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NUREG-1945, Vol. 1

Environmental Impact Statement for the Proposed Eagle Rock Enrichment Facility in Bonneville County, Idaho

Final Report

Chapters 1 through 10

Office of Federal and State Materials and
Environmental Management Programs

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ABSTRACT

On December 30, 2008, AREVA Enrichment Services LLC (AES) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a license to construct, operate, and decommission the proposed Eagle Rock Enrichment Facility (EREF). The proposed EREF would be located in Bonneville County, Idaho, approximately 32 kilometers (20 miles) west of Idaho Falls. Revisions to the license application were submitted by AES on April 23, 2009, and April 30, 2010. If licensed, the proposed facility would enrich uranium for use in commercial nuclear fuel for power reactors. AES would employ a gas centrifuge enrichment process to enrich uranium to up to five percent uranium-235 by weight, with a planned maximum target production of 6.6 million separative work units (SWUs) per year. AES initiated preconstruction activities (e.g., site preparation) in late 2010 under an exemption approved by the NRC to conduct such activities prior to licensing. If its license application is approved, AES expects to begin facility construction in 2011and commence initial production in 2014, reaching peak production in 2022. AES's license would be for a term of 30 years. Prior to license expiration in 2041, AES would seek to renew its license to continue operating the proposed facility or plan for the decontamination and decommissioning of the proposed facility per the applicable licensing conditions and NRC regulations. The proposed EREF would be licensed in accordance with the provisions of the *Atomic Energy Act*. Specifically, an NRC license under Title 10, "Energy," of the U.S. *Code of Federal Regulations* (10 CFR) Parts 30, 40, and 70 would be required to authorize AES to possess and use special nuclear material, source material, and byproduct material at the proposed EREF site.

This Environmental Impact Statement (NUREG-1945) (EIS) was prepared in compliance with the *National Environmental Policy Act of 1969*, as amended (NEPA), and the NRC regulations for implementing NEPA (10 CFR Part 51). This EIS evaluates the potential environmental impacts of preconstruction activities and of the proposed action, which is to construct, operate, and decommission the proposed EREF near Idaho Falls in Bonneville County, Idaho. Also, this EIS describes the environment potentially affected by AES's proposal, evaluates reasonable alternatives to the proposed action, describes AES's environmental monitoring program and mitigation measures, and evaluates the costs and benefits of the proposed action.

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CONTENTS

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EXECUTIVE SUMMARY

BACKGROUND

Under the provisions of the *Atomic Energy Act* and pursuant to Title 10 of the U.S. *Code of Federal Regulations* (10 CFR) Parts 30, 40, and 70, the U.S. Nuclear Regulatory Commission (NRC) is considering whether to issue a license that would allow AREVA Enrichment Services, LLC (AES) to possess and use byproduct material, source material, and special nuclear material at a proposed gas centrifuge uranium enrichment facility near Idaho Falls in Bonneville County, Idaho, for a period of 30 years. The scope of activities to be conducted under the license would include the construction, operation, and decommissioning of the proposed Eagle Rock Enrichment Facility (EREF). The application for the license was filed with the NRC by AES by letter dated December 30, 2008. Revisions to the license application were submitted by AES on April 23, 2009 (Revision 1) and April 30, 2010 (Revision 2). To support its licensing decision on AES's proposed EREF, the NRC determined that the NRC's implementing regulations in 10 CFR Part 51 for the *National Environmental Policy Act* (NEPA) require the preparation of an Environmental Impact Statement (EIS). The development of this EIS is based on the NRC staff's review of information provided by AES, independent analyses, and consultations with the U.S. Fish and Wildlife Service and other Federal agencies, Native American tribes, the Idaho State Historic Preservation Office (SHPO) and other State agencies, and local government agencies.

The enriched uranium produced at the proposed EREF would be used to manufacture nuclear fuel for commercial nuclear power reactors. Enrichment is the process of increasing the concentration of the naturally occurring and fissionable uranium-235 isotope. Uranium ore usually contains approximately 0.72 weight percent uranium-235. To be useful in light-water nuclear power plants as fuel for electricity generation, the uranium must be enriched up to 5 weight percent uranium-235.

THE PROPOSED ACTION

The proposed action considered in this EIS is for AES to construct, operate, and decommission a uranium enrichment facility, the proposed EREF, at a site near Idaho Falls in Bonneville County, Idaho. To allow the proposed action to take place, the NRC would issue a license to AES as discussed above. The proposed EREF would be located on a 186-hectare (460-acre) section of a 1700-hectare (4200-acre) parcel of land that it intends to purchase from a single private landowner. Current land uses of the proposed EREF property include native rangeland, nonirrigated seeded pasture, and irrigated cropland. The proposed EREF, if approved, would be situated on the north side of US 20, about 113 kilometers (70 miles) west of the Idaho/Wyoming State line and approximately 32 kilometers (20 miles) west of Idaho Falls. The eastern boundary of the U.S. Department of Energy's (DOE) Idaho National Laboratory (INL) is 1.6 kilometers (1 mile) west of the proposed property. The lands north, east, and south of the proposed property are a mixture of private-, Federal-, and State-owned parcels, with the Federal lands managed by the Bureau of Land Management (BLM).

Using a gas centrifuge process, the proposed EREF would produce uranium enriched up to 5 percent by weight in the isotope uranium-235, with a planned maximum target production of 6.6 million separative work units (SWUs) per year. An SWU is a unit of measurement used in the nuclear industry, pertaining to the process of enriching uranium for use as fuel for nuclear power plants. If the license is approved, facility construction would begin in 2011 with heavy construction (construction of all major buildings and structures) continuing for 7 years into 2018. The proposed EREF would begin initial production in 2014 and reach peak production in 2022. Operations would continue at peak production until approximately 9 years before the license expires. Decommissioning activities would then begin and be completed by 2041. Decommissioning would involve the sequential shutdown of the 4 Separation Building Modules (SBMs) resulting in a gradual decrease in production. Each SBM would take approximately 4.5 years to decommission.

Supplemental information on a proposed 161-kilovolt (kV) electrical transmission line required to power the proposed EREF was submitted by AES on February 18, 2010. The NRC has no jurisdiction over transmission lines; therefore, the transmission line for the proposed EREF is not considered part of the proposed action. However, construction and operation of this transmission line are considered in this EIS under cumulative impacts.

NRC EXEMPTION FOR AES TO CONDUCT CERTAIN PRECONSTRUCTION ACTIVITIES

On June 17, 2009, AES submitted a request for an exemption from certain NRC regulations to allow commencement of certain preconstruction activities on the proposed EREF site prior to NRC's decision to issue a license for the construction, operation, and decommissioning of the proposed EREF. On March 17, 2010, the NRC granted an exemption authorizing AES to conduct the requested preconstruction activities. Under the exemption, these preconstruction activities are not considered by the NRC as part of the proposed action, although the environmental impacts of these activities are discussed in this EIS along with the impacts of facility construction.

Specifically, the exemption covers the following activities and facilities:

- clearing of approximately 240 hectares (592 acres) for the proposed EREF
- site grading and erosion control
- excavating the site including rock blasting and removal
- constructing a stormwater retention pond
- constructing main access and site roadways
- installing utilities
- erecting fences for investment protection
- constructing parking areas
- erecting construction buildings, offices (including construction trailers), warehouses, and guardhouses

This exemption authorizes AES to conduct the stated activities, provided that none of the facilities or activities subject to the exemption would be components of AES's Physical Security Plan or its Standard Practice Procedures Plan for the Protection of Classified Matter, or otherwise be subject to NRC review or approval. AES initiated preconstruction activities in late 2010.

PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action would be to allow AES to construct, operate, and decommission a facility using gas centrifuge technology to enrich uranium up to 5 percent by weight of uranium-235, with a production capacity of 6.6 million SWU per year, at the proposed EREF near Idaho Falls in Bonneville County, Idaho. This facility would contribute to the attainment of national energy security policy objectives by providing an additional reliable and economical domestic source of low-enriched uranium to be used in commercial nuclear power plants.

Nuclear power currently supplies approximately 20 percent of the nation's electricity. The United States Enrichment Corporation Paducah Gaseous Diffusion Plant, Paducah, Kentucky, is currently the primary U.S. supplier of low-enriched uranium for nuclear fuel in the United States. However, the URENCO USA facility (formerly known as the National Enrichment Facility) in Lea County, New Mexico, which began initial operations in June 2010, may provide additional enrichment services in the future as construction continues on its remaining cascade halls. The American Centrifuge Plant (ACP) in Piketon, Ohio, which is currently under construction, and the proposed Global Laser Enrichment (GLE) Facility in Wilmington, North Carolina, for which the NRC is currently reviewing its license application, may also provide additional domestic enrichment services in the future. The existing operating Paducah, Kentucky, enrichment plant supplies approximately 15 percent of the current U.S. demand for low-enriched uranium. The United States Enrichment Corporation also imports downblended (diluted) weapons-grade uranium from Russia through the Megatons to Megawatts Program to supply an additional 38 percent of the U.S. demand. The remaining 47 percent of low-enriched uranium is imported from foreign suppliers. The current primary dependence on a single U.S. supplier and foreign sources for low-enriched uranium imposes reliability risks for the nuclear fuel supply to U.S. nuclear power plants. National energy policy emphasizes the importance of having a reliable domestic source of enriched uranium for national energy security. The production of enriched uranium at the proposed EREF would be equivalent to about 40 percent of the current and projected demand (15 to16 million SWUs) for enrichment services within the United States.

ALTERNATIVES TO THE PROPOSED ACTION

In this EIS, the NRC staff considered a reasonable range of alternatives to the proposed action, including alternative sites for an AES enrichment facility, alternative sources of low-enriched uranium, alternative technologies for uranium enrichment, and the no-action alternative. Two of the alternatives, the proposed action and the no-action alternative, were analyzed in detail. The approved preconstruction activities discussed earlier are assumed to occur prior to NRC's decision to grant a license to AES and, therefore, are assumed to occur under both the proposed action and the no-action alternative.

Under the no-action alternative, the proposed EREF would not be constructed, operated, and decommissioned in Bonneville County, Idaho. Uranium enrichment services would continue to be performed by existing domestic and foreign uranium enrichment suppliers. However, URENCO USA would provide and the ACP and potentially the proposed GLE Facility may provide enrichment services in the future.

AES considered 44 alternative sites throughout the United States. AES evaluated these sites based on various technical, safety, economic, and environmental selection criteria, and concluded that the Eagle Rock site in Bonneville County, Idaho, met all of the criteria. The NRC staff reviewed AES's site-selection process and results to determine if any site considered by AES was obviously superior to the proposed Eagle Rock site. The NRC staff determined that the process used by AES was rational and objective, and that its results were reasonable. Based on its review, the NRC staff concluded that none of the candidate sites were obviously superior to the AES preferred site in Bonneville County, Idaho.

The NRC staff examined three alternatives to satisfy domestic enrichment needs: (1) reactivate the Portsmouth Gaseous Diffusion Plant near Piketon, Ohio; (2) downblend highly enriched uranium instead of constructing a domestic uranium enrichment facility; and (3) purchase low-enriched uranium from foreign sources. These alternatives were eliminated from further consideration based on concerns related to reliability, excessive energy consumption, and national energy security, and did not meet national energy policy objectives involving the need for a reliable, economical source of domestic uranium enrichment.

The NRC staff also evaluated alternative technologies to the gas centrifuge process: electromagnetic isotope separation, liquid thermal diffusion, gaseous diffusion, Atomic Vapor Laser Isotope Separation, Molecular Laser Isotope Separation, and separation of isotopes by laser excitation. These technologies were eliminated from further consideration based on factors such as the technology immaturity, economic impracticality, or exclusive licensing.

In addition, the NRC staff considered conversion and disposition methods for depleted uranium hexafluoride (UF_6): (1) beneficial use of depleted UF_6, and (2) conversion at facilities other than the new facilities that the U.S. Department of Energy (DOE) has built at Portsmouth and Paducah. For the purposes of this analysis, because the current available inventory of depleted uranium exceeds the current and projected future demand for the material, the depleted UF_6 generated by the proposed EREF was considered a waste product, and disposition alternatives involving its use as a resource were not further evaluated.

Existing fuel fabrication facilities have not expressed an interest in performing depleted UF_6 conversion services, and the cost for the services would be difficult to estimate; therefore, this alternative was eliminated from further consideration. However, International Isotopes, Inc. submitted a license application to the NRC on December 31, 2009, to construct and operate a depleted UF_6 conversion facility near Hobbs, New Mexico. On February 23, 2010, the NRC staff accepted the license application, and has initiated a formal safety and environmental review.

POTENTIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

This EIS evaluates the potential environmental impacts of the proposed action. A standard of significance has been established for assessing environmental impacts. Following the Council on Environmental Quality's regulations in 40 CFR 1508.27, the NRC staff has assigned each impact one of the following three significance levels:

- SMALL. The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

- MODERATE. The environmental effects are sufficient to noticeably alter but not destabilize important attributes of the resource.

- LARGE. The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

As described in Chapter 4, the environmental impacts of preconstruction and the proposed action would mostly be SMALL. Some potential impacts would be SMALL to MODERATE or MODERATE in a few cases; and there would be LARGE, though intermittent, short-term impacts in one resource area during preconstruction. Methods for mitigating the potential impacts are identified in Chapters 4 and 5. Environmental measurement and monitoring methods are described in Chapter 6.

Summarized below are the potential environmental impacts of the proposed action on each of the resource areas considered in this EIS. Each summary is preceded by the impact significance level for the respective resource areas.

Land Use

SMALL. The construction of a uranium enrichment facility would alter the current land use, which consists primarily of agriculture and undeveloped rangeland. The 240-hectare (592-acre) proposed EREF site under consideration would be located entirely on a 1700-hectare (4200-acre) private parcel of land. Bonneville County has zoned the location as G-1, Grazing, which allows for industrial development, and is intended to allow certain activities that should be removed from population centers in the county. The operation of a uranium enrichment facility is consistent with the county's zoning. It is not anticipated that construction and operation of the proposed EREF would have any effect on the current land uses found on the surrounding public lands managed by the BLM.

Restrictions to land use would begin with the purchase of the proposed property by AES. The alteration of land use would begin during preconstruction and continue during construction. Preconstruction activities would result in the alteration of the land as a result of activities such as land clearing and grading, restricted access to the proposed EREF property, and cessation of agricultural uses (grazing and crop production). The majority of impacts to land use would occur during preconstruction. However, since large land areas in the county will continue to be used for grazing and crop production, including the BLM-managed lands surrounding the proposed EREF property, land use impacts resulting from preconstruction and construction would be SMALL.

Operation of the proposed EREF would restrict land use on the proposed property to the production of enriched uranium. The operation of the proposed EREF is not expected to alter land use on adjacent properties. Impacts on land use due to operations would be SMALL.

At the end of decommissioning, the buildings and structures would be available for unrestricted use. As a result, impacts on land use due to decommissioning would be SMALL.

Historic and Cultural Resources

SMALL TO MODERATE. Impacts to historic and cultural resources would occur primarily during preconstruction. Construction would take place on ground previously disturbed by preconstruction activities. There are 13 cultural resource sites (3 prehistoric, 6 historic, and 4 multi-component) in the surveyed areas of the proposed EREF property. One of these sites, the John Leopard Homestead (MW004), is located within the footprint of the proposed EREF, and has been recommended as eligible for the *National Register of Historic Places*. Site MW004 would be destroyed by preconstruction activities. However, AES mitigated impacts to site MW004 prior to land disturbance through professional excavation and data recovery, and other similar homestead site types exist in the region. Therefore, the impact to site MW004 would be limited to a MODERATE level.

Construction and operation of the proposed EREF would be unlikely to result in visual or noise impacts on the Wasden Complex, an important group of archaeological sites, because it is located approximately 1.6 kilometers (1.0 mile) from the proposed EREF site and sits behind a ridge that partially blocks the view. Other impacts during operations would be SMALL because no intact historic or cultural resources would remain.

Decommissioning would not likely affect historic and cultural resources because any areas disturbed during decommissioning would have been previously disturbed during preconstruction and construction. Therefore, impacts would be SMALL.

Visual and Scenic Resources

SMALL TO MODERATE. Impacts to visual and scenic resources result when contrasts are introduced into a visual landscape. The proposed project site and surrounding areas consist primarily of sagebrush semi-desert to the north, east, and west of the proposed site. The proposed facility would be located approximately 2.4 kilometers (1.5 miles) from areas of public view, including US 20 and the Hell's Half Acre Wilderness Study Area (WSA) to the south which contains the remains of a 4000-year-old lava flow. The BLM gave a Visual Resource Management (VRM) Class I designation to the WSA, which applies to areas of high scenic quality.

Visual impacts during preconstruction could result along US 20 from increased activity at the proposed site and fugitive dust, but these would be of a relatively short duration. The clearing of vegetation and installation of a perimeter fence would change the visual setting; however, they would not drastically alter the overall appearance of the area. Impacts on visual and scenic resources due to preconstruction would be SMALL.

Construction of the proposed EREF would introduce visual intrusions that are out of character with the surrounding area. While initial construction activities would commence on a cleared area, such a view is not very intrusive on the visual landscape. Similarly, fugitive dust generated during the construction period would be of a temporary nature and cause minimal disturbance to the viewshed. However, because of the extent of the proposed EREF project, the type and size of equipment involved in construction, and the industrial character of buildings to be built, construction of the proposed EREF would create significant contrast with the surrounding visual environment, which is predominantly rangeland and cropland. Thus, visual impact levels associated with construction would range from SMALL to MODERATE.

Construction and operation of the proposed EREF would be unlikely to result in visual impacts on the Wasden Complex due to its distance from the proposed EREF site and location behind a ridgeline that obscures views of the lower portions of the proposed facility. However, operations would have an impact on the surrounding visual landscape. The proposed facility is visually inconsistent with the current setting, and its operation is expected to alter the visual rating on surround public lands, which would be a MODERATE visual impact. Also, plant lighting at night could be perceivable at the trailhead of the Hell's Half Acre WSA, although probably not from the Craters of the Moon National Park located 72 kilometers (45 miles) to the west of the proposed EREF site.

At the end of decommissioning, the buildings and structures would be available for unrestricted use. As a result, impacts on visual and scenic resources would remain MODERATE.

Air Quality

SMALL to LARGE. Air emissions during preconstruction and construction would include fugitive dust from heavy equipment working on the proposed site, engine emissions from construction equipment onsite and vehicles transporting workers and materials to the proposed site, and emissions from diesel-fueled generators. The generators, although not intended to provide power for construction activities, would be operated weekly for preventative maintenance. During preconstruction, fugitive dust from land clearing and grading operations would result in large releases of particulate matter. Such impacts would be MODERATE to LARGE during certain preconstruction periods and activities that would be temporary and brief in duration. Otherwise, impacts on ambient air quality from preconstruction would be SMALL for all hazardous air pollutants (HAPs) and all criteria pollutants except particulates. Air quality impacts during construction would be SMALL for all HAPs and all criteria pollutants.

During operations, the proposed EREF would not be a major source of air emissions, although there is a potential for small gaseous releases associated with operation of the process that could contain UF_6, hydrogen fluoride (HF), and uranyl fluoride (UO_2F_2). Also, small amounts of nonradioactive air emissions consisting of carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM), volatile organic compounds (VOCs), and sulfur dioxide (SO_2) would be released:

- from the auxiliary diesel electric generators to supply electrical power when power from the utility grid is not available

- during building and equipment maintenance activities

• from trucks, automobiles, and other vehicles in use onsite

Air emissions are not expected to impact regional visibility. Ambient air modeling predicts that impacts on ambient air quality from the routine operation of the proposed EREF would be SMALL with respect to all criteria pollutants and all HAPs.

During decommissioning, impacts would result from emissions including fugitive dust (mitigated by dust suppression work practices) and CO, NO_x, PM, VOCs, and SO_2 from transportation equipment and would be SMALL.

Geology and Soils

SMALL. Impacts on about 240 hectares (592 acres) of land would occur primarily during preconstruction, as a result of soil-disturbing activities (blasting, excavating, grading, and other activities) that loosen soil and increase the potential for erosion. Because these impacts are short-term and can be mitigated, impacts on geology and soils would be SMALL. Construction activities could cause short-term impacts such as an increase in soil erosion at the proposed site. Soil erosion could result from wind action and rain, although rainfall in the vicinity of the proposed site is low. Compaction of soils due to heavy vehicle traffic would increase the potential for soil erosion via runoff. Impacts would be SMALL.

Impacts on soils during operations at the proposed facility would also be SMALL because activities would not increase the potential for soil erosion beyond that for the surrounding area. The impacts to soil quality from atmospheric deposition of pollutants during operations would be SMALL.

Land disturbance associated with decommissioning could temporarily increase the potential for soil erosion at the proposed EREF site, resulting in impacts similar to (but less than) those during the preconstruction/construction phase. As a result, impacts to soils due to decontamination and decommissioning activities would be SMALL.

Water Resources

SMALL. During preconstruction and construction, stormwater runoff would be diverted to a stormwater detention basin, thus the potential for contaminated stormwater discharging to water bodies on adjacent properties is low. No surface water sources would be used. Natural surface water bodies are absent within and near the proposed EREF site, and groundwater occurs at depths of 202 meters (661 feet) to 220 meters (722 feet). Annual maximum groundwater usage rates from the Eastern Snake River Plain (ESRP) aquifer in Bonneville County during preconstruction and construction comprise about 16 percent of the annual water right appropriation that has been transferred to the proposed property for use as industrial water. Therefore, impacts on surface water quality, the regional water supply, and groundwater quality during preconstruction and construction would be SMALL.

Water usage rates during operations would remain well within the water right appropriation. Both average and peak annual water use requirements would be less than 1 percent of the total groundwater usage from the ESRP aquifer. No process effluents would discharge to the retention or detention basins or into surface water. Therefore, liquid effluents would have a

SMALL impact on water resources. Because all the water discharged to the Cylinder Storage Pads Stormwater Retention Basins would evaporate, the basins would have a SMALL impact on the quality of water resources. The site Stormwater Detention Basin seepage would also have a SMALL impact on water resources of the area because no wastewater would be discharged to the basin.

Since the usage and discharge impacts to water resources during the decommissioning phase would be similar to those during construction, the impacts to water resources would remain SMALL.

Ecological Resources

SMALL TO MODERATE. Preconstruction activities such as land clearing could result in direct impacts due to habitat loss and wildlife mortality as well as indirect impacts to ecological resources in surrounding areas, primarily from fugitive dust and wildlife disturbance. Approximately 75 hectares (185 acres) of sagebrush steppe habitat and 55 hectares (136 acres) of nonirrigated pasture would be eliminated. Impacts on plant communities and wildlife from preconstruction would be MODERATE. Construction activities that could impact ecological resources include constructing the proposed UF_6 storage pads and EREF buildings. However, most construction activities would occur in areas that would have already been disturbed by preconstruction activities. Impacts on vegetation would occur primarily from any additional vegetation clearing. Impacts would include the generation of fugitive dust, spread of invasive species, changes in drainage patterns, soil compaction, erosion of disturbed areas, potential sedimentation of downgradient habitats, and accidental releases of hazardous or toxic materials (e.g., fuel spills). These activities could also result in some wildlife mortality and would cause other wildlife to relocate as a result of noise, lighting, traffic, and human presence. Collisions with construction equipment and other vehicles may cause some wildlife mortality. No rare or unique plant communities, or threatened or endangered species, have been found or are known to occur on the proposed site, although habitat on the proposed property is known to be used by greater sage-grouse (a Federal candidate species). Construction (and preconstruction) activities are not expected to result in population-level impacts on any Federally listed or State-listed species, which the U.S. Fish and Wildlife Service has stated are not present on the proposed EREF property. Impacts of construction of the proposed facility would be SMALL.

Operation of the proposed EREF could result in impacts on wildlife and plant communities as a result of noise, lighting, traffic, human presence, air emissions, and retention/detention ponds. However, these impacts would be SMALL.

Vegetation and wildlife that became established near the proposed facility could be affected by decommissioning activities. Impacts during decommissioning would be similar to those during construction and would be SMALL.

Noise

SMALL. Most of the major noise-producing activities (site clearing and grading, excavations [including the use of explosives], utility burials, construction of onsite roads [including the US 20 interchanges], and construction of the ancillary buildings and structures) would occur during preconstruction. Noise impacts from initial preconstruction activities may exceed established standards at some locations along the proposed EREF property boundary for relatively short periods of time. However, because of the distances involved, expected levels of attenuation, application of mitigation measures, and the expected limited presence of human receptors at these locations, the impacts of noise during preconstruction would be SMALL for human receptors. The nearest resident is located approximately 7.7 kilometers (4.8 miles) east of the proposed site. No residence is expected to experience unacceptable noise levels during construction. Noise impacts from construction may exceed established standards at some offsite locations for relatively short periods of time. However, because of the distances involved, expected levels of attenuation, and AES's commitment to appropriate mitigations, the impacts would be SMALL for human receptors. During the overlap period when partial operations begin while building construction continues, noise impacts from construction and operation are expected to be additive, but still substantially reduced from noise levels during initial construction.

Major noise sources associated with facility operation include the six diesel-fueled emergency generators, commuter traffic, the movement of delivery vehicles, and operation of various pumps, compressors, and cooling fans. Operational noise estimates at the proposed property boundary satisfy all relevant or potentially relevant U.S. noise standards and guidance. Residents in the vicinity of US 20, who would otherwise be unaffected by noise from the proposed EREF industrial footprint, would be impacted by slightly increased traffic noise. Noise impacts from proposed EREF operation would be SMALL.

Noise sources and levels during decommissioning would be similar to those during construction, and peaking noise levels would be expected to occur for short durations. As a result, noise impacts from decommissioning would be SMALL.

