE-ID 1995a: Table 2 Appendix J).

4.5 Aesthetic and Scenic Resources

This section describes the visual character of the INEEL and the RWMC and briefly discusses the scenic areas in the vicinity of the INEEL. A detailed description of the INEEL's aesthetic and scenic resources is contained in Volume 2, Part A, Section 4.5 of the DOE INEL EIS.

The INEEL is part of the Snake River Plain ecosystem and generally consists of sagebrush steppe and native grasses. Seventy-five percent of the land that borders the site is managed by the Federal government (BLM and Forest Service), 24 percent is privately owned, and 1 percent is State-owned. The surrounding volcanic cones, domes, and mountain ranges are visible throughout the INEEL. As discussed in Section 4.2, Land Use, eight primary facility areas are located on the INEEL. The INEEL facilities look like commercial/industrial complexes and are widely dispersed throughout the INEEL. Although many INEEL facilities are visible from highways, most facilities are located over half a mile from public roads.

4.5.1 Visual Character of the Advanced Mixed Waste Treatment Project Site

The RWMC is a restricted-access area located 7 miles southwest of the CFA at the INEEL. The RWMC is located in a depression circumscribed by basaltic lava ridges. The ground surface is relatively flat at an elevation of about 5,000 feet above sea level. The BLM has classified the acreage within INEEL as Visual Resource Management Class III (mixed use: i.e., contrasts to the basic elements caused by management activity are evident, but should remain subordinated to the existing landscape) and IV (industrial use: i.e., any contrast attracts attention and is a dominant feature of the landscape in terms of scale). The RWMC maintains industrial uses consistent with Class IV. The proposed AMWTP site would be located within the TSA Zone of the RWMC between existing structures (see Figure 1.4-1).

4.5.2 Scenic Areas

Lands adjacent to the INEEL under the BLM jurisdiction are designated as Visual Resource Management Class II (i.e., changes in any of the basic elements [form, line, color, texture] caused by a management activity should not be evident in the characteristic landscape) (BLM 1984, 1986). This designation urges preservation and retention of the existing character of the landscape. Lands within the INEEL boundaries are designated as Class III and IV, the most lenient classes in terms of allowed modification.

The Craters of the Moon National Monument is located about 13 miles southwest of the INEEL's western boundary. The Monument contains a designated Wilderness Area, for which Class I (very high) air quality standards, or minimal degradation, must be maintained.

The BLM has listed the Black Canyon Wilderness Study Area, located adjacent to the INEEL (see Figure 4.2-1), for 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 (i.e., natural ecological changes and very limited management activity are allowed.

Features of the natural landscape have special significance to the Shoshone-Bannock tribes, and some INEEL features such as East Butte and Middle Butte are within the visual range of the Fort Hall Indian Reservation.

4.6 Geology

This section describes the geological, mineral resources, seismic, and volcanic characteristics of the INEEL, the RWMC, and surrounding area. A more detailed description of geology at the INEEL can be reviewed in Appendix E–2 and in the DOE INEL EIS, Volume 2, Section 4.6.

4.6.1 General Geology

The INEEL occupies a relatively flat area on the northwestern edge of the Eastern Snake River Plain (Figure 4.6-1). The INEEL area consists of a broad plain that has been built up from the eruptions of multiple flows of basaltic lava and deposition sediments. The flows at the surface at the INEEL and surrounding area range in age from 1.2 million to 2,100 years. The Plain is bounded on the north and south by the north-to-northwest-trending mountains and valleys of the Basin and Range Province, comprised of folded and faulted rocks. The Plain is bounded on the northeast by the Yellowstone Plateau. The Plain features thin, discontinuous, interbedded deposits of wind-blown loess and sand; water-borne alluvial fan, lacustrine, and flood-plain alluvial sediments; and rhyolitic domes (Kuntz et al. 1990).

The seismic characteristics of the Plain and the adjacent Basin and Range Province are different. Earthquakes and active faulting are associated with Basin and Range tectonic activity. The Plain, however, has historically experienced few and small earthquakes (King et al. 1987, Pelton et al. 1990, Woodward-Clyde 1992a, Jackson et al. 1993). The major episode of Basin and Range faulting began 20 to 30 million years ago and continues today, most recently associated with the October 28, 1983, Borah Peak earthquake northwest of the RWMC. The earthquake had a surface magnitude of 7.3 with peak horizontal acceleration of 0.022 to 0.078g at the INEEL (Jackson 1985).

Four northwest-trending volcanic rift zones (VRZ) (Figure 4.6-2) are known to lie across the Plain at or near the INEEL; they have been attributed to basaltic eruptions that occurred 4 million to 2,100 years ago (Bowman 1995, Hackett and Smith 1992, Kuntz et al. 1990).

INEEL soils are derived from volcanic and sedimentary rocks from nearby highlands. In the southern part of the INEEL, the soils are gravelly to rocky and generally shallow. The northern portion is composed mostly of unconsolidated clay, silt, and sand. The thickness of surficial sediments on the INEEL ranges from less than one foot at basalt outcrops east of the Idaho Chemical Processing Plant (ICPP) to 313 feet near and southeast of the Big Lost River sinks (Anderson 1996b).

The RWMC is situated in a small valley surrounded by basaltic ridges rising to 60 feet above the landscape. Surface sediments vary in thickness from about 2 to 23 feet and consist of unconsolidated clay, silt, and gravel (Anderson 1996b). The elevation of the RWMC is 5,010 feet above mean sea level. Surface sediment at the proposed site of the AMWTP would be excavated to construct the building foundation on bedrock.

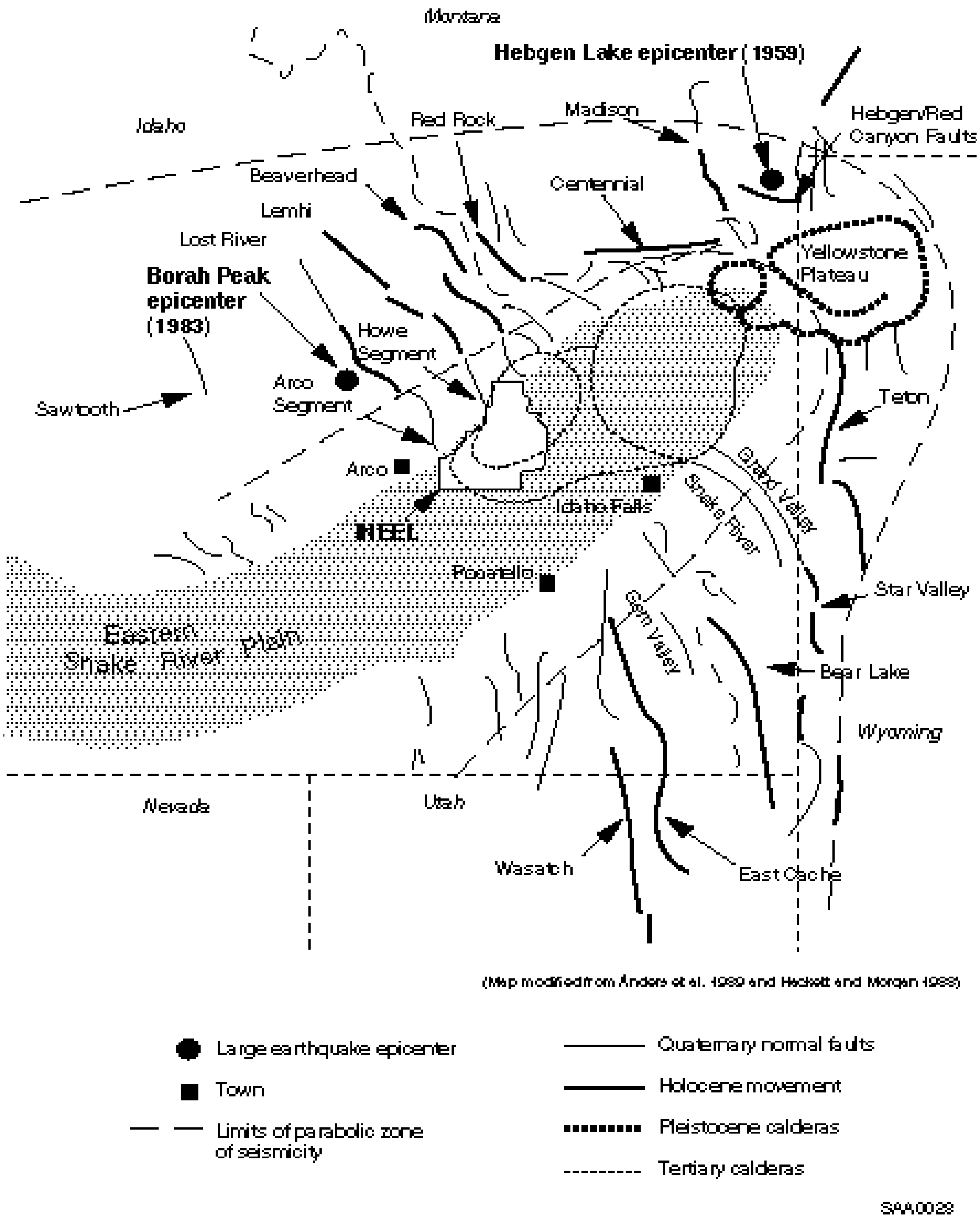


Figure 4.6-1. Geologic features in the region of the INEEL.

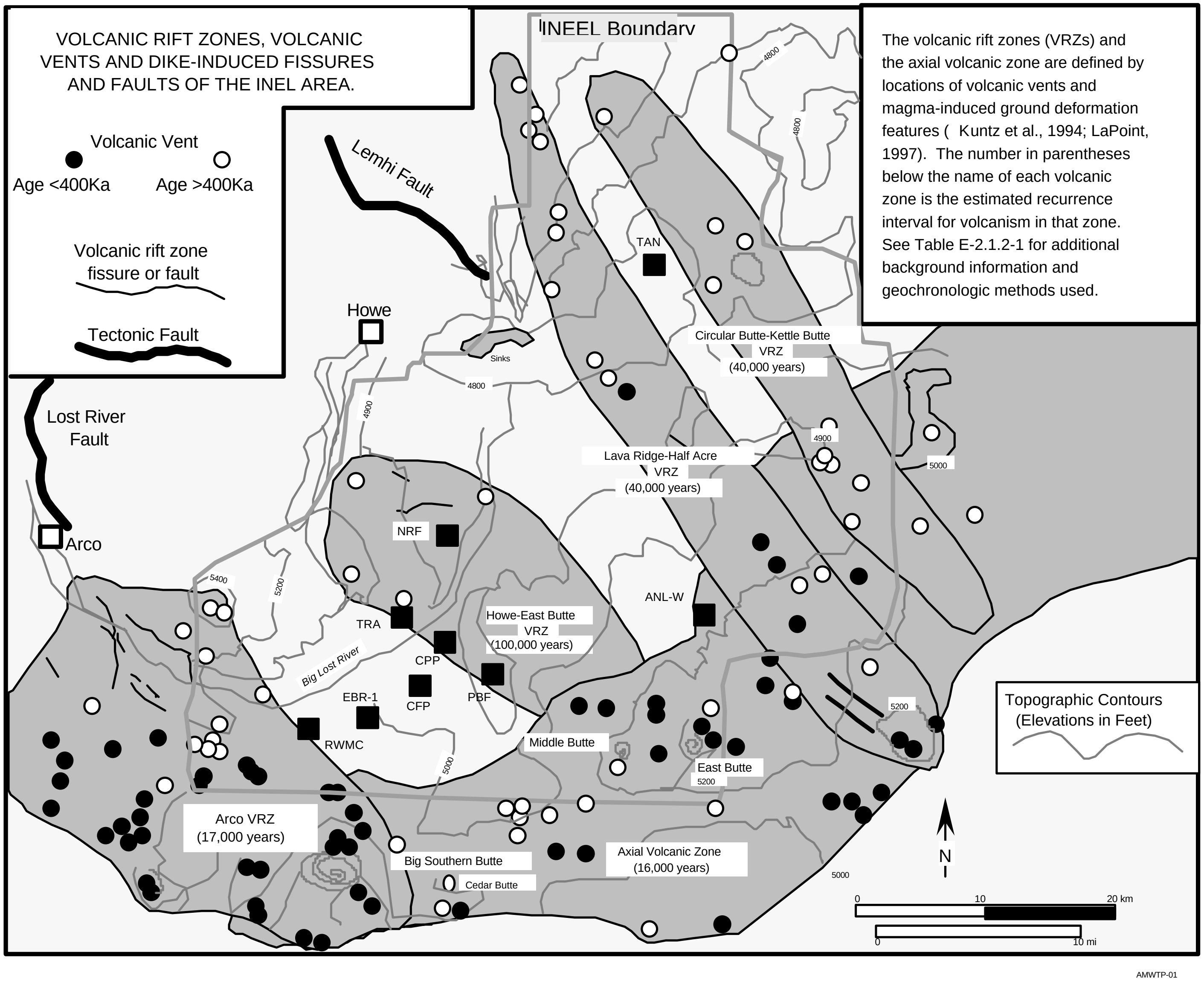


Figure 4.6-2. Map of INEEL, showing locations of VRZs and lava flow hazard zones.

4.6.2 Mineral Resources

Mineral resources within the INEEL boundary include sand, gravel, pumice, silt, clay, and aggregate. These resources are extracted at several quarries or pits at INEEL and used for road construction and maintenance, new facility construction and maintenance, and waste management activities. The RWMC uses construction materials extracted from the existing INEEL borrow source areas (Figure 4.2-2). The geologic history of the Plain makes the potential for petroleum production at the INEEL very low. The potential for geothermal energy exists at INEEL; however, a study conducted in 1979 at INEEL identified no commercial quantities of geothermal fluids (Mitchell et al. 1980).

4.6.3 Seismic Hazards

The Snake River Plain has a remarkably low rate of seismicity, whereas the surrounding Basin and Range has a fairly high rate of seismicity (Woodward-Clyde 1992a). Major seismic hazards consist of the effects from ground shaking and surface deformation (e.g., surface faulting, tilting). Other potential seismic hazards such as avalanches, landslides, mudslides, and soil liquefaction are not likely to occur at the INEEL because the local geologic conditions are not conducive to these types of activities. Based on the seismic history and the geologic conditions of the area, a moderately low seismic risk exists at INEEL including the RWMC where the proposed AMWTP would be sited (see Appendix E-2). However, moderate to strong ground shaking can affect the INEEL from earthquakes in the Basin and Range.

For purposes of siting new facilities within the INEEL, a series of seismic hazard maps have been generated (Smith 1995). Through the use of contour lines, these maps show the levels of ground motion (accelerations due to gravity [g]) to be expected at various return periods. For a 500-year period, the RWMC falls within the 0.10g contour; and, for a 2,000-year return period, it falls within the 0.18g contour (see Appendix E-2). Although the contoured ground motions can be used for site selection purposes and as a general guide to the levels of seismic hazard any place on the INEEL, they are not for design of facilities. INEEL seismic design basis events are determined by the INEEL Natural Phenomena Committee and incorporated into the INEEL Architectural and Engineering Standards based on seismic hazard studies and the requirements of DOE Order 420.1. The potential seismic risk would be considered and incorporated in the design of the AMWTP. Section 5.14, Facility Accidents, presents the potential impacts of postulated seismic events.

4.6.4 Volcanic Hazards

Volcanic hazards include the effects of lava flows, fissures, uplift, subsidence, volcanic earthquakes, and ash flows or airborne ash deposits. Basalt volcanic activity occurred from 4 million to 2,100 years ago in the INEEL site area. The statistics of 116 measured INEEL-area lava flow lengths and areas were used to define the two lava flow hazard zones (Figure 4.6-2). The most recent and closest volcanic eruption occurred 2,000 years ago at the Craters of the Moon National Monument 15 miles southwest of the INEEL (Kuntz et al. 1992). Based on probability analysis of the volcanic history in and near the south-central INEEL area, the Volcanism Working Group estimated that the conditional probability that basaltic volcanism would affect a south-central INEEL location is less than 2.5×10^{-5} per year (once per 40,000 years or longer), where the hazard associated with Axial Volcanic Zone volcanism is greatest (VWG 1990). The estimated recurrence interval for the Axial Volcanic Zone is 16,000 years, 17,000 years for the Arco VRZ, and 40,000 years for the Lava Ridge-Hells Half Acre VRZ (Hackett and Smith 1994).