Transportation

SMALL TO MODERATE. Preconstruction activities for the proposed EREF would cause an impact on the local transportation network due to the construction of highway entrances, the daily commute of workers, daily construction deliveries, and waste shipments. Traffic slowdowns or delays would only be expected to occur at the entrance to the proposed EREF during access road construction and shift changes; the impacts on overall traffic patterns and volumes would be MODERATE on US 20 and SMALL on Interstate 15 (I-15). The primary impact would be increased traffic on nearby roads. Impacts during construction would occur from transportation of personnel, construction materials, and nonradiological waste. All traffic to and from the proposed EREF during preconstruction and construction would use US 20. Construction activities at the proposed EREF site could result in a 55 percent increase in traffic volume on US 20 (including the period when construction and operations overlap). Because traffic volume is expected to remain below the design capacity of I-15 and traffic slowdowns or delays would only be expected to occur at the entrance to the proposed EREF during shift changes, the impacts on overall traffic patterns and volumes during construction would be SMALL to MODERATE on US 20 and SMALL on I-15. For the most part, the impacts from the truck traffic to and from the proposed site during construction would be SMALL.

Operations impacts would occur from the transport of personnel, nonradiological materials, and radioactive material to and from the proposed EREF, especially during the period when construction and operation overlap. Increased traffic during facility operation would have a SMALL to MODERATE impact on the current traffic on US 20 (SMALL for any off-peak shift change). The impacts of truck traffic to and from the proposed site during operation would be SMALL. Annual transportation routine impacts and accident risks (radiological and chemical) would be SMALL.

Traffic during the initial portion of the decommissioning would be approximately the same as for the period when construction and operations overlap. Traffic after the cessation of operations would be less than during either construction or operation. Impacts on local traffic on US 20 would be SMALL to MODERATE.

Public and Occupational Health

SMALL. During preconstruction, impacts on occupational safety resulting from injuries, illnesses, and exposures to fugitive dust, pollutants, and vapors would be SMALL, based on estimates of the number of incidents. During construction, nonradiological impacts could include injuries and illnesses incurred by workers and impacts due to exposure to chemicals or other nonradiological substances. All such potential impacts would be SMALL because all activities would take place under typical construction workplace safety regulations. No radiological impacts are expected during facility construction.

Nonradiological impacts during facility operation include worker illnesses and injuries and impacts from worker or public exposure to hazardous chemicals used or present during operations, mainly uranium and HF. Due to low estimated concentrations of uranium and HF at public (proposed property boundary) and workplace receptor locations, nonradiological impacts due to exposures to hazardous chemicals (including uranium and HF) during operations would be SMALL.

Assessment of potential radiological impacts from facility operations considers both public and occupational exposures to radiation, and includes exposures to workers completing the facility construction during initial phases of operation. Exposure pathways include inhalation of airborne contaminants, ingestion of contaminated food crops, direct exposure from material deposited on the ground, and external exposure associated with the stored UF_6 cylinders. Impacts from exposure of members of the public would be SMALL. Worker exposures would vary by job type, but would be carefully monitored and maintained as low as reasonably achievable (ALARA) and impacts would be SMALL.

For a hypothetical individual member of the public at the proposed EREF property boundary and the nearest resident, the maximum annual total effective dose equivalents would be 0.014 millisievert per year (1.4 millirem per year) and 2.1×10^{-6} millisievert per year (2.1×10^{-4} millirem per year), respectively. Dose equivalents attributable to operation of the proposed EREF would be small compared to the normal background radiation range of 2.0 to 3.0 millisieverts (200 to 300 millirem) dose equivalent. This equates to radiological impacts during proposed EREF operation that would be SMALL.

The nature of decommissioning activities would be similar to that during construction and operation. Impacts from occupational injuries and illnesses and chemical exposures would be SMALL. Occupational radiological exposures would be bounded by the potential exposures during operation, because the quantities of uranium material handled would be less than or equal to that during operations. An active environmental monitoring and dosimetry (external and internal) program would be conducted to maintain ALARA doses to workers and to individual members of the public. Therefore, the impacts of decommissioning on public and occupational health would be SMALL.

Waste Management

SMALL. Solid nonhazardous wastes generated during preconstruction would be transported offsite to an approved local landfill. Hazardous wastes (e.g., waste oil, greases, excess paints, and other chemicals) generated during preconstruction would be packaged and shipped offsite to a licensed treatment, storage, and disposal facility (TSDF). Impacts from nonhazardous solid waste and hazardous waste generation during preconstruction would be SMALL due to the available current or future capacity at local and regional disposal facilities. Construction would generate about 6116 cubic meters (8000 cubic yards) of nonhazardous solid waste per year, not including recyclable materials such as scrap structural steel, sheet metal, and piping. About 23,000 liters (6200 gallons) and 1000 kilograms (2200 pounds) of hazardous waste would be generated annually. The impacts of nonhazardous and hazardous waste generation during construction would be SMALL due to the available current or future capacity at local and regional disposal facilities.

During operation, approximately 70,307 kilograms (154,675 pounds) of industrial, nonhazardous, nonradioactive solid waste and approximately 146,400 kilograms (322,080 pounds) of low-level radioactive waste (not including depleted UF_6) are expected to be generated annually. The proposed facility would also generate approximately 5062 kilograms (11,136 pounds) of hazardous wastes and 100 kilograms (220 pounds) of mixed waste annually. All wastes would be transferred to offsite licensed waste disposal facilities with suitable disposal capacity. The impacts of this waste generation would be SMALL.

During peak operation, the proposed EREF is expected to generate 1222 cylinders of depleted UF_6 annually, which would be temporarily stored on an outdoor cylinder storage pad in approved Type 48Y containers before being transported to a DOE-owned or private conversion facility. Storage of uranium byproduct cylinders at the proposed EREF would occur for the duration of, but not beyond, the proposed facility's 30-year operating lifetime. The impacts from temporary storage of depleted UF_6, from the conversion of depleted UF_6 to U_3O_8 at an offsite location, and from the transportation of the U_3O_8 conversion product to a potential disposal site would be SMALL.

During decommissioning, radioactive material from decontamination of contaminated equipment would be packaged and shipped offsite for disposal. Wastes to be disposed would include 7700 cubic meters (10,070 cubic yards) of low-level radioactive waste. Due to the availability of adequate disposal capacity, waste management impacts would be SMALL.

Socioeconomics

SMALL. Employment and income impacts were evaluated using an 11-county ROI in Idaho – including Bannock, Bingham, Blaine, Bonneville, Butte, Caribou, Clark, Fremont, Jefferson, Madison, and Power Counties. Wage and salary spending and expenditures associated with materials, equipment, and supplies would produce income and employment and local and State tax revenue, resulting in a beneficial impact. Preconstruction would create 308 jobs and $11.9 million in the first year, and 1687 jobs would be created during the peak year of construction with $65.0 million of income. Operations would produce 3289 jobs and $92.4 million in income in the first year of full operations. The jobs created include jobs at the proposed EREF and those indirectly created elsewhere in the 11-county ROI due to preconstruction, construction, and operation of the proposed EREF. Because preconstruction and construction activities would constitute less than 1 percent of total 11-county ROI employment, the economic impact of constructing the proposed EREF would, therefore, be SMALL.

As it is anticipated that a number of workers will move into the area during each phase of the proposed project, with the majority of the demographic and social impacts associated with population in-migration likely to occur in Bingham and Bonneville Counties, the impacts of the proposed EREF on population, housing, and community services are assessed for a two-county ROI, consisting of Bingham and Bonneville Counties. The migration of workers and their families into surrounding communities would affect housing availability, area community services such as healthcare, schools, and law enforcement, and the availability and cost of public utilities such as electricity, water, sanitary services, and roads resulting in an adverse impact. Because of the small number of in-migrating workers expected during preconstruction, construction, and operations, the impact on housing and community and educational services employment would be SMALL.

Decommissioning would provide continuing employment opportunities for some of the existing workforce and for other residents of the 11-county ROI. Additional, specialized decommissioning workers would also be required from outside the 11-county ROI. Expenditures on salaries and materials would contribute to the area economy, although less than during operations, and the State would continue to collect sales tax and income tax revenues. The socioeconomic impact of decommissioning activities would be SMALL.

Environmental Justice

SMALL. The potential impacts of the proposed EREF would mostly be SMALL for the resource areas evaluated. For these resources areas, the impacts on all human populations would be SMALL. Potential impacts would be SMALL to MODERATE or MODERATE in a few cases, which could potentially affect environmental justice populations; and there would be LARGE, though intermittent, short-term impacts from fugitive dist during preconstruction. However, as there are no low-income or minority populations within the 4-mile area around the proposed facility, these impacts would not be disproportionately high and adverse for these population groups.

Impacts of decommissioning would be SMALL. Because impacts on the general population would generally be SMALL to MODERATE in other resource areas, and because there are no low-income or minority populations defined according to Council on Environmental Quality (CEQ) guidelines within the 4-mile area around the proposed facility, decommissioning would not be expected to result in disproportionately high or adverse impacts on minority or low-income populations.

Accidents

SMALL TO MODERATE. Six accident scenarios were evaluated in this EIS as a representative selection of the types of accidents that are possible at the proposed EREF. The representative accident scenarios selected vary in severity from high- to intermediate-consequence events and include accidents initiated by natural phenomena (earthquake), operator error, and equipment failure. The consequence of a criticality accident would be high (fatality) for a worker in close proximity. Worker health consequences are low to high from the other five accidents that involve the release of UF_6. Radiological consequences to a maximally exposed individual (MEI) at the Controlled Area Boundary (proposed EREF property boundary) are low for all six accidents including the criticality accident. Uranium chemical exposure to the MEI is high for one accident and low for the remainder. For HF exposure to an MEI at the proposed property boundary, the consequence of three accidents is intermediate, with a low consequence estimated for the remainder. All accident scenarios predict consequences to the collective offsite public of less than one lifetime cancer fatality. Impacts from accidents would be SMALL to MODERATE. Plant design, passive and active engineered and administrative controls, and management of these controls would reduce the likelihood of accidents.

POTENTIAL ENVIRONMENTAL IMPACTS OF THE NO-ACTION ALTERNATIVE

This EIS also considers the potential environmental impacts of the no-action alternative, which are summarized below. It is assumed that preconstruction activities have taken place under the no-action alternative. The impact conclusions presented in this EIS for the no-action alternative address the impacts of denying the license, but do not include the impacts of the NRC-approved preconstruction activities. This is because a decision by the NRC not to issue the license does not cause the impacts of preconstruction under the no-action alternative. As described in Chapter 4, the anticipated environmental impacts from the no-action alternative would range from SMALL to MODERATE.

Should the nation's need for enriched uranium continue to increase and necessitate the construction and operation of another domestic enrichment facility at an alternate location, impacts could occur for each resource area and could range from SMALL to LARGE. The nature and scale of these impacts could be similar to those of the proposed action, but would depend on several facility- and site-specific factors.

Land Use

SMALL. Under the no-action alternative, AES would purchase the proposed property and restrictions on grazing and agriculture would occur. The zoning designation for the property would remain G-1 Grazing whether or not the proposed EREF is constructed. Current land uses of grazing and farming could potentially resume. Impacts to local land use would be SMALL.

Historic and Cultural Resources

SMALL TO MODERATE. Under the no-action alternative, the proposed EREF would not be constructed. Site MW004 would not be affected by NRC's licensing action, and Section 106 of the *National Historic Preservation Act* would not apply because no Federal action would be involved. However, the removal of site MW004, which has already occurred, resulted in a LARGE impact because the site no longer exists; but because AES removed this site through professional excavation and data recovery and there are other homestead sites of this type found in the region, the impact has been mitigated to a MODERATE level. No visual or noise effects would occur to the viewshed for the Wasden Complex.

Visual and Scenic Resources

SMALL. Under the no-action alternative, since the proposed EREF would not be constructed, no visual intrusions to the existing landscape would occur. The current land cover would be altered, but no large industrial structures would be constructed. The existing natural character of the area would largely remain intact. The lack of development would be consistent with BLM's VRM Class I designation for the Hell's Half Acre WSA, and no intrusions to the Wasden Complex viewshed would occur.

Air Quality

SMALL. Under the no-action alternative, the air quality impacts associated with construction and operation of the proposed EREF would not occur. The proposed site could revert to agricultural activities, which would impact ambient air quality through the release of criteria pollutants from the operation of agricultural vehicles and equipment and the release of fugitive dusts from the tilling of soils. Local air impacts associated with the no-action alternative would be SMALL.

Geology and Soils

SMALL. Under the no-action alternative, no additional land disturbance from construction would occur, and the proposed site could revert to crop production and grazing activities. Wind and water erosion would continue to be the most significant natural processes affecting the geology and soils at the proposed site. Impacts would be SMALL.

Water Resources

SMALL. Under the no-action alternative, additional water use may or may not occur, depending on future plans for the proposed property. Water resources would be unchanged. Water usage could continue at the current rate should agricultural activities resume at the proposed site. No changes to surface water quality would be expected, and the natural (intermittent) surface flow of stormwater on the proposed site would continue. No additional groundwater use or adverse changes to groundwater quality would be expected. Impacts would be SMALL.

Ecological Resources

SMALL. Most impacts on ecological resources would occur during preconstruction. The potential impacts associated with the construction, operation, and decommissioning of the proposed EREF would not occur. Revegetation of the proposed site could occur with renewal of some wildlife habitat. The land could revert to crop production and grazing activities. Impacts would be SMALL.

Noise

SMALL. Under the no-action alternative, none of the noise impacts associated with proposed EREF construction, operation, or decommissioning would occur. Land uses on the proposed EREF site could revert to previous applications, livestock grazing and/or crop production, with concomitant noise levels and SMALL impacts.

Transportation

SMALL. Under the no-action alternative, traffic volumes and patterns would remain unchanged from existing conditions. The current volume of radioactive material and chemical shipments from other sources in the area would not increase. Impacts would be SMALL.

Public and Occupational Health

SMALL. Under the no-action alternative, health impacts from construction, operation, and decommissioning would not occur. Worker and public impacts from chemical and radioactive hazards would also not occur. Should the land be returned to grazing and agriculture, current use impacts would be expected and would be SMALL.

Waste Management

SMALL. Under the no-action alternative, no proposed EREF construction, operational, or decommissioning wastes (including sanitary, hazardous, low-level radioactive wastes, or mixed wastes) would be generated or require disposition. Impacts from waste management would be SMALL.

Socioeconomics

SMALL. Under the no-action alternative, any beneficial or adverse consequences of the proposed action would not occur. All socioeconomic conditions in the 11-county ROI would remain unchanged. Impacts would be SMALL.

Population in the area surrounding the proposed EREF, in Bonneville and Bingham Counties, is expected to grow in accordance with current projections, with the total population in the region projected to be approximately 156,491 in 2013 and 168,331 in 2017. In association with population growth, the social characteristics of the region, including housing availability, school enrollment, and availability of law enforcement and firefighting resources, are expected to change over time. However, future changes in these characteristics are difficult to quantify, and no projections of their future growth are available.

Environmental Justice

SMALL. The no-action alternative would not be expected to cause any high and adverse impacts. It would not raise any environmental justice issues.

Accidents

SMALL. Under the no-action alternative, potential accidents and accident consequences from operation of the proposed EREF would not occur. Impacts would be SMALL.

COSTS AND BENEFITS OF THE PROPOSED ACTION

While there are national energy security and fiscal benefits associated with the proposed action, and local socioeconomic benefits in the 11-county ROI in which the proposed EREF would be located, there are also direct costs associated with the preconstruction, construction, and operation phases of the proposed project, as well as impacts on various environmental resources. These impacts would mostly be SMALL, and in a few cases SMALL to MODERATE, or MODERATE in magnitude and small in comparison to the local and national benefits of the proposed action. In addition, most of the impacts to environmental resources associated with the proposed action would result from preconstruction activities at the proposed site, and would also occur under the no-action alternative. The principal socioeconomic impact or benefit of the proposed EREF project would be an increase in employment and income in the 11-county ROI. Although the majority of the costs, and most of the socioeconomic impacts, of the various phases of proposed EREF development would occur in the 11-county ROI, there would be economic, fiscal and, in particular, energy security benefits, which would occur at the local, State, and national levels.

Average employment created in the 11-county ROI during the year of peak construction is estimated at 1687 full-time jobs, with $0.7 million in State income tax revenues and $5.1 million in State sales taxes. During the proposed EREF full operations phase beginning in 2022, 3289 annual jobs would be created. During this period, the State of Idaho would benefit from $1.3 million annually in income taxes, while Bonneville County would collect $3.5 million annually in property tax receipts. Although it can be assumed that some portion of paid State sales and income taxes would be returned to the 11-county ROI under revenue-sharing arrangements between each county and the State government, the exact amount that would be received by each county cannot be determined. Although there are economic and fiscal benefits associated with the proposed action in the 11-county ROI, these impacts would be SMALL.

The direct costs associated with the proposed action may be categorized by the following life-cycle stages: facility construction, operation, depleted uranium disposition, and decommissioning. In addition, costs would be incurred for preconstruction activities under both the proposed action and the no-action alternative. In addition to monetary costs, the proposed action would result in impacts on various resource areas, which are considered “costs” for the purpose of this analysis. The resource areas and corresponding impacts are described in detail in Chapter 4 of this EIS. As discussed earlier, the impacts of preconstruction and the proposed action would mostly be SMALL, and in a few cases SMALL to MODERATE, or MODERATE, for all resource areas.

The proposed action could result in the maximum annual production of 6.6 million SWUs of enriched uranium in peak years, which would represent an augmentation of the domestic supply of enriched uranium and, along with other planned new enrichment facilities, would meet the need for increased domestic supplies of enriched uranium for national energy security. Thus, the proposed action would generate national and regional benefits and costs. The national benefit would be an increase in domestic supplies of enriched uranium that would assist the national energy security need. The regional benefits would be increased employment, economic activity, and tax revenues in the 11-county ROI. Costs associated with the proposed project are, for the most part, limited to the resource areas in the 11-county ROI.

COMPARISON OF THE PROPOSED ACTION AND NO-ACTION ALTERNATIVE

The impacts of the proposed action and the no-action alternative are briefly summarized and compared below. A more detailed summary and comparison is provided in Chapter 2, Table 2-6. As discussed earlier, it is assumed that the previously discussed preconstruction activities take place under both alternatives and, therefore, the impacts associated with preconstruction activities take place regardless of which alternative is selected. As a result, the comparison of alternatives presented below and in Chapter 2 is intended to highlight the differences between the two alternatives after preconstruction activities have occurred.

Under the no-action alternative, the proposed EREF would not be constructed, operated, and decommissioned in Bonneville County, Idaho. The Paducah Gaseous Diffusion Plant in Paducah, Kentucky, the URENCO USA facility in Lea County, New Mexico, and the downblending of highly enriched uranium under the Megatons to Megawatts Program would remain the sole sources of domestically generated low-enriched uranium for U.S. commercial nuclear power plants. The URENCO USA facility is still under construction and with the ACP, which is currently under construction, may provide additional enrichment services in the future. The license application for an additional enrichment facility, the proposed GLE Facility, is currently under review by the NRC. Foreign enrichment sources would be expected to continue to supply approximately 85 percent of U.S. nuclear power plants' demand until new domestic enrichment facilities are constructed and operated.

The no-action alternative would have SMALL impacts on land use, visual and scenic resources, air quality, geology and soils, water resources, ecological resources, noise, transportation, public and occupational health, waste management, socioeconomics, environmental justice, and facility accidents, and SMALL to MODERATE impacts on historic and cultural resources. The costs and benefits of constructing, operating, and decommissioning the proposed EREF would not occur. Additional domestic enrichment facilities could be constructed in the future with impacts expected to be SMALL to LARGE, depending on facility- and site-specific conditions.

In comparison to the no-action alternative, the proposed action would also have SMALL impacts on land use, air quality, geology and soils, water resources, ecological resources, noise, public and occupational health, waste management, socioeconomics, and environmental justice, but would have SMALL to MODERATE impacts on historic and cultural resources, visual and scenic resources, transportation, and facility accidents. The proposed action would have positive impacts in the region on employment and income, and on State and Federal tax revenues.

CUMULATIVE IMPACTS

This EIS also considers cumulative impacts that could result from the proposed action when added to other past, present, and reasonably foreseeable future actions (Federal, non-Federal, or private). No ongoing or planned developments were identified within 16 kilometers (10 miles) of the proposed project location, which includes the ROI for all affected resource areas except socioeconomics, which extends to an 80.5-kilometer (50-mile) radius. Proposed developments within 80.5 kilometers (50 miles) that could contribute to a regional socioeconomic impact in combination with the proposed project include the proposed Mountain States Transmission Intertie, a proposed 500-kV electrical transmission line running between western Montana and southeastern Idaho. The preferred route lies approximately 40 kilometers (25 miles) to the west of the proposed EREF site, running north-south. Two other alternate routes lie closer, the nearest running adjacent to the western boundary of the proposed EREF property just outside of INL property, and the other route crossing US 20 about 10 miles east of the proposed EREF site. In addition, impacts from the construction of a proposed new 161-kV transmission line, a substation, and substation upgrades for the proposed EREF are addressed as cumulative impacts in this EIS, as this action is not under the NRC's jurisdiction and, therefore, not considered by the NRC to be part of the proposed action. In general, the anticipated cumulative impacts from the proposed action would be SMALL. Cumulative impacts associated with the no-action alternative would be generally less than those for the proposed action, except in terms of local job creation.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Preconstruction activities and the proposed action would result in unavoidable adverse impacts on the environment. These impacts would mostly be SMALL and SMALL to MODERATE or MODERATE in a few cases, with the potential for temporary and brief LARGE impacts on air quality from fugitive dust, and would, in most cases, be mitigated. The area needed for construction and operation of the proposed EREF would be cleared of vegetation, which would lead to the displacement of some local wildlife populations. There would be temporary impacts from preconstruction and the construction of new facilities, including increased fugitive dust, increased potential for soil erosion and stormwater pollution, and increased vehicle traffic and emissions. Water consumption from onsite wells would be relatively small, and the risk for significant adverse impacts on neighboring residential wells or public supply wells would be SMALL. During operations, workers and members of the public could be exposed to radiation and chemicals, although the impacts of these exposures would be SMALL.

Preconstruction and the proposed action would necessitate short-term commitments of resources and would permanently commit certain other resources (such as energy and water). This EIS defines short-term uses as generally affecting the present quality of life for the public (i.e., the 30-year license period for the proposed EREF) and long-term productivity as affecting the quality of life for future generations on the basis of environmental sustainability. The short-term use of resources would result in potential long-term socioeconomic benefits to the local area and the region.

Workers, the public, and the environment would be exposed to increased amounts of hazardous and radioactive materials over the short term from operations of the proposed EREF. Construction and operation would require a long-term commitment of terrestrial resources, such as land, water, and energy. Short-term impacts would be minimized by the application of appropriate mitigation measures. Upon the closure of the proposed EREF, AES would decontaminate and decommission the buildings and equipment and restore them for unrestricted use. Continued employment, expenditures, and tax revenues generated during the proposed action would directly benefit the local, regional, and State economies.

Irreversible commitment of resources refers to resources that are destroyed and cannot be restored, whereas an irretrievable commitment of resources refers to material resources that once used cannot be recycled or restored for other uses by practical means. The proposed action would include the commitment of land, water, energy, raw materials, and other natural and human-generated resources. Following decommissioning, the land occupied by the proposed facility would likely remain industrial beyond license termination. Water required during preconstruction and the proposed action would be obtained from new and existing wells at the proposed EREF property and would be replenished through natural mechanisms. Wastewaters would be treated to meet applicable standards and would evaporate. Energy used in the form of electricity and diesel fuel would be supplied through new infrastructure connecting to existing systems in the Idaho Falls area. The specific types of construction materials and the quantities of energy and materials used cannot be determined until final facility design is completed, but it is not expected that these quantities would strain the availability of these resources.

During operation of the proposed EREF, natural UF_6 would be used as feed material, requiring the mining of uranium (not licensed by the NRC) and other front end operational steps in the uranium fuel cycle (licensed by the NRC). This use of uranium would be an irretrievable resource commitment.

Even though the land used to construct the proposed EREF would be returned to other productive uses after the proposed facility is decommissioned, there would be some irreversible commitment of land at other offsite locations used to dispose of solid wastes generated by the proposed facility. In addition, wastes generated during the conversion of depleted UF_6 produced by the proposed facility and the depleted uranium oxide conversion product from the conversion of depleted UF_6 would be disposed at a licensed offsite LLRW disposal facility. Land used for disposal of these materials would represent an irreversible commitment of land. No solid wastes or depleted uranium oxide conversion product originating from the proposed EREF would be disposed of on the proposed EREF property. When the proposed facility is decommissioned, some building materials would be recycled and reused. Other materials would be disposed of in a licensed and approved offsite location, and the amount of land used to dispose of these materials would be an irretrievable land resource.

ACRONYMS AND ABBREVIATIONS

^{234}U	uranium-234 (U-234)
^{235}U	uranium-235 (U-235)
$^{235}UF_6$	uranium-235 hexafluoride
^{238}U	uranium-238 (U-238)
$^{238}UF_6$	uranium-238 hexafluoride
AAC	acceptable ambient concentration
AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
ACP	American Centrifuge Plant
ADAMS	Agencywide Documents Access and Management System
AERMOD	AMS/EPA Regulatory Model
AES	AREVA Enrichment Services, LLC
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APE	Area of Potential Effect
Argonne	Argonne National Laboratory
ASTM	American Society of Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
AVLIS	Atomic Vapor Laser Isotope Separation
BEA	U.S. Bureau for Economic Analysis
BLM	U.S. Bureau of Land Management
BLS	U.S. Bureau of Labor Statistics
BMP	best management practice
BSPB	Blending, Sampling, and Preparation Building
CAA	*Clean Air Act*
CAB	Centrifuge Assembly Building or Controlled Area Boundary
CaF_2	calcium fluoride
Cal/EPA	California Office of Environmental Health Hazard Assessment
CCS	Center for Climate Studies
CDC	Centers for Disease Control and Prevention
CEDE	committed effective dose equivalent
CEQ	Council on Environmental Quality
CFR	U.S. *Code of Federal Regulations*
CH_4	methane
CTF	Centrifuge Test Facility
CO	carbon monoxide
CO_2	carbon dioxide
CREP	Conservation Reserve Enhancement Program
CWA	*Clean Water Act*
CY	calendar year
D&D	decontamination and decommissioning
DDT	dichlorodiphenyltrichloroethane

DEM	Digital Elevation Model
DNFSB	Defense Nuclear Facilities Safety Board
DNL	day/night average noise level
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
DOEQAP	DOE Quality Assurance Program
DOL	U.S. Department of Labor, U.S. Bureau of Labor Statistics
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EDE	effective dose equivalent
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EMP	Effluent Monitoring Program
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERDA	Energy Research and Development Administration
EREF	Eagle Rock Enrichment Facility
ESA	*Endangered Species Act*
ESRP	Eastern Snake River Plain
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FGR	Federal Guidance Report
FR	*Federal Register*
FTE	full-time equivalent
FWCA	*Fish and Wildlife Coordination Act*
FWS	U.S. Fish and Wildlife Service
GAO	U.S. General Accounting Office
GCRP	U.S. Global Climate Change Research Program
GDP	Gaseous Diffusion Plant
GE	General Electric
GEVS	Gaseous Effluent Ventilation System
GHG	greenhouse gas
GLE	Global Laser Enrichment
GWP	Global Warming Potential
HAP	hazardous air pollutant
HEPA	high-efficiency particulate air
HEU	high-enriched uranium
HF	hydrogen fluoride or hydrofluoric acid
HFC	hydrofluorocarbon
HPS	Health Physics Society
HRCQ	Highway Route Controlled Quantity
HVAC	heating, ventilating, and air conditioning
HUD	U.S. Department of Housing and Urban Development

I	Interstate
IAC	*Idaho Administrative Code*
ICRP	International Commission on Radiological Protection
IDAPA	*Idaho Administrative Procedures Act*
IDC	Idaho Department of Commerce
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
IGS	Idaho Geological Survey
INL	Idaho National Laboratory
IPCC	Intergovernmental Panel on Climate Change
IPCS	International Programme on Chemical Safety
IROFS	Items Relied on for Safety
IS	*Idaho Statutes*
ISA	Integrated Safety Analysis
ISAC	Idaho Sage-grouse Advisory Committee
ISACTAT	Idaho Sage-grouse Advisory Committee Technical Assistance Team
ISCORS	Interagency Steering Committee on Radiation Standards
ISTC	Idaho State Tax Commission
ITD	Idaho Transportation Department
IWRB	Idaho Water Resource Board
LCF	latent cancer fatality
L_{dn}	day/night maximum average sound level
L_{eq}	equivalent sound level
LES	Louisiana Energy Services
LEU	low-enriched uranium
LLRW	low-level radioactive waste
LOS	level of service
LTTS	Low Temperature Take-off Stations
LWR	light water reactor
MAPEP	Mixed Analyte Performance Evaluation Program
MCL	maximum contaminant level
MCNP	Monte Carlo N-Particle
MDC	minimum detectable concentration
MDEQ	Montana Department of Environmental Quality
MEI	maximally exposed individual
MFC	Materials and Fuels Complex
MLIS	molecular laser isotope separation
MOA	Memorandum of Agreement
MRI	Midwest Research Institute
MSL	mean sea level
MW(e)	Megawatt electric
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NCES	National Center for Education Statistics

NCRP	National Council on Radiation Protection and Measurements
NEF	National Enrichment Facility
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NEPA	*National Environmental Policy Act of 1966*
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	*National Historic Preservation Act of 1966*
NIOSH	National Institute of Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLCD 1992	National Land Cover Data 1992
NMFS	National Marine Fisheries Service
NMVOC	nonmethane volatile organic compound
NNL	National Natural Landmark
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	nitrogen oxides
NPCR	National Program of Cancer Registries
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRCP	National Council on Radiation Protection
NRCS	U.S. Natural Resources Conservation Service
NRHP	*National Register of Historic Places*
NWS	National Weather Service
O_3	ozone
OECD	Organisation for Economic Co-operation and Development
OEL	occupational exposure levels
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
PFC	perfluorocarbon
PGA	peak ground acceleration
PM	particulate matter
$PM_{2.5}$	particulate matter equal to or smaller than 2.5 micrometers in diameter
PM_{10}	particulate matter equal to or smaller than 10 micrometers in diameter
PNNL	Pacific Northwest National Laboratory
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
PWR	pressurized water reactor
RAB	Restricted Area Boundary
RAI	Request for Additional Information
RCRA	*Resource Conservation and Recovery Act*

REMP	Radiological Environmental Monitoring Program
RMP	Rocky Mountain Power or range management plan
ROI	region of influence
ROW	right-of-way
SAAQS	State Ambient Air Quality Standards
SARA	*Superfund Amendments and Reauthorization Act*
SBM	Separations Building Module
SDWA	*Safe Drinking Water Act*
SER	Safety Evaluation Report
SF_6	sulfur hexafluoride
SHPO	State Historic Preservation Office(r)
SILEX	separation of isotopes by laser excitation
SMCL	secondary maximum contaminant level
SO_2	sulfur dioxide
SPCC	Spill Prevention Control and Countermeasures
SPL	sound pressure level
SUNSI	Sensitive Unclassified Non-Safeguards Information
SVOC	semivolatile organic compound
SWPPP	Stormwater Pollution Prevention Plan
SWU	separative work unit
TEDE	Total Effective Dose Equivalent
TI	transportation index
TLD	thermoluminescent dosimeter
TRAGIS	Transportation Routing Analysis Geographic Information System
TSB	Technical Support Building
TSDF	treatment, storage, and disposal facility
U_3O_8	triuranium octaoxide
UO_2F_2	uranyl fluoride
UBC	uranium byproduct cylinder
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
URENCO	URENCO Group
USACE	U.S. Army Corps of Engineers
U.S.C.	*United States Code*
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USEC	U.S. Enrichment Corporation
USGS	U.S. Geological Survey
USSLWG	Upper Snake Sage-grouse Local Working Group
VOC	volatile organic compound
VRI	visual resource inventory

VRM	visual resource management
VTM	vehicle miles traveled
WSA	Wilderness Study Area

1 INTRODUCTION

1.1 Background

The U.S. Nuclear Regulatory Commission (NRC) prepared this Environmental Impact Statement (EIS) in response to an application submitted by AREVA Enrichment Services, LLC (AES) for a license that would allow the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility near Idaho Falls in Bonneville County, Idaho (Figure 1-1). Revisions to the license application were submitted by AES on April 23, 2009 (Revision 1) and April 30, 2010 (Revision 2). The proposed facility is referred to as the Eagle Rock Enrichment Facility (EREF).

The NRC's Office of Federal and State Materials and Environmental Management Programs prepared this EIS as required by Title 10, "Energy," of the U.S. *Code of Federal Regulations* (10 CFR) 51.20(b)(10). In particular, 10 CFR 51.20 (b)(10) states that issuance of a license for a uranium enrichment facility requires the NRC to prepare an EIS or a supplement to an EIS. The NRC's regulations under 10 CFR Part 51 implement the requirements of the *National Environmental Policy Act of 1969*, as amended (NEPA) (Public Law 91-190). The Act requires Federal agencies to assess the potential impacts of their actions affecting the quality of the human environment.

1.2 The Proposed Action

The proposed action is for AES to construct, operate, and decommission a gas centrifuge uranium enrichment facility near Idaho Falls, in Bonneville County, Idaho. If the NRC issues a license to AES under the provisions of the *Atomic Energy Act of 1954*, the license would authorize AES to possess and use special nuclear material, source material, and byproduct material at the proposed EREF for a period of 30 years, in accordance with the NRC's regulations in 10 CFR Parts 70, 40, and 30, respectively. The scope of activities to be conducted under the license would include the construction, operation, and decommissioning of the proposed EREF.

AES has proposed that the EREF be located on a 186-hectare (460-acre) section of a 1700-hectare (4200-acre) parcel of land that it intends to purchase from a single private landowner. The only structure presently on the property is a potato storage facility at the south end of the site. Current land uses of the property include native rangeland, nonirrigated seeded pasture, and irrigated cropland.

AES plans to conduct preconstruction and construction of the proposed EREF from 2010 to 2022.[1] Partial facility operations will commence in 2014, with an 8-year startup period that would run concurrently with construction activities. The facility is expected to reach full production capacity in 2022. Decommissioning or potential license renewal activities would begin in advance of scheduled license expiration (anticipated to be 2041).

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[1] As discussed in Section 1.4.1, certain site preparation activities, referred to as "preconstruction" activities in this EIS, are explicitly excluded from the definition of construction in 10 CFR 51.4. Preconstruction activities are not considered part of the proposed action.

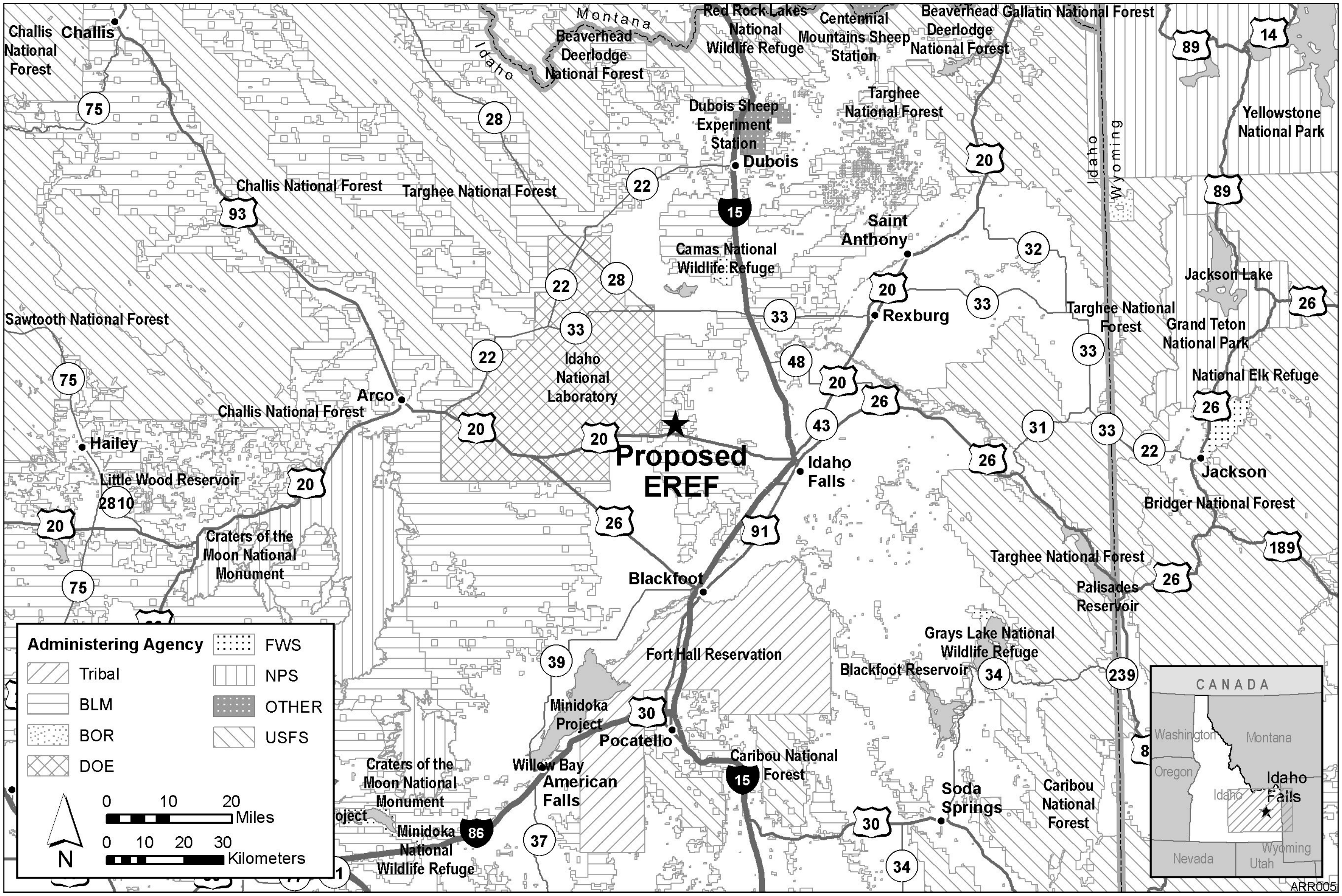

Figure 1-1 Location of the Proposed Eagle Rock Enrichment Facility (EREF)

AES intends that the proposed EREF would help fulfill needs for domestic enriched uranium capacity for nuclear electrical generation and contribute to national energy security (i.e., provide additional reliable and economical uranium enrichment capacity in the United States) (AES, 2010b). This purpose and need are discussed in detail in Section 1.3.

Natural uranium ore usually contains approximately 0.72 weight percent uranium-235, and this percentage is significantly less than the 3 to 5 weight percent uranium-235 required by the nuclear power plants currently employed or proposed in the United States and in most other countries as fuel for electricity generation. Therefore, uranium must be enriched in one of the steps of the nuclear fuel cycle (Figure 1-2) so it can be used in commercial light-water nuclear power plants. Enrichment is the process of increasing the percentage of the naturally occurring and fissile uranium-235 isotope and decreasing the percentage of uranium-238.

AES's license application seeks authorization to produce enriched uranium up to a nominal 5 percent by weight of uranium-235, which meets the needs of most U.S. power plants. Enriched uranium from the proposed EREF would be used in commercial light-water nuclear power plants and is called low-enriched uranium (LEU). Uranium used in military reactors and nuclear weapons has a much higher percentage of uranium-235 by weight and is called highly enriched uranium (HEU).

AES has requested a license for a nominal annual production capacity of 6 million separative work units (SWUs) per year and a maximum production capacity of 6.6 million SWUs[2] per year. An SWU represents the level of effort or energy required to raise the concentration of uranium-235 to a specified level.

1.3 Purpose and Need for the Proposed Action

As discussed in Section 1.2, the proposed action is for AES to construct, operate, and decommission a facility to enrich uranium up to 5 percent by weight of uranium-235, with a nominal annual production capacity of 6 million SWUs and a maximum annual production capacity of 6.6 million SWUs. The proposed facility would use the gas centrifuge uranium enrichment process and would be constructed on an undeveloped site in Bonneville County, Idaho. The proposed action is intended to satisfy the need for an additional economical domestic source of enriched uranium.

The purpose of the proposed action is to fulfill the following needs:

- the need for enriched uranium to fulfill electricity generation requirements

- the need for domestic supplies of enriched uranium for national energy security

[2] An SWU is a unit of measurement used in the nuclear industry pertaining to the process of enriching uranium for use as fuel for nuclear power plants. It describes the effort needed to separate uranium-235 and uranium-238 atoms in natural uranium to create a final product that is richer in uranium-235 atoms. For 114 kilograms (251 pounds) of natural uranium, it takes about 70 SWUs to produce 10 kilograms (22 pounds) of uranium enriched to 5 percent uranium-235. It takes on the order of 100,000 SWUs of enriched uranium to fuel a typical 1000-megawatt commercial nuclear reactor for a year (USEC, 2009).

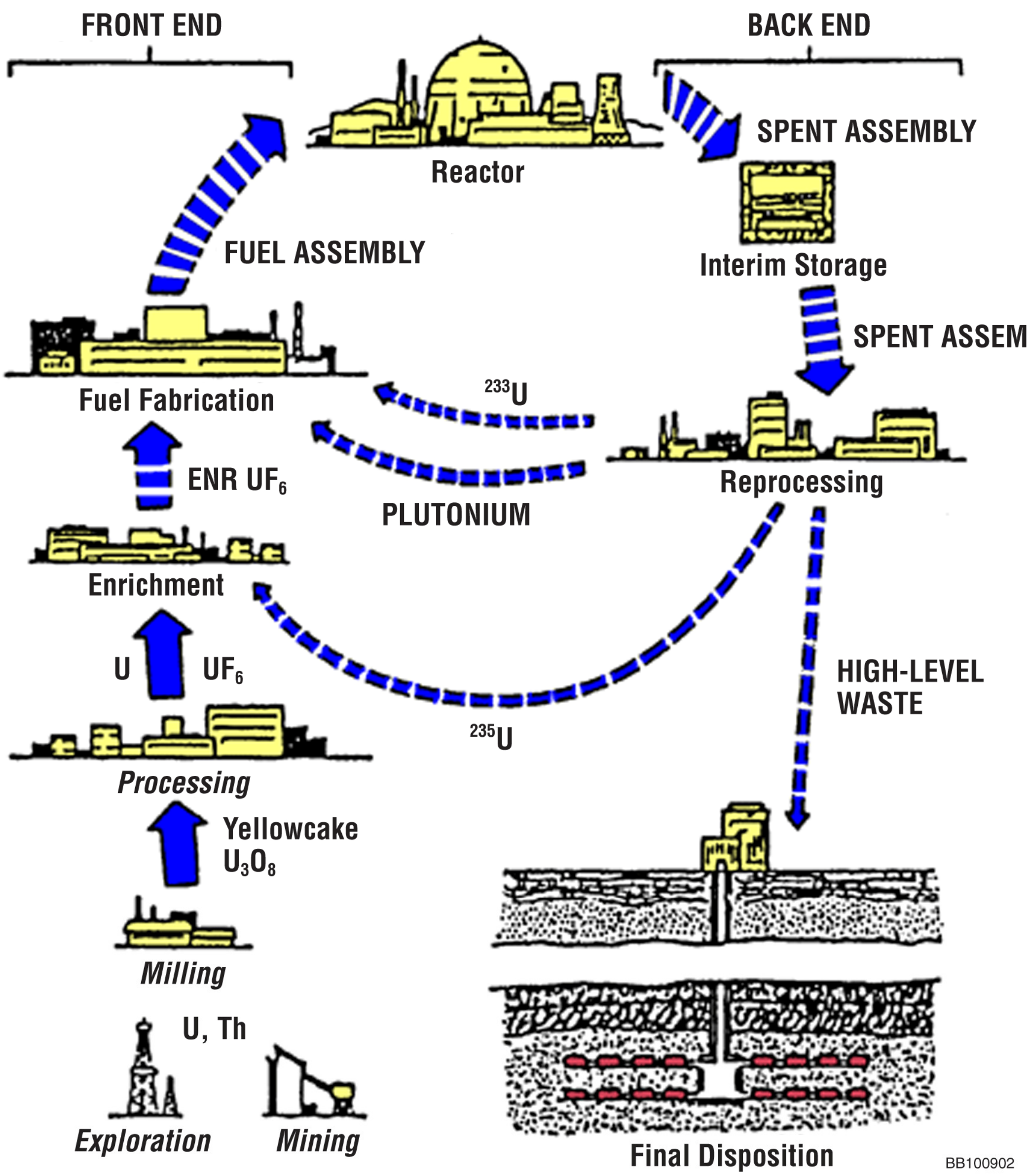

Figure 1-2 Nuclear Fuel Cycle (NRC, 2008)

The following sections discuss each of these needs and how each is addressed by the proposed action.

1.3.1 The Need for Enriched Uranium to Fulfill Electricity Requirements

Enriched uranium from the proposed EREF would be used in U.S. commercial nuclear power plants. According to the Energy Information Administration (EIA) in its *Annual Energy Outlook 2010 with Projections to 2035* (EIA, 2010a), these plants currently supply approximately 20 percent of the nation's electricity requirements. As future demand for electricity increases, the need for LEU to fuel nuclear power plants is also expected to increase (EIA, 2010a).

For the case based on established policies and current trends (the reference case), the EIA estimates that nuclear capacity grows from 100,600 megawatts in 2008 to 112,900 megawatts in 2035, including 4000 megawatts of expansion at existing plants and 8400 megawatts of new capacity (EIA, 2010a). Also, the EIA estimates that nuclear generation will grow from 806 billion kilowatt hours in 2008 to between 882 and 951 billion kilowatt hours in 2035, depending on the low- or high-growth scenarios.

The NRC expects to license the next generation of nuclear power plants using 10 CFR Part 52. Part 52 governs the issuance of standard design certifications (DCs), early site permits (ESPs), and combined licenses (COLs) for nuclear power plants. The NRC staff is engaged in numerous ongoing interactions with vendors and utilities regarding prospective new reactor applications and licensing activities. Based on these interactions, the NRC staff has received a significant number of new reactor COL applications (COLAs) since 2007. As of December 2010, the NRC is actively reviewing 12 COLAs for a total of 20 nuclear reactor units. The NRC has suspended 6 COLA reviews due to changes in applicants' business strategies or the timing of their construction plans. One of the suspended COLAs was converted by the applicant to an ESP application. Assuming licensing requirements are met, the NRC is poised to issue two COLs by the end of 2011.

The NRC has three DC applications and two DC amendment applications currently under review. As of December 2010, one DC application and one DC amendment are in rulemaking. The NRC received two Advanced Boiling Water Reactor (ABWR) DC renewal requests in calendar year 2010 and expects to receive one new DC application by FY2012.

The EIA forecasts of nuclear generating capacity combined with applications from the nuclear power industry for construction and operation of new plants suggest a continuing, if not increasing, demand for LEU. In addition, the EIA forecasts that the annual demand for enrichment services may vary between 12.9 million and 15.7 million SWUs from 2006 through 2025 (EIA, 2003).

The demand for enriched uranium in the United States is currently being fulfilled by three main categories of supply:

- *Domestic production of enriched uranium provides about 15 percent of U.S. demand* (EIA, 2010b). The primary uranium enrichment facility currently operating in the United States is the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky, run by USEC Inc.'s subsidiary, the United States Enrichment Corporation. A similar existing enrichment facility in the United States is the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio, but it ceased production in May 2001 and will no longer produce enriched uranium, as the plant has been placed in cold shutdown (a condition whereby the plant is undergoing preparation for decommissioning and decontamination) (DOE, 2010a). The URENCO USA facility (formerly known as the National Enrichment Facility [NEF]) in Lea County, New Mexico, operated by Louisiana Energy Services LLC (LES), began initial operations in June 2010. This facility, which is still under construction and will continue to increase production as its remaining cascade halls are completed, is expected to reach a capacity of about 1.6 million SWUs per year in August 2011 (about half of its full capacity of approximately 3 million SWUs per year, as currently licensed by the NRC). Full licensed capacity would not be reached until sometime later. An expansion to 5.9 million SWUs per year is being considered by LES, but an application for the expansion has not yet been submitted to the NRC.

- *The Megatons to Megawatts Program provides about 38 percent of U.S. demand* (EIA, 2010b). Under this program, the United States Enrichment Corporation implements the 1993 government-to-government agreement between the United States and Russia that calls for Russia to convert 500 metric tons (550 tons) of HEU from dismantled nuclear warheads into LEU (DOE, 2010b). This is equivalent to about 20,000 nuclear warheads. The United States Enrichment Corporation purchases the enriched portion of the "downblended" material, tests it to make sure it meets specifications, adjusts the enrichment level if needed, and then sells it to its electric power generation customers for fuel in commercial nuclear power plants. All program activities in the United States now take place at the Paducah plant (NRC, 2006). This program is scheduled to expire in 2013 (DOE, 2010b).

- *Other foreign sources provide about 47 percent of U.S. demand*. Other countries that produce and export enriched uranium to the United States include China, France, Germany, the Netherlands, and the United Kingdom (EIA, 2010b).

The current 5-year average U.S. demand for enriched uranium is approximately 14 million SWUs per year (EIA, 2010b). As noted, recent forecasts indicate that this demand could reach 15 to 16 million SWUs by 2025, depending on the rate of nuclear generation growth in the United States (EIA, 2003). From 2005 through 2009, the United States Enrichment Corporation delivered approximately 10 to 13 million SWUs to customers annually, of which 5.5 million SWUs per year were from the Megatons to Megawatts Program. Of the remaining 4.5 to 7.5 million SWUs, an average of approximately 2 million SWUs were sold for use in the United States and the balance exported (USEC, 2010). Therefore, of the amount sold for use in the United States from 2005 to 2009, approximately 2 million SWUs (about15 percent of U.S. demand) came from enrichment at the PGDP and 5.5 million SWUs (about 38 percent of U.S. demand) came from downblending at the Megatons to Megawatts Program, which depends on deliveries from Russia (EIA, 2010b; USEC, 2010). Accordingly, about 85 percent (38 percent from the Megatons to Megawatts Program plus 47 percent from other foreign sources) of U.S. demand is currently supplied by foreign sources.

It is anticipated that all gaseous diffusion enrichment operations in the United States will cease to exist in the near future due to the higher cost of aging facilities (DOE, 2007). The Megatons to Megawatts Program is scheduled to expire in 2013 (DOE, 2010b). As noted, these two sources meet about half (53 percent) of the current U.S. demand for LEU.