Although there is a history of volcanism in the INEEL area, explosive volcanic eruptions are improbable. Lava flows associated with Axial Volcanic Zone volcanism are considered more of a potential hazard at the RWMC. The DOE INEL EIS, Volume 2, Section 5.14, Facility Accidents, presents the effects of a hypothetical lava flow that covers the RWMC. Section 5.14 of this EIS presents tiered analyses of the effects of a hypothetical lava flow that covers the AMWTP after scaling factors have been applied to both frequency and consequences. The scaling was based on AMWTP project-specific-related changes in RWMC waste inventories and handling.

4.7 Air Resources

This section describes the air resources of the INEEL and the surrounding area. The discussion includes the climatology and meteorology of the region, a summary of applicable regulations, descriptions of radiological and nonradiological air contaminant emissions, and a characterization of existing levels of air pollutants. Emphasis is placed on changes in air resource conditions since the characterization performed to support the DOE INEL EIS, Section 4.7, Air Resources, from which this document is tiered. Additional detail and background information on the material presented in this section can be found in Appendix E-3, Air Resources.

4.7.1 Climate and Meteorology

The Eastern Snake River Plain climate exhibits low relative humidity, wide daily temperature swings, and large variations in annual precipitation. Average seasonal temperatures measured onsite range from 18.8°F in winter to 64.8°F in summer, with an annual average temperature of about 42°F. Temperature extremes range from a summertime maximum of 103°F to a wintertime minimum of -49°F. Annual precipitation is light, averaging 8.71 inches, with monthly extremes of 0 to 5 inches. The maximum 24-hour precipitation is 1.8 inches. The greatest short-term precipitation rates are primarily attributable to thunderstorms, which occur approximately two or three days per month during the summer. Average annual snowfall at the INEEL is 27.6 inches, with extremes of 59.7 inches and 6.8 inches.

Most onsite locations experience the predominant southwest/northeast wind flow of the Eastern Snake River Plain, although terrain features near some locations cause variations from this flow regime. An illustration of annual wind flow is provided by the wind roses in Figure 4.7-1. These wind roses show the frequency of wind direction (in other words, the direction from which the wind blows) and speed at three of the meteorological monitoring sites on the INEEL for the period 1988 to 1992. Multi-year wind roses exhibit little variability in time and are representative of current conditions. INEEL wind roses reflect the predominance of southwesterly winds that result during storm passage and from daily solar heating. Winds from this direction are frequently unstable or neutral, promoting effective dispersion, and extend to a considerable depth through the atmosphere. At night, cool, stable air frequently drains down the valley in a shallow layer from the northeast toward the southwest. Under these conditions, dispersion is limited until solar heating the following day mixes the plume through the mixed depth. Winds above such stable layers exhibit less variability and provide the transport environment for materials released from INEEL sources.

The highest hourly average near-ground wind speed measured onsite is 51 miles per hour from the west-southwest, with a maximum instantaneous gust of 78 miles per hour (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 between 1950 to 1997. 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 20 miles southwest of the proposed AMWTP site), the annual average visual range is 144 miles (Notar 1998)[1].

[1] The visual range at the time the DOE INEL EIS analyses were performed was 97 miles.

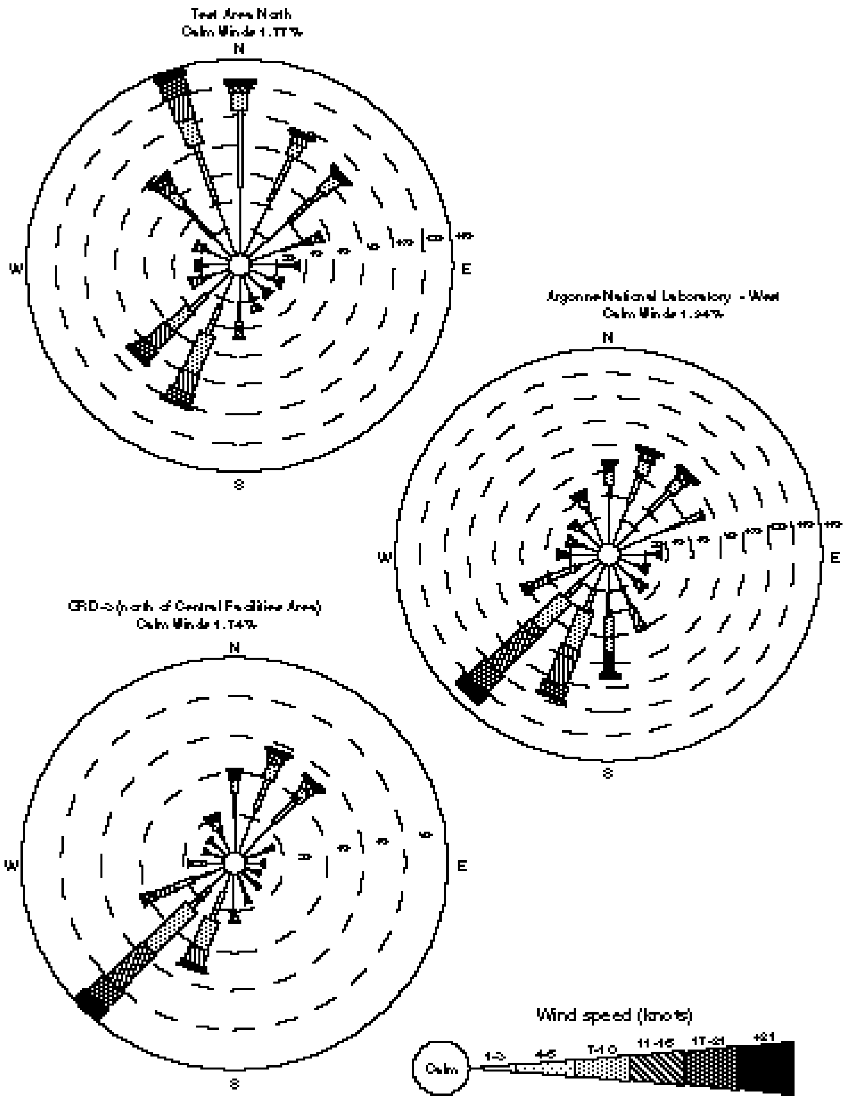


Figure 4.7-1. Annual average wind direction and speed at meteorological monitoring stations on the INEEL.

4.7.2 Standards and Regulations

Air quality regulations have been established to protect the public from potential harmful effects of air pollution. These regulations (1) designate acceptable levels of pollution in ambient air, (2) establish limits on radiation doses to members of the public, (3) establish limits on air pollutant emissions and resulting deterioration of air quality due to vehicular and other sources of human origin, (4) require air permits to regulate (control) emissions from stationary (nonvehicular) sources of air pollution, and (5) designate prohibitory rules, such as rules that prohibit open burning. The Federal *Clean Air Act* (and amendments) provides the framework to protect the nation's air resources and public health and welfare. In Idaho, the Environmental Protection Agency (EPA) and the State of Idaho Department of Health and Welfare (IDHW), Division of Environmental Quality, are jointly responsible for establishing and implementing programs that meet the requirements of the Federal *Clean Air Act*. INEEL activities are subject to air quality regulations and standards established under the *Clean Air Act* and by the State of Idaho (IDHW 1997) and to internal policies and requirements of the DOE. The area around the INEEL is in attainment or unclassified for all National Ambient Air Quality Standards (NAAQS). Air quality standards and programs applicable to INEEL operations are summarized in Appendix E-3, Air Resources.

4.7.3 Radiological Air Quality

The population of the Eastern Snake River Plain is exposed to environmental radiation of both natural and human origin. This section summarizes the sources and levels of radiation exposure in this geographical region, including sources of airborne radionuclide emissions from the INEEL.

4.7.3.1 Sources of Radioactivity. The major source of radiation exposure in the Eastern Snake River Plain is natural background radiation. Sources of radioactivity related to INEEL operations contribute a small amount of additional exposure.

Background radiation includes sources such as cosmic rays; radioactivity naturally present in soil, rocks, and the human body; and airborne radionuclides of natural origin (such as radon). Radioactivity still remaining in the environment as a result of worldwide atmospheric testing of nuclear weapons also contributes to the background radiation level, although in very small amounts. The natural background dose for residents of the Eastern Snake River Plain is estimated at about 360 millirem per year, with more than half (about 200 millirem per year) caused by the inhalation of radioactive particles formed by the decay of radon (DOE-ID 1997c).

INEEL operations can result in releasing radioactivity to air either directly (such as through stacks or vents) or indirectly (such as by resuspension of radioactivity from contaminated soils). Emissions from INEEL facilities include radioisotopes of the noble gases (argon, krypton, and xenon) and iodine; particulate fission products, such as ruthenium, strontium, and cesium; radionuclides formed by neutron activation, such as tritium (hydrogen-3), carbon-14, and cobalt-60; and heavy elements, such as uranium, thorium, and plutonium, and their decay products. Table 4.7-1 provides a summary of the principal types of airborne radioactivity emitted during 1995 and 1996 from INEEL facilities.

4.7.3.2 Existing Radiological Conditions. Monitoring and assessment activities are conducted to characterize existing radiological conditions at the INEEL and surrounding environment. Results of these activities show that exposures resulting from airborne radionuclide emissions are well within applicable standards and are a small fraction of the dose from background sources. These results are discussed in the following sections for both onsite and offsite environments.

Table 4.7-1. Summary of airborne radionuclide emissions (in curies) for 1995 and 1996 from facility areas at the INEEL.

	Tritium/ Carbon-14		Iodines		Noble gases		Mixed fission and activation products[a]		U/Th/TRU[b]	
Area	1995	1996	1995	1996	1995	1996	1995	1996	1995	1996
Monitored sources										
Argonne National Laboratory-West	-	8.9E+00	-[c]	-	1.0E+01	1.0E+03	7.9E-07	3.5E-06	3.1E-05	3.2E-05
Central Facilities Area	-	-	-	-	-	-	-	-	-	-
Idaho Chemical Processing Plant	4.4E+00	1.4E+02	9.6E-03	5.5E-02	6.6E-04	2.9E-02	4.3E-04	3.4E-04	1.1E-06	6.5E-06
Naval Reactors Facility	-	-	-	-	-	-	-	-	-	-
Power Burst Facility	3.8E-02	4.1E-02	2.7E-05	2.7E-05	-	-	-	-	-	-
Rad. Waste Management Complex	-	-	-	-	-	-	-	-	-	-
Test Area North	-	-	-	-	-	-	-	-	-	-
Test Reactor Area	-	-	-	-	-	-	-	-	-	-
INEEL Total	4.5E+00	1.5E+02	9.6E-03	5.5E-02	1.0E+01	1.0E+03	4.3E-04	3.4E-04	3.2E-05	3.8E-05
Other release points										
Argonne National Laboratory-West	5.9E-02	1.9E-02	-	-	-	5.1E-04	1.2E-05	7.8E-06	2.8E-07	1.3E-07
Central Facilities Area	-	-	-	-	-	-	3.1E-06	3.1E-06	1.2E-05	1.3E-05
Idaho Chemical Processing Plant	2.1E-04	2.1E-08	1.8E-09	1.8E-09	-	-	3.6E-04	4.3E-03	6.4E-06	2.0E-06
Naval Reactors Facility	8.6E-01	1.3E+00	5.4E-06	2.4E-05	4.9E-01	4.5E-02	8.9E-06	3.5E-04	-	4.9E-06
Power Burst Facility	-	-	-	-	-	-	1.7E-07	5.8E-07	4.0E-08	1.5E-07
Rad. Waste Management Complex	-	-	-	-	-	-	1.4E-13	1.4E-05	-	2.0E-06
Test Area North	6.8E-03	1.4E-04	-	-	-	-	2.8E-06	4.2E-06	1.4E-05	1.3E-06
Test Reactor Area	1.3E+01	1.3E+01	1.3E-02	2.9E-03	1.4E+03	1.8E+03	3.4E+00	6.0E+00	2.5E-06	9.0E-06
INEEL Total	1.4E+01	1.4E+01	1.3E-02	2.9E-03	1.4E+03	1.8E+03	3.4E+00	6.0E+00	3.5E-05	3.2E-05
Fugitive sources										
Argonne National Laboratory-West	-	-	-	-	-	-	-	-	-	-
Central Facilities Area	6.6E+00	5.6E+00	-	-	-	-	1.9E-05	1.9E-05	6.6E-08	6.4E-08
Idaho Chemical Processing Plant	8.9E-09	8.9E-09	3.8E-08	3.8E-08	-	-	9.2E-06	1.6E-06	5.9E-08	5.7E-08
Naval Reactors Facility	-	1.3E+00	-	2.4E-05	-	-	7.8E-05	2.8E-04	-	5.0E-06
Power Burst Facility	-	1.4E-02	-	-	-	-	5.8E-05	5.8E-05	1.5E-07	1.5E-07
Rad. Waste Management Complex	9.0E+02	7.0E+02	-	-	-	-	1.4E-05	1.4E-05	9.5E-09	9.5E-09
Test Area North	5.9E-02	5.9E-02	-	-	-	-	3.5E-06	1.3E-04	9.4E-08	9.4E-08
Test Reactor Area	8.0E+01	8.0E+01	-	-	-	-	1.1E-02	1.1E-01	3.0E-04	2.9E-04
INEEL Total	9.9E+02	7.9E+02	3.8E-08	2.4E-05	-	-	1.1E-02	1.1E-01	3.0E-04	3.0E-04
Total INEEL releases										
Argonne National Laboratory-West	5.9E-02	8.9E+00	-	-	1.0E+01	1.0E+03	1.3E-05	1.1E-05	3.2E-05	3.2E-05
Central Facilities Area	6.6E+00	5.6E+00	-	-	-	-	2.2E-05	2.2E-05	1.2E-05	1.3E-05
Idaho Chemical Processing Plant	4.4E+00	1.4E+02	9.6E-03	5.5E-02	6.6E-04	2.9E-02	8.0E-04	4.6E-03	7.5E-06	8.6E-06
Naval Reactors Facility	8.6E-01	2.6E+00	5.4E-06	4.8E-05	4.9E-01	4.5E-02	8.7E-05	6.3E-04	-	9.9E-06
Power Burst Facility	3.8E-02	5.5E-02	2.7E-05	2.7E-05	-	-	5.8E-05	5.9E-05	1.9E-07	3.0E-07
Rad. Waste Management Complex	9.0E+02	7.0E+02	-	-	-	-	1.4E-05	2.8E-05	9.5E-09	2.0E-06
Test Area North	6.6E-02	5.9E-02	-	-	-	-	6.2E-06	1.4E-04	1.4E-05	1.4E-06
Test Reactor Area	9.3E+01	9.3E+01	1.3E-02	2.9E-03	1.4E+03	1.8E+03	3.4E+00	6.1E+00	3.0E-04	3.0E-04
INEEL Total	1.0E+03	9.5E+02	2.2E-02	5.8E-02	1.4E+03	2.9E+03	3.4E+00	6.2E+00	3.7E-04	3.7E-04

Source: DOE-ID 1996b and 1997a.

a. Mixed fission and activation products that are primarily particulate in nature (e.g., cobalt-60, strontium-90, and cesium-137).

b. U/Th/TRU = Radioisotopes of heavy elements such as uranium, thorium, plutonium, americium, neptunium, etc.

[c.] The emissions from this group are negligibly small or zero.

It is important to note that characterizations of existing conditions also take into account increases in radionuclide emissions and radiation doses that are projected to occur between the present and the time that the proposed AMWTP becomes operational. These increases are assumed to be adequately described by the impacts associated with the Preferred Alternative assessed in the DOE INEL EIS (Section 5.7 and Appendix F-3). Thus, all subsequent reference to "baseline conditions and projected increases" refers to existing conditions plus increases associated with the DOE INEL EIS Preferred Alternative. However, some modifications were necessary to correct or update the Preferred Alternative impacts as follows:

- The Preferred Alternative included a conceptual facility (called the Idaho Waste Processing Facility) that has been replaced by the proposed AMWTP.
- The Preferred Alternative included operation of the Waste Experimental Reduction Facility (WERF), which would not operate concurrently with the proposed AMWTP.
- The Preferred Alternative addressed impacts that would occur within or around the entire INEEL, and some of these areas are unaffected by the proposed AMWTP.

The specific modifications made to reflect these conditions are described in Appendix E-3.

4.7.3.2.1 Onsite Doses. An indication of radiological conditions is obtained by comparing radiation levels on and near the INEEL boundary communities and distant locations (Figure 4.7-2). Results from onsite and boundary community locations include contributions from background conditions and INEEL emissions, while distant locations represent background conditions beyond the influence of INEEL emissions. These data show that over the most recent 5-year period for which results are available (1992-1996), average radiation exposure levels for the boundary locations were no different than those at distant stations. The average annual dose measured by the Environmental Science and Research Foundation, Inc. during 1996 was 123 millirem for distant locations and 124 millirem for boundary community locations. The corresponding averages measured by Lockheed Martin Idaho Technologies Company (LMITCO) were 127 millirem for the distant group and 125 millirem for the boundary group. These differences are well within the range of normal variation. On the INEEL, dosimeters around some facilities may show slightly elevated levels, since many are intentionally placed to monitor dose rate in areas adjacent to radioactive material storage areas or areas of known soil contamination (DOE-ID 1997c).

The DOE INEL EIS (Sections 4.7 and 5.7) assessed the radiation dose to workers at major INEEL facility areas that results from radionuclide emissions from INEEL facilities. The maximum dose at any onsite area resulting from cumulative emissions was estimated at 0.32 millirem per year (Leonard 1993a)[1]. If corrected to remove contributions of the WERF, this dose would be 0.21 millirem per year. In either case, this dose is a very small fraction of the DOE-established occupational dose limit (5,000 millirem per year) and is below the National Emissions Standard for Hazardous Air Pollutants (NESHAP) dose limit of 10 millirem per year. The NESHAP limit applies to the maximally exposed individual (MEI) (not to workers) but is the most restrictive limit for airborne releases and serves as a useful comparison.

[1] The DOE INEL EIS (Section 5.7) analysis included a short-term, temporary remediation project (operation of a portable water treatment unit) which was projected to result in a localized dose rate of about 4 millirem per year; however, due to its short-term nature, that operation is not considered representative of baseline conditions and has not been included in the current baseline.

Figure 4.7-2. Offsite environmental dosimeter and foodstuff sampling locations.

4.7.3.2.2 Offsite Doses. The offsite population may receive a radiation dose as a result of radiological conditions directly attributable to INEEL operations. The dose associated with radiological emissions is assessed annually to demonstrate compliance with the NESHAP standard. The effective dose equivalent to the MEI resulting from radionuclide emissions from INEEL facilities during 1995 and 1996 has been estimated at 0.018 millirem and 0.031 millirem, respectively (DOE-ID 1996). These doses are well below both the NESHAP dose limit (10 millirem per year) and the dose received from background sources (about 360 millirem per year).

The DOE INEL EIS (Sections 4.7 and 5.7) provided an estimate of the collective dose to the population surrounding the INEEL as a result of air emissions from all facilities that were expected (at the time the analysis was performed) to become operational before June 1, 1995. The annual collective dose to the surrounding population, based on 1990 U.S. Census Bureau data, was estimated at 0.3 person-rem. This dose applies to the total population residing within a circular area with a 50-mile radius extending from each major facility. The total population within this area is about 120,000 people, resulting in an average individual dose of about 0.003 millirem.

If only the population within 50 miles of the proposed AMWTP location is considered, the annual collective dose from baseline sources is about 0.085 person-rem. Projected increases associated with the DOE INEL EIS Preferred Alternative would increase this dose to about 0.42 person-rem. This population dose of 0.42 person-rem would be distributed over a population of roughly 80,000 and is very small when compared with the annual dose received by the same population from background sources (about 29,000 person-rem).

It should be noted that the collective dose depends not only on the types and levels of emissions, but also on the size and distribution pattern of the surrounding population. Thus, the future baseline population dose could increase even if emission rates do not change. If emission rates remained constant, the collective dose would increase by an amount that corresponds directly to the population growth rate.

4.7.3.3 Summary of Radiological Conditions. Radioactivity and radiation levels resulting from INEEL air emissions are very low, well within applicable standards, and negligible when compared to doses received from natural background sources. This applies both to onsite conditions to which INEEL workers or visitors may be exposed and offsite locations where the general population resides. Health risks associated with maximum potential exposure levels in the onsite and offsite environments are described in Section 4.12, Occupational and Public Health and Safety.

4.7.4 Nonradiological Conditions

Persons in the Eastern Snake River Plain are exposed to sources of air pollutants, such as agricultural and industrial activities, residential wood burning, wind-blown dust, and automobile exhaust. Many of the activities at the INEEL also emit air pollutants. The types of pollutants that are assessed here include (1) the criteria pollutants regulated under the State and NAAQS and (2) other types of pollutants with potentially toxic properties called toxic (or hazardous) air pollutants. Criteria pollutants include nitrogen dioxide, sulfur dioxide, carbon monoxide, lead, ozone, and respirable particulate matter (particles that are small enough to pass easily into the lower respiratory tract PM_{10} and $PM_{2.5}$), for which NAAQS have been established. Volatile organic compounds are assessed as precursors leading to the development of ozone[1]. Toxic air pollutants include cancer-causing agents, such as arsenic, benzene, carbon tetrachloride, and formaldehyde, as well as substances that pose noncancer health hazards, such as fluorides, ammonia, and hydrochloric and sulfuric acids.

4.7.4.1 Sources of Air Emissions. The types of nonradiological emissions from INEEL facilities and activities are similar to those of other major industrial complexes. Combustion sources such as boilers and emergency generators emit both criteria and toxic air pollutants. Sources such as chemical processing operations, waste management activities (other than combustion), and research laboratories emit primarily toxic air pollutants. Waste management, construction, and related activities (such as excavation) also generate fugitive particulate matter.

The DOE INEL EIS (Sections 4.7 and 5.7) characterized baseline emission rates for existing facilities for two separate cases. The *actual emissions case* represented the collective emission rates of nonradiological pollutants experienced by INEEL facilities during 1991 for criteria pollutants and 1989 for

[1] Ozone is formed by reactions of oxides of nitrogen and oxygen in the presence of sunlight. Volatile organic hydrocarbons, sometimes called precursor organics, contribute to the formation of ozone. Oxides of nitrogen and volatile organic hydrocarbons are, therefore, regulated as precursors to ozone formation.

toxic air pollutants. The *maximum emissions case* represents a scenario in which all permitted sources at the INEEL are assumed to operate in such a manner that they emit specific pollutants to the maximum extent allowed by operating permits or applicable regulations. These emissions were also adjusted to take projected increases (through June 1995) into account.

Actual INEEL-wide emissions for 1995 and 1996 are presented in DOE/ID-10537 and DOE/ID-10594, respectively (DOE-ID 1996b, DOE-ID 1997a). A comparison of actual criteria pollutant emissions during 1995 and 1996 with levels previously assessed in the DOE INEL EIS (Section 4.7) under the maximum emissions case is presented in Table 4.7-2. For each criteria pollutant except lead, the current (1995-1996) emission rates are at least a factor of three less than the levels assessed in the DOE INEL EIS (Section 4.7). In the case of lead, the average hourly emission rates during 1996 were about three times higher than the levels assessed in the DOE INEL EIS (Section 4.7). However, the analysis in the DOE INEL EIS (Section 4.7) determined that the maximum ambient air concentration of lead was about 0.1 percent of the applicable standard. In addition, less than 1 percent of 1996 lead emissions were from sources located within the RWMC.

Table 4.7-2. Comparison of recent criteria air pollutant emissions estimates for the INEEL with the levels assessed under the maximum emissions case in the DOE INEL EIS.

	DOE INEL EIS (Section 4.7) Maximum baseline case		Actual sitewide emissions					
			1995			1996		
Pollutant	Maximum hourly (kg/hr)	Annual average (kg/yr)	Actual hourly (kg/hr)	Maximum Hourly (kg/hr)	Annual average (kg/yr)	Actual hourly (kg/hr)	Maximum hourly (kg/hr)	Annual average (kg/yr)
Carbon monoxide	250	2,200,000	82	123	127,273	73	155	154,545
Nitrogen dioxide	780	3,000,000	245	441	209,091	218	636	218,182
Particulate matter[a]	290	900,000	32	50	200,000	30	45	181,818
Sulfur dioxide	350	1,700,000	109	209	109,091	68	300	118,182
Lead compounds	0.084	----	0.0035	0.77	4.6	0.27	1.9	1.5
VOCs[b]	ns[c]	ns	86	105	10,000	43	59	16,364

Sources: 1995 INEEL Air Emissions Inventory Report (DOE-ID 1996b); 1996 INEEL Air Emissions Inventory Report (DOE-ID 1997a).

a. The particle size of particulate matter emissions is assumed to be in the respirable range (less than 10 microns).

b. VOCs = volatile organic compounds, excluding methane.

c. ns = not specified; the DOE INEL EIS (Section 4.7) evaluated emissions of specific types of VOCs from individual facilities, but did not include a total for the maximum baseline case.

It should also be noted that the New Waste Calcining Facility (NWCF), which is the single largest source of nitrogen dioxide emissions at the INEEL, did not operate during 1995-1996 (DOE-ID 1997c). Operation of that facility can substantially increase annual nitrogen dioxide emissions; however, those emission levels would still be well below the maximum case assessed in the DOE INEL EIS (Section 4.7). The NWCF is currently scheduled to be shut down in 1999 and would not restart unless major emission control modifications are made to bring the facility into compliance with proposed maximum available control technology standards for combustion of hazardous waste, as well as other applicable State of Idaho requirements.

The DOE INEL EIS (Section 4.7) identified 26 toxic air pollutants that were emitted from INEEL facilities in quantities exceeding the screening level established by the State of Idaho. (The health hazard associated with toxic air pollutants emitted in lesser quantities is considered low enough by the State of Idaho not to require detailed assessment.) For a few toxic air pollutants, actual 1996 emissions were greater than the levels assessed in the DOE INEL EIS (Section 4.7). These increases were primarily attributable to decontamination and decommissioning activities. Unlike criteria pollutants, the regulations governing toxic emissions from the proposed AMWTP apply only to incremental increases of these pollutants and not the sum of baseline levels and incremental increases (IDHW 1997).

4.7.4.2 Existing Conditions. The assessment of nonradiological air quality described in the DOE INEL EIS (Sections 4.7 and 5.7) was based on the assumption that the available monitoring data are not sufficient to allow a meaningful characterization of existing air quality and that such a characterization must rely on an extensive program of air dispersion modeling. The modeling program applied for this purpose utilized computer codes, methods, and assumptions that are considered acceptable by the EPA and the State of Idaho for regulatory compliance purposes. The methodology applied in these assessments is described in detail in Appendix F-3 of the DOE INEL EIS. The remainder of this section describes the results of the assessments in the DOE INEL EIS (Sections 4.7 and 5.7) for air quality conditions in the affected environment (i.e., concentrations of pollutants in air within and around the INEEL). Potential changes in the affected air environment resulting from changes in INEEL emission levels (compared to those at the time the assessments in the DOE INEL EIS, Sections 4.7 and 5.7, were performed) are also discussed.

4.7.4.2.1 Onsite Conditions. The DOE INEL EIS (Section 4.7) contains an assessment of existing conditions as a result of cumulative toxic air pollutant emissions from sources located within all areas of the INEEL. (Criteria pollutant levels were assessed only for ambient air locations, that is, locations to which the general public has access.) The onsite levels were compared to occupational exposure limits established to protect workers. With one exception, the estimated onsite concentrations were estimated at levels well below the occupational standards. The exception was for maximum short-term benzene concentration, which slightly exceeded the standard at the maximum predicted location within the CFA. Those levels resulted primarily from gasoline and diesel fuel storage tank emissions at the CFA-754 Tank Farm; however, those tanks were taken out of service in 1995, and current benzene levels are estimated to be below the occupational standard for that substance.

4.7.4.2.2 Offsite Conditions. Estimated maximum offsite pollutant concentrations were assessed in the DOE INEL EIS (Section 4.7) for locations along the INEEL boundary, public roads within the site boundary, and at Craters of the Moon Wilderness Area. The results for criteria pollutants are presented in Table 4.7-4 of the DOE INEL EIS (Section 4.7) and indicate that all concentrations are well within the ambient air quality standards for both the actual and maximum emissions cases. For the maximum emissions baseline, the highest sulfur dioxide concentration (over a 3-hour period) at the site boundary is about 13 percent of the standard, while the highest 24-hour particulate matter level is about 33 percent of the standard. Levels of all other pollutants are less than 12 percent of applicable standards. The highest offsite levels are estimated to occur at the boundary south and south-southwest of CFA. Somewhat higher results were obtained for public roads traversing the site, with 24-hour particulate matter at 53 percent of the standard and 3- and 24-hour sulfur dioxide at 45 and 37 percent of the standard, respectively. Values at Craters of the Moon Wilderness Area were below 10 percent of applicable standards in all cases. It should be noted that actual emissions of these pollutants from INEEL facilities are much lower than those assumed for the maximum scenario, so there is a wide margin of protection inherent in these results.

In the DOE INEL EIS (Section 4.7), concentrations of criteria pollutants from certain sources were also compared to Prevention of Significant Deterioration (PSD) regulations, which have been established to ensure that air quality remains good in those areas where ambient air quality standards are not exceeded. (See Appendix E-3, Figure E-3-1, for a description of these regulations.) These PSD increments are allowable increases over baseline conditions from sources that have become operational after certain baseline dates. Increments have been established for sulfur dioxide, respirable particulates, and nitrogen dioxide. Separate increments are established for pristine areas, such as national parks or wilderness areas (termed Class I areas) and for the nation as a whole (Class II areas). Craters of the Moon Wilderness Area is the Class I area nearest the INEEL, while the site boundary and public roads are the applicable Class II areas.

The amount of increment consumed by existing sources subject to PSD regulation has been assessed for all increment-consuming sources operating as of May 1, 1994 (Raudsep et al. 1995), and for projected increases associated with implementation of alternatives described in the DOE INEL EIS (Section 5.7) (Belanger et al. 1995). The amount of increment consumed by existing sources (as of May 1, 1994) operating at maximum allowable emission rates is less than 10 percent of the allowable increment for all annual evaluations but somewhat higher for short-term assessments. The amount of the allowable increment at Craters of the Moon Wilderness Area consumed by INEEL sources is 53 percent for sulfur dioxide levels averaged over any 3-hour period. For the Class II area represented by public access locations on and near the INEEL, the maximum consumption is 43 percent and applies to respirable particulate matter levels averaged over any 24-hour period.

An update of Class II area PSD increment consumption attributable to sources in the south-central portion of the INEEL has been recently performed (Abbott 1997). That assessment included sources subject to PSD regulation that were operational as of June 1996. The results of that assessment (Table 4.7-3) are in general agreement with the results reported in the DOE INEL EIS (Section 4.7), although the amount of Class II increment consumed by short-term sulfur dioxide and annual average nitrogen dioxide levels are higher than the previously assessed values. As can be seen in Table 4.7-3, consumption of the allowable 3-hour and 24-hour sulfur dioxide increments is now assessed at 26 percent and 31 percent, respectively, compared to the DOE INEL EIS values of 14 percent and 22 percent. Nitrogen dioxide increment consumption is now assessed at 1.6 percent compared to the previously assessed value of 0.9 percent.