To help fill the anticipated supply deficit, other potential future domestic sources of supply have emerged in recent years. In addition to the URENCO USA facility mentioned above, the USEC American Centrifuge Plant (ACP) in Piketon, Ohio, has received a license from the NRC (NRC, 2005, 2006) and is currently under construction. The NRC is currently reviewing a license application submitted by GE-Hitachi Global Laser Enrichment, LLC (GE-Hitachi) to construct and operate the proposed Global Laser Enrichment (GLE) Facility in Wilmington, North Carolina (GE-Hitachi, 2009). The URENCO USA facility and ACP are based on the gaseous centrifuge technology, while the GLE Facility is based on a newer, laser enrichment process under development. LES has announced a potential plan to expand the annual capacity of its URENCO USA facility in New Mexico from 3 million to 5.9 million SWUs per year in response to customer expressions of the need for additional enrichment services (URENCO, 2008). However, as noted above, the URENCO USA facility, although currently operating, is still under construction and is not expected to reach half of its currently licensed annual capacity of 3 million SWUs per year until August 2011. ACP is licensed to produce 3.5 million SWUs annually. The GE-Hitachi application is for a 6-million-SWU-per-year plant. Based on the projected need for LEU by existing reactors and proposed new reactors, with the target capacity of 6.6 million SWUs per year for the proposed EREF (this EIS), the total projected enrichment capacity in the United States would exceed the projected demand (approximately 16 million SWUs per year) by about 6 million SWUs per year if all of the enrichment facilities were constructed and operated at their rated capacities (and assuming the URENCO USA facility is authorized to operate at 5.9 million SWUs and the Paducah Gaseous Diffusion Plant is shut down). However, given the uncertainties in future development and/or potential expansion of the proposed projects, this projected level of extra capacity would not provide the needed assurance that the enriched uranium would be reliably available when needed for domestic nuclear power production.

1.3.2 The Need for Domestic Supplies of Enriched Uranium for National Energy Security

All of the current domestic production of enriched uranium currently originates primarily from the aging gaseous diffusion plant in Paducah, Kentucky, and to a lesser extent from the URENCO USA facility in Lea County, New Mexico, that began initial operations in June 2010 and is still under construction. This situation creates a severe reliability risk in U.S. domestic enrichment capacity. Any disruption in the supply of enriched uranium for domestic commercial nuclear reactors could have a detrimental impact on national energy security because nuclear reactors supply approximately 20 percent of the nation's electricity requirements. The proposed EREF could play an important role in assuring the nation's ability to maintain a reliable and economical domestic source of enriched uranium by providing such additional enrichment capacity. Further, this additional capacity would lessen U.S. dependence on foreign sources of enriched uranium.

In a letter to the NRC regarding general policy issues raised by the LES license application, the U.S. Department of Energy (DOE) stated that uranium enrichment is a critical step in the production of nuclear fuel and noted the decline in domestic enrichment capacity (DOE, 2002). In its 2002 letter, DOE also referenced comments made by the U.S. Department of State indicating that "maintaining a reliable and economical U.S. uranium enrichment industry is an important U.S. energy security objective" (DOE, 2002). The proposed EREF could contribute to the attainment of national energy security policy objectives by providing an additional domestic source of enriched uranium. This additional capacity would lessen U.S. dependence on foreign sources of enriched uranium.

At present, gaseous diffusion is the primary technology currently in commercial use in the United States. Gaseous diffusion technology has relatively large resource requirements that make it less attractive than gas centrifuge technology, from both an economic and an environmental perspective (NRC, 2006). Gas centrifuge technology, used at the URENCO USA facility, proposed for the EREF, and to be used at the ACP, is known to be more efficient and substantially less energy-intensive than gaseous diffusion technology. The new laser enrichment technology proposed for the GLE Facility is still under development.

1.4 Scope of the Environmental Analysis

To fulfill its responsibilities under NEPA, the NRC has prepared this EIS to analyze the environmental impacts (i.e., direct, indirect, and cumulative impacts) of the proposed EREF as well as reasonable alternatives to the proposed action. The scope of this EIS includes consideration of both radiological and nonradiological impacts associated with the proposed action and the reasonable alternatives.

In addition, this EIS identifies resource uses, monitoring programs, potential mitigation measures, unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and irreversible and irretrievable commitments of resources.

The development of this EIS was based on (1) the NRC staff's review of the AES license application (AES, 2010a), which includes a supporting Environmental Report, AES's responses to Requests for Additional Information (RAIs) (AES, 2009b), and subsequent sage-grouse survey (North Wind, 2010a) and supplemental wildlife survey report submittals (North Wind, 2010b); (2) the NRC staff's review of additional information provided by AES and its consultants in recent letters to and from State agencies (AES, 2010c; Idaho SHPO, 2010; WCRM, 2010); (3) the NRC staff's independent verification and analyses; (4) public and agency comments received during the scoping period and the Draft EIS public comment period; and (5) the NRC staff's consultations with other Federal agencies and with Native American tribes and State and local government agencies. In addition, the development of this EIS was closely coordinated with the development of the NRC's Safety Evaluation Report (SER) (*Safety Evaluation Report for the Eagle Rock Enrichment Facility in Bonneville County, Idaho*, NUREG-1951, September 2010 [NRC, 2010a]), which is the outcome of the NRC safety review of the AES license application for the proposed EREF.

1.4.1 Scope of the Proposed Action

The scope of the proposed action consists of the construction, operation, and decommissioning of the proposed EREF. Therefore, all activities associated with these actions must be considered. Construction activities consist of site preparation (e.g., clearing the land and construction of access roads) and facility construction (erection of the buildings and structures concerned with uranium enrichment). A distinction between site preparation and facility construction is made because of an exemption request submitted by AES as discussed below. Operation activities include those involved in the enrichment of uranium (shipment, receipt, storage, and processing of natural uranium and storage and shipment of enriched and depleted uranium). Decommissioning activities include those involved in facility shutdown such as equipment and building decontamination for disposal or reuse.

On June 17, 2009, AES submitted a request for exemption (AES, 2009a) from specific NRC requirements governing "Commencement of Construction" as specified under 10 CFR 70.4, 70.23(a)(7), 30.4, 30.33(a)(5), 40.4, and 40.32(e). This exemption was approved by the NRC on March 17, 2010 (NRC, 2010b). The exemption allows AES to proceed with certain activities that are considered outside of NRC regulatory purview (they are not related to radiological health and safety or the common defense and security) before obtaining an NRC license to construct and operate the proposed EREF (the proposed action). These activities, discussed further in Section 2.1.4.1, are referred to as “preconstruction” activities, because they are not considered construction activities as defined in NRC regulations. See 10 CFR 51.4 (defining “construction”) and 10 CFR 70.4 (defining “commencement of construction”); also compare 10 CFR 50.2 (defining “construction” and “constructing”) and the NRC’s *Final Interim Staff Guidance COL/ESP-ISG-004 on the Definition of Construction and on Limited Work Authorizations* (NRC, 2009). Specifically, 10 CFR 51.4 states, in relevant part, that “construction” does not include the following activities:

i. Changes for temporary use of the land for public recreational purposes;

ii. Site exploration, including necessary borings to determine foundation conditions or other preconstruction monitoring to establish background information related to the suitability of the site, the environmental impacts of construction or operation, or the protection of environmental values;

iii. Preparation of a site for construction of a facility, including clearing of the site, grading, installation of drainage, erosion and other environmental mitigation measures, and construction of temporary roads and borrow areas;

iv. Erection of fences and other access control measures;

v. Excavation;

vi. Erection of support buildings (such as, construction equipment storage sheds, warehouse and shop facilities, utilities, concrete mixing plants, docking and unloading facilities, and office buildings) for use in connection with the construction of the facility;

vii. Building of service facilities, such as paved roads, parking lots, railroad spurs, exterior utility and lighting systems, potable water systems, sanitary sewerage treatment facilities, and transmission lines;

viii. Procurement or fabrication of components or portions of the proposed facility occurring at other than the final, in-place location at the facility;

ix. Manufacture of a nuclear power reactor under a manufacturing license under subpart F of part 52 of this chapter to be installed at the proposed site and to be part of the proposed facility; or

x. With respect to production or utilization facilities, other than testing facilities and nuclear power plants, required to be licensed under Section 104.a or Section 104.c of the Act, the erection of buildings which will be used for activities other than operation of a facility and which may also be used to house a facility (e.g., the construction of a college laboratory building with space for installation of a training reactor).

As indicated in (iii) of the list above, site preparation is one component of preconstruction. As used in this document, the term “site preparation” includes the items specifically listed in (iii) above (i.e., clearing of the site, grading, installation of drainage, erosion and other environmental mitigation measures, and construction of temporary roads and borrow areas).

The NRC's decision to grant the exemption request to AES was based on the NRC staff finding that the request to perform certain preconstruction activities is authorized by law, will not endanger life or property or common defense and security, and is in the public interest. The exemption covered the following activities and facilities:

- clearing of approximately 240 hectares (592 acres)
- site grading and erosion control
- excavating the site including rock blasting and removal
- constructing a stormwater retention pond
- constructing main access and site roadways
- installing utilities
- erecting fences for investment protection
- constructing parking areas
- erecting construction buildings, offices (including construction trailers), warehouses, and guardhouses

The authorization to conduct these listed activities or construct the listed facilities prior to the NRC licensing decision was based on the condition that none of the facilities or activities subject to the exemption will be, at a later date, a component of AES's Physical Security Plan or its Standard Practice Procedures Plan for the Protection of Classified Matter or otherwise subject to NRC review or approval. Approval of the exemption request does not indicate that a licensing decision has been made by the NRC. Preconstruction activities would be completed by AES with the risk that a license may not be issued. Although the activities covered by the NRC's March 17, 2010, exemption (NRC, 2010b) are referred to in this document as "preconstruction" activities, some of these activities may continue after the commencement of construction, if a license is issued.

These activities authorized under the exemption approval are expected to occur whether or not the license is granted. As a result, the NRC does not consider these activities as part of the proposed action or the no-action alternative. However, because they are related to the construction of the proposed EREF, NRC staff analyzed their impacts in Chapter 4 as part of the impacts considered under "Preconstruction and Construction." However, the staff also attempted, to the extent possible, to separate the impacts from preconstruction and construction activities into those that would occur as a result of preconstruction activities and those that would occur as a result of construction activities as defined in 10 CFR 50.2 and 10 CFR 51.4. The staff also considered all of these impacts in evaluating the cumulative impacts of the EREF project.

Further, the NRC has no regulatory jurisdiction over the 161-kilovolt (kV) electrical transmission line that is required to power the EREF (its installation and operation are not related to radiological health and safety or the common defense and security). Therefore, the installation and operation of this transmission line is not considered by the NRC to be part of the proposed action. The installation and operation of this transmission line is considered under cumulative impacts in Chapter 4 of this EIS.

1.4.2 Scoping Process and Public Participation Activities

The NRC regulations in 10 CFR Part 51 contain requirements for conducting a scoping process prior to the preparation of an EIS. Scoping was used to help identify the relevant issues to be discussed in detail in this EIS. Scoping was also used to help determine issues that are beyond the scope of this EIS, which do not warrant a detailed discussion, or that are not directly relevant to the assessment of potential impacts from the proposed action.

On May 4, 2009, the NRC published in the *Federal Register* (74 FR 20508) a Notice of Intent (NOI) to prepare an EIS for the construction, operation, and decommissioning of the proposed EREF and to conduct the scoping process for the EIS. The NOI summarized the NRC's plans to prepare the EIS and presented background information on the proposed EREF. For the scoping process, the NOI initiated the public scoping period and invited comments on the proposed action, and announced a public scoping meeting to be held concerning the project.

On June 4, 2009, the NRC staff held the public scoping meeting in Idaho Falls, Idaho. During this meeting, a number of individuals offered oral and written comments and suggestions to the NRC concerning the proposed EREF and the development of the EIS. In addition, the NRC received written comments from various individuals during the public scoping period that ended on June 19, 2009. The NRC carefully reviewed the scoping comments (both oral and written) and then consolidated and categorized these comments by topical areas.

After the scoping period, the NRC issued the *Environmental Scoping Summary Report: Proposed AREVA Enrichment Services Eagle Rock Enrichment Facility in Bonneville County, Idaho* in September 2009. This report is provided in Appendix A. The report identifies categories of issues to be analyzed in detail in the EIS and issues determined to be beyond the scope of the EIS.

1.4.3 Issues Studied in Detail

As stated in the NOI, the NRC identified issues to be studied in detail as they relate to implementation of the proposed action. The public identified additional issues during the subsequent public scoping process. Issues identified by the NRC and the public that could have short- or long-term impacts from the potential construction and operation of the proposed EREF include:

- accidents
- alternatives
- air quality
- compliance with applicable regulations
- costs and benefits
- cumulative impacts
- decommissioning
- historic and cultural resources
- land use
- need for the facility
- noise
- public and occupational health
- resource commitments
- socioeconomic impacts

- depleted uranium disposition
- ecological resources
- environmental justice
- geology and soils
- transportation
- visual and scenic resources
- waste management
- water resources

1.4.4 Issues Eliminated from Detailed Study

The NRC has determined that detailed analysis associated with mineral resources was not necessary because there are no known nonpetroleum mineral resources at the proposed site that would be affected by any of the alternatives being considered.

The NRC also determined that detailed analysis of the impact of the proposed EREF on associated actions that include the overall nuclear fuel cycle activities was not necessary. This is because the proposed project would not measurably affect uranium mining and milling operations and the demand for enriched uranium. The amount of mining and milling depends upon the stability of market prices for uranium balanced with the concern of environmental impacts associated with such operations (NRC, 1980). The demand for enriched uranium in the United States is primarily driven by the number of commercial nuclear power plants and their operation. The proposed EREF would only result in the creation of new transportation routes within the fuel cycle to and from the enrichment facility. The existing transportation routes between the other facilities are not expected to be altered. Because the environmental impacts of all of the transportation routes other than those to and from the proposed EREF have been previously analyzed, they are eliminated from further study (NRC, 1977, 1980).

1.4.5 Issues Outside the Scope of the EIS

The following issues raised during the scoping process have been determined to be outside the scope of this EIS:

- safety and security

- credibility of the applicant

- nonproliferation

As noted in Section 1.4, some of these issues are analyzed in detail in the NRC's SER (NRC, 2010a) and are only summarized in the EIS. For example, within the area of safety and security, the SER analyzes the probabilities and consequences of various accidents at the proposed EREF, as well as measures to prevent those accidents and mitigate their effects. This EIS does not go into the same level of detail, but provides, in Section 4.2.15, an accident analysis for the purpose of assessing the potential environmental impacts of accidents.

NRC regulations require that information submitted as part of a license application be complete and accurate in all material respects. See, e.g., 10 CFR 70.9. At the same time, the general credibility of an applicant is not an issue the NRC addresses in an EIS. Rather, the NRC evaluates the submitted application based on its merits and performs an independent verification of the proposal put forth in the applicant's application.

The issue of nonproliferation was most recently addressed by the NRC in an August 25, 2010, letter from NRC Chairman Gregory B. Jaczko to the Honorable John M. Spratt, Jr., Congressman, U.S. House of Representatives (NRC, 2010c). This letter was in response to Congressman Spratt's June 30, 2010, letter (Spratt et al., 2010) in which he requested that the NRC conduct a nuclear nonproliferation assessment as part of the review of license applications for new nuclear technologies. The relevant statements from Chairman Jaczko's letter are as follows:

> *"The NRC has adopted a comprehensive regulatory infrastructure and implements an integrated set of activities directed against the unauthorized disclosure of information and technology considered important to common defense and security and the diversion of nuclear materials inimical to public health and safety and the common defense and security. The NRC's key regulations in this area (10 CFR Parts 73, 74, and 95) provide comprehensive requirements governing the control of, and access to, information, physical security of materials and facilities, and material control and accounting. Other NRC regulatory requirements are directed at preventing unauthorized disclosure of classified information, safeguards information (SGI), and sensitive unclassified nonsafeguards information. As appropriate, the NRC may supplement these requirements by order consistent with its statutory obligation to protect the common defense and security and public health and safety.*
>
> *"Beyond the NRC's regulations, uranium enrichment facility licensees have voluntarily committed to implement additional measures to protect information associated with classified enrichment technologies. The Nuclear Energy Institute developed a guidance document for the enrichment facility licensees and certificate holders which the NRC staff has endorsed. Licensees are now implementing these additional measures and incorporating their commitments in their site security plans. These additional measures and commitments become part of their licensing basis. In addition, the staff is working with other agencies to provide additional Federal involvement in protecting uranium enrichment technologies and establishing information protection measures.*
>
> *"Given the NRC's comprehensive regulatory framework, ongoing oversight, and active interagency cooperation, it is the NRC's current view that a formal nuclear nonproliferation assessment would not provide any additional benefit to protection of the common defense and security....*
>
> *"I want to assure you that the NRC takes your concerns very seriously and that we will continue to regulate nuclear materials and sensitive technology to ensure protection of public health and safety and the environment, promotion of the common defense and security, and fulfillment of U.S. obligations for nonproliferation and international agreements."*

Nonproliferation is therefore outside the scope of the EIS.

1.4.6 Draft EIS Public Comment Period and Public Participation Activities

The NRC staff issued the Draft EIS for public review and comment on July 21, 2010, and announced its availability on that date in the *Federal Register* (75 FR 4266) in accordance with 10 CFR 51.73, 51.74, and 51.117. The official public comment period on the Draft EIS began with publication in the *Federal Register* on July 23, 2010, of a Notice of Availability of the Draft EIS (75 FR 43160). The 45-day public comment period ended on September 13, 2010.

During the public comment period, the NRC staff held two public comment meetings – in Boise, Idaho, on August 9, 2010, and in Idaho Falls, Idaho, on August 12, 2010. The NRC staff posted meeting notices for both meetings in the NRC's public involvement website. Oral comments on the Draft EIS were presented by about 50 people at the Boise meeting and about 46 people at the Idaho Falls meeting. A court reporter recorded the oral comments and other meeting proceedings and prepared a written transcript for each meeting. In addition to oral comments received at the public meetings, the NRC staff received written comments on the Draft EIS during the public meetings, and written comments by postal mail and emails during the public comment period. The public meeting transcripts and written comments are part of the public record for the proposed EREF project.

All the comments received by the NRC on the Draft EIS were reviewed and considered by the NRC staff in developing the Final EIS. In Appendix I of this EIS, these comments are presented in groups by topic and summarized, and the NRC's responses to the comments are provided. The NRC staff made the public comment meeting transcripts part of the public record, contained in the NRC's Agencywide Documents Access and Management System (ADAMS). The meeting transcripts are also available in the NRC's public website for the proposed EREF project, at http://www.nrc.gov/materials/fuel-cycle-fac/arevanc.html#3. Other comment documents were added to ADAMS as they were received by the NRC.

Members of the public can access ADAMS at http://www.nrc.gov/reading-rm/adams.html. From this website, the transcripts and other comment documents can be accessed by entering their ADAMS Accession Numbers (or ML numbers). The ADAMS Accession Numbers for the comment documents are identified in Table I-1 in Appendix I.

In general, the issues identified in the comments were similar to those brought up during the EIS scoping process (see Section 1.4.2 and Appendix A). The comments received during the Draft EIS public comment period were on topics in all the major issues and resource areas addressed in the EIS except for noise and environmental justice. As discussed in Section 1.4.5, issues that are related to safety and security, nonproliferation, and the credibility of the applicant are not part of the scope of the EIS. Other safety issues are addressed in the NRC's SER (NRC, 2010a).

1.4.7 Changes from the Draft EIS

The majority of changes to the Draft EIS that the NRC staff made in preparing the Final EIS were minor corrections and a number of updates and clarifications. Among these changes, based on recent project developments or certain comments on the Draft EIS (see Appendix I, Section I.5), updated or additional information has been included in the EIS in some of the resource area sections and other sections and appendices, to provide more current or complete information and/or analyses. The impacts assessed and the NRC staff's findings and conclusions remain unchanged for all resource areas.

The most noteworthy of the changes from the Draft EIS are identified below:

Chapter 1 Introduction

- Information in Sections 1.3.1 and 1.3.2 relating to purpose and need for the proposed action has been updated.

- Additional information explaining why nonproliferation is not within the scope of the EIS has been added to Section 1.4.5.

- Information on the Draft EIS public comment period and associated public participation activities, and on comments received on the Draft EIS, has been added (see Section 1.4.6).

- Information in Sections 1.5.4.1 and 1.5.4.2 regarding *Endangered Species Act* and *National Historic Preservation Act* (NHPA) consultations, respectively, conducted by the NRC staff has been updated.

Chapter 2 Alternatives

- Information in the introduction to Section 2.1 has been updated to indicate that AES initiated preconstruction activities in late 2010.

- Information in Section 2.1.5.1 regarding the status of conversion facilities for depleted uranium hexafluoride has been updated.

- Information in Section 2.2 regarding the no-action alternative has been updated.

- Information on mitigation of impacts to historic and cultural resources due to preconstruction activities, and on the NHPA Section 106 consultation, has been updated in Table 2-6, Section 2.4, under both the proposed action and no-action alternative.

Chapter 3 Affected Environment

- Information in Section 3.2.1 regarding the applicability of the *Farmland Protection Policy Act* to the proposed EREF project has been updated.

- Additional information on seismicity/earthquakes has been added to Section 3.6.1.1.

Chapter 4 Environmental Impacts and Chapter 5 Mitigation

- Information on mitigation of impacts to historic and cultural resources due to preconstruction activities, and on the NHPA Section 106 consultation, has been updated in Sections 4.2.2.1 and 4.2.2.3.

- Information on potential visual impacts from construction and operation of the proposed EREF on the quality of the recreational experience at Hell's Half Acre Wilderness Study Area (WSA) has been added to Section 4.2.3.1.

- Information on water appropriation and usage during construction and operation was updated in Sections 4.2.6.1 and 4.2.6.2, respectively.

- Additional NRC-recommended mitigation measures for potential impacts to water quality during preconstruction and construction have been added to Sections 4.2.6.3 and 5.2 (Table 5-3).

- Expanded discussions of impacts on sage–grouse during operation of the proposed EREF have been provided in Sections 4.2.7.2 and 4.3.7.

- Additional AES mitigation measures for potential impacts to ecological resources have been added to Sections 4.2.7.3 and 5.1 (Table 5-1), and additional NRC-recommended mitigation measures have been added to Sections 4.2.7.2 and 5.2 (Tables 5-3 and 5-4).

- For comparison with the original ground-level release calculations, impacts on public health from elevated releases of radionuclides from the proposed EREF during normal operation were added in Section 4.2.10.2 (details added in Appendix E, Section E.3.1).

- Expanded coverage on solid, liquid, and mixed wastes has been provided in Section 4.2.11.2.

- Section 4.2.12.4 has been added to provide a discussion of the potential effect of a facility such as the proposed EREF on surrounding property values.

- Information has been added to Section 4.2.17 regarding the estimated amount of CO_2 emissions avoided from coal-burning power plants through use by nuclear power plants of fuel fabricated from UF_6 enriched at the proposed EREF

- Clarification on the region of influence (ROI) used in the cumulative impact analysis has been added to the introduction to Section 4.3

- Information on water usage during construction and operation of the proposed EREF was updated in Section 4.3.6. Also provided in Section 4.3.6 is additional information on prior contamination of the Eastern Snake River Plain (ESRP) aquifer originating from Idaho National Laboratory (INL).

<u>Chapter 6 Environmental Measurement and Monitoring Programs</u>

- Clarifications regarding the groundwater monitoring program have been added to Section 6.1.5.

- Additional information has been added to Section 6.2.2.1 regarding ecological monitoring along the proposed 161-kV transmission line to provide power for the proposed EREF.

Appendix B Consultation Letters

- Appendix B has been updated to reflect additional consultations conducted since the Draft EIS was issued.

Appendix E Dose Methodology and Impacts

- Impacts on public health from elevated releases of radionuclides from the proposed EREF during normal operation were estimated in Section E.3.1 for comparison with the previously estimated impacts from ground-level releases.

1.4.8 Related Relevant Documents

The following documents were reviewed as part of the development of this EIS.

- *Environmental Impact Statement for the Proposed American Centrifuge Plant in Piketon, Ohio, Final Report. NUREG-1834, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, April 2006.* This EIS analyzes the potential environmental impacts of the proposed siting, construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility at the existing DOE reservation in Piketon, Ohio. Its description of the purpose and need of the proposed action, as well as its review of alternatives to the proposed action, are highly relevant to the alternatives analysis for the proposed ERE project. The environmental impacts discussed for the proposed ACP are also relevant to the impact analysis for the proposed EREF, especially the analysis of cumulative impacts associated with the management of depleted uranium and low-level wastes from the proposed EREF, the ACP, the NEF, and the proposed GLE Facility, as well as the existing DOE inventory of depleted uranium hexafluoride (UF_6).

- *Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico, Final Report. NUREG-1790, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, June 2005.* This EIS analyzes the potential environmental impacts of the proposed siting, construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility near Eunice, New Mexico. Its description of the purpose and need of the proposed action, as well as its review of alternatives to the proposed action, are highly relevant to the alternatives analysis for the proposed EREF project. The environmental impacts discussed for the proposed NEF are also relevant to the impact analysis for the proposed EREF, especially the analysis of cumulative impacts associated with the management of depleted uranium and low-level wastes from the proposed EREF, the ACP, the NEF, and the proposed GLE Facility, as well as the existing DOE inventory of depleted UF_6.

- *Final Environmental Impact Statement for the Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site. DOE/EIS-0360, Oak Ridge Operations, Office of Environmental Management, U.S. Department of Energy, June 2004.* This site-specific EIS analyzes the impacts associated with the construction, operation, and decommissioning of a depleted UF_6 conversion facility at the Portsmouth, Ohio, site. The EIS also evaluates the impacts of transporting cylinders (depleted UF_6, enriched uranium, and empty) to Portsmouth that used to be stored at the East Tennessee

Technology Park near Oak Ridge, Tennessee. Also evaluated are transportation of depleted UF_6 conversion products and waste materials to a disposal facility; transportation and sale of the hydrogen fluoride produced as a conversion co-product; and neutralization of hydrogen fluoride to calcium fluoride and the sale or disposal of the calcium fluoride in the event that the hydrogen fluoride product is not sold. The results presented in the EIS are relevant to the management, use, and potential impacts associated with the depleted UF_6 that would be generated at the proposed EREF and the cumulative impacts of depleted UF_6 from the ACP, the NEF, the proposed EFEF, and the proposed GLE Facility, as well as the existing DOE inventory of depleted UF_6.

- *Final Environmental Impact Statement for the Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site. DOE/EIS-0359, Oak Ridge Operations, Office of Environmental Management, U.S. Department of Energy, June 2004*. This site-specific EIS is very similar to the EIS for the Portsmouth, Ohio, site, except that the conversion facility is at the Paducah, Kentucky, site.

- *Environmental Assessment: Disposition of Russian Federation Titled Natural Uranium. DOE/EA-1290, Office of Nuclear Energy, Science and Technology, U.S. Department of Energy, June 1999.* This Environmental Assessment (EA) analyzed the environmental impacts of transporting natural UF_6 from the gaseous diffusion plants to the Russian Federation. Transportation by rail and truck were considered. The EA addresses both incident-free transportation and transportation accidents. The results presented in this EA are relevant to the transportation of UF_6 for the proposed EREF.

- *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride. DOE/EIS-0269, Office of Nuclear Energy, Science and Technology, U.S. Department of Energy, April 1999*. This EIS analyzes strategies for the long-term management of the depleted UF_6 inventory that was stored at three DOE sites near Paducah, Kentucky; Portsmouth, Ohio; and Oak Ridge, Tennessee, at the time this EIS was prepared. This EIS also analyzes the potential environmental consequences of implementing each alternative strategy for the period 1999 through 2039. The results presented in this EIS are relevant to the management, use, and potential impacts associated with the depleted UF_6 that would be generated at the proposed EREF and the cumulative impacts of depleted UF_6 from the ACP, the NEF, the proposed EREF, and the proposed GLE Facility, as well as the existing DOE inventory of depleted UF_6.

- *Advanced Mixed Waste Treatment Project (AMWTP) Final Environmental Impact Statement. DOE/EIS-0290, Idaho Operations Office, U.S. Department of Energy, January 1999*. This site-specific EIS evaluates the alternatives associated with the treatment and packaging of stored onsite radioactive waste at the Idaho National Laboratory (INL) site for offsite disposal. Treatment of offsite radioactive waste is also considered. As the INL is located within approximately 1 mile of the proposed EREF property located in Bonneville County, Idaho, the characterization of the affected environment in this EIS is relevant to existing conditions (e.g., air quality, ecology, geology, and hydrology) at and near the proposed EREF site.

- *Idaho High-Level Waste & Facilities Disposition, Final Environmental Impact Statement. DOE/EIS-0287, Idaho Operations Office, U.S. Department of Energy, September 2002*. This site-specific EIS evaluates the alternatives associated with the treatment and disposal of certain mixed wastes (waste with both hazardous and radioactive components) generated by past spent nuclear fuel reprocessing operations at the INL. As the INL is located within approximately 1 mile of the proposed EREF property located in Bonneville County, Idaho, the characterization of the affected environment in this EIS is relevant to existing conditions (e.g., air quality, ecology, geology, and hydrology) at and near the proposed EREF site.

- *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power. DOE/EIS-0373D, Office of Nuclear Energy, Science and Technology, U.S. Department of Energy, June 2005*. This EIS analyzes the impacts from the consolidation of facilities necessary for the production of radioisotope power systems. One site considered is the INL in southeastern Idaho. As the INL is located within approximately 1 mile of the proposed EREF property located in Bonneville County, Idaho, the characterization of the affected environment in this EIS for the INL is relevant to existing conditions (e.g., air quality, ecology, geology, and hydrology) at and near the proposed EREF site.

1.5 Applicable Statutory and Regulatory Requirements

1.5.1 Applicable State of Idaho Requirements

Certain environmental requirements, including some discussed earlier, have been delegated to State authorities for implementation, enforcement, or oversight. Table 1-1 provides a list of State of Idaho environmental requirements.

1.5.2 Permit and Approval Status

Several construction and operating permit applications must be prepared and submitted by AES or its agents, and regulatory approval and/or permits must be received prior to EREF project construction or facility operation. Decommissioning of the EREF would be addressed in the decommissioning plan required pursuant to 10 CFR Parts 30 and 40. Table 1-2 lists the potentially required Federal, State, and local permits and their present status.

1.5.3 Cooperating Agencies

No Federal, State, or local agencies or tribes have come forward as cooperating agencies in the preparation of this EIS.

1.5.4 Consultations

The consultation requirements of the *Endangered Species Act of 1973* and the *National Historic Preservation Act* apply to the NRC regarding the licensing of the proposed EREF. The consultation correspondence discussed below is provided in Appendix B of this EIS.

Table 1-1 State of Idaho Environmental Requirements

Law/Regulation	Citation	Requirements
Air Pollution Control	*Idaho Administrative Procedures Act* (IDAPA) 58.01.01 authorized by *Idaho Statutes* (IS), Title 39, Chapter 1, Environmental Quality – Health	Requires a permit before an owner or operator may begin the construction or modification of any stationary source, facility, major facility, or major modification; stationary source permit applicants must demonstrate compliance with all applicable Federal, State, and local emission standards, and that the source will not cause or significantly contribute to a violation of any ambient air quality standard.
Water Quality Standards	IDAPA 58.01.02, authorized by IS, Title 39, Chapter 1, Environmental Quality – Health, and Chapter 36, Water Quality	Designates uses for waters in the State and establishes water quality standards to protect those uses; places restrictions on the discharge of wastewaters and on human activities which may adversely affect public health and water quality in State waters.
Public Water Drinking Systems	IDAPA 58.01.08 authorized by IS, Title 39, Chapter 1, Environmental Quality – Health	Controls and regulates the design, construction, operation, maintenance, and quality control of public drinking water systems; adopts 40 CFR Parts 141 and 143 national primary and secondary drinking water regulations by reference. Requires a plan that demonstrates that the water system has adequate technical and managerial capacity and written approval of the site by the Idaho Department of Environmental Quality prior to drilling a public water system well.
Hazardous Waste	IDAPA 58.01.05 as authorized by IS, Title 39, Chapter 44, Hazardous Waste Management	Requires hazardous waste permits for treating, storing, or disposing of hazardous wastes; permit provisions are dependent on volumes and types of wastes generated and management level (i.e., storage, treatment, and/or disposal).

Table 1-1 State of Idaho Environmental Requirements (Cont.)

Law/Regulation	Citation	Requirements
Protection of Graves	IS, Title 27, Chapter 5, Protection of Graves	Prohibits willful removal, mutilation, defacing, injuring, or destroying any cairn or grave; allows excavation by a professional archaeologist if action is necessary to protect the burial site from foreseeable destruction and upon prior notification to affected parties.
Disposal of Radioactive Materials	IDAPA 58.01.10 as authorized by IS, Title 39, Chapter 44, Hazardous Waste Management	Regulates the disposal of radioactive materials not regulated under the *Atomic Energy Act of 1954*, as amended, at State-permitted facilities; places restrictions on disposal of certain radioactive materials at municipal solid waste landfills and identifies other approved disposal options for radioactive materials. Adopts the radiation protection standards contained in 10 CFR Part 20.
Preservation of Historic Sites	IS, Title 67, Chapter 46, Preservation of Historic Sites	Authorizes the governing body of any county or city to establish a historic preservation commission that can conduct surveys of local historic properties, acquire interests in them, and participate in land use planning.
Wastewater Rules	IDAPA 58.01.16 as authorized by IS, Title 39, Chapter 1, Environmental Quality – Health, and Chapter 36, Water Quality	Requires the State to certify that the NPDES permit issued by the EPA complies with the State's water quality standards.
Well Construction Standards Rules	IDAPA 37.03.09 as authorized by IS, Title 42, Chapter 2, Appropriation of Water – Permits, Certificates, and Licenses – Survey	Establishes minimum standards for the construction of all new wells and the modification and decommissioning (abandonment) of existing wells; applies to all water wells, monitoring wells, and other artificial openings and excavations in the ground that are more than 18 feet in vertical depth below land surface.
Rules Governing Classification and Protection of Wildlife	IDAPA 13.01.06, as authorized by IS, Title 36, Chapter 2, Classifications and Definitions	Defines and lists State threatened and endangered species and bans taking or possessing them.
Individual/Subsurface Sewage Disposal Rules	IDAPA 58.01.03 as authorized by IS, Title 39, Chapter 1, Environmental Quality – Health	Requires a permit to construct, modify, or repair individual or subsurface sewage disposal systems.

Table 1-2 Potentially Applicable Permitting and Approval Requirements and Their Status for the Construction, Operation, and Decommissioning of the Proposed Eagle Rock Enrichment Facility

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
Federal			
Domestic Licensing of Special Nuclear Material, Domestic Licensing of Source Material, Rules of General Applicability to Domestic Licensing of Byproduct Material	NRC	10 CFR Part 70, 10 CFR Part 40, 10 CFR Part 30 as authorized by the *Atomic Energy Act*	Submitted
NPDES Industrial Stormwater Permit	EPA Region 10	40 CFR Part 122 as authorized by the CWA	Application to be submitted[a]
NPDES Construction General Permit	EPA Region 10	40 CFR Part 122 as authorized by the CWA	Applications to be submitted by AES and Rocky Mountain Power[a]
Section 404 Permit	U.S. Army Corps of Engineers (USACE)	40 CFR Part 230 authorized by the CWA	Not required per letter issued by the USACE
Endangered Species Act Consultation	FWS	50 CFR Part 402 authorized by the *Endangered Species Act*	Not required per letter issued by the FWS
State			
Air: Permit to Construct	Idaho Department of Environmental Quality/Air Quality Division (IDEQ/AQD)	*Idaho Administrative Procedures Act* (IDAPA) 58.01.01 authorized by the *Idaho Environmental Protection and Health Act*	Not required; proposed EREF satisfies IDAPA Permit to Construct exemptions
Air: Operating Permit (under Title V)	IDEQ/AQD	IDAPA 58.01.01 authorized by the *Idaho Environmental Protection and Health Act*	Not required; proposed EREF emissions do not meet thresholds

Table 1-2 Potentially Applicable Permitting and Approval Requirements and Their Status for the Construction, Operation, and Decommissioning of the Proposed Eagle Rock Enrichment Facility (Cont.)

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
State (Cont.)			
National Emission Standards for Hazardous Air Pollutants Permit	IDEQ/AQD	IDAPA 58.01.01 authorized by the *Idaho Environmental Protection and Health Act*	Not required; proposed EREF would not be a major source of criteria air pollutants or source of hazardous air pollutants
Hazardous Waste Permit	IDEQ/Waste Management and Remediation Division	IDAPA 58.01.05 authorized by the *Hazardous Waste Management Act*	Not required; the proposed EREF qualifies as a small quantity generator – a generator identification number will be requested
NPDES Section 401 Permit Certification	IDEQ/Water Quality Division (WQD)	IDAPA 58.01.16 authorized by the *Idaho Environmental Protection and Health Act*	Certification decisions will be made when EPA issues the proposed final NPDES permits
Well Drilling Permit	Idaho Department of Water Resources	IDAPA 37.03.09 as authorized by Title 42 of the *Idaho Statutes*	Application to be submitted
Easement on State Owned Land	Department of Lands	IDAPA 20.03.08 authorized by the *Public Depository Law*	Not required; access nor easement is needed over the endowment trust lands proximate to the proposed EREF
Safe Drinking Water Act Drinking Water System	IDEQ/WQD	IDAPA 58.01.08 authorized by the *Idaho Environmental Protection and Health Act*	Comprehensive treatment plan will be prepared; operations will be placed under a licensed operator
Sanitary System Permit	IDEQ/WQD	IDAPA 58.01.03 authorized by the *Idaho Environmental Protection and Health Act*	Not required for the proposed EREF (zero-discharge system), but may be required for the Visitor Center.

Table 1-2 Potentially Applicable Permitting and Approval Requirements and Their Status for the Construction, Operation, and Decommissioning of the Proposed Eagle Rock Enrichment Facility (Cont.)

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
State (Cont.)			
Access Permit	Idaho Transportation Department	IDAPA 39.03.42 authorized by Titles 40, 49, and 67 of the *Idaho Statutes*	Application to be submitted
Construction Permits: Electrical, Plumbing, HVAC	Idaho Division of Building Safety	IDAPA 07.01.01, 07.02.04, 07.07.01 authorized by Title 54 of the *Idaho Statutes*	Application to be submitted
Machine-produced Radiation Registration	Idaho Department of Health and Welfare/Radiation Control Agency	IDAPA 16.02.27 authorized by Title 56 of the *Idaho Statutes*	Application to be submitted
County			
Construction Permits: Structural, Mechanical	Bonneville County	*Bonneville County Ordinance 218-07*	Application to be submitted

[a] Updates on the NPDES permitting process can be viewed on the EPA website at: http://cfpub.epa.gov/npdes/stormwater/noi/noidetail_new.cfm?ApplId=IDR10CI01.

1.5.4.1 *Endangered Species Act of 1973* Consultation

NRC staff consulted with the FWS to comply with the requirements of Section 7 of the *Endangered Species Act*. On June 17, 2009, the NRC staff sent a letter to the FWS Eastern Idaho Field Office describing the proposed action and requesting a list of threatened and endangered species and critical habitats that could potentially be affected by the proposed action. By letter dated July 15, 2009, the FWS Eastern Idaho Field Office indicated that no listed species are present at the project location. On February 18, 2010, the NRC sent a letter to the FWS Eastern Idaho Field Office reporting the installation of a proposed electrical transmission line to power the proposed EREF project and requesting a list of threatened and endangered species and critical habitats that could potentially be affected by the proposed transmission line and associated facilities. By letter dated March 9, 2010, the FWS Eastern Idaho Field Office pointed out that the protections provided to bald eagles under the *Bald and Golden Eagle Protection Act* and the *Migratory Bird Treaty Act* remain in place even though the bald eagle is no longer included on the list of threatened and endangered species in the lower 48 States. The March letter also referenced the potential of transmission lines to affect migratory birds. A letter dated July 14, 2010, from the NRC to the FWS Eastern Idaho Field Office, transmitted a copy of the Draft EIS, summarized the contents of the above correspondence, and also summarized an April 15, 2010, telephone conversation between the NRC and Mr. Ty Matthews of the FWS Eastern Idaho Field Office. During that conversation, Mr. Matthews indicated that the list of endangered, threatened, proposed, and candidate species provided by the FWS with its March 9, 2010, letter was for Bonneville County in general; he did not believe that these species are in the vicinity of, or potentially impacted by, the proposed transmission line project; and consultation by the NRC with the FWS under Section 7 of the *Endangered Species Act* would not be needed for these species for the proposed project.

In addition, the NRC has reviewed the results of field surveys (see Section 4.2.7) and determined that no threatened or endangered species would be affected by the proposed EREF.

Additionally, by letters dated June 22, 2009, and June 24, 2009, the NRC communicated with the Idaho Department of Fish and Game and the Idaho Office of Energy Resources, respectively, regarding the proposed action. The NRC again corresponded with the Idaho Department of Fish and Game and the Idaho Office of Energy Resources on February 10, 2010, and February 18, 2010, respectively, reporting the installation of a transmission line to power the proposed EREF project. The Idaho Department of Fish and Game (IDFG) corresponded with the NRC on August 4, 2009, and April 14, 2010. On June 8, 2010, the NRC provided IDFG with additional information on sage grouse surveys conducted for the project.

1.5.4.2 *National Historic Preservation Act of 1966* Section 106 Consultation

Pursuant to Section 106 of the NHPA, in a letter dated June 17, 2009, the NRC initiated consultation with the Idaho State Historical Society, State Historic Preservation Office (SHPO). In this letter, the NRC identified the Area of Potential Effect (APE) for the proposed project and informed the SHPO that archaeological surveys of the APE had been undertaken by a contractor to AES. Also in the letter, the NRC stated its intent to use the NEPA process to comply with Section 106 of the NHPA as allowed in 36 CFR Part 800.8. In a letter dated September 16, 2009, the NRC discussed the AES request to commence preconstruction activities prior to NRC's completion of its environmental review. In a letter dated February 17, 2010, the NRC relayed that a 161-kV transmission line would be constructed and operated to power the proposed EREF and that the APE for the proposed EREF had changed. On April 16, 2010, Argonne National Laboratory (Argonne), on behalf of the NRC, provided the SHPO with copies of the following AES documents: a report providing information on the proposed 161-kV transmission line project to provide power to the proposed EREF; a Treatment Plan describing the process for mitigating the adverse effect from the proposed EREF project to site MW004 (the *National Register of Historic Places* (NRHP)-eligible John Leopard Homestead) by professional excavation and data recovery (see Sections 3.3.4 and 4.2.2); a report presenting the findings of X-ray fluorescence (XRF) analysis conducted on obsidian artifacts found in the proposed EREF project's APE; and an archaeological survey report conducted for the unsurveyed portions of the expanded APE identified in the NRC's February 17, 2010 letter. In a letter dated May 3, 2010, the SHPO acknowledged the expanded EREF project footprint and proposed transmission line project described in the NRC's February 17, 2010, letter; requested additional copies and/or clarifications of certain AES cultural resource survey reports; expressed support for the proposed treatment of (i.e., mitigation of an adverse effect to) site MW004, and appreciation for receiving a letter report on the XRF analysis of obsidian artifacts; and outlined the next steps in the consultation process including development of a Memorandum of Agreement (MOA) between the NRC and the SHPO to define the mitigation of the adverse effect resulting from the removal of site MW004 as a result of the proposed EREF project.

A letter from the NRC dated July 14, 2010, continued the Section 106 consultation process, notified the SHPO of the issuance of the Draft EIS, and transmitted copies of the Draft EIS for the SHPO's review and comment. In addition, this letter discussed the NRC staff's determination of the APE for the proposed EREF and transmission line projects and the staff's preliminary determination in the Draft EIS of the impacts on historic and cultural resources that would result from the preconstruction, construction, operation, and decommissioning of the proposed project, including the adverse effect on site MW004 and the proposed mitigation of the adverse effect by professional excavation. In a letter dated July 22, 2010, the SHPO stated that they had reviewed the Draft EIS and found that the historic and cultural resource sections accurately reflected the identification efforts conducted to date under Section 106 of the NHPA. Additionally, the letter recommended that a statement be added in the Final EIS that effects on site MW004 will be resolved through an MOA.

By letter dated August 31, 2010, the NRC informed the Advisory Council on Historic Preservation (ACHP) of the adverse effect to site MW004 as a result of the proposed EREF project and that the NRC is drafting an MOA regarding the mitigation of this adverse effect. Also, this letter presented the NRC's invitation to the ACHP to participate in the NHPA Section 106 consultation for the proposed EREF project; provided relevant background information on the proposed project and on the MOA; and transmitted copies of project consultation letters, cultural resource survey reports, and related documents. By letter dated September 20, 2010, the ACHP responded that they do not believe their participation in the consultation to resolve the adverse effect is needed at this time, but may reconsider this decision if they receive a request for participation from a consulting party or other party. The ACHP also stated that once the MOA is signed, it must be filed with the ACHP to complete the requirements of Section 106 of the NHPA.

On June 4, 2009, the NRC met with the Shoshone-Bannock Tribal Council to inform them of the project. By letter dated July 29, 2009, the NRC formally initiated the Section 106 consultation process with the Shoshone-Bannock Tribes. By letters dated September 16, 2009, and February 19, 2010, the NRC continued the consultation process with the Shoshone-Bannock Tribes regarding the AES request to commence certain activities prior to NRC's completion of its environmental review and the installation of the transmission line and associated structures, respectively. On August 11, 2010, the NRC again met with the Shoshone-Bannock Tribal Council to discuss, and answer questions about, the proposed project. In a letter dated October 8, 2010, the NRC described the adverse effect to site MW004, informed the Tribes about the development of an MOA for the proposed EREF project, and invited the Shoshone-Bannock Tribes to participate in the development of the MOA as a concurring party. In a December 22, 2010, telephone conversation with a tribal representative, the NRC was informed that the Shoshone-Bannock Tribes want to be a party to the MOA.

Follow-ups on correspondence with the SHPO and the Shoshone-Bannock Tribes were conducted through subsequent telephone conversations and emails (see Appendix B, Section B.2). On October 13, 2010, the NRC informed the SHPO, by email, that AES had begun work on the mitigation of site MW004, in the manner identified in the Treatment Plan provided to the SHPO with Argonne's letter dated April 16, 2010. On January 26, 2011, the NRC informed the SHPO that the Shoshone-Bannock Tribes had accepted the NRC's invitation to be a concurring party on the MOA, and about the NRC's progress on developing a draft of the

MOA for review by the parties. Additional information regarding development of the MOA is presented in Section 4.2.2.1 of this EIS.

1.6 Organizations Involved in the Proposed Action

Two organizations have specific roles in the implementation of the proposed action:

- AES is the NRC license applicant. If the license is granted, AES would be the holder of an NRC license to construct, operate, and decommission the proposed EREF and for the possession and use of special nuclear material, source material, and byproduct material at the proposed EREF. AES would be responsible for constructing, operating, and decommissioning the proposed facility in compliance with that license and applicable NRC regulations.

  AES is a Delaware limited liability corporation that was formed solely to provide uranium enrichment services for commercial nuclear power plants. AES is a wholly owned subsidiary of AREVA NC Inc. AREVA NC Inc. is a wholly owned subsidiary of the AREVA NC SA, which is part of AREVA SA (AES, 2010b). AES has indicated that its principal business location is in Bethesda, Maryland. The NRC intends to examine any foreign relationship to determine whether it is inimical to the common defense and security of the United States. The foreign ownership, control, and influence issue is beyond the scope of this EIS and is addressed as part of the NRC's SER (NRC, 2010a).

- The NRC is the licensing agency. The NRC has the responsibility to evaluate the license application for compliance with the NRC regulations associated with uranium enrichment facilities. These include standards for protection against radiation in 10 CFR Part 20 and requirements in 10 CFR Parts 30, 40, and 70 that would authorize AES to possess and use byproduct material, source material, and special nuclear material, respectively, at the proposed EREF. The NRC is responsible for regulating activities, as applicable, performed within the proposed EREF through its licensing review process and subsequent inspection program. To fulfill the NRC responsibilities under NEPA, the environmental impacts of the proposed project are evaluated in accordance with the requirements of 10 CFR Part 51 and documented in this EIS.

1.7 References

(AES, 2009a) AREVA Enrichment Services, LLC. Letter from Sam Shakir (President and CEO, AES) to the U.S. Nuclear Regulatory Commission dated June 17. "Subject: Request for Exemption from 10 CFR 70.4, 10 CFR 70.23(a)(7), 10 CFR 30.4, 10 CFR 30.33(a)(5), 10 CFR 40.4, and 10 CFR 40.32(e) Requirements Governing 'Commencement of Construction.'" ADAMS Accession No. ML091770390.

(AES, 2009b) AREVA Enrichment Services, LLC. Letter from Jim Kay (Licensing Manager, AES) to the U.S. Nuclear Regulatory Commission dated September 9, 2009. "Subject: Response to Requests for Additional Information – AREVA Enrichment Services LLC Environmental Report for the Eagle Rock Enrichment Facility." ADAMS Accession No. ML092530636.

(AES, 2010a) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility, Revision 2 to License Application." April. ADAMS Accession No. ML101610549.

(AES, 2010b) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Environmental Report, Rev. 2." Bethesda, Maryland. April. ADAMS Accession No. ML101610549.

(AES, 2010c) AREVA Enrichment Services, LLC. Letter from Jim Kay (Licensing Manager, AES) to the Idaho Department of Fish and Game dated December 7, 2010. "Subject: Response to IDFG Comments to NRC Related to the EREF Transmission Line." ADAMS Accession No. ML103420579.

(DOE, 2002) U.S. Department of Energy. Letter from W.J. Magwood, IV (U.S. Department of Energy) to M.J. Virgilio (U.S. Nuclear Regulatory Commission) dated July 25. ADAMS Accession No. ML022350130.

(DOE, 2007) U.S. Department of Energy. "Uranium Enrichment Decontamination & Decommissioning Fund 2007 Report to Congress." Oak Ridge Office and Portsmouth/Paducah Project Office. <http://www.em.doe.gov/pdfs/5th_triennial_report_final.pdf> (Accessed April 16, 2010). ADAMS Accession No. ML103490664.

(DOE, 2010a) U.S. Department of Energy. "Portsmouth Plant History." Portsmouth/Paducah Project Office. January. <http://www.pppo.energy.gov/port_history.html> (Accessed January 28, 2010). ADAMS Accession No. ML101790051.

(DOE, 2010b) U.S. Department of Energy, National Nuclear Security Administration. "U.S.-Russian Highly Enriched Uranium Purchase Agreement." January. <http://www.nnsa.energy.gov/nuclear_nonproliferation/highly_enriched_uranium_disposition.htm> (Accessed January 28, 2010).

(EIA, 2003) Energy Information Administration, U.S. Department of Energy. "U.S. Nuclear Fuel Cycle Projections 2000-2025." Washington, D.C. January. <http://www.eia.doe.gov/cneaf/nuclear/page/forecast/projection.html> (Accessed April 5, 2005). ADAMS Accession No. ML101790059.

(EIA, 2010a) Energy Information Administration, U.S. Department of Energy. "Annual Energy Outlook 2010 with Projections to 2035." DOE/EIA-0383(2010). Washington, D.C. April. <http://www.eia.doe.gov/oiaf/archive/aeo10/index.html> (Accessed November 15, 2010). ADAMS Accession No. ML103480627.

(EIA, 2010b) Energy Information Administration, U.S. Department of Energy. "Uranium Marketing Annual Report." Washington, D.C. August. <http://www.eia.doe.gov/cneaf/nuclear/umar/umar.html> (Accessed November 15, 2010). ADAMS Accession No. ML103480604.