The DOE INEL EIS (Sections 4.7 and 5.7) assessed concentrations of toxic air pollutants and compared the results to the ambient air standards promulgated for new sources by the State of Idaho Rules for Control of Air Pollution in Idaho (IDHW 1997). These standards are increments that apply only to new or modified sources and not to existing emissions. Nevertheless, these increments were used as “reference levels” for comparing current conditions with recommendations for ensuring public health protection in association with new sources of emissions. Annual average concentrations of carcinogenic toxics were assessed for offsite locations (site boundary and Craters of the Moon Wilderness Area), while levels of noncarcinogenic toxics were assessed for locations along public roads as well as at these offsite locations.

Maximum offsite concentrations of carcinogenic toxics (summarized in Table 4.7-7 of the DOE INEL EIS) occur at the site boundary due south of CFA. All carcinogenic air pollutant levels are below the reference levels. Noncarcinogenic air pollutant levels (Table 4.7-8 of the DOE INEL EIS) are all well below the reference levels (1 percent or less) at all site boundary locations. Levels at some public road locations, which are closer to emissions sources, are higher than site boundary locations, but still well below the reference levels.

Table 4.7-3. PSD increment consumption at Class II areas at the INEEL by existing (1996) sources subject to PSD regulation.

Pollutant	Averaging time	PSD increment[a] (μg/m³)	Maximum predicted concentration		Amount of PSD increment consumed[b] (μg/m³)	Percent of PSD increment consumed	
			INEEL boundary (μg/m³)	Public Roads (μg/m³)		Current assessment	DOE INEL EIS assessment
	3-hour						
Sulfur dioxide	24-hour	512	96	133	133	26	14
	Annual	91	16	28	28	31	22
		20	1.3	1.8	1.8	9	9
Respirable particulates[c]	24-hour	30	3.0	13	13	43	43
	Annual	17	0.11	0.85	0.85	5	5.3
Nitrogen dioxide	Annual	25	0.036	0.38	0.38	1.5	0.9

Sources: Abbott 1997; DOE 1995.
a. All increments specified are State of Idaho standards (IDHW 1997).
b. The amount of increment consumed is equal to the highest value of either the site boundary or public road locations.
c. Data on particulate size are not available for most sources. For purposes of comparison to the respirable particulate increments, it is conservatively assumed that all particulates emitted are of respirable size (that is, 10 microns or less in diameter).

4.7.4.3 Summary of Nonradiological Air Quality. The air quality on and around the INEEL is good and within applicable guidelines. The area around the INEEL is in attainment or unclassified for all NAAQS. Levels of criteria pollutants were assessed in the DOE INEL EIS (Section 4.7) and found to be well within applicable standards for the maximum emissions scenario. Changes in criteria pollutant emission rates since the assessments in the DOE INEL EIS (Section 4.7) were performed are not of a magnitude to alter those findings. For toxic emissions, all INEEL boundary and public road levels have been found to be well below reference levels appropriate for comparison. Current emission rates for some toxic pollutants are higher than the baseline levels assessed in the DOE INEL EIS (Section 4.7), but resultant ambient concentrations are expected to remain below reference levels. Similarly, all toxic pollutant levels at onsite locations are expected to remain below occupational limits established for protection of workers.

4.8 Water Resources

This section describes existing water resources, site hydrologic conditions, existing water quality for surface and subsurface water, water use, and water rights. The subsurface water section also describes the vadose zone (or unsaturated zone and perched water bodies) located between the land surface and the Snake River Plain Aquifer. Since the existing major facility area (RWMC) would be affected most by the proposed action, the water resources for the RWMC and surrounding areas are emphasized.

A previous EIS (DOE INEL EIS) conducted an extensive review of the INEEL's affected environment. In lieu of duplication of that discussion in this EIS, the applicable sections of Volume 2 of the DOE INEL EIS are referenced (Section 4.8 and Appendix F-2.2) for surface and subsurface water and water rights. New water resources information obtained after issue of the DOE INEL EIS for the RWMC and surrounding areas follows.

4.8.1 Surface Water

Other than three intermittent streams, Big Lost River, Little Lost River, and Birch Creek, the remaining surface water bodies consist of natural wetland-like and manmade percolation and evaporation ponds. No wetland areas exist within the RWMC boundary. The following sections discuss the regional drainage, local runoff, floodplains, and surface water quality with emphasis on the RWMC area.

4.8.1.1 Regional Drainage. The INEEL is located in the Pioneer Basin, a closed drainage basin that includes three main tributaries, Big Lost River, Little Lost River, and Birch Creek. These streams receive water from mountain watersheds located to the north and northwest of the INEEL (Figure 4.8-1). Stream flows are depleted by irrigation diversions and infiltration losses along the stream channels prior to reaching the site boundaries. Stream flows on the INEEL do occur when melting of above-average mountain snowpack causes water to flow in the Big Lost River. A diversion dam was constructed to prevent floodwater impacts to the RWMC. Flow of the Big Lost River on the INEEL averaged 292.55 cubic feet per second and ranged from 0.0 cubic feet per second to 440 cubic feet per second from June 1, 1995, to August 14, 1995. During the timespan from September 1995 to mid-July 1996, the average flow was 53.5 cubic feet per second with the highest one-day flow of 366 cubic feet per second on June 15, 1996 (USGS 1998).

4.8.1.2 Local Runoff. Three historical flood events (1962, 1969, and 1982) have occurred at the RWMC as a consequence of rapid snowmelt combined with heavy rains and warm winds, resulting in runoff water from the surrounding areas entering the facility. Upgrades to the perimeter drainage system around the facility have greatly reduced the likelihood of local basin flooding affecting the RWMC. The current peripheral drainage ditch and the main discharge channel are designed for a maximum 10,000-year combined rain-on-snow storm event (Dames and Moore 1993). Since 1982, soil has been added to the surface of the SDA to create sufficient slopes to direct water away from pits and trenches and into surrounding drainage systems. Although several instances of standing water have occurred due to rapid spring thaws in combination with frozen ground since 1982, there has not been flooding from off the RWMC due to improvements in the dikes and drainage diversion systems and monitoring (Becker et al. 1996).

4.8.1.3 Floodplains. The elevation of the Big Lost River just upstream from the diversion dam is approximately 46 feet higher than the elevation of the RWMC at the proposed AMWTP facility site (USGS 1998). The Big Lost River poses no flood threat to the RWMC (Becker et al. 1996) (Figure 4.8-1). The Big Lost River flows northeast, away from the RWMC, to its termination in the playas. A detailed flood-routing analysis of a hypothetical failure of the Mackay Dam resulting from hydrologic and seismic failures showed the RWMC would not be inundated from flow from the Big Lost River (DOE 1995, Figure 4.8-1). The RWMC is separated from the Big Lost River by a lava ridge that serves as a hydraulic barrier; therefore, the Big Lost River is not a surface water flowpath for contaminant transport at the RWMC. Big Lost River flows have not entered the RWMC during its operating period, which began in 1952.

4.8.1.4 Surface Water Quality. RWMC sewage lagoon wastewater samples were collected from the time the lagoons were constructed (April 1995) through 1996. The lagoons received sanitary sewage effluent from support facilities at the RWMC. All nonradiological analyses detected in water samples from the RWMC lagoons are typical of those that occur in sanitary sewage. No unusual compounds or elements nor volatile organics were detected. The concentrations of all radiological analyses detected in water samples collected from the RWMC sewage lagoons were below drinking water standards and derived concentration guides (LMITCO 1997b). For National Pollutant Discharge Elimination System (NPDES) monitoring purposes, three sampling collection points exist within the RWMC. These sampling collection points are located along the northern boundary of the RWMC. RWMC-MP-01 is located upgradient from the SDA and RWMC- MP-02 is located at the interface of the SDA and the TSA. RWMC- MP-03 is located downgradient of the TSA. Sample results obtained in 1996 from one of the three sampling collection sites revealed one storm water sample that exceeded the EPA maximum contaminant level (MCL) for cadmium (0.005 mg/L), chromium (0.1 mg/L), and lead (0.015 mg/L) and the EPA secondary MCL level for total dissolved solids of 500 mg/L. The gross alpha concentration of 33.3 picocuries per liter in this sample exceeded the EPA MCL of 15 picocuries per liter. This sample also contained detectable total suspended solids, which indicates background concentrations in suspended sediments may have contributed to detectable levels of metals and gross alpha. Samples collected from the other two collection sites had no results above EPA MCLs and DOE derived concentration guides, except for two pH samples and one total dissolved solids sample (LMITCO 1997b).

4.8.2 Subsurface Water

Subsurface water at the INEEL occurs in the Snake River Plain Aquifer and the vadose zone. The Snake River Plain Aquifer is the source of all water used at the INEEL. The EPA designated the Snake River Plain Aquifer a sole-source aquifer in 1991 (FR 1991). The Snake River Plain Aquifer, the largest aquifer in Idaho, consists of a series of saturated fractured brecciated basaltic flows, rubbled zones, sedimentary rocks, and sediment materials that underlie the Eastern Snake River Plain. Water enters the regional aquifer from the west, north, and east. Most of the inflow occurs as underflow from alluvial-filled valleys along tributaries of the Snake River on the east side of the plain from mountain ranges on the north, and from the alluvial valleys of Birch Creek, Little Lost River, and Big Lost River on the west. Little recharge occurs through the surface of the plain except for flow in the channel of the Big Lost River, its diversion areas, precipitation, and some surface irrigation (Jorgensen et al. 1994). Groundwater is primarily discharged from the aquifer through springs that flow into the Snake River and from pumping for irrigation.

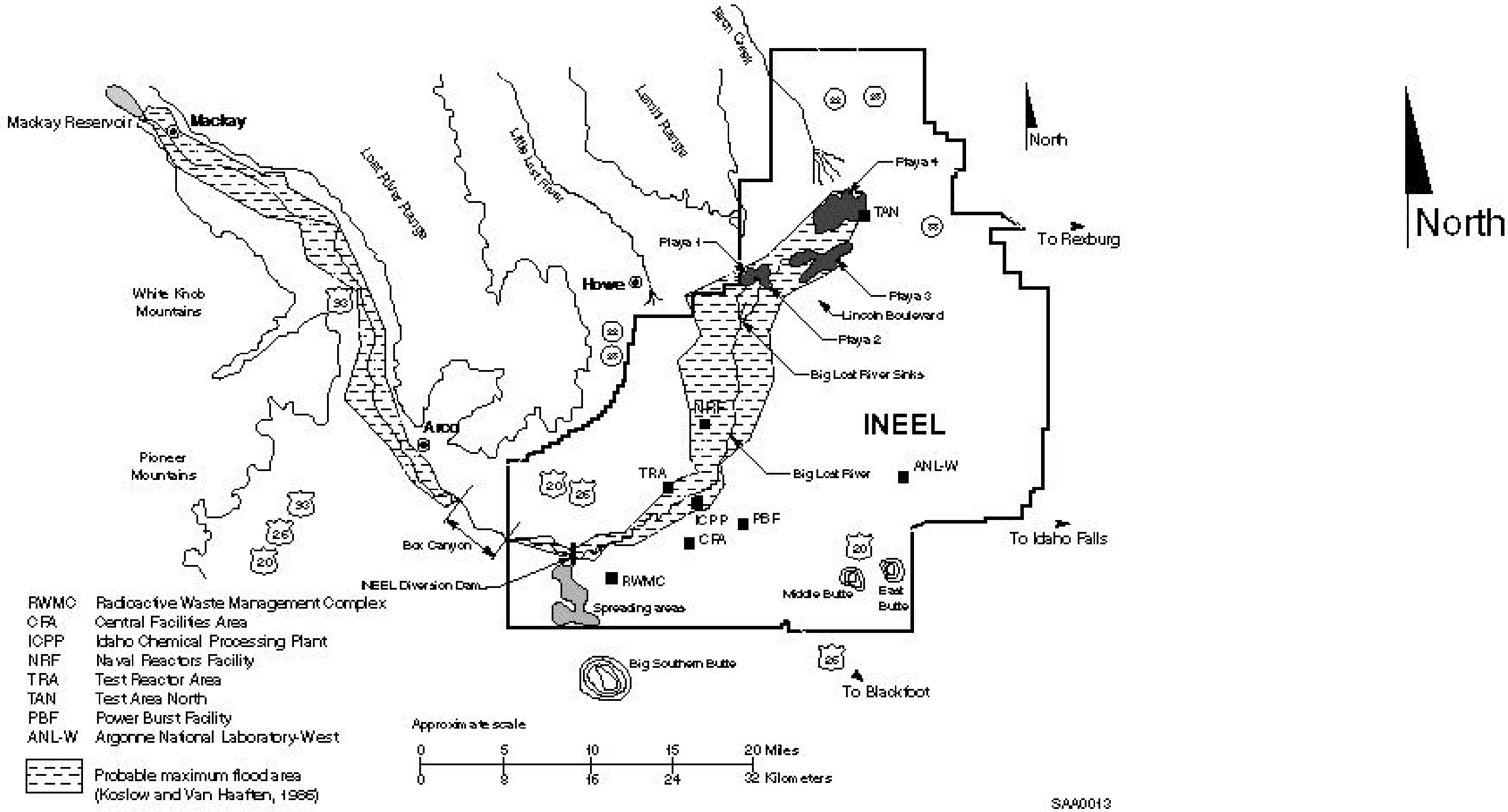


Figure 4.8-1. Locations of selected INEEL facilities shown with the predicted inundation area for the probable maximum flood-inducing overtopping failure of the Mackay Dam (Bennett 1990).

4.8.2.1 Local Hydrogeology. The INEEL covers about 890 square miles of the north-central portion of the Snake River Plain Aquifer. Depth to groundwater from the land surface at the INEEL ranges from approximately 200 feet in the north to over 900 feet in the south (Pittman et al. 1988). Depth to groundwater near the RWMC is approximately 590 feet. The U.S. Geological Survey (USGS) performs water level monitoring and chemical analyses in approximately 24 aquifer wells (Figure 4.8-2) within and surrounding the RWMC. Water level measurements and sampling schedules vary between quarterly and annually for these wells (LMITCO 1997b). Water levels in the vicinity of the RWMC may have exhibited a response to Big Lost River water infiltrating into the spreading areas (Becker et al. 1996). Competing hypotheses exist on whether this additional Big Lost River water influences gradients beneath the RWMC. Future groundwater modeling will determine whether gradient reversals beneath the RWMC occur (Becker et al. 1996). Figure 4.8-3 shows the water level on a local scale around the SDA portion of the RWMC during the fall of 1992 (Burgess et al. 1994).

In addition, perched aquifer zones are present in the vicinity of the RWMC. Vertically, the perched zones consist of two regions referred to as shallow and deep. The shallow perched water refers to ephemeral saturated zones that form at the contact between the shallow surficial sediments and underlying basalt. Deep perched water occurs at greater depths that are above, but in association with, the 110-foot and 240-foot interbeds. A geologic cross-section along the southern boundary of the RWMC oriented northwest to southeast shows the interbeds related to the perched aquifer and the Snake Plain River Aquifer (Figure 4.8-4). Three of the perched water monitoring wells were inadvertently constructed such that water could enter the annular space at depths above the monitoring zone. Two of these wells were reconstructed in 1995 to eliminate this possibility (Becker et al. 1996).

The *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) Record of Decision signed by the DOE, EPA, and the State of Idaho, which documented the agreement to use the vapor vacuum extraction with treatment as the remediation technology for the vadose zone at RWMC, became final on December 2, 1994. This system was required as a result of small quantities of site-related contaminants reaching the Snake River Plain Aquifer. The full-scale extraction treatment system became operational January 11, 1996 (DOE-ID 1997c).