(GE-Hitachi, 2009) GE-Hitachi Global Laser Enrichment, LLC. "GE-Hitachi Global Laser Enrichment LLC Commercial Facility Wilmington, North Carolina, License Application." April 30. <http://adamswebsearch2.nrc.gov/idmws/ViewDocByAccession.asp?AccessionNumber=ML091870999> (Accessed August 18, 2009). ADAMS Accession No. ML091870999.

(Idaho SHPO, 2010) Idaho State Historic Preservation Office. Letter from S. Pengilly (Idaho Deputy SHPO) to J. Kay (AREVA) dated November 26, 2010. "Re: Geotechnical Borings at the Proposed Twin Buttes Substation within Cultural Resource Site 10BV246 (MW004), Eagle Rock Enrichment Facility, Bonneville County, Idaho." ADAMS Accession No. ML110240061.

(North Wind, 2010a) North Wind, Inc. "Sage Grouse Survey Report, Eagle Rock Enrichment Facility." May 13. ADAMS Accession No. ML103570078.

(North Wind, 2010b) North Wind, Inc. "Wildlife Survey Report, Eagle Rock Enrichment Facility." December 10. ADAMS Accession No. ML103570068.

(NRC, 1977) U.S. Nuclear Regulatory Commission. "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes." NUREG-0170, Vol. 1. December. ADAMS Accession No. ML022590265.

(NRC, 1980) U.S. Nuclear Regulatory Commission. "Final Generic Environmental Impact Statement on Uranium Milling, Project M-25." NUREG- 0706. Office of Nuclear Material Safety and Safeguards. September. ADAMS Accession No. ML032751663.

(NRC, 2005) U.S. Nuclear Regulatory Commission. "Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico." Final Report. NUREG-1790, Vol. 1. Office of Nuclear Material Safety and Safeguards, Washington, D.C. June. <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1790/> (Accessed July 21, 2009).

(NRC, 2006) U.S. Nuclear Regulatory Commission. "Environmental Impact Statement for the Proposed American Centrifuge Plant in Piketon, Ohio." NUREG-1834. Office of Nuclear Material Safety and Safeguards, Washington, D.C. April. <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1834/> (Accessed March 26, 2009).

(NRC, 2008) U.S. Nuclear Regulatory Commission. "Typical Stages of the Nuclear Fuel Cycle." November 21. <http://www.nrc.gov/materials/fuel-cycle-fac/stages-fuel-cycle.html> (Accessed August 18, 2009). ADAMS Accession No. ML101790076.

(NRC, 2009) U.S. Nuclear Regulatory Commission. "Final Interim Staff Guidance COL/ESP-ISG-004 on the Definition of Construction and on Limited Work Authorizations." February. ADAMS Accession No. ML090430435.

(NRC, 2010a) U.S. Nuclear Regulatory Commission. "Safety Evaluation Report for the Eagle Rock Enrichment Facility in Bonneville County, Idaho." Docket No. 70-7015, AREVA Enrichment Services, LLC, NUREG-1951, Office of Nuclear Material Safety and Safeguards. September. ADAMS Accession No. ML102710296.

(NRC, 2010b) U.S. Nuclear Regulatory Commission. Letter from D. Dorman (U.S. Nuclear Regulatory Commission) to G. Harper (AREVA Enrichment Services, LLC) dated March 17. “Subject: Approval of AREVA Enrichment Services LLC Exemption Request Related to Requirements Governing Commencement of Construction (TAC L32730).” ADAMS Accession No. ML093090152.

(NRC, 2010c) U.S. Nuclear Regulatory Commission. Letter from G. Jaczko (U.S. Nuclear Regulatory Commission) to J. Spratt, Jr. (U.S. House of Representatives) dated August 25. ADAMS Accession No. ML10200056.

(Spratt et al., 2010) Letter from J.M. Spratt, Jr., J. Fortenberry, A. Carson, A. Schiff, B. Foster, and D. Lamborn (U.S. House of Representatives) to G. Jaczko (U.S. Nuclear Regulatory Commission) dated June 30, 2010. ADAMS Accession No. ML101870023.

(URENCO, 2008) URENCO. “National Enrichment Facility Expansion.” Press release. December 12. <http://www.urenco.com/content/169/National-Enrichment-Facility-expansion.aspx> (Accessed February 1, 2010). ADAMS Accession No. ML101790083.

(USEC, 2009) USEC, Inc. “What’s a SWU?” <http://www.usec.com/whatisaswu.htm> (Accessed July 1, 2010).

(USEC, 2010) USEC, Inc. “Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange act of 1934 for the Fiscal Year Ended December 31, 2009.” March 1. <http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MzcxMTE0fENoaWxkSUQ9MzY4MDY0fFR5cGU9MQ==&t=1> (Accessed December 9, 2010). ADAMS Accession No. ML103480637.

(WCRM, 2010) Western Cultural Resources Management, Inc. Letter from J. Sigler (WCRM) to K. Reid (Idaho Deputy SHPO) dated November 17, 2010. “Re: To Summarize Western Cultural Resource Management’s Data Recovery Activities for the Eagle Rock Enrichment Facility Project Located in Bonneville County, Idaho.” ADAMS Accession No. ML103280087.

2 ALTERNATIVES

This chapter describes and compares the proposed action and alternatives to the proposed action. As discussed in Chapter 1, the proposed action is for AREVA Enrichment Services, LLC (AES) to construct, operate, and decommission a gas centrifuge uranium enrichment facility, known as the Eagle Rock Enrichment Facility (EREF), near Idaho Falls, in Bonneville County, Idaho. In this Environmental Impact Statement (EIS), the U.S. Nuclear Regulatory Commission (NRC) staff evaluated a reasonable range of alternatives to the proposed action, including alternative sites for the AES facility, alternative sources of low-enriched uranium, alternative technologies for uranium enrichment, and the no-action alternative. Under the no-action alternative, AES would not construct, operate, or decommission the proposed EREF. Therefore, the no-action alternative provides a basis against which the potential environmental impacts of the proposed action are evaluated and compared. The EIS also discusses alternatives for the disposition of depleted uranium hexafluoride (UF_6) resulting from enrichment operations over the lifetime of the proposed EREF.

Section 2.1 presents detailed technical descriptions of the proposed action and related actions, including descriptions of the proposed site, gas centrifuge enrichment technology, and activities at the proposed EREF. The activities at the proposed EREF are grouped under preconstruction and construction, operation, and decontamination and decommissioning. Disposition of depleted UF_6 is also discussed in Section 2.1. Section 2.2 describes the no-action alternative. Section 2.3 discusses alternatives to the proposed action that were considered but not analyzed in detail, including alternative sites, enrichment technologies other than the proposed gas centrifuge technology, and use of alternate sources of enriched uranium. The chapter concludes with a comparison of predicted environmental impacts of the proposed action and no-action alternatives (Section 2.4) and a preliminary recommendation from the NRC staff regarding the proposed action (Section 2.5).

2.1 Proposed Action

The proposed action is for AES to construct, operate, and decommission a gas centrifuge uranium enrichment facility near Idaho Falls, in Bonneville County, Idaho. To allow the proposed action, the NRC would need to grant AES a license to possess and use special nuclear material, source material, and byproduct material at the proposed EREF. The NRC license, if granted, would be for a period of 30 years (i.e., through 2041), after which AES would request renewal of the license or begin decommissioning of the proposed facility. AES initiated preconstruction activities for the proposed EREF in late 2010, under an exemption granted by NRC (see Section 1.4.1). If NRC grants the license, AES plans to start construction of the proposed EREF in 2011, begin commercial enrichment operations in 2014, and increase to the maximum target production capacity by 2022, as shown in Table 2-1.

The location of the proposed site is described in Section 2.1.1. The gas centrifuge enrichment process and the proposed facility are described in Sections 2.1.2 and 2.1.3, respectively. Section 2.1.4 describes the phases of the proposed action. The options for management of the depleted UF_6 tails generated at the proposed facility are reviewed in Section 2.1.5.

Table 2-1 Proposed Eagle Rock Enrichment Facility Schedule

Milestone	Estimated Date
Initiate Preconstruction Work	October 2010
Requested License Approval	February 2011
Initiate Facility Construction	February 2011
Start First Cascade	February 2014
Complete Heavy Construction	February 2018
Achieve Production Output of 3.3 million SWUs	March 2018
Complete Construction	February 2022
Achieve Full Nominal Production Output	March 2022
Submit Decommissioning Plan to NRC	February 2030
Complete Construction of Decontamination and Decommissioning Facility	February 2032
Decontamination and Decommissioning Completed	February 2041

Source: AES, 2010a.

Much of the information presented below on the description of the proposed site, the proposed EREF, and the proposed action and related activities is taken from information provided by AES in its Environmental Report (AES, 2010a).

2.1.1 Location and Description of the Proposed Site and Vicinity

As shown in Figures 1-1 and 2-1, the proposed EREF, if approved, would be situated on the north side of US 20, about 113 kilometers (70 miles) west of the Idaho/Wyoming State line. The proposed EREF would be located approximately 32 kilometers (20 miles) west of Idaho Falls (the nearest major city), approximately 32 kilometers (20 miles) east of Atomic City, and approximately 40 kilometers (25 miles), 60 kilometers (37 miles), and 76 kilometers (47 miles) north of Blackfoot, Fort Hall, and Pocatello, respectively. The Fort Hall Indian Reservation, which encompasses about 220,150 hectares (544,000 acres), lies to the south. The nearest boundary of the reservation is about 44 kilometers (27 miles) from the proposed site. The nearest residence is 7.7 kilometers (4.8 miles) east of the proposed site. The nearest counties are Bonneville, Jefferson, and Bingham Counties, parts of which are within 8 kilometers (5 miles) of the proposed site.

The proposed EREF would be located on a 186-hectare (460-acre) site (the “proposed site”) within a privately owned, approximately 1700-hectare (4200-acre) property (the “property” or “proposed property”) that would be purchased by AES from a single landowner (AES, 2010a). Within the 1700-hectare (4200-acre) proposed property are a 16-hectare (40-acre) parcel administered by the U.S. Bureau of Land Management (BLM) and two additional 16-hectare (40-acre) parcels for which the Federal Government had reserved rights under the *Atomic Energy Act of 1946*, as amended, to certain radioactive materials that might be present (e.g., uranium, thorium), along with the right to enter the land to prospect for, mine, and remove

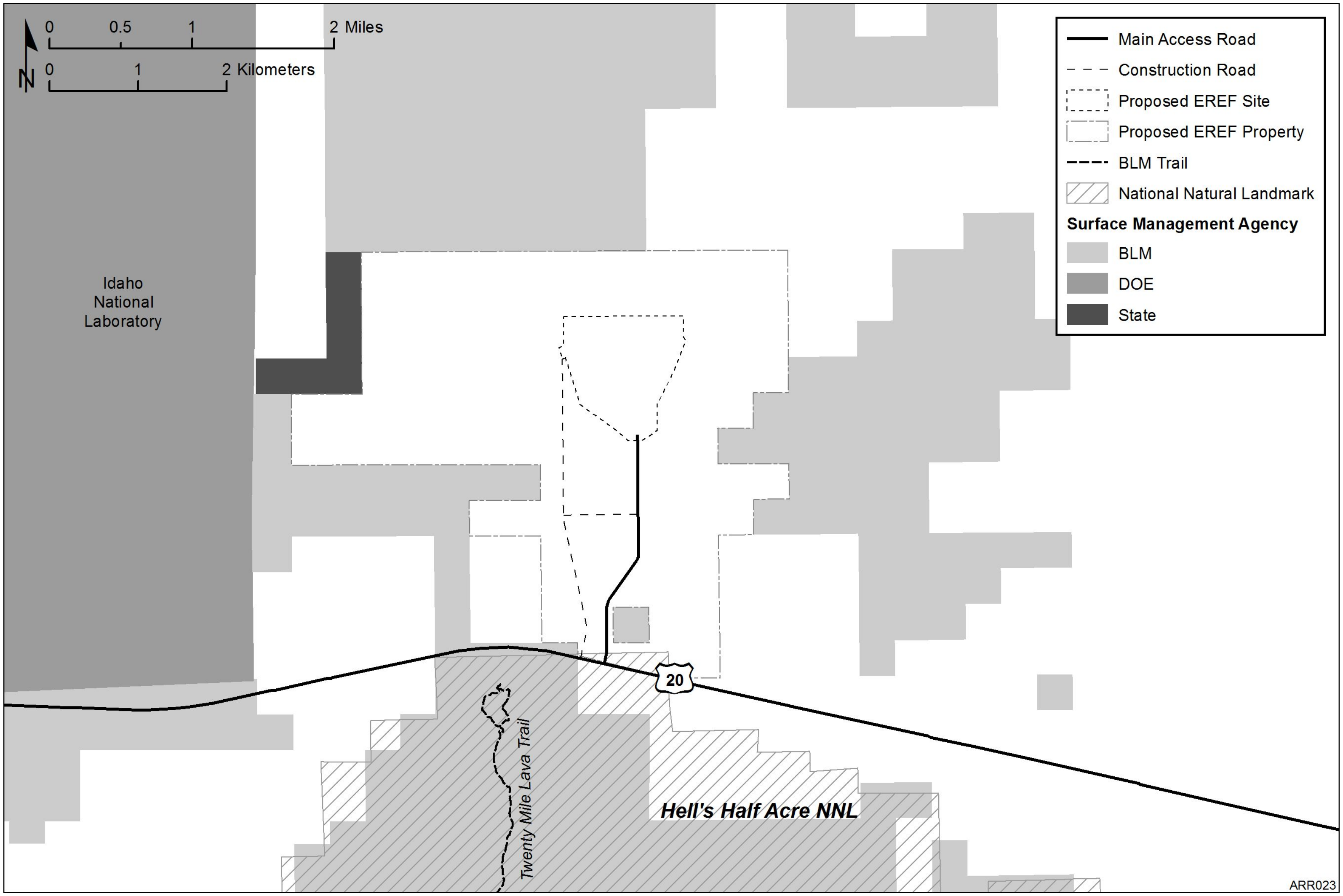

Figure 2-1 Location of the Proposed EREF Site in Bonneville County, Idaho

those materials. However, these reservations were subsequently relinquished pursuant to Section 68.b of the *Atomic Energy Act of 1954*, as amended, 42 U.S.C. 2098(b), and no longer have any legal effect on the property (AES, 2010a). The only right-of-way (ROW) on the proposed property is the ROW for US 20, which forms part of the southern property boundary.

The proposed EREF property consists primarily of relatively flat and gently sloping surfaces with small ridges and areas of rock outcrop; and is semiarid steppe covered by eolian soils of variable thickness that incompletely cover broad areas of volcanic lava flows. Uses of this property, including the proposed EREF site within it, include native rangeland, nonirrigated seeded pasture, and irrigated cropland. Wheat, barley, and potatoes are grown on 389 hectares (962 acres) of the proposed property. A potato storage facility is located at the south end. The property is seasonally grazed.

The main land uses within 8 kilometers (5 miles) of the proposed site are grazing and agriculture. Grazing occurs on State-owned land immediately to the west of the proposed property and on BLM land immediately to the east. The nearest offsite croplands are located within about 0.8 kilometer (0.5 mile) of the southeast corner of the proposed property; and the nearest feedlot and dairy operations are about 16 kilometers (10 miles) to the east.

The eastern boundary of the U.S. Department of Energy's (DOE) Idaho National Laboratory (INL) is 1.6 kilometers (1 mile) west of the proposed property. The INL land closest to the proposed site is undeveloped rangeland. The closest facility on the INL property to the proposed EREF property is the Materials and Fuels Complex (MFC), located approximately 16 kilometers (10 miles) west of the proposed property boundary. The lands north, east, and south of the proposed property are a mixture of private-, Federal-, and State-owned parcels.

Structures located within an 8-kilometer (5-mile) radius of the proposed EREF site include a transformer station (Kettle Substation) adjacent to the proposed site to the east and potato cellars, one 3.2 kilometers (2 miles) to the west of the proposed site and one 7.7 kilometers (4.8 miles) to the east. Public use areas in the immediate vicinity of the proposed AES property include a hiking trail in Hell's Half Acre Lava Field National Natural Landmark (NNL) on the south side of US 20 (see Figure 2-1). Hell's Half Acre is also a Wilderness Study Area (WSA) and is on Federal land managed by the BLM. There is also a small lava tube cave located approximately 8 kilometers (5 miles) east and south of the proposed property. The Wasden Complex, consisting of caves formed by collapsed lava tubes, is located approximately 3.2 kilometers (2 miles) northeast of the footprint of the proposed EREF.

2.1.2 Gas Centrifuge Enrichment Process

The proposed EREF would employ a proven gas centrifuge technology for enriching natural uranium (NRC, 2005b). Figure 2-2 shows the basic construction of a gas centrifuge. The technology uses a rotating cylinder (rotor) spinning at a high circumferential rate of speed inside a protective casing. The casing maintains a vacuum around the rotor and provides physical containment of the rotor in the event of a catastrophic rotor failure.

Uranium hexafluoride (UF_6) gas is fed through a fixed pipe into the middle of the rotor, where it is accelerated and spins at almost the same speed as the rotor. The centrifugal force produced by the spinning rotor causes the heavier uranium-238 hexafluoride ($^{238}UF_6$) molecules to concentrate close to the rotor wall and the lighter uranium-235 hexafluoride ($^{235}UF_6$) molecules to collect closer to the axis of the rotor. This separation effect initially occurs only in a radial direction, which increases when the rotation is supplemented by a convection current produced by a temperature difference along the rotor axis (thermoconvection). A centrifuge with this kind of gas circulation (i.e., from top to bottom near the rotor axis and from bottom to top by the rotor wall) is called a counter-current centrifuge.

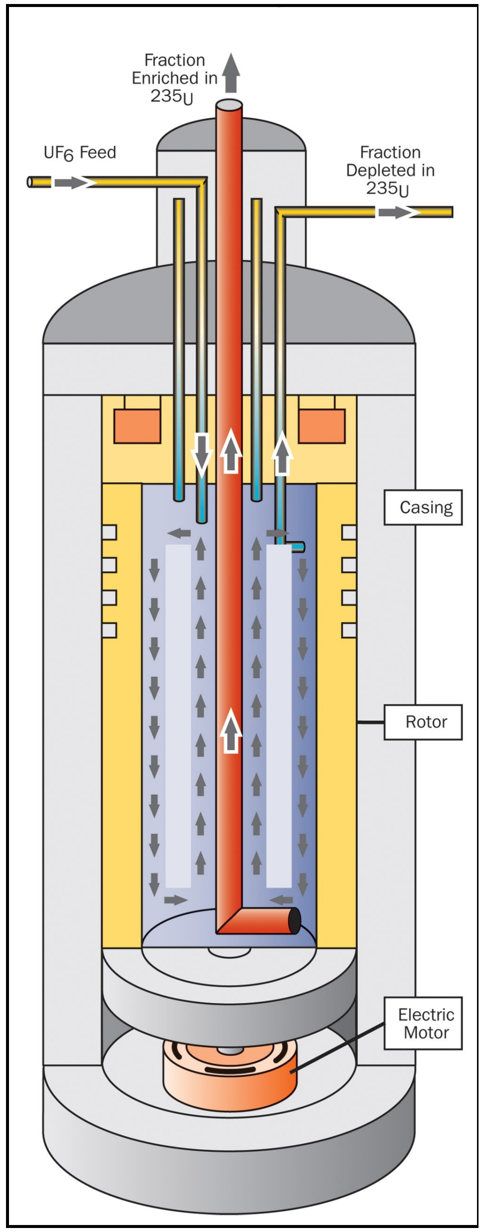

Figure 2-2 Schematic of a Gas Centrifuge (NRC, 2009a)

The inner and outer streams become more enriched/depleted in uranium-235 in their respective directions of movement. The biggest difference in concentration in a counter-current centrifuge does not occur between the axis and the wall of the rotor, but rather between the two ends of the centrifuge rotor. In the flow pattern shown in Figure 2-2, the enriched UF_6 is removed from the lower end of the rotor and the depleted UF_6 is removed at the upper end through take-off pipes that run from the axis close to the wall of the rotor.

The enrichment level achieved by a single centrifuge is not sufficient to obtain the desired concentration of 3 to 5 percent by weight of uranium-235 in a single step; therefore, a number of centrifuges are connected in series to increase the concentration of the uranium-235 isotope. Additionally, a single centrifuge cannot process a sufficient volume for commercial production, which makes it necessary to connect multiple centrifuges in parallel to increase the volume flow rate. The arrangement of centrifuges connected in series to achieve higher enrichment and in parallel for increased volume is called a “cascade.” A full cascade contains hundreds of centrifuges connected in series and parallel. Figure 2-3 is a diagram of a segment of a uranium enrichment cascade showing the flow path of the UF_6 feed, enriched UF_6 product, and depleted UF_6 gas. In the proposed EREF, 12 cascades would be grouped in a Cascade Hall, and each Separations Building Module (SBM) would house two Cascade Halls. There would be four identical SBMs in the full-capacity plant.

2.1.3 Description of the Proposed Eagle Rock Enrichment Facility

The major facility buildings and structures in the proposed EREF are described in Section 2.1.3.1. Section 2.1.3.2 describes the supporting utilities. Site access would be via the local road network, as discussed in Section 2.1.3.3.

What Is Enriched Uranium?

Uranium is a naturally occurring radioactive element. In its natural state, uranium contains approximately 0.72 percent by weight of the uranium-235 isotope, which is the fissile isotope of uranium. There is a very small (0.0055 percent) quantity of the uranium-234 isotope, and most of the remaining mass (99.27 percent) is the uranium-238 isotope. All three isotopes are chemically identical and only differ slightly in their physical properties. The most important difference between the isotopes is their mass. This small mass difference allows the isotopes to be separated and makes it possible to increase (i.e., "enrich") the percentage of uranium-235 in the uranium to levels suitable for nuclear power plants or, at very high enrichment, nuclear weapons.

Most civilian nuclear power reactors use low-enriched uranium fuel containing 3 to 5 percent by weight of uranium-235. Uranium for most nuclear weapons is enriched to greater than 90 percent.

Uranium would arrive at the proposed EREF as natural UF_6 in solid form in a Type 48X or 48Y transport cylinder from existing conversion facilities in Port Hope, Ontario, Canada; Metropolis, Illinois; or overseas sources. To start the enrichment process, the cylinder of UF_6 is heated, which causes the material to sublime (change directly from a solid to a gas). The UF_6 gas is fed into the enrichment cascade where it is processed to increase the concentration of the uranium-235 isotope. The UF_6 gas with an increased concentration of uranium-235 is known as "enriched" or "product." Gas with a reduced concentration of uranium-235 is referred to as "depleted" UF_6 or "tails."

Source: NRC, 2005b.

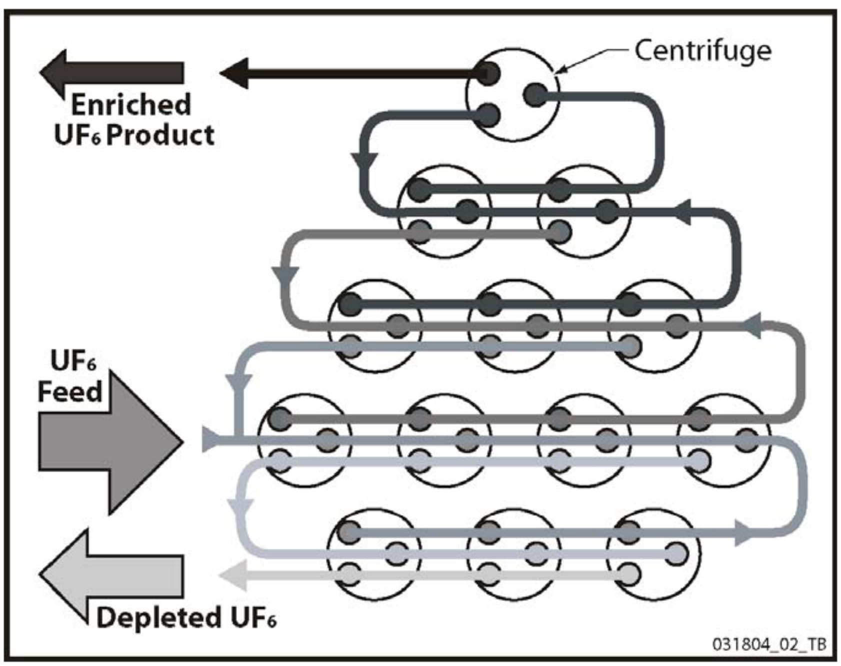

Figure 2-3 Diagram of Enrichment Cascade (NRC, 2005b)

2.1.3.1 Major Facility Buildings and Structures

Buildings/structures within the proposed EREF will include the following:

- Cylinder Storage Pads
- Centrifuge Assembly Building
- Separations Building Modules
- Cylinder Receipt and Shipping Building
- Blending, Sampling, and Preparation Building
- Technical Support Building
- Operations Support Building
- Electrical and Mechanical Services Buildings
- Administration Building
- Visitor Center
- Security and Secure Administration Building

The main process facilities at the proposed EREF are the four SBMs, with each identical unit capable of handling approximately one-quarter of plant capacity (AES, 2010a). Each SBM consists of two Cascade Halls. Each Cascade Hall is able to produce enriched UF_6 with a specific assay (weight percent uranium-235), giving the proposed EREF the capability of producing up to eight different assays at one time.

Cylinder Storage Pads

Concrete storage pads would be constructed for storing full feed cylinders (Type 48Y) containing natural UF_6 prior to use in the enrichment process, full tails cylinders (Type 48Y) containing depleted UF_6 after the enrichment process, full product cylinders (Type 30B) containing enriched UF_6 after the enrichment process, and empty feed, tails, and product cylinders. There will be a total of four pads (one pad for each of the above uses), although the empty tails pad will bisect the full tails cylinder pad.

The pads for storage of the full feed cylinders, full tails cylinders, and empty cylinders would be located next to each other on the north side of the proposed facility. The pad capacities would be 712 full feed cylinders, 25,718 full tails cylinders, and 1840 empty cylinders. The feed cylinders would be single-stacked, while the tails and empty cylinders would be double-stacked. The pad for empty cylinders would be sized to temporarily store these cylinders for up to six months. The full tails cylinders would be stacked two high in concrete saddles that would elevate them approximately 20 centimeters (8 inches) above ground level. The pad for full tails cylinders would be expanded as additional storage is required up to the maximum expected facility lifetime generation of 25,718 cylinders, if necessary (AES, 2010a). Figure 2-4 shows a cylinder stacking operation using a specialized carrier.

Full product cylinders would be single-stacked on a single pad adjacent to the Cylinder Receipt and Shipping Building. The pad would be sized to accommodate approximately 1032 cylinders.

Figure 2-4 Stacking Depleted UF_6 Cylinders in a Storage Yard (DOE, undated a)

Centrifuge Assembly Building

The Centrifuge Assembly Building would be used for the assembly, inspection, and mechanical testing of the centrifuges prior to installation in the Cascade Halls. The building would be separated into areas for centrifuge component storage, centrifuge assembly, and assembled centrifuge storage. This building would also contain the Centrifuge Test and Postmortem Facilities that would be used to test the functional performance and operational problems of production centrifuges and ensure compliance with design parameters in addition to providing an area for the dismantlement of potentially contaminated centrifuges and also to prepare for their disposal.

Separations Building Modules

The eight proposed Cascade Halls would be contained in four identical Separations Building Modules near the center of the proposed EREF. Figure 2-5 is a photograph of centrifuges inside a Cascade Hall at URENCO. Each of the eight proposed Cascade Halls would house 12 cascades, and each cascade would consist of hundreds of centrifuges connected in series and parallel to produce enriched UF_6. Each Cascade Hall would be capable of producing a maximum of 825,000 separative work units (SWUs) per year.

The centrifuges would be mounted on precast concrete floor-mounted stands (flomels). Each Cascade Hall would be enclosed by a structural steel frame supporting insulated sandwich panels (metal skins with a core of insulation) to maintain a constant temperature within the cascade enclosure.

In addition to the Cascade Halls, each SBM would house a UF_6 Handling Area and a Process Service Corridor. The UF_6 Handling Area would contain the UF_6 feed input system as well as the enriched UF_6 product and depleted UF_6 take-off systems. The Process Service Corridor would contain the gas transport piping and equipment, which would connect the cascades with each other and with the product and depleted materials take-off systems. The Process Service Corridor would also contain key electrical and cooling water systems.

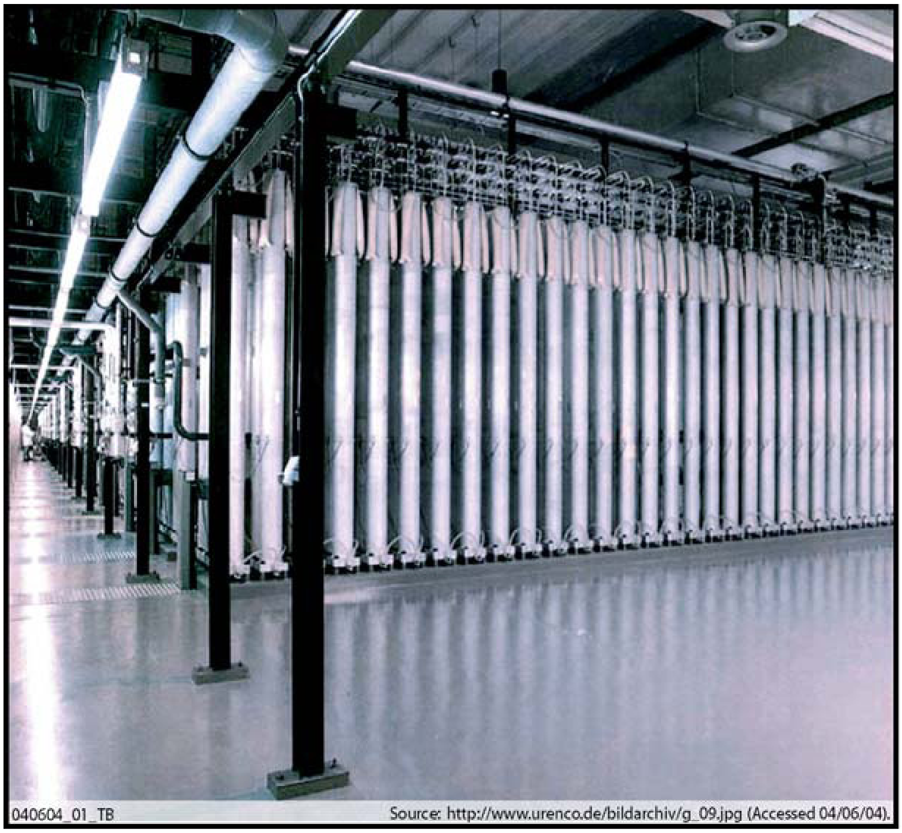

Figure 2-5 Centrifuges inside a Cascade Hall (NRC, 2005b)

Cylinder Receipt and Shipping Building

All UF_6 cylinders (feed, product, and tails) would enter and leave the proposed EREF through the Cylinder Receipt and Shipping Building. Full feed and empty product and tails cylinders delivered to the proposed EREF would be inspected, unloaded off the transport trucks, and sent to their appropriate locations. Outgoing cylinders (empty feed and full product and tails) would be prepared for shipment, including overpack protection as necessary, and loaded on the transport trucks.

Blending, Sampling, and Preparation Building

The primary function of the Blending, Sampling, and Preparation Building would be filling and sampling the Type 30B product cylinders with UF_6 enriched to customer specifications. Other activities within the building would include cylinder preparation, inspection, testing, and maintenance. The Ventilation Room, which is also located in this building, would provide a set-aside area for testing and inspecting Type 30B, 48X, and 48Y cylinders for use in the proposed EREF. The Ventilation Room would be maintained under negative pressure and would require entry and exit through an airlock.

Technical Support Building

The Technical Support Building would contain radiological support areas for the proposed facility and would act as the secure point of entry to the SBMs and the Blending, Sampling, and Preparation Building. This building would contain the following functional areas:

- The Radiation Monitoring Room would separate the uncontaminated areas from the potentially contaminated areas of the proposed plant. It would include personnel radiation monitoring equipment, hand-washing facilities, and safety showers.

- The Laundry Sorting Room would be used to sort potentially contaminated and soiled clothing and similar articles according to their level of contamination for either disposal or laundering onsite or offsite.

- The Solid Waste Collection Room would be used for processing wet and dry low-level solid waste.

- The Liquid Effluent Collection and Treatment Room would be used to collect, monitor, and treat potentially contaminated liquid effluents produced onsite.

- The Truck Bay/Shipping and Receiving Area would be used to load and ship low-level radioactive and hazardous wastes to licensed treatment and disposal facilities.

- The Gaseous Effluent Ventilation System would be used to remove uranium and other radioactive particles and hydrogen fluoride from the potentially contaminated process gas streams.

- The Decontamination Workshop would provide a facility for removing radioactive contamination from contaminated materials and equipment.

- Other workshops would provide space for maintenance of chemical traps, mobile vacuum pump skids, valves, and pumps.

- The Maintenance Facility would provide space for the normal maintenance of contaminated equipment used at the proposed EREF, as well as all instrument and control equipment, lighting, power, and associated processes and pipe work.

- The Laboratory Areas contain rooms for the receipt, preparation, analysis, and storage of various samples. A number of chemical analysis methods used for uranium isotope measurement and UF_6 quality assurance are available including mass spectrometry, atomic emission spectroscopy, alpha/beta/gamma counting, and gas Fourier transform infrared spectrometry.

Operation Support Building

The Operation Support Building would be located next to the Technical Support Building and would provide nonradiological support functions for the proposed EREF. This building would contain the following functional areas:

- The Control Room would be the main monitoring point for the entire plant and provide all of the facilities for the control of the plant.

- The Security Alarm Center would be the primary security monitoring station for the proposed facility. All electronic security systems would be controlled and monitored from this center.

- Workshops for the maintenance and repair of uncontaminated plant equipment would be provided. The Vacuum Pump Rebuild Workshop would service pumps and other miscellaneous equipment. The Mechanical, Electrical, and Instrumentation Workshop would service pump motors, all instrument and control equipment, lighting, power, and associated process and services pipe work.

- The Medical Room would provide space for a nurse's station and room for medical examinations.

- The Environmental Laboratory Area would provide rooms and space for various laboratory areas that receive, prepare, and store various samples.

Electrical and Mechanical Services Buildings

The Electrical Services Building would be adjacent to the north side of the SBMs, housing four standby diesel generators. Building heating, ventilation, and air-conditioning equipment as well as switchgears and control panels would be housed in the building.

The Mechanical Services Building would be located south of the SBMs, housing air compressors, demineralized water systems, and the centrifuge cooling water system pumps, heat exchangers, and expansion tanks.

Administration Building

The Administration Building would contain general office areas. All personnel access to the proposed EREF would occur through the Administration Building.

Visitor Center

The Visitor Center would be located outside the security fence close to US 20.

Security and Secure Administration Building

The Security and Secure Administration Building would be near the Administration Building. The building would contain secure office areas and would provide the only access (the Entry Exit Control Point) to the inside areas of the proposed EREF. Personnel must first pass through the Administration Building to gain access to the Security and Secure Administration Building.

2.1.3.2 Utilities

The proposed EREF would require the installation of water and electrical utility lines. Natural gas will not be used. Sanitary waste would be treated in a packaged domestic Sanitary Sewage Treatment Plant.

Water for the proposed facility would be provided from onsite groundwater wells. The proposed EREF's water requirement is expected to be approximately 24,900 cubic meters per year (6,570,000 gallons per year) in support of plant operations. Of this, approximately 2100 cubic meters per year (554,800 gallons per year) would be consumed by plant processes and 22,800 cubic meters per year (6,023,000 gallons per year) would be used for potable water (AES, 2010a).

The proposed EREF is anticipated to require approximately 64 megavolt-amperes (MVA) of power when all cascades are in operation (AES, 2010a). A new 161-kV electrical transmission line would be run from the existing Bonneville Substation approximately 16 kilometers (10 miles) east of the proposed EREF site (AES, 2010a). The new transmission line and associated structures would be located entirely on private land within Bonneville County. Rocky Mountain Power, a division of PacifiCorp, will be the builder, owner, and operator. The line would extend west from the Bonneville Substation 14.5 kilometers (9 miles) to the Kettle Substation, continuing an additional 1.2 kilometers (0.75 mile) to the west to the proposed EREF property. Once on the property, the transmission line would go to the north and then circle to the west and south around the proposed EREF site to the proposed new Twin-Buttes Substation, which would be adjacent to the proposed EREF site. The entire length of the transmission line would be approximately 22.1 kilometers (13.8 miles) (AES, 2010a).

A packaged sanitary sewage treatment system (Domestic Sanitary Sewage Treatment Plant) would be installed onsite for the collection and treatment of sanitary and uncontaminated liquid wastes. Residual treated effluent from the system would be discharged to the two single-lined Cylinder Storage Pads Stormwater Retention Basins where it would evaporate. The total annual discharge from the system is expected to be approximately 18,700 cubic meters per year (4,927,500 gallons per year) (AES, 2010a). This sanitary discharge source is not expected to contain any uranic material. Solid sanitary wastes from the treatment system would be temporarily stored in a holding tank and disposed of at an approved offsite location.

2.1.3.3 Local Road Network

The proposed EREF property lies immediately north of US 20, approximately 32 kilometers (20 miles) west of Idaho Falls and the junction of US 20 and Interstate 15 (I-15). US 20 extends from Idaho Falls in the east to the junction with US 26 northwest of Atomic City. The proposed EREF property lies along this route where US 20 is a two-lane highway. Access to the proposed EREF site would be from two planned access roads to US 20 (see Figure 2-6). All traffic to and from the proposed EREF (for construction, employees, and shipments) would use one of these access roads (AES, 2010a). Controlled and public access to these roads has yet to be determined by AES.

The primary shipping route for all of the proposed EREF's incoming and outgoing truck shipments would be eastbound US 20 to its intersection with I-15, which is the major

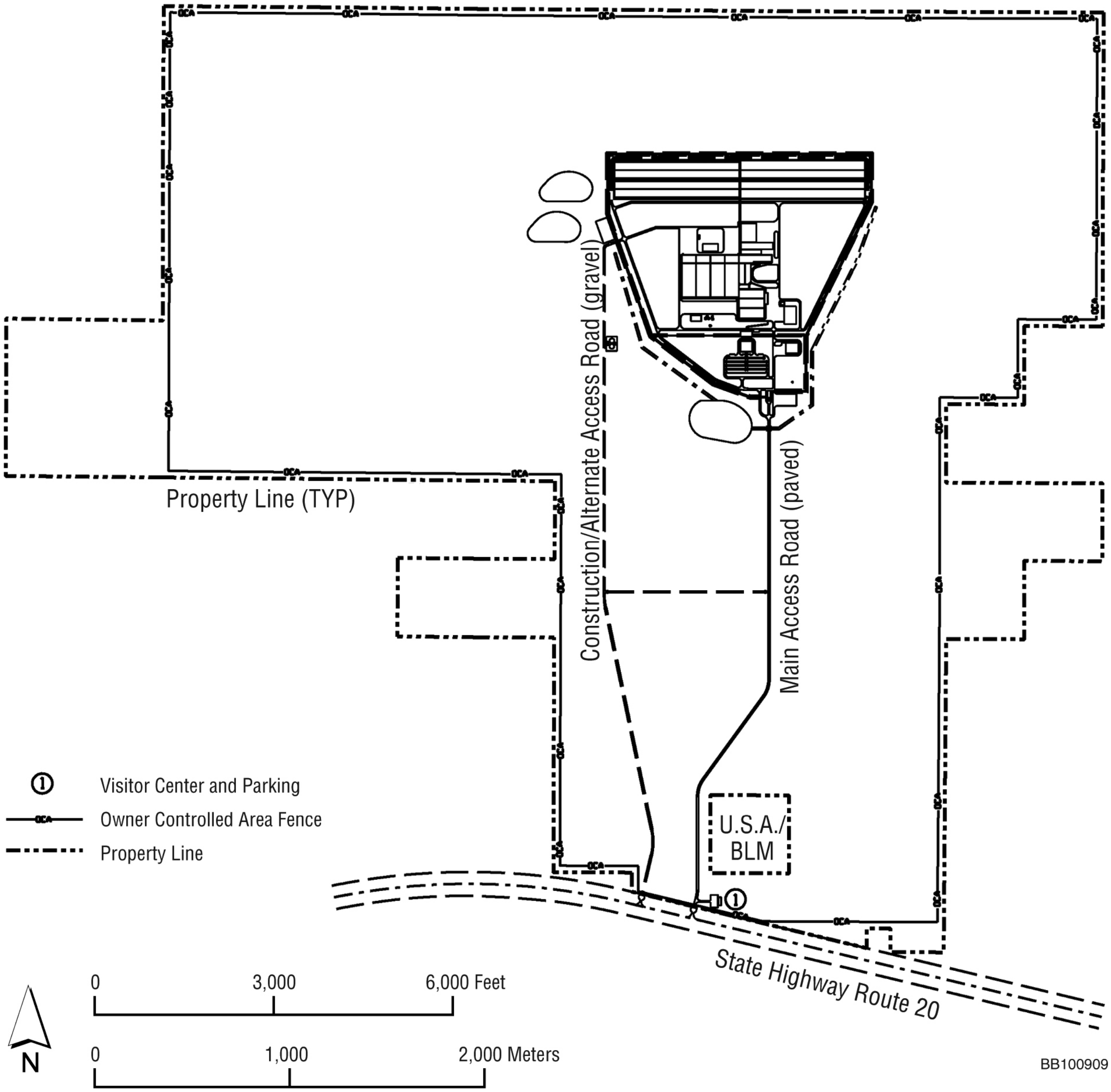

Figure 2-6 Site Plan for the Proposed Eagle Rock Enrichment Facility (AES, 2010a)

north-south access to the region. The nearest interstate highway access to the west would be I-84, which intersects US 20 approximately 296 kilometers (184 miles) away from the proposed site. Idaho Falls is also served by US 26 and US 91.

2.1.4 Description of the Phases of the Proposed Action

As discussed previously, the proposed action would be conducted in three phases: (1) preconstruction and construction, (2) facility operation, and (3) decontamination and decommissioning. Each of these phases is described in the following sections. The general site plan is shown in Figure 2-6.

2.1.4.1 Preconstruction and Construction Activities

Preconstruction

As discussed in Section 1.4.1, the NRC has approved an exemption request from AES (AES, 2009) to conduct certain preconstruction activities prior to the NRC issuing a license to AES for the construction, operation, and decommissioning of the proposed EREF. The exemption (NRC, 2010a) covers the following activities and facilities:

- clearing the site (e.g., removal of vegetation and debris)
- site grading and erosion control
- excavating the site including rock blasting and removal
- installing parking areas
- constructing the stormwater detention pond
- constructing two highway access roadways and site roads
- installing utilities (e.g., temporary and permanent power) and storage tanks
- installing fences for investment protection (not used to implement the Physical Security Plan)
- installing construction buildings, offices (including construction trailers), warehouses, and guardhouses

Conventional earthmoving and grading equipment would be used to clear and grade the site. In some areas, blasting and rock excavation may be required. Preconstruction for the proposed EREF would affect approximately 240 hectares (592 acres) on the 1700-hectare (4200-acre) proposed property. The disturbed area would consist of 186 hectares (460 acres) for construction activities (see below), including future permanent plant structures, and an additional 53.6 hectares (132.5 acres) for temporary construction facilities, parking areas, material storage, and excavated areas for underground utilities. The total disturbed area would be cleared of vegetation, and approximately 164.9 hectares (407.5 acres) would be graded. Grading would include cutting and filling approximately 778,700 cubic meters (27,500,000 cubic feet) of soil (AES, 2010a).

Facility Construction

Facility construction would encompass the erection of the SBMs and facility support structures described in Section 2.1.3. All major facility support structures would be constructed in the first 3 years (2011–2013). The first SBM would be completed in 2014, and heavy construction would continue into 2018 when the second SBM would become operational. During this period of heavy construction (2011–2018), typical building construction activities would take place involving the construction trades and associated truck deliveries of concrete, steel and steel reinforcement, wiring, piping, and other building materials. Scrap pieces of construction debris would be trucked offsite to local landfills. Hazardous waste would be sent to an appropriately licensed facility for treatment and disposal.

By early 2018, SBMs 1 and 2 would be fully operational and the building shells for SBMs 3 and 4 would have been erected. After 2018, truck delivery of centrifuge components would occur during the latter phase of construction as centrifuges are installed in the remaining SBMs with completion of the last SBM in 2022.

Temporary construction buildings and warehouses would be removed after facility construction is complete. Also, temporary construction areas, such as laydown areas, would be restored at this time.

2.1.4.2 Facility Operation

The proposed EREF would be constructed in stages to allow enrichment operations to begin while additional Cascade Halls are still under construction. Facility operation would commence with limited production after the completion of the first cascade. This ramped production schedule would allow the proposed facility to begin operation only 3 years after the license is issued. Production of enriched UF_6 product would increase from approximately 825,000 SWUs in the third year to a maximum of 6.6 million SWUs by the 10th year and start to ramp down again in the 24th year (AES, 2010a).

At full production, the proposed EREF would employ an estimated 550 full-time workers and receive up to 17,518 metric tons (19,310 tons) per year, in up to 1424 Type 48Y cylinders, of UF_6 feed material containing a concentration of 0.72 percent by weight of the uranium-235 isotope (AES, 2010a). The natural UF_6 feed material would be processed by the cascades to generate up to 2252 metric tons (2482 tons) of low-enriched UF_6 product and 15,270 metric tons (16,832 tons) of depleted UF_6 material each year.

The subsections below discuss operations in detail, including receipt of UF_6 feed material, generation of UF_6 product, shipping UF_6 product, generation rate of depleted UF_6 tails, and supporting production process systems.

Receiving UF_6 Feed Material

The natural feed material would be shipped to the proposed EREF in standard Type 48Y cylinders. This cylinder is a U.S. Department of Transportation-approved container for transporting Type A material (DOE, 1999a). The radioactive materials transported in this container are subject to 10 CFR Part 71 and 49 CFR Parts 171 to 173 shipping regulations. These regulations include requirements for an internal pressure test without leakage, free drop test without loss or dispersal of UF_6, and thermal test requirements without rupture of the containment system. In addition, shipments would be required to have fissile controls. A fully loaded Type 48Y cylinder contains approximately 12 metric tons (14 tons) of material and is shipped one per truck (DOE, 1999b). After receipt and inspection, the cylinder could be stored until needed or connected to the gas centrifuge cascade at one of several feed stations discussed in the next section. Once installed in the feed station, the transport cylinders would be heated to sublime the solid UF_6 into a gas that would be fed to the gas centrifuge enrichment cascade.

AES anticipates receiving feed cylinders at the proposed EREF from U.S. and foreign origins. In the United States, the UF_6 production facility is located in Metropolis, Illinois. The proposed EREF would receive feed cylinders from foreign UF_6 production facilities through ports in Baltimore, Maryland; and Portsmouth, Virginia; as well as from Port Hope, Ontario, Canada.

After each feed cylinder has been emptied, it would be inspected and processed for reuse. The proposed EREF would have the capability to provide for internal cleaning or decontamination of the cylinders in the Blending, Sampling, and Preparation Building. This capability is intended for preparation of the 30B enriched product cylinders, but could be used for empty feed cylinders if necessary (AES, 2010a). The empty Type 48Y feed cylinders would be used as tails cylinders to store depleted UF_6 material on the Cylinder Storage Pads or would be returned to the supplier (empty feed cylinder with a "heel").

Producing Enriched UF_6 Product

The enrichment process would begin with sublimation of the solid UF_6 into the gas phase and purification of the gaseous UF_6. The UF_6 would then be routed through the centrifuge cascades where enriched and depleted streams would be created, as discussed in Section 2.1.2. The enriched product stream and the depleted waste stream would exit the cascades separately and would be desublimed (solidified) in their respective systems. These four major elements of the enrichment process would occur in the following systems contained in the SBMs (AES, 2010b):

- UF_6 Feed System
- Cascade System
- Product Take-off System
- Tails Take-off System

In the UF_6 Feed System, feed cylinders would be loaded into Solid Feed Stations, vented for removal of light gases, primarily air and hydrogen fluoride (HF), and heated to sublime the UF_6. The light gases and UF_6 gas generated during feed purification would be routed to the Feed Purification Subsystem where the UF_6 would be desublimed in cold traps and the HF would be captured in chemical traps. The UF_6 would be then sublimed again and routed into the cascade system.

After sublimation and purification, the UF_6 would be routed through the centrifuge cascades in the Cascade System. As discussed in Section 2.1.2, each centrifuge has a thin-walled, vertical, cylindrically shaped rotor that spins around a central post within an outer casing. Feed, product, and tails streams would enter and leave the centrifuge through the central post. Control valves, restrictor orifices, and controllers would provide uniform flow of product and tails.

Depleted UF_6 exiting the cascades would be transported from the high vacuum of the centrifuge for desublimation into Type 48Y tails cylinders at subatmospheric pressure. This process would occur in the Tails Take-off System. The primary equipment in this system includes vacuum pumps and the Tails Low Temperature Take-off Stations (LTTS). Chilled air would flow over cylinders in the Tails LTTS to effect the desublimation. Filling of the Type 48Y cylinders would be monitored with a load cell system, and filled cylinders would be transferred outdoors to the Full Tails Cylinder Storage Pad.

In the Product Take-off System, enriched UF_6 from the cascades – low-enriched product between 3 and 5 percent by weight of the uranium-235 isotope – would be desublimed into Type 30B product cylinders. The Product Take-off System consists of vacuum pumps, product LTTS, UF_6 cold traps, and vacuum pump/chemical trap sets. The pumps would transport the UF_6 from the cascades to the Product LTTS at subatmospheric pressure. The heat of desublimation of the UF_6 would be removed by cooling air routed through the LTTS. The product stream normally would contain small amounts of light gases that may have passed through the centrifuges. Therefore, a UF_6 cold trap and vacuum pump/trap set would be provided to vent these gases from the Type 30B product cylinder. Any UF_6 captured in the cold trap is periodically transferred to another product cylinder for use as product or blending stock. Filling of the product cylinders would be monitored with a load cell system, and filled cylinders would be transferred to the Product Liquid Sampling System for sampling.

Blending stock would be used in the Product Blending System, which would be used to produce enrichment levels other than those produced in any given Cascade Hall. The system would contain donor stations for two donor cylinders of different assays and a receiver station. Operation of the donor and receiver stations would be similar to that for the Solid Feed Stations and the LTTS, respectively. The Product Liquid Sampling System would use autoclaves to liquefy the UF_6 in Type 30B product cylinders. Samples would be extracted from each cylinder to verify the product assay level (weight percent uranium-235).

Supporting functions of the enrichment process would include sample analysis, equipment decontamination and rebuild, liquid effluent treatment, and solid waste management. All gas-phase processes would be conducted at subatmospheric pressures to mitigate hazards, should a break in the process lines or equipment occur.