4.8.2.2 Subsurface Water Quality. Currently, the following contaminants are monitored in the vicinity of the RWMC: gross alpha, gross beta, tritium, a complete suite of volatile and semivolatile organics, chromium, mercury, nitrate/nitrite-N, carbon-14 (C-14), iodine-129 (I-129), technetium-99 (Tc-99), and strontium-90 (Sr-90). In addition, the USGS monitors for americium-241, plutonium-239/240 (Pu-239/240), plutonium-238 (Pu-238), cadmium, and cesium-137 (Cs-137) (Becker et al. 1996).

Table 4.8-1 gives the highest detected concentration since the DOE INEL EIS for the RWMC. The values were obtained from Becker et al. (1996) and LMITCO (1997b).

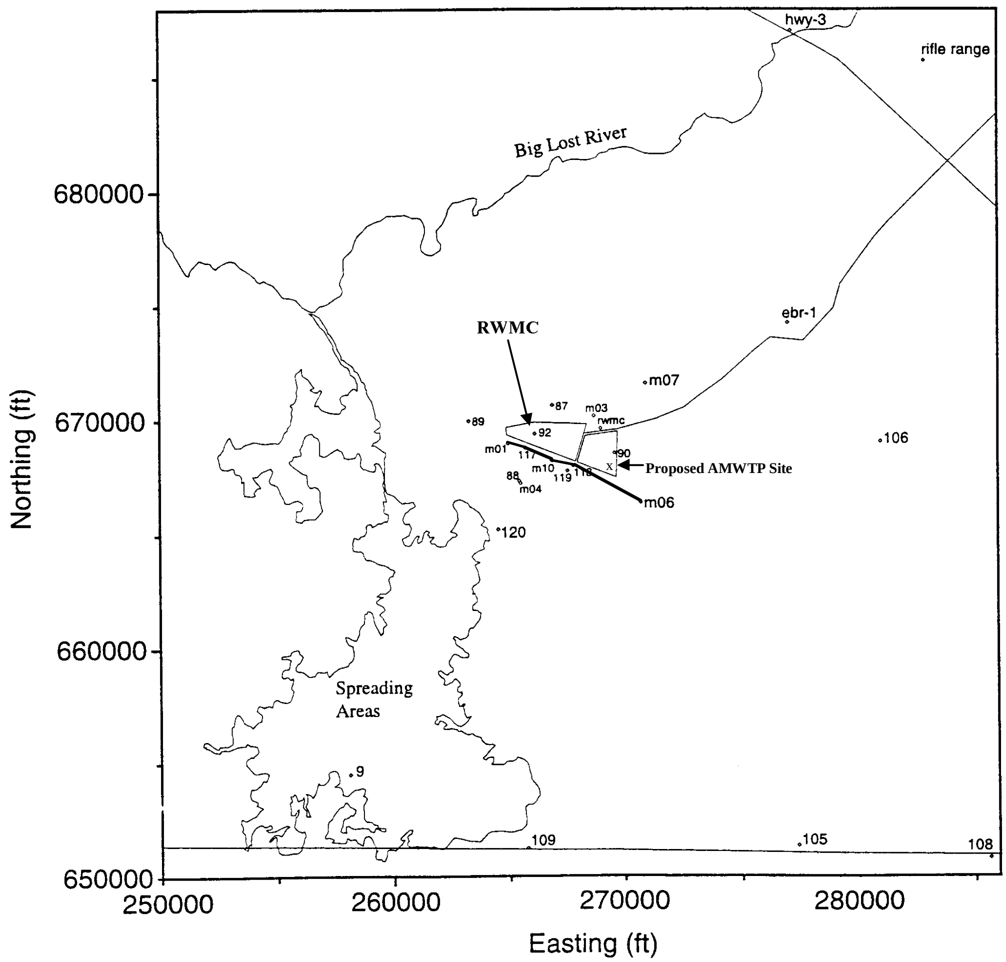
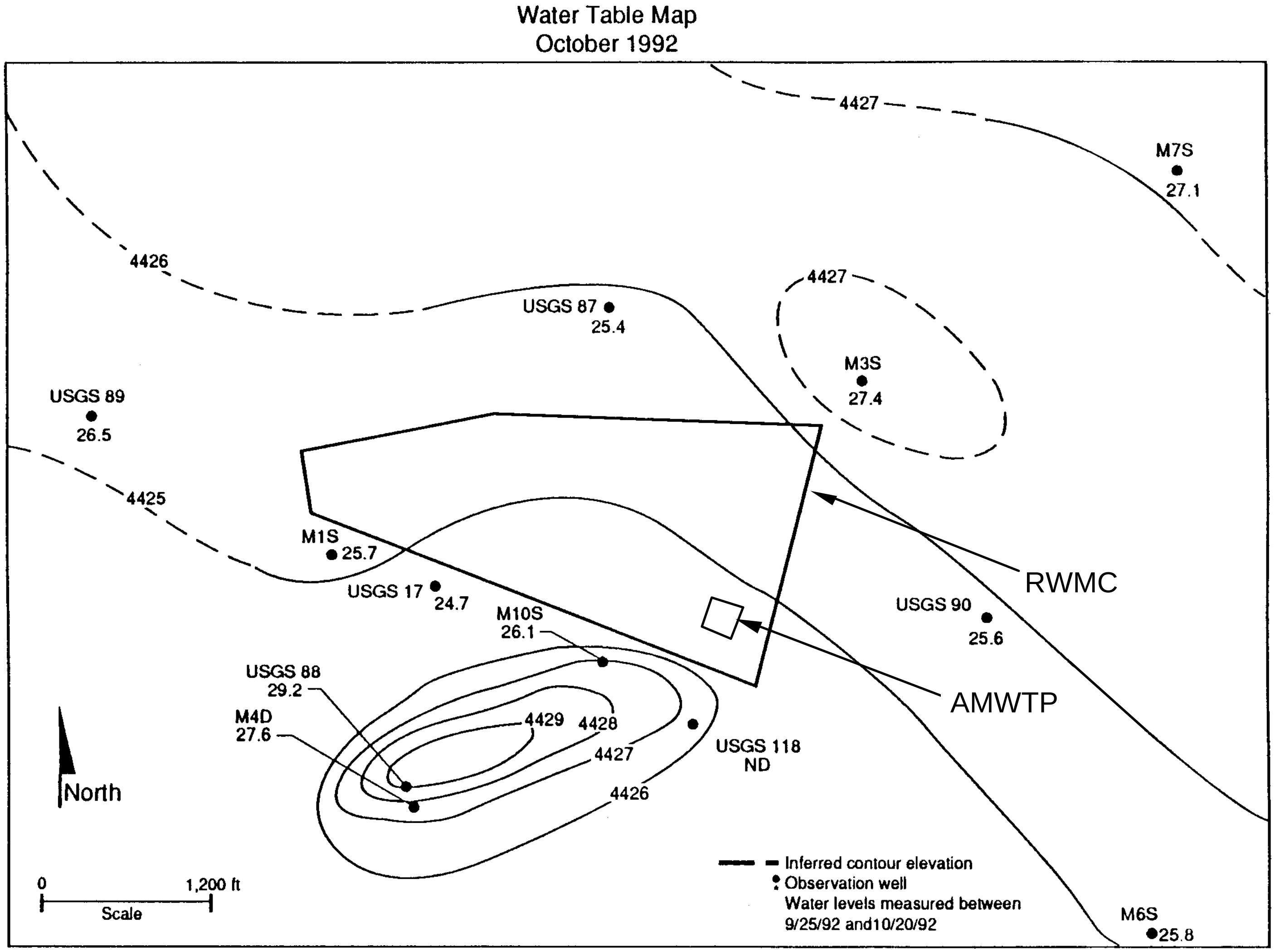


Figure 4.8-2. USGS aquifer water level monitoring wells in the RWMC vicinity.



Note: Contour interval is one foot.

Figure 4.8-3. Water level map of the Snake River Plain Aquifer at the SDA of the RWMC.

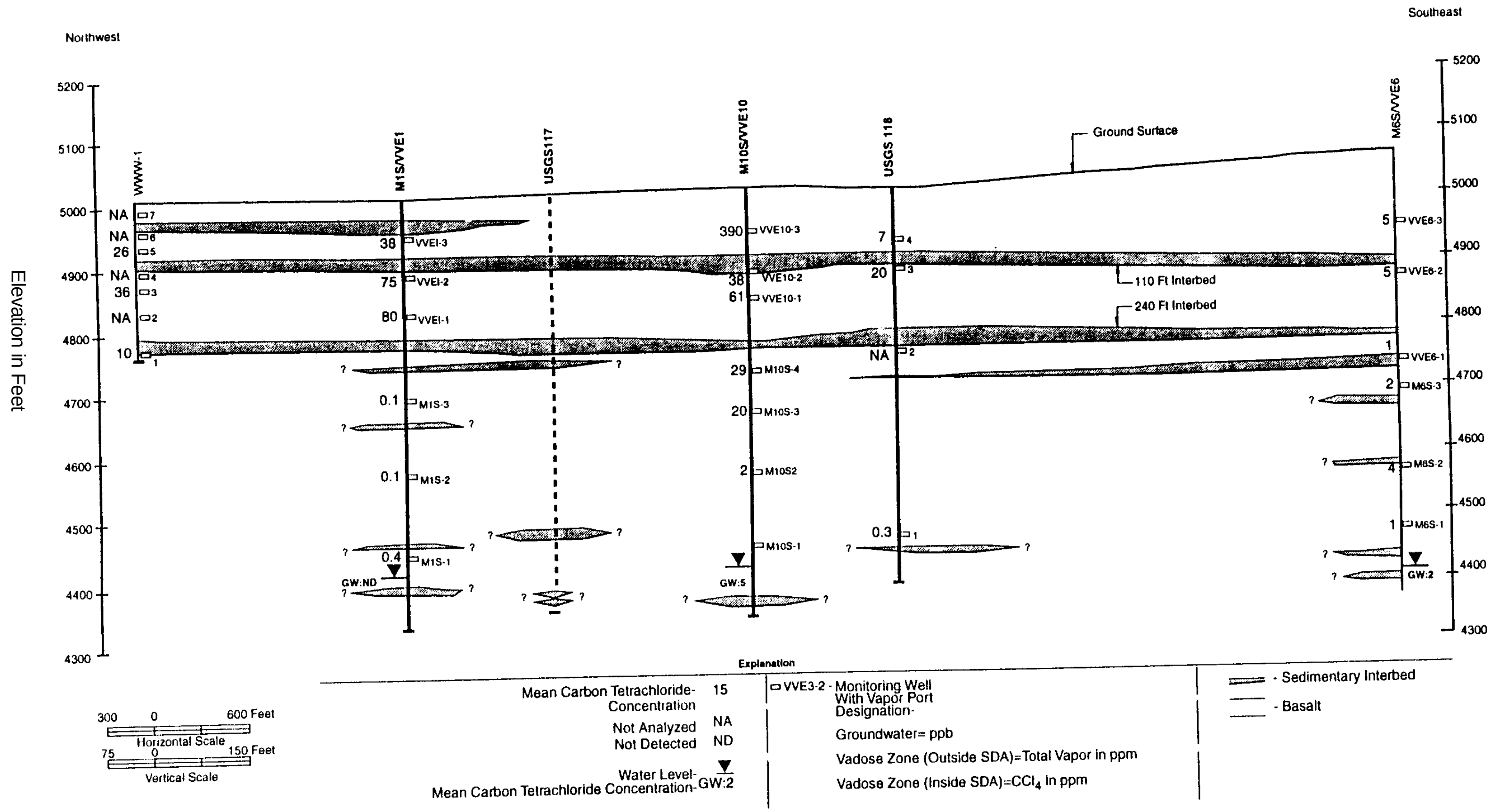


Figure 4.8-4. NW-SE Cross-Section along the RWMC southern boundary (Becker et al. 1996).

Table 4.8-1. Summary of highest detected contaminant concentrations in groundwater within the RWMC (1995 to 1996).

Parameter	Highest detected concentration since DOE INEL EIS (year of detection)[a]	Current EPA Maximum Contaminant Level (EPA MCL)[b]	DOE Derived Concentration Guide (DCGs)[c]
Radionuclides in picocuries per liter			
Americium-241	Less than method Detection limit (MDL)	15[d]	30
Cesium-137	Less than MDL	200	3,000
Carbon-14	28 (1995)	2,000	70,000
Iodine-129	Less than MDL	1	500
Technetium-99	1.1 (1995)	900	100,000
Strontium-90	Less than MDL	8	1,000
Plutonium-238	Less than MDL	15[d]	40
Plutonium-239/240	Less than MDL	15[d]	30
Tritium	1500 (1996)	20,000	200,000
Nonradioactive metals in milligrams per liter			
Cadmium	Less than MDL	0.005	Not applicable
Chromium	0.996 (1995)	0.1	Not applicable
Mercury	Less than MDL	0.002	Not applicable
Inorganic salts in milligrams per liter			
Chloride	87[e] (1996)	250	Not applicable
Nitrate as N	2.1 (1995)	10	Not applicable
Organic compounds in milligrams per liter			
Carbon tetrachloride	0.007 (1995)	0.005	Not applicable
Chloroform	0.002 (1995)	0.1[f]	Not applicable
1,1,1-Trichloroethane	0.0009 (1995)	0.2	Not applicable
Tetrachloroethylene	0.0004 (1995)	0.005	Not applicable
Trichloroethylene	0.003 (1995)	0.005	Not applicable

a. Values taken from Becker et al. 1996, except where footnoted.
b. EPA MCL values taken from EPA 1996.
c. DOE DCGs for radionuclides taken from DOE Order 5400.5 (DOE 1993).
d. Maximum contaminant levels have not been established for plutonium-238, plutonium-239, plutonium-240 and americium-241. However, these radionuclides have not been detected above the established limits for gross alpha particle activity or the proposed adjusted gross alpha activity maximum contaminant limits for drinking water.
e. Values taken from LMITCO 1997b.
f. Values are for total trihalomethanes, which chloroform is one.

The Environmental Science and Research Foundation collects semiannual drinking water samples from boundary and distant communities and surface water samples from the Snake River at Idaho Falls and Bliss. In addition, quarterly drinking water and surface water samples are collected from the Magic Valley area. Each water sample collected is submitted for gross analyses for alpha- and beta-emitting radionuclides, as well as tritium analysis using liquid scintillation. Tritium was found above the minimum detectable concentration in four offsite drinking water samples. It was not detected in offsite surface water samples. The highest concentration, 160 picocuries per liter from Blackfoot in May 1996, was 0.8 percent of the EPA maximum contaminant level for tritium of 20,000 picocuries per liter (DOE-ID 1997c).

4.8.3 Water Use and Rights

Surface water is not withdrawn at the INEEL. All three tributaries, Big Lost River, Little Lost River, and Birch Creek, have the following designated uses: irrigation for agriculture, cold-water biota, salmonid spawning, and primary and secondary contact recreation. Prior to reaching the INEEL boundary, the Little Lost River and Birch Creek are diverted for irrigation, and irrigation and hydroelectric power, respectively, during the summer months. During the winter months, water in all three tributaries is used to recharge the aquifer (Becker et al. 1996).

Groundwater use on the Snake River Plain includes irrigation; food processing; aquaculture; and domestic, rural, public, and livestock supply. The Snake River Plain Aquifer is the source of all water used at the INEEL. The EPA designated the Snake River Plain Aquifer a sole-source aquifer in 1991 (56 FR 50634, October 7, 1991). The amount of water utilized on the INEEL from the Snake River Plain Aquifer is approximately 1.9 billion gallons each year.

The INEEL received a well construction permit from the Idaho Department of Water Resources in 1996 for eight new wells. The Idaho Department of Water Resources has granted underground injection control permits allowing the continued operation of eight deep injection wells, defined as Class V under 40 CFR 144.6 at the INEEL (DOE-ID 1997c). Seven of these are located at the INEEL and are used for draining excess surface water runoff to avoid facility flooding. The eighth well is located at the INEEL Research Center and is a closed-loop heat exchange system. For surface water, one NPDES point source permit is pending, with two granted. The Idaho Department of Environmental Quality granted four wastewater land application permits with five additional permits pending. The U.S. Army Corps of Engineers issued one 404 Permit (DOE-ID 1997c).

Domestic and fire water is pumped from a production well in the RWMC and is then stored in two 250,000-gallon water storage tanks or pressurized by the fire water and domestic water pumps and distributed to the different buildings. For the Pit 9 comprehensive demonstration project, an additional production well was installed (DOE-ID 1996c).

DOE holds a Federal Reserve Water Right for the INEEL, which permits a water pumping capacity of 80 cubic feet per second and a maximum water consumption of 11.4 billion gallons per year for drinking, process water, and noncontact cooling. Because it is a Federal Reserved Water Right, the INEEL’s priority on water rights dates back to its establishment in 1950 (DOE INEL EIS).

4.9 Ecological Resources

This section describes the biotic resources on the INEEL, which are typical of the Snake River Plain ecosystem. Threatened and endangered species, wetlands, and radioecology are also discussed. A detailed description of the INEEL ecology can be reviewed in the DOE INEL EIS, Volume 2, Section 4.9 (DOE 1995).

4.9.1 Flora

The INEEL lies in a cool desert ecosystem dominated by shrub-steppe communities. Most land within the INEEL is relatively undisturbed and provides important habitat for species native to the region. The vegetation associations on INEEL can be grouped into six types: juniper woodland, native grassland, shrub-steppe, lava, modified large ephemeral playas, and wetland-like vegetation types (Figure 4.9-1). Over 90 percent of the INEEL is covered by shrub-steppe vegetation, which is dominated by big sagebrush (*Artemisia tridentata*), saltbush (*Atriplex corfertifolia and A. nuttali*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). Grasses include cheatgrass (*Bromus tectorum*), Indian ricegrass (*Oryzopsis hymenoides*), wheatgrasses (*Agropyron cristatum and A. desertorum*), and bottlebrush squirreltail (*Sitanion hysterix)*. The RWMC lies within the big sagebrush/bluebunch wheatgrass/green rabbitbrush vegetation type.

Disturbed areas (e.g., industrial areas, parking lots, roads) cover only 2 percent of the INEEL. Disturbed areas, such as the RWMC, frequently are dominated by introduced annuals, including Russian thistle (*Salsola kali*), halogetan (*Halogeton glomeratus*), and cheatgrass. These species are noxious and usually provide less food and cover for wildlife compared to native species and are competitive with perennial native species. The proposed AMWTP site is a previously disturbed area that is essentially devoid of any vegetation. The proposed area for the possible expansion of the sewage lagoon system is within a disturbed construction laydown area. The power line corridor that would have to be constructed to serve the AMWTP would cross an area adjacent to the RWMC occupied by big sagebrush/bluebunch wheatgrass/green rabbitbrush vegetation.

4.9.2 Fauna

Over 270 vertebrate species have been recorded on the INEEL, including 46 mammal, 204 bird, 10 reptile, 2 amphibian, and 9 fish species (Arthur et al. 1984, Reynolds et al. 1986). The INEEL provides an important winter range for deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and pronghorn (*Antelocapra americana*). During some winters on the INEEL, historical highs have reached about 30 percent of Idaho’s total population. Pronghorn wintering areas are located in the northeastern portion of the INEEL, in the area of the Big Lost River sinks, in the west-central portion of the INEEL along the Big Lost River, and in the south-central portion of the INEEL. Other species include mice, ground squirrels, rabbits and hares, songbirds (sage sparrow [*Amphispiza belli*], western meadowlark [*Sturnella neglecta*]), sage grouse (*Centrocerus urophasianus*), lizards, and snakes. Migratory species, including mourning dove (*Zenaida macroura*), waterfowl, and raptors, use the INEEL for part of the year. Predators observed on the INEEL include raptors, bobcats (*Lynx rufus*), mountain lions *(Felis concolor*), and coyotes (*Canis latrans*). Additional information on fauna is provided in Anderson et al. (1995).

Species found within the RWMC area include deer mice (*Peromyscus maniculatus*), Montane vole (*Microtus montanus*), Ord’s kangaroo rat (*Dipodomys ordii*), Townsend’s ground squirrel (*Citellus townsendi*), badger (*Taxidea taxus*), marmot (*Marmota* spp.), horned lark (*Eremophila alpestris*), mountain cottontail rabbit (*Sylvilagus nuttalli*), sage grouse, owls, western meadowlark, and coyote.

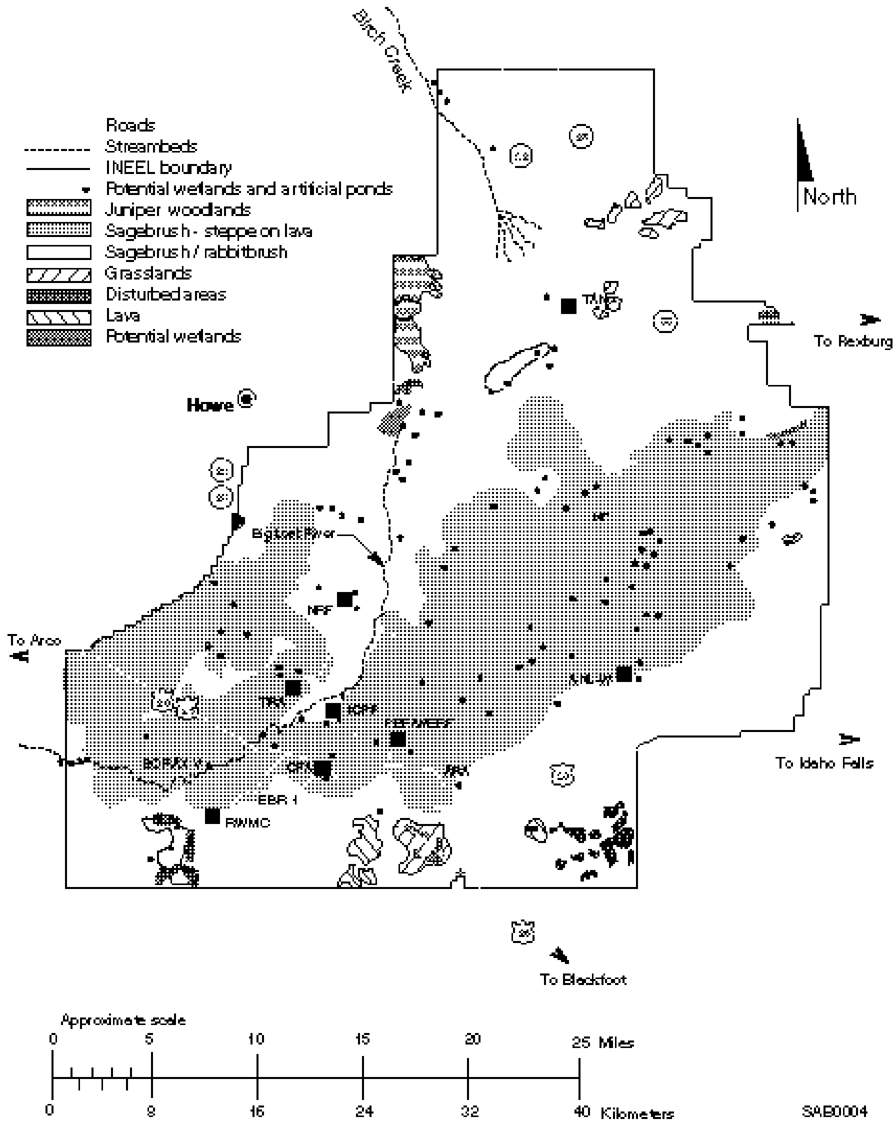


Figure 4.9-1. Approximate distribution of vegetation map at the INEEL.

4.9.3 Threatened, Endangered, and Sensitive Species

Federal-listed animal species potentially occurring on the INEEL include the peregrine falcon *(Falco peregrinus)* and bald eagle *(Haliaeetus leucocephalus).* Peregrine falcons (endangered) have been observed within the boundary of the INEEL infrequently, only in the winter and for only brief periods. Bald eagles (threatened) are observed each winter near or on the INEEL, but only in areas of the site north of the Test Area North and near Howe.

Two State-protected species (Merriam shrew [*Sorex merriami*] and the long-billed curlew [*Numenius americanus*]) potentially occur on the INEEL. Ten animal species listed by the State as species of special concern occur on the INEEL. None of the Federal- or State-listed animal species have been observed on the RWMC where the AMWTP would be constructed or along the proposed power line corridor (Rope et al. 1993). No Federal- or State-listed plant species were identified as potentially occurring on the INEEL. Volume 2, Part A, Section 4.9.3 of the DOE INEL EIS listed eight plant species as sensitive, rare, or unique known to occur on the INEEL; however, four of these species have been dropped from consideration because they were found to be common (Idaho CDC 1998a). Four plant species (Table 4.9-1) identified by other Federal agencies (U.S. Forest Service or BLM) and the Idaho Native Plant Society as sensitive, rare, or unique are known to occur on the INEEL (Idaho CDC 1998b), but not on the RWMC, along the proposed power line corridor or near the RWMC sewage ponds.

Table 4.9-1. Sensitive, rare, or unique plant species that may be found on the INEEL.[a]

Species	Status[b]
Lemhi milkvetch (Astragalus aquilonius)	BLM, FS, INPS-S
Winged-seed evening primrose (Camissonia pterosperma)	BLM, INPS-S
Sepal-tooth dodder (Cuscuta denticulata)	INPS-1
Spreading gilia (Ipomopsis [Gilia] polycladon)	BLM, INPS-2

a. The species identified as sensitive, rare, or unique are uncommon on the INEEL because they require unique microhabitat conditions (Idaho CDC 1998a). The plant species are distant from disturbed facilities.
b. BLM = Bureau of Land Management monitored; FS = U.S. Forest Service monitored; INPS-S = Idaho Native Plant Society sensitive; INPS-M = Idaho Native Plant Society monitored; INPS-1 = Idaho Native Plant Society, State Priority 1; INPS-2 = Idaho Native Plant Society, State Priority 2.

4.9.4 Wetlands

National Wetland Inventory maps prepared by the U.S. Fish and Wildlife Service have been completed for most of the INEEL. The National Wetland Inventory maps indicate that the potential wetland-like areas are associated with the Big Lost River, the Big Lost River Spreading Areas, and the Big Lost River sinks, although smaller (less than 1 acre) isolated wetland-like areas also occur (Figure 4.9-2). Other spreading areas (e.g., Birch Creek Playa) that occur during high-water years and intermittently in other years are also shown on Figure 4.9-2. Approximately 20 potential wetlands listed by the U.S. Fish and Wildlife Service are manmade (e.g., industrial waste and sewage treatment ponds, borrow pits, and gravel pits) and are not considered regulated jurisdictional wetlands. The scattered artificial ponds, potential wetlands, and intermittent waters serve as water sources to many wildlife species including songbirds, and mammals. There are no natural wetland areas within the RWMC boundary; however, there are two sewage lagoons adjacent to the boundary.

4.9.5 Radioecology

Potential radiological effects on plants and animals are measured at the population, community, or ecosystem level. Measurable effects of radionuclides on plants and animals, however, have only been observed in individuals on areas adjacent to INEEL facilities, and not at the population, community, or ecosystem level.

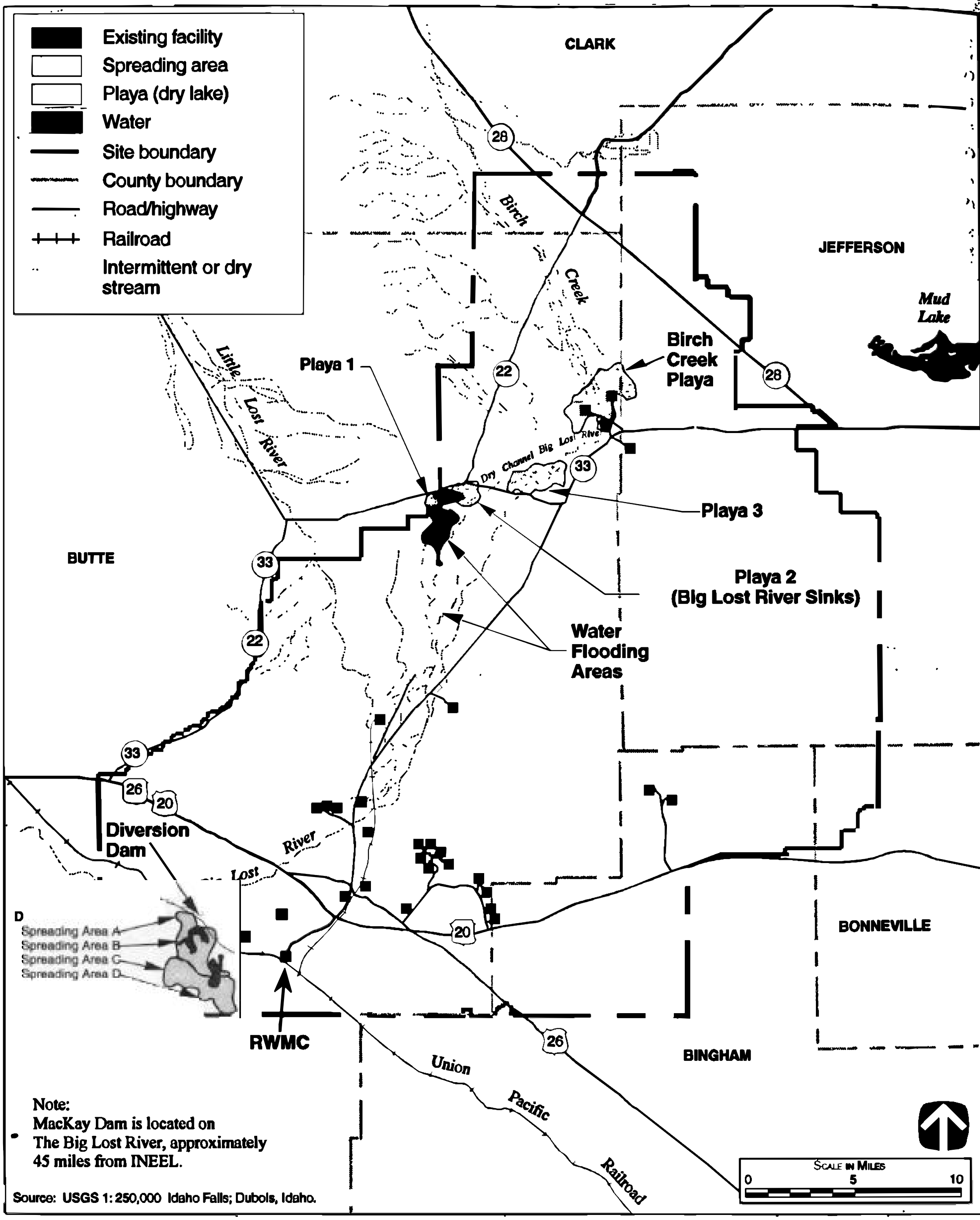


Figure 4.9-2. Surface water features at the INEEL.

Radionuclides have been found above background levels in individuals of some plant and animal species on and around the INEEL (Morris 1993). Studies conducted by Halford and Markham (1984) and Arthur et al. (1986) concluded that small mammals, such as deer mice, Ord's kangaroo rat, and Montane vole at the Test Reactor Area waste percolation pond and the SDA at the RWMC, received higher concentrations of activation and fission products than small mammals from control areas on the INEEL. Statistically significant differences in several physiological parameters were found between deer mice inhabiting the same two areas and control areas (Evenson 1981). However, radiation exposures were too small to cause cellular changes in the mice. All studies reported that doses to individual organisms were too low to cause any effects at the population level.

Radioecology studies of vegetation at the RWMC have been conducted by Arthur (1982) to document radionuclide concentrations primarily in Russian thistle and crested wheatgrass. About 90 percent of the radioactivity in RWMC vegetation was attributed to Sr-90 and Cs-137; however, no significant difference in concentrations of Sr-90 or Cs-137 was detected between RWMC and control samples for either species. The study concluded that vegetation was not a major transport mechanism for radionuclides from the RWMC.

Gamma contamination of predators that consume rodents at the Test Reactor Area and RWMC has been shown to be insignificant (<100 pCi/g whole body for raptors and <30 pCi/g feces for coyotes) (Craig et al. 1979, Arthur and Markham 1982). The dose from internal consumption of radionuclides was less than is thought to be required for observable effects (0.1 rad per day [36.5 rads per year]) to occur to individual animals (IAEA 1992). Also, on the basis of limited data, and the infrequent use by the few bald eagles and peregrine falcons observed near contaminated areas, there is no evidence based on measurements that these species are consuming harmful concentrations of radioactive contaminants in their prey (Morris 1993).

4.10 Noise

This section discusses the noise levels at the INEEL. The noise level at the INEEL ranges from 10 decibels A-weighted (dBA) (i.e., referenced to the A scale, approximating human hearing response) for the rustling of grass outdoors to as much as 115 dBA indoors, the upper limit for unprotected hearing exposure established by the Occupational Safety and Health Administration (OSHA). The natural environment of the INEEL has relatively low ambient noise levels of about 35 to 40 dBA due to natural sources (EPA 1971). Waste shredding and painting operations at the CFA produced the highest indoor noise levels measured at the INEEL at 104 dBA and 99 dBA, respectively. Noise measurements taken along U.S. Highway 20 about 50 feet from the roadway during a peak commuting period indicate that the sound level from traffic ranges from 64 to 86 dBA (Abbott et al. 1990). Buses are the primary highway noise source (71 to 81 dBA at 50 feet).

Existing INEEL-related noises of public significance are dominated by transportation sources. During the normal work week, most of the 4,000 to 5,000 employees who work at the INEEL are transported daily to the site from surrounding communities and back again over approximately 300 bus routes. About 300 to 500 private vehicles also travel to and from the INEEL site each day.

Public exposure to aircraft nuisance noise is negligible. Onsite INEEL activities have little influence on public exposure to aircraft noise, since security helicopters are no longer based at INEEL. Noise originating from occasional commercial aircraft crossing the INEEL at high altitude is indistinguishable from natural background noise.

Normally, no more than one train per day and usually fewer than one train per week services the INEEL via the Scoville spur. Rail transport noises originate from diesel engines, wheel/track contact, and whistle warnings at rail crossings.

The noise generated at the INEEL is not propagated at detectable levels offsite, since all public areas are at least 4 miles away from site facility areas. Previous studies of the effects of noise on wildlife indicate that even very high intermittent noise levels at the INEEL (over 100 dBA) would have no deleterious effect on wildlife productivity (Leonard 1993b).

4.11 Traffic and Transportation

Roads are the primary access to and from the INEEL. Commercial shipments are transported by truck and plane, some bulk materials are transported by train, and waste is transported by truck and train. This section discusses existing traffic volumes, transportation routes, transportation accidents, and waste and materials transportation. This information has been summarized from Section 4.11, Traffic and Transportation, of Volume 2 of DOE INEL EIS and has been updated when relevant to the impacts being assessed.

4.11.1 Roadways

4.11.1.1 Infrastructure—Regional and Site Systems. Two interstate highways serve the regional area as shown in Figure 4.11-1. Interstate 15, a north-south route along the Snake River, is approximately 25 miles east of the INEEL. Interstate 86 intersects Interstate 15 approximately 40 miles south of the INEEL and provides a primary linkage from Interstate 15 to points west. Interstate 15 and U.S. Highway 91 are the primary access routes through the Shoshone-Bannock reservation. U.S. Highways 20 and 26 are the main access routes through the southern portion of the INEEL. Idaho State Routes 22, 28, and 33 pass through the northern portion of the INEEL. Table 4.11-1 shows the baseline (1991) traffic for several of these access routes. The Level-of-Service of these highway segments is designated "free flow," which is defined as "operation of vehicles is virtually unaffected by the presence of other vehicles" (TRB 1994).

A road system of approximately 87 miles of paved surface has been developed on the INEEL, including about 18 miles of service roads that are closed to the public. The onsite road system at the INEEL undergoes continuous maintenance. The proposed AMWTP facility would be located at the RWMC site in the southwestern corner of the INEEL. The principal route to the RWMC is via Van Buren and Adams Boulevards. The turnoff to the RWMC is located between Highway 20 mile posts 266 and 267. Both roads are paved, all-weather roads suitable for heavy truck use. Two alternate, weather-dependent routes to the RWMC are via graded dirt roads. Within the TSA, the three storage pad aprons provide all-weather surfaces for vehicular traffic. All access roads are paved.

Table 4.11-1. Baseline traffic for selected highway segments in the vicinity of the INEEL.

Route	Average daily traffic	Peak hourly traffic
U.S. Highway 20—Idaho Falls to INEEL	2,290	344
U.S. Highway 20/26—INEEL to Arco	1,500	225
U.S. Highway 26—Blackfoot to INEEL	1,190	179
State Route 33—west from Mud Lake	530	80
Interstate 15—Blackfoot to Idaho Falls	9,180	1,380

Source: DOE 1995.

4.11.1.2 Transit Modes. Four major modes of INEEL-related transit use the regional highways, community streets, and INEEL roads to transport people and commodities: DOE buses and shuttle vans, DOE motor pool vehicles, commercial vehicles, and personal vehicles. Table 4.11-2 summarizes the baseline miles for INEEL-related traffic.

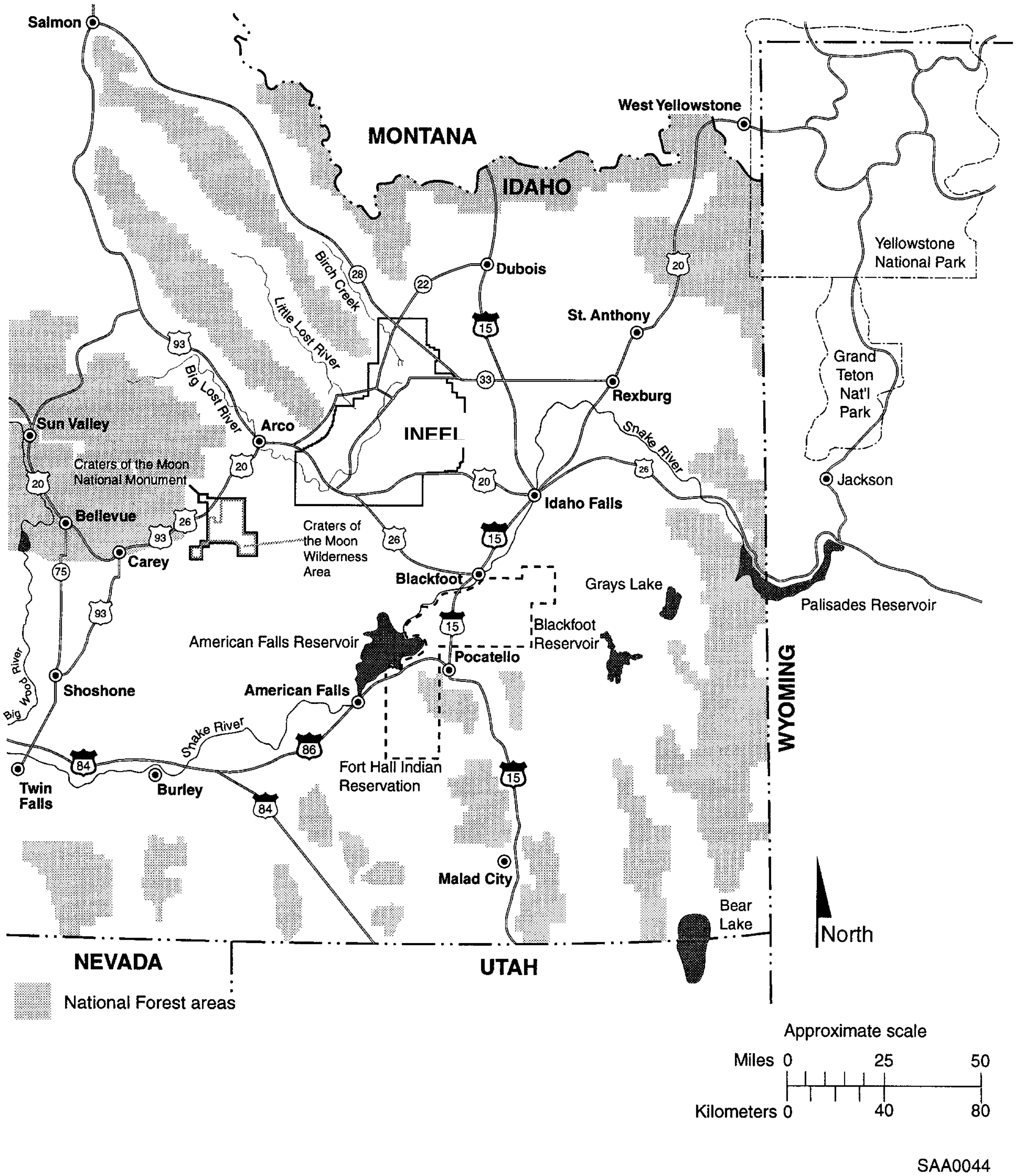


Figure 4.11-1. Regional roadway infrastructure in southeastern Idaho.

4.11.2 Railroads

Union Pacific Railroad lines in southeastern Idaho provide railroad freight service to Idaho Falls from Butte, Montana, to the north, and from Pocatello, Idaho, and Salt Lake City, Utah, to the south. The Union Pacific Railroad's Arco Branch crosses the southern portion of the INEEL and provides rail service to the INEEL. This branch connects at the Scoville Siding with a DOE spur line, which links with developed areas within the INEEL. The Arco Branch also passes approximately 0.5 miles south of RWMC. In 1974, a railroad spur to the TSA was completed to permit direct shipment of waste to the RWMC. Rail shipments to and from the INEEL usually are limited to bulk commodities, spent nuclear fuel, and radioactive waste. During Fiscal Year 1992, there were 23 loaded rail shipments to the INEEL and no loaded outbound rail shipments. The Settlement Agreement (U.S. v. Batt 1995) limits the shipment of naval spent fuel to the INEEL to 20 shipments per year from 1997 through 2035. Because the loaded rail shipments to the INEEL primarily consist of naval spent fuel, this limitation also effectively limits rail shipments to the INEEL.

Table 4.11-2. Baseline annual vehicle miles traveled for traffic related to the INEEL.

Transit mode	Vehicle miles traveled
DOE buses	6,068,200
Other DOE vehicles	9,183,100
Personal vehicles on highways to INEEL	7,500,000
Commercial vehicles	905,900
TOTAL	23,657,200

Source: DOE 1995.

4.11.3 Airports and Air Traffic

Airlines provide Idaho Falls with jet aircraft passenger and cargo service. Local charter service is available in Idaho Falls, and private aircraft use the major airport and numerous other airfields in the area. The total number of landings at the Idaho Falls airports for 1991 and 1992 were 5,367 and 5,598, respectively. The Idaho Falls and Pocatello Airports collectively record nearly 7,500 landings annually.

Non-DOE air traffic over the INEEL is limited to altitudes greater than 1,000 feet over buildings and populated areas, and non-DOE aircraft are not permitted to use the site. The primary air traffic at the INEEL is occasional high-altitude commercial jet traffic since INEEL no longer operates DOE helicopters.

4.11.4 Accidents

For the years 1993 through 1997, the average motor vehicle accident rate was 1.9 accidents per million miles for DOE buses (Carroll 1998), which compares with a nationwide accident rate of 12.8 accidents per million miles for all motor vehicles. There are no recorded air accidents associated with the INEEL.

Collisions between wildlife and trains or motor vehicles are an impact from any human activities involving transportation of materials or humans. Wildlife, such as antelope, often bed down on the train tracks and use the tracks for migration routes when snow accumulation is high. Train collisions with wildlife can involve large numbers of animals and have a significant impact on the local population.

Accidents involving motor vehicles and wildlife generally involve individual animals and may occur during any season.

4.11.5 Transportation of Waste and Materials

Hazardous, radioactive, industrial, commercial, and recyclable wastes are transported onsite and off the INEEL. Numerous regulations and requirements which govern transportation of hazardous and radioactive materials are adhered to at the INEEL in order to protect public health and safety. Four main categories of radioactive materials are associated with current INEEL activities: spent nuclear fuel, TRU waste, low-level mixed waste (LLMW), and low-level waste. High-level waste is stored at the INEEL, but currently is not transported. The possible shipment of high-level waste is being addressed in other NEPA documents (see Table 1.5-1).

A baseline of radiological doses from incident-free, onsite waste and materials transportation at the INEEL was established using six years of data (1987 through 1992). Results are presented in Table 4.11-3 in terms of the collective doses and cancer fatalities for 1995 to 2005. The baseline includes no offsite shipments. Additional discussions of radiological conditions at the INEEL are presented in Section 4.12, Occupational and Public Health and Safety.

Table 4.11-3. Collective doses and fatalities from incident-free onsite shipments at the INEEL for 1995 to 2005.

	Estimated collective dose (person-rem)	Estimated cancer fatalities
Occupational	6.6	0.0026
General population	0.14	0.000070

Source: DOE 1995.

4.12 Occupational and Public Health and Safety

This section presents the potential health effects to the public and workers as a result of current operations at the INEEL. Since RWMC would be affected most by the proposed actions, occupational health and safety at RWMC are emphasized. This section provides an update of the health impacts from the release of radioactive and nonradioactive constituents and historical health and safety data presented in the DOE INEL EIS. Additional detail and background information on the material presented in this section are included in Appendix E-4, Occupational and Public Health and Safety.

The DOE INEL EIS included an extensive discussion of the INEEL affected environment; in lieu of duplication here Section 4.2 of Volume 1 and Section 4.12 of Volume 2 of that document are referenced.

4.12.1 Radiological Health Risk

The potential health risk to workers and the public from exposure to radionuclides was assessed in Volume 2, Section 4.12.1, of the DOE INEL EIS. The assessment included the evaluation of health effects from routine airborne releases from facilities at the INEEL. The three categories of exposed individuals were (1) a MEI at the site boundary, (2) population within 50 miles, and (3) maximally exposed onsite involved worker. The potential radiological health effects to workers and the public from routine air emissions calculated in the DOE INEL EIS are summarized in the following paragraphs. The potential radiological dose from routine airborne releases at the INEEL are incremental to the dose from natural background radiation. The estimated natural background radiation dose for the Snake River Plain is presented for comparison.

The human health risk associated with radiological emissions is assessed based on risk factors contained in the International Commission on Radiological Protection recommendations (ICRP 1991). For the calculation of health effects from exposure to airborne radionuclides, the annual doses provided in Section 4.7, Air Resources, were multiplied by the appropriate ICRP risk factors.

Table 4.12-1 provides summaries of the annual dose, risk factors, and estimated increased lifetime risk of developing fatal cancer based on the annual exposure. These risks are presented for the maximally exposed onsite worker and MEI near the site boundary (public) for years 1995 and 1996. The offsite individual annual dose of 0.031 millirem in 1996 corresponds to lifetime excess fatal cancer risk of approximately 1 in 60 million. The worker dose of 0.32 millirem corresponds to a lifetime excess fatal cancer risk of approximately 1 in 7 million. Current regulations limit the dose resulting from releases of airborne radioactivity from DOE facilities to no more than 10 millirem per year to any member of the public.

Table 4.12-1. Lifetime excess fatal cancer risk due to annual exposure to routine airborne releases at the INEEL.

Maximally exposed individual	Annual dose (millirem)	Risk factor (risk/person-millirem)	Risk (excess fatal cancer)
Onsite worker	3.2E-01	4.0E-07	1.3E-07
Offsite individual (public) 1995[a]	1.8E-02	5.0E-07	9.0E-09
Offsite individual (public) 1996[a]	3.1E-02	5.0E-07	1.6E-08

a. Differences in offsite individual doses between 1995 and 1996 are based on differences in INEEL facility emissions (see Section 4.7, Table 4.7-1).

Table 4.12-2 provides summaries of the population dose, risk factor, and estimated increased lifetime risk of developing fatal cancer based on annual exposure to the surrounding population for the year 1995. The surrounding population consists of approximately 120,000 people within a 50-mile radius of the CFA at INEEL. The total baseline collective population dose of 0.30 person-rem corresponds to a lifetime excess fatal cancer risk of approximately 1.5×10^{-4} within the entire population over the next 70 years.

Workers at the INEEL and RWMC may be exposed either internally (from inhalation and ingestion) or externally (from direct exposure) to radiation. The largest fraction of occupational dose received by INEEL and, similarly, RWMC workers, is from external radiation from direct exposure or groundshine. The average occupational dose from 1991 to 1995 to individuals with measurable doses was 0.155 rem, which results in an average annual collective dose of about 211 person-rem. This collective dose corresponds to a lifetime increased fatal cancer risk of 0.084 for INEEL, including the RWMC personnel (DOE 1996b). The average occupational dose DOE-wide from 1991 to 1995 to individuals with measurable doses was 0.074 rem, which results in an average annual collective dose of about 2,007 person-rem (DOE 1996b); this corresponds to a lifetime increased fatal cancer risk of 1 occurrence in 35,000 for the average occupational dose throughout the DOE Complex.

Table 4.12-2. Increased population risk of developing excess fatal cancers due to routine airborne releases at the INEEL.

Year	Population dose[a] (person-rem)	Risk factor (risk/person-rem)	Risk (number of fatal cancer)
1995	3.0E-01	5.0E-04	1.5E-04

a. The population dose of 0.3 person-rem from the DOE INEL EIS, Section 4.12.1.

To put the offsite doses from the INEEL into perspective, it is useful to compare them to the natural background radiation levels in the vicinity of the INEEL. The estimated annual dose equivalent from natural sources for an individual living on the Snake River Plain is approximately 360 millirem (Appendix E-3, Air Resources). The annual dose and estimated incremental lifetime risk of developing fatal cancer reported in Tables 4.12-1 and 4.12-2 are in addition to natural background.

Estimates of potential health effects for onsite workers were made assessing drinking water sampling data as presented in Section 4.8, Water Resources. The highest average radionuclide concentration in any RWMC site drinking water distribution system measured was tritium, at a concentration of 1,500 picocuries per liter. This level is well below regulatory limits of 20,000 picocuries per liter. Consumption of this water for 50 years (an assumed maximum employment duration) would result in an estimated dose equivalent of 3.5 millirem, with a corresponding estimated fatal cancer risk of 1 occurrence in 700,000.

Potential health effects to the offsite population from the groundwater pathway are unchanged from the health effects reported in the DOE INEL EIS, which were calculated as an excess incidence of cancer risk of 1 occurrence in 170 million under INEEL baseline operating conditions.

4.12.2 Nonradiological Health Risk

The potential health risk to workers and the public from exposure to carcinogenic and noncarcinogenic chemicals was assessed in Volume 2, Section 4.12.1, of the DOE INEL EIS. The assessment included the evaluation of health effects from routine airborne releases from facilities at INEEL to a MEI at the site boundary and a maximally exposed onsite worker. The potential nonradiological health effects to workers and the public from routine air emissions calculated in the DOE INEL EIS are summarized in the following paragraphs.

For non-occupational exposures to members of the public, data concerning the toxicity of carcinogenic and noncarcinogenic constituents were obtained from dose-response values approved by the EPA (EPA 1993, 1994). The values included slope factors and unit risks for evaluating cancer risks, reference doses and reference concentrations for evaluating exposures to noncarcinogens, and primary NAAQS for evaluating criteria pollutants. For the individual noncarcinogenic toxic air pollutants, all hazard quotients were less than one. The hazard quotient is a ratio of the calculated concentration in the air to the reference concentration. This indicates that no adverse health effects would be projected as a result of noncarcinogenic emissions. The offsite excess cancer risk from carcinogenic emissions ranged from 1 in 1.4 million for formaldehyde to 1 in 625 million for trichloroethylene (DOE INEL EIS, Table 4.12-6). The hazard quotients for criteria air pollutants associated with maximum baseline emissions were all less than one. This indicates that no adverse health effects were projected from criteria pollutant emissions. The recent actual site-wide emissions for criteria pollutants presented in Section 4.7, Air Resources, Table 4.7-2 are fewer than those assessed in the DOE INEL EIS.

For occupation exposures to workers at the INEEL, modeled chemical concentrations were compared with the applicable occupational standard. The comparison was made by calculating a hazard quotient, which is a ratio between the calculated concentration in air and the applicable standard. The hazard quotients for noncarcinogenic and carcinogenic air pollutants at the INEEL were less than one with the exception of benzene at CFA, for which the hazard quotient was slightly greater than one. The RWMC was predicted to be the location of maximum concentration for only 3 of the 13 carcinogenic air pollutants assessed and none of the noncarcinogenic air pollutants assessed.

The highest chemical constituent concentration measured in the RWMC site production well head was carbon tetrachloride, at a concentration of 7 micrograms per liter. This concentration is higher by a factor of 1.4 than the maximum contaminant level for drinking water of 5 micrograms per liter. Carbon tetrachloride concentrations in the RWMC site drinking water system did not exceed 5 micrograms per liter. A concentration of 7 micrograms per liter of carbon tetrachloride would indicate an excess incidence of cancer risk of 1 occurrence in 40,000 using an ingestion slope factor of 0.13 kilogram-day per milligram (EPA 1993).

4.12.3 Industrial Safety

The radiation doses and nonradiological hazards presented here are based on personnel monitoring data and reported occupational incidences at the INEEL. For occupational exposure to ionizing radiation, health effects assessments are based on actual exposure measurements. For routine workplace hazards, the health risk is presented as reported injuries, illness, and fatalities in the workforce.

At the INEEL, occupational nonradiological health and safety programs are composed of industrial hygiene programs and occupational safety programs. Total recordable case rates for injury and illness incidence at INEEL varied from an annual average of 3.0 to 3.7 per 200,000 work hours from 1992 to

1996. During this time, total lost workday cases ranged from 1.2 to 1.8 per 200,000 work hours. Total recordable case rates for injury and illnesses for INEEL workers are comparable to those for DOE and its contractors across the United States, which varied from 3.5 to 3.8 per 200,000 work hours. During this time, total lost workday case rates varied from 1.6 to 1.8 per 200,000 work hours. One fatality occurred at INEEL between 1992 and 1996 when an employee fell from an elevated area. Detailed information on the INEEL and RWMC occupational health and safety is presented in Appendix E-4, Occupational and Public Health and Safety.

4.13 Idaho National Engineering and Environmental Laboratory Services

This section describes the current INEEL services available to the proposed AMWTP. These services include water, electricity, fuel, wastewater disposal, security and emergency protection, communication, and waste minimization/pollution prevention. Certain services for the RWMC that may affect the proposed AMWTP are also described. The contents of this section are tiered from DOE INEL EIS Volume 2, Part A, Section 4.13, which is summarized here and updated as applicable.

4.13.1 Water Consumption

The water supply system for each facility area at INEEL is independent and is provided by wells. No natural surface water is used. DOE's water rights permit allows INEEL to pump 36,000 gallons per minute of groundwater, but not to exceed 11.4 billion gallons per year (Teel 1993). Water consumption for years in which data were available is shown in Table 4.13-1.

The RWMC water supply system consists of two 250,000-gallon storage tanks fed by a deep well. One tank is dedicated to fire fighting water storage, and one tank is dedicated to potable water storage. The potable water tank serves as a backup fire fighting water tank. The RWMC water supply system has unused excess capacity.

Table 4.13-1. Water consumption at the RWMC and the INEEL.

Year(s)	Gallons per year - RWMC (in millions)	Gallons per year - INEEL (in billions)
1987-1991 (Teel1993)	not available	1.9
1994 (Litus 1997)	9.65	1.5
1995 (Litus 1997)	5.67	1.2
1996 (Litus 1997)	0.482	0.37
1997 (Sehlke 1998)	4.19	1.3

4.13.2 Electricity Consumption

Electric power is supplied to the INEEL by the Idaho Power Company. The contract with Idaho Power (IPC/DOE 1996) is for up to 45,000 kilowatts monthly at 138 kilovolts, the site power transmission line loop is rated 138 kilovolts, and peak demand on the system from 1990 through 1993 was about 40,000 kilowatts (Mantlik 1998a). Average usage prior to 1993 was slightly less than 217,000 megawatt-hours per year (DOE INEL EIS, Volume 2, Part A, Section 4.13). Usage in 1997 for INEEL was 173,862 megawatt-hours, 3,584 megawatt-hours for Pit 9, and 6,206 megawatt-hours for the RWMC (Mantlik 1998b). Within the last two years, a new 138-kilovolt line was constructed from CFA to the RWMC.

4.13.3 Fuel Consumption

Fuels consumed at the INEEL consist of liquid petroleum fuels, coal, and propane. At the INEEL from 1990 through 1992, average fuel consumption for 1990 through 1992 (DOE 1995) and for 1997 (Mantlik 1998c) is given in Table 4.13-2. Fuel storage is provided at each facility.

4.13.4 Wastewater Disposal

The smaller onsite facility areas at INEEL primarily use septic tanks and drain fields. Wastewater treatment facilities are provided for larger areas such as CFA, the ICPP, and the Test Reactor Area.

Table 4.13-2. Average fuel consumption amounts at the INEEL and the RWMC.

Type of fuel	Average per year 1990-1992	INEEL 1997	RWMC 1997
Heating oil	2,795,000 gallons	1,563,536 gallons	NA[a]
Diesel fuel	1,500,000 gallons	617,947 gallons	(b)
Propane gas	150,000 gallons	130,249 gallons	48,019 gallons
Gasoline	557,000 gallons	343,660 gallons	NA
Jet fuel	73,100 gallons	0	0
Kerosene	33,800 gallons	not available	NA
Coal	9,000 short tons	12,533 short tons	NA

Source: Mantlik 1998b.
a. NA: not applicable.
b. A very small but unknown amount is used.

The RWMC uses sewage lagoons south of the complex. This system may have some available capacity.

Average annual wastewater (sewage) discharge volume on the INEEL for 1993 was 142 million gallons (DOE INEL EIS, Volume 2, Part A, Section 4.13). Wastewater (sewage) disposal at INEEL for 1997 was about 149 million gallons and for the RWMC for 1997 was 1.27 million gallons (Mantlik 1998d).

4.13.5 Security and Emergency Protection

The fire protection and prevention, security, and emergency preparedness resources at the INEEL are described in this section. These resources are described in more detail in DOE INEL EIS Volume 2, Part A, Section 4.13, INEL Services, and are summarized here and updated as appropriate from other references.

An extensive communication system exists at INEEL which connects all of the areas and facilities, such as the RWMC and CFA, with each other and the DOE-ID facilities in Idaho Falls. The communication system includes radio systems, data lines, and phone lines.

Three fire stations on the INEEL provide support to the entire site. Equipment and expertise to respond to explosions, fires, spills, and medical emergencies are available at each station. The station locations are at Test Area North, Argonne National Laboratory-West, and CFA. A new fire station and training facility was recently completed at CFA. The fire department also provides INEEL with ambulance, emergency medical technician, and hazardous material response services. Mutual aid agreements exist with other fire fighting organizations, including the BLM and the cities of Idaho Falls, Blackfoot, and Arco.

An approximately 25,000-square-foot medical facility staffed with doctors and nurses is located at the CFA and can provide support for certain medical emergencies. The facility is staffed 24 hours a day and seven days a week. Basic medical equipment, such as X-Ray machines, patient examination equipment, offices, and basic medical testing and laboratory equipment, is provided. Also included are an emergency room, a radiological decontamination room, a cardiac/other treatment room, and an ambulance garage. A communication center provides an emergency phone directly to the fire department.

Emergency preparedness programs are administered and staffed by each INEEL contractor under the direction and supervision of DOE. The communication center is the Warning Communication Center in the DOE-ID Headquarters building in Idaho Falls. This center is staffed by the prime contractor with DOE oversight and supports on-scene commanders in charge of emergency response. Mutual aid agreements exist with all regional county and major city fire departments, police, and medical facilities.

The emergency preparedness program at the RWMC is described in the *Radioactive Waste Management Complex Safety Analysis Report* (LMITCO 1997c). There are three categories of emergency facilities: the Emergency Operations Center, Emergency Control Centers, and facility Command Posts. Emergency actions are directed from the RWMC Command Post. The RWMC Emergency Coordinator, supported by the RWMC Emergency Response Organization has the overall responsibility for the initial and ongoing response to and mitigation of RWMC emergencies. The Emergency Control Centers at the CFA supports the RWMC Command Post. The INEEL Emergency Response Organization responds to the Emergency Operations Center in the DOE-ID Headquarters building in Idaho Falls.

The security program consists of three categories:

- Security operations - Security operations provides asset protection (classified matter, special nuclear material, facilities, and personnel) and technical security (computer and information). Security operations includes the INEEL protective force, which is administered by DOE and supplied by contractors.

- Personnel security - The personnel security staff processes security clearances.

- Safeguards - The safeguards organization is responsible for the management and accountability of special nuclear materials. Each INEEL contractor has a safeguards and security staff with similar responsibilities to manage the security at its facilities.

4.13.6 Waste Minimization/Pollution Prevention

The Waste Minimization/Pollution Prevention programs that apply to the management of materials and wastes at INEEL are summarized in this section. More detailed descriptions are contained in the Annual Report of Waste Generation and Pollution Prevention Progress (DOE 1997a) and the DOE-ID Pollution Prevention Plan (DOE-ID 1997d). The waste streams at INEEL include high-level, TRU, LLMW, and low-level radioactive wastes and hazardous, industrial, and commercial solid wastes.

The INEEL has programs in place to reduce the toxicity and quantity of waste generated. Physical or engineering processes are used to reduce or eliminate waste generation; recycle; and reduce the volume, toxicity, or mobility of waste. The volume of radioactive waste is reduced through more intensive surveying, waste segregation, and administrative and engineering controls. These plans and their accomplishments have been described in various documents including site treatment plans (DOE-ID 1995) and annual progress reports (DOE 1997a). Overall, in 1996 the INEEL Waste Minimization/Pollution Prevention efforts resulted in the reduction of waste generation by 1,000 cubic meters and the saving of more than $2 million.

Industrial and commercial solid waste is disposed of in the INEEL Landfill Complex at CFA. There is about 225 acres of land available for solid waste disposal at the Landfill Complex. The capacity is sufficient to dispose of INEEL waste for 30 to 50 years. Recyclable materials are segregated from the solid waste stream at each INEEL facility. The average annual volume of waste disposed at the Landfill Complex from 1988 through 1992 was 68,000 cubic yards (EG&G 1993). For 1996 and 1997, the volume of waste was approximately 59,000 and 71,000 cubic yards, respectively.

In November 1996, a paper pelletizer project (DOE-ID 1997e) was brought on-line. This system is referred to as a "cuber" because of the shape of the pellets. This system converts nonradioactive office waste into fuel for the INEEL Coal Fired Steam Generation Facility. Current plans are that all combustible waste at INEEL would be diverted to the cuber, resulting in a reduction of nonradioactive waste going to the landfill.