Shipping Enriched Product

Enriched UF_6 product would be shipped in a Type 30B cylinder, which is 76 centimeters (30 inches) in diameter and 206 centimeters (81 inches) long and holds a maximum of 2.3 metric tons (2.5 tons) of 5-percent enriched $^{235}UF_6$. Figure 2-7 shows Type 30B enriched product cylinders and overpacks loaded for transport. At full production, the proposed EREF would produce approximately 1032 enriched product cylinders annually for shipment to customers. Potential customers are fuel fabrication facilities in Richland, Washington; Columbia, South Carolina; Wilmington, North Carolina; and overseas through ports at Portsmouth, Virginia, and Baltimore, Maryland.

Depleted UF_6 Generation

During operation of the proposed EREF, the production of depleted UF_6 material would increase from 1909 metric tons (2105 tons) per year during initial production to 15,267 metric tons (16,830 tons) per year during peak production. This material would fill between 153 and

Figure 2-7 Truck Loaded with Five 30B Enriched Product Cylinders Loaded for Transport in Their Protective Overpacks (DOE, undated b)

1222 Type 48Y cylinders per year. Table 2-2 shows the potential maximum expected quantity of cylinders that would be filled with depleted UF_6 material each year during the anticipated life of the proposed EREF. The values presented reflect the sequential startup and shutdown of the cascades.

<u>Production Process Support Systems</u>

Enriched UF_6 would be the primary product of the proposed EREF. Production of enriched UF_6 would require the safe operation of multiple plant support systems to ensure the safe operation of the proposed facility. The supporting process systems required for the safe and efficient production of enriched UF_6 product would include the following (AES, 2010b):

- Gaseous Effluent Ventilation Systems (GEVSs)
- Liquid Effluent Collection and Treatment System
- Centrifuge Test and Postmortem Facilities Exhaust Filtration System
- Solid Waste Collection System
- Decontamination System

<u>Gaseous Effluent Ventilation Systems</u>

Gaseous effluent ventilation systems for each SBM and for the Technical Services Building would be designed to collect the potentially contaminated gaseous effluent streams in the plant and treat them before discharge to the atmosphere. Each system would route these streams through a filter system prior to exhausting out a vent stack, which would contain a continuous

Table 2-2 Depleted UF_6 Tails Generation[a]

Years (number after license is issued)	Annual Number of 48Y Tails Cylinders	Cumulative Number of 48Y Tails Cylinders
1	0	0
2	0	0
3	153	153
4	306	459
5	459	918
6	611	1529
7	764	2293
8	917	3210
9	1069	4279
10 to 23	1222	5501 to 21,387
24	1069	22,456
25	917	23,373
26	764	24,137
27	611	24,748
28	459	25,207
29	306	25,513
30	166	25,679
31	26	25,705
32	13	25,718

[a] Note that the tails generation provided by AES is conservative in that it provides a maximum number of tails cylinders that could be produced over the lifetime of the proposed EREF. It is based on a 30-year production life with appropriate ramp-up/ramp-down in capacity rather than an actual 30-year license period which includes the time necessary to first construct the proposed facility. In reality, AES would not be producing additional tails cylinders beyond 30 years after a license is issued and may start the ramp-down sooner than 24 years after the license is issued.
Source: AES, 2010b.

monitor to measure radioactivity level (alpha) and HF levels. The GEVS for SBM 1 would also serve the Blending, Sampling, and Preparation Building.

Each gaseous effluent vent system would transport potentially contaminated gases through a subatmospheric duct network to a set of redundant filters (a pre-filter, a high-efficiency particulate air [HEPA] filter, an activated carbon filter impregnated with potassium carbonate, and another HEPA filter) and fans. The cleaned gases would be discharged to the atmosphere via rooftop stacks. The fan would maintain an almost constant subatmospheric pressure in front of the filter section by means of a differential pressure controller.

Liquid Effluent Systems

The Liquid Effluent Collection and Treatment System would collect potentially contaminated liquid effluents generated in a variety of plant operations and processes. These liquid effluents would be collected and stored in tanks prior to processing. The effluent input streams would include hydrolyzed UF_6, degreaser water, citric acid, floor wash water, and miscellaneous effluent. The contaminated liquids would be processed for uranium removal through several precipitation units, filtration units, microfiltration units, and evaporation units. The final step would use an evaporation process that discharges clean steam to the atmosphere. Any resulting solid waste would be shipped offsite for disposal at an approved facility.

Centrifuge Test and Postmortem Facilities Exhaust Filtration System

The Centrifuge Test and Postmortem Facilities Exhaust Filtration System would exhaust potentially hazardous contaminants from the Centrifuge Test and Postmortem Facilities. The system would also ensure the Centrifuge Postmortem Facility is maintained at a negative pressure with respect to adjacent areas.

The ductwork would be connected to a one-filter station and would exhaust through a fan. The filter station and fan would be able to handle 100 percent of the effluent exhaust. Activities that require the Centrifuge Test and Postmortem Facilities Exhaust Filtration System to be operational would be manually stopped if the system fails or shuts down. After filtration, the clean gases would be discharged through the monitored exhaust stack on the Centrifuge Assembly Building. The Centrifuge Assembly Building exhaust stack would be monitored for hydrogen fluoride and alpha radiation.

Solid Waste Collection System

In addition to the depleted UF_6, operation of the proposed EREF would generate other radioactive and nonradioactive solid wastes. Solid waste would be segregated and processed based on its classification as wet-solid or dry-solid wastes and segregated into radioactive, hazardous, or mixed-waste categories. Wet solid waste would include wet trash (waste paper, packing material, rags, wipes, etc.), oil-recovery sludge, oil filters, miscellaneous oils (such as cutting machine oils), solvent recovery sludge, and uranic waste precipitate. Dry solid waste would include trash (combustible and nonmetallic items), activated carbon, activated alumina, activated sodium fluoride, HEPA filters, scrap metal, laboratory waste, and dryer concentrate.

Radioactive solid waste would be sent to a licensed low-level radioactive waste disposal facility. AES is considering options that include shipping its low-level radioactive waste to a treatment facility in Oak Ridge, Tennessee, and disposal sites near Richland, Washington, and Clive, Utah. Material that would be classified as mixed waste may also be handled at the Oak Ridge, Tennessee, and Clive, Utah, facilities. Nonradioactive and nonhazardous wastes – including office and warehouse trash such as wood, paper, and packing materials; scrap metal and cutting oil containers; and building ventilation filters – would be sent to a commercial landfill for disposal. Hazardous wastes would be sent to an appropriately licensed facility for treatment and disposal.

Decontamination System

The Decontamination System would be designed to remove radioactive contamination from centrifuges, pipes, instruments, and other potentially contaminated equipment. The system would contain equipment and processes to disassemble, clean and degrease, decontaminate, and inspect plant equipment. Scrap and waste material from the decontamination process would be sent to the Solid Waste Collection System or the Liquid Effluent Collection and Treatment System for segregation and treatment prior to offsite disposal at a licensed facility. Exhaust air from the decontamination system area would pass through the gaseous effluent ventilation systems before discharge to the atmosphere.

2.1.4.3 Decontamination and Decommissioning

The proposed EREF would be licensed to operate for 30 years. At the end of this period, unless AES files a timely application for license renewal, the proposed EREF would be decontaminated and decommissioned in accordance with applicable NRC license termination requirements. The intent of decommissioning is to return the entire proposed EREF site to levels suitable for unrestricted use in accordance with 10 CFR 20.1402 requirements (AES, 2010a). Decontamination and decommissioning is projected to take 9 years, beginning in 2032 with completion expected in 2041. The SBMs would be decommissioned in the first 8 years, and there would be one additional year for final site surveys and activities (AES, 2010b). SBM 1 is scheduled to be the first to operate and would be the first to undergo decontamination and decommissioning. Decontamination and decommissioning of the other SBMs would follow in turn. SBM 4 would be the last module to operate and to be decommissioned. The remaining plant systems and buildings would be decommissioned after final shutdown of SBM 4 (AES, 2010b). All proprietary equipment and radiologically contaminated components would be removed, decontaminated, and shipped to a licensed disposal facility. The buildings, structures, and selected support systems would be cleaned and released for unrestricted use.

Decontamination and decommissioning of the proposed EREF would be funded in accordance with the Decommissioning Funding Plan (DFP) for the proposed EREF (AES, 2010b). The DFP, prepared by AES in accordance with 10 CFR 70.25(a) and the guidance in NUREG-1757 (NRC, 2006), would provide information required by 10 CFR 70.25(e) regarding AES's plans for funding the decommissioning of the proposed EREF and the disposal of depleted uranium tails generated as a result of plant operations. Funding would be provided by AES by means of a Letter of Credit in accordance with NRC regulations in 10 CFR Part 70 and guidance in NUREG-1757 (NRC, 2006).

Decontamination and decommissioning activities for the proposed EREF are anticipated to occur more than 20 years in the future, and therefore only a general description of the activities that would be conducted can be developed at this time for the EIS. The proposed facility would follow NRC decommissioning requirements in 10 CFR 70.38.

Decommissioning of a facility such as the proposed EREF would generally include the following activities:

- installation of decontamination facilities
- purging of process systems and equipment
- dismantling and removal of facilities and equipment
- decontamination and destruction of confidential materials
- decontamination of equipment, facilities, and structures
- survey and spot decontamination of outdoor areas
- removal and sale of any salvaged materials
- removal and disposal of wastes
- management and disposal of depleted uranium
- final radiation survey to confirm that the release criteria have been met

At the end of the useful life of each SBM, the enrichment process equipment would be shut down and UF_6 removed to the fullest extent possible by normal process operation. This would be followed by evacuation and purging with nitrogen. The shutdown and purging portion of the decommissioning process would take approximately 3 months for each cascade.

Decontamination Facilities

New decontamination facilities would be constructed in existing site buildings such as the Centrifuge Assembly Building prior to shutdown of SBM 1. The decontamination facilities would provide specialized handling of the thousands of centrifuges along with the UF_6 vacuum pumps and valves.

Contaminated plant components would be cut up or dismantled and then processed through the decontamination facilities. Contamination of site structures would be limited to areas in the Separations Building Modules and Technical Services Building, and would be maintained at low levels throughout plant operation by regular surveys and cleaning. The use of special sealing and protective coatings on porous and other surfaces that might become radioactively contaminated during operation would simplify the decontamination process, and the use of standard good-housekeeping practices during operation of the proposed facility would ensure that final decontamination of these areas would require minimal removal of surface concrete or other structural material.

Dismantling the Facility

Dismantling would require cutting and disconnecting all components requiring removal. The activities would be simple but very labor-intensive and would generally require the use of protective clothing. The work process would be optimized through consideration of the following measures:

- minimizing the spread of contamination and the need for protective clothing

- balancing the number of cutting and removal operations with the resultant decontamination and disposal requirements

- optimizing the rate of dismantling with the rate of decontamination facility throughput

- providing storage and laydown space as required for effective workflow, criticality, safety, security, etc.

- balancing the cost of decontamination and salvage with the cost of disposal

To avoid laydown space and contamination problems, dismantling would proceed generally no faster than the downstream decontamination process.

Items to be removed from the facilities would be categorized as potentially reusable equipment, recoverable scrap, and wastes. However, operating equipment would not be assumed to have reuse value after 30 years of operation. Wastes would also have no salvage value.

A significant amount of scrap aluminum, steel, copper, and other metals would be recovered during the disassembly of the enrichment equipment. For security and convenience, the uncontaminated materials would likely be shredded or smelted to standard ingots and, if possible, sold at market price. The contaminated materials would be disposed of as low-level radioactive waste.

Prompt decontamination or removal of all materials from the proposed site that would prevent release of the facility for unrestricted use would be performed. This approach would avoid long-term storage and monitoring of radiological and hazardous wastes onsite. All of the enrichment equipment would be removed, and only the building shells and site infrastructure would remain. All remaining facilities would be decontaminated to levels that would allow for unrestricted use.

Disposal

All wastes produced during decontamination and decommissioning would be collected, handled, and disposed of in a manner similar to that described for those wastes produced during normal operation. Wastes would consist of normal industrial trash, nonhazardous chemicals and fluids, small amounts of hazardous materials, and radioactive wastes. Radioactive wastes would consist primarily of crushed centrifuge rotors, trash, and citric cake. Citric cake consists of uranium and metallic compounds precipitated from citric acid decontamination solutions.

Radioactive wastes would ultimately be disposed of in licensed low-level radioactive waste disposal facilities. Hazardous wastes would be disposed of in licensed hazardous waste disposal facilities. Nonhazardous and nonradioactive wastes would be disposed of in a manner consistent with good industrial practice and in accordance with applicable regulations. A complete estimate of the wastes and effluent to be produced during decommissioning would be provided in the Decommissioning Plan that AES would submit prior to the start of the decommissioning.

Final Radiation Survey

A final radiation survey would verify complete decontamination of the proposed EREF prior to allowing the proposed site to be released for unrestricted use. The evaluation of the final radiation survey would be based in part on an initial radiation survey performed prior to initial operation. The initial site radiation survey would determine the natural background radiation levels in the area of the proposed EREF, thereby providing a benchmark for identifying any increase in radioactivity levels in the area. The final survey would measure radioactivity over the entire site and compare it to the original benchmark survey. The intensity of the survey would vary depending on the location (i.e., the buildings, the immediate area around the buildings, and the remainder of the site). A final radiation survey report would document the survey procedures and results, and would include, among other things, a map of the survey of the proposed site, measurement results, and a comparison of the proposed EREF site’s radiation levels to the surrounding area. The results would be analyzed to show that they were below allowable residual radioactivity limits; otherwise, further decontamination would be performed.

2.1.5 Depleted Uranium Management

The term “depleted uranium” refers to any chemical form of uranium (e.g., UF_6 and U_3O_8) that contains uranium-235 in concentrations less than the 0.7 percent found in natural uranium. As discussed in Section 2.1.4.2, the uranium enrichment process would generate a depleted UF_6 stream (also called tails). In contrast to the uranium in the enriched UF_6 produced by the enrichment facility, the uranium in the depleted UF_6 stream would be depleted in the uranium-235 isotope of uranium. At full production, the proposed EREF would generate 15,270 metric tons per year (16,800 tons per year) of depleted UF_6. Initially, the depleted UF_6 would be stored in

Waste Classification of Depleted Uranium

Depleted uranium is different from most low-level radioactive waste in that it consists mostly of long-lived isotopes of uranium, with small quantities of thorium-234 and protactinium-234. Depleted uranium is source material as defined in 10 CFR Part 40, and, if treated as a waste, it falls under the definition of low-level radioactive waste per 10 CFR 61.2. The Commission affirmed that depleted uranium is properly considered a form of low-level radioactive waste in Louisiana Energy Services, L.P. (National Enrichment Facility), CLI-05-5, 61 NRC 22 (January 18, 2005). This means that depleted uranium could be disposed of in a licensed low-level radioactive waste facility if the licensing requirements for land disposal of radioactive waste as indicated in 10 CFR Part 61 are met.

Sources: NRC, 1991, 2005b.

Type 48Y cylinders on the Full Tails Cylinder Storage Pads (AES, 2010a). Each Type 48Y cylinder would hold approximately 12.5 metric tons (13.8 tons), which means that at full production the proposed site would generate approximately 1222 cylinders of depleted UF_6 every year. During the operation of the proposed facility, the plant could generate and store up to 25,718 cylinders of depleted UF_6 (AES, 2010a). AES would own the depleted UF_6 and maintain the cylinders while they are in storage. Maintenance activities would include periodic inspections for corrosion, valve leakage, and distortion of the cylinder shape, and touch-up painting as required. Problem cylinders would be removed from storage and the material transferred to another storage cylinder. The proposed storage area would be kept neat and free of debris, and all stormwater or other runoff would be routed to the Cylinder Storage Pad Stormwater Retention Basins for monitoring and evaporation.

The Defense Nuclear Facilities Safety Board (DNFSB) has reported that long-term storage of depleted UF_6 in the UF_6 form represents a potential chemical hazard if not properly managed (DNFSB, 1995). For this reason, the strategic management of depleted uranium includes the conversion of depleted UF_6 stock to a more stable uranium oxide (e.g., triuranium octaoxide [U_3O_8]) form for long-term management (OECD, 2001). Also, the DOE evaluated multiple disposition options for depleted UF_6 and agreed that conversion to U_3O_8 was preferable for long-term storage and disposal of the depleted uranium in its oxide form, due to the chemical stability of U_3O_8 (DOE, 2000). Therefore, the disposal option considered in the EIS is the conversion of the depleted UF_6 to U_3O_8 at either a DOE-owned or commercial conversion facility followed by disposal as U_3O_8. Direct disposal of depleted UF_6 was ruled out because of its chemical reactivity (DOE, 1999b).

2.1.5.1 Conversion of Depleted UF_6

AES has requested the DOE to accept all depleted UF_6 generated at the proposed EREF for conversion to the oxide form for disposal (AES, 2010a). This plan is based on Section 3113 of the 1996 *USEC Privatization Act*, 42 U.S.C. 2297h-11, which states the DOE “shall accept for disposal low-level radioactive waste, including depleted uranium if it were ultimately determined to be low-level radioactive waste, generated by ... any person licensed by the Nuclear Regulatory Commission to operate a uranium enrichment facility under section 53, 63, and 193 of the *Atomic Energy Act of 1954* (42 U.S.C. 2073, 2093, and 2243).” On January 18, 2005, the Commission issued its ruling that depleted uranium is considered a form of low-level radioactive waste (NRC, 2005a). The Commission also stated that, pursuant to Section 3113 of the *USEC Privatization Act*, disposal at a DOE facility represents a “plausible strategy” for the disposition of depleted uranium tails (NRC, 2005a).

DOE has constructed two conversion plants to convert the depleted UF_6 now in storage at Portsmouth, Ohio, and Paducah, Kentucky, to U_3O_8 and hydrofluoric acid. Both plants are currently undergoing operational tests. The Portsmouth plant is expected to go into full operation in summer 2011, and the Paducah plant by early fall of 2011 (Sparks, 2011). AES would transport the depleted UF_6 generated by the proposed EREF to either of these new facilities and pay DOE to convert and dispose of the material. The proposed EREF would generate approximately 321,235 metric tons (354,101 tons) in total over its operating lifetime (AES, 2010a). The depleted UF_6 would be processed in a DOE-operated conversion facility and then shipped offsite for disposal.

Depleted UF_6 Conversion Process

Depleted UF6 conversion is a continuous process in which depleted UF6 is vaporized and converted to U3O8 by reaction with steam and hydrogen in a fluidized-bed conversion unit. The hydrogen is generated using anhydrous ammonia, although an option of using natural gas is being investigated. Nitrogen is also used as an inert purging gas and is released to the atmosphere through the building stack as part of the clean off-gas stream. The depleted U3O8 powder is collected and packaged for disposition. The process equipment would be arranged in parallel lines. Each line would consist of two autoclaves, two conversion units, a hydrofluoric acid recovery system, and process off-gas scrubbers. The Paducah facility would have four parallel conversion lines. Equipment would also be installed to collect the hydrofluoric acid co-product and process it into any combination of several marketable products. A backup hydrofluoric acid neutralization system would be provided to convert up to 100 percent of the hydrofluoric acid to calcium fluoride for storage and/or sale in the future, if necessary.

Source: DOE, 2004a,b.

In addition to the DOE disposition option for depleted UF_6, one or more NRC-licensed commercial depleted UF_6 conversion facilities may become available during the proposed EREF's operational lifetime. One commercial entity (International Isotopes, Inc.) submitted a license application (International Isotopes, 2009) on December 31, 2009, to construct and operate a new depleted UF_6 "de-conversion" facility in Hobbs, New Mexico.

The NRC staff is currently reviewing this application (NRC, 2010b). Although International Isotopes calls its process "de-conversion," it is similar to DOE's conversion process. If a commercial facility performs the conversion to U_3O_8, DOE is still obligated to accept the U_3O_8 for disposal if requested by AES, per Section 3113 of the *USEC Privatization Act*.

2.1.5.2 Disposal of Depleted Uranium

The Commission has stated that depleted uranium in any form (e.g., UF_6, U_3O_8) is considered a form of low-level radioactive waste (NRC, 2005a). However, the chemical reactivity of depleted UF_6 precludes it from being a stable waste form, and thus makes it unsuitable for direct disposal without conversion (DOE, 1999b). As discussed in Section 2.1.5.1, AES has requested the DOE to accept all depleted UF_6 generated at the proposed EREF for conversion to the oxide form for disposal (AES, 2010a). After conversion of depleted uranium tails (depleted UF_6) to U_3O_8, disposal of this U_3O_8 at a commercial low-level waste disposal facility would be a viable option if the disposal facility meets the requirements of 10 CFR Part 61.

2.2 No-Action Alternative

Under this alternative, AES would not construct, operate, and decommission the proposed EREF in Bonneville County, Idaho. Under the no-action alternative, the NRC assumes that the preconstruction activities that have been approved by exemption and are described in Section 2.1.4.1 will take place.

Under the no-action alternative, the uranium fuel fabrication facilities in the United States would continue to obtain low-enriched uranium from the currently available sources or potential new sources. As described in Section 1.3.1, the two currently available domestic sources of low-enriched uranium available to fuel fabricators are the Paducah Gaseous Diffusion Plant (PGDP) and the URENCO USA facility. Foreign enrichment sources are currently supplying as much as 85 percent of U.S. nuclear power plants' demand.

The Megatons to Megawatts Program will expire by 2013, potentially eliminating downblending as a source of low-enriched uranium (LEU) (DOE, 2010). The PGDP, which opened in 1952, uses gaseous diffusion technology, a process that is more energy intensive than newer technologies such as gas centrifuge. The NRC has already granted licenses to two commercial entities to construct and operate gas centrifuge enrichment facilities: the Louisiana Energy Services (LES) URENCO USA facility in New Mexico and the USEC American Centrifuge Plant (ACP) in Ohio. These two facilities are currently under construction and are designed to produce 3 million and 3.5 million SWUs per year, respectively, when complete and generating at full licensed capacity. However, the URENCO USA facility, while currently operating, is still under construction and is not expected to reach half of its currently licensed annual capacity of 3 million SWUs until August 2011, and LES has yet to submit an application to the NRC for a potential expansion from 3 million to 5.9 million SWUs per year. In addition, the NRC is currently reviewing an application from GE-Hitachi Global Laser Enrichment, LLC to construct and operate the Global Laser Enrichment (GLE) Facility, a proposed laser-based enrichment facility that would be located in North Carolina. If the GLE Facility is licensed and constructed, it would produce enriched uranium with annual production levels of up to 6 million SWU annually. If the three facilities begin operations, this would represent a more efficient and less costly means of producing low-enriched uranium than the current gaseous diffusion technology at the PGDP.

2.3 Alternatives Considered but Eliminated

As required by NEPA and NRC regulations, the NRC staff has considered alternatives to the proposed action of construction, operation, and decommissioning of the proposed EREF. The range of alternatives to the proposed action was determined by considering the underlying purpose and need for the proposed action. Specifically, the range of alternatives was determined by considering other ways to provide enriched uranium to fulfill electricity generation requirements and provide reliable and economic domestic supplies of enriched uranium for national energy security. This analysis led to the following set of alternatives:

- alternative sites other than the proposed Bonneville County site

- alternative sources of LEU

- alternative technologies available for uranium enrichment

These alternatives were considered but eliminated from further analysis based on economic, environmental, national security, or technological maturity factors. The following sections discuss these alternatives and the reasons NRC staff eliminated them from further consideration.

2.3.1 Alternative Sites

This section discusses AES's site-selection process and site selection criteria, and identifies the alternative sites for the proposed AES uranium enrichment facility (including the proposed EREF site in Bonneville County, Idaho). AES used a structured four-step approach to select a preferred site within the United States that met technical, environmental, safety, and business requirements (AES, 2010a):

1. Identify potential regions and sites,
2. Screen candidate sites (Phase I),
3. Evaluate sites passing Phase I criteria (Phase II), and
4. Identify a preferred site.

The primary objectives of environmental acceptability, meeting technical requirements, and providing operational efficiencies were adhered to by AES throughout the screening process. Many environmental impacts can be avoided or significantly reduced through proper site selection.

The NRC staff reviewed the AES site-selection process to determine if a site considered by AES was obviously superior to the proposed EREF site in Bonneville County, Idaho (NRC, 2002). The NRC staff determined that the process used by AES was rational and objective, and that the results were reasonable. None of the candidate sites was obviously superior to the AES preferred site in Bonneville County, Idaho.

2.3.1.1 Identification of Regions and Sites

Four criteria were used for the identification of suitable regions in which to site a proposed uranium enrichment facility:

1. *Peak ground acceleration (PGA).* Consideration of PGA is necessary due to centrifuge sensitivity to vibration; U.S. Geological Survey (USGS) general seismic hazard maps were reviewed to identify areas with a PGA less than 0.09g.

2. *Tornado frequency*. Construction of facilities designed to withstand tornado wind speeds greater than 257 kilometers per hour (160 miles per hour; probability of 10^{-5} per year) was considered to be cost-prohibitive to meeting design standards and safety and operational requirements.

3. *Hurricane frequency*. Areas were identified where hurricanes with wind speeds no greater than 154 kilometers per hour (96 miles per hour) were likely to occur in order to meet design standards and safety and operational requirements.

4. *Severe winter weather*. Evaluated because of their potential impact on maintaining operations, weather and road closure data were reviewed in order to avoid areas with a high potential for road closures caused by severe winter weather.

Areas of the United States that were clearly to be avoided because of seismic or weather concerns were excluded from further consideration. Those regions that were marginal were retained. Figure 2-8 shows the regions of the United States that were found to meet the initial four criteria. Suitable sites were identified within the retained areas with assistance from local elected officials and economic development organizations.

2.3.1.2 Screen Candidate Sites (Phase I)

Following application of the initial criteria, the 44 sites as identified in Table 2-3 were considered in the next site selection step. Phase I screening consisted of evaluation of the candidate sites against 11 criteria. Professional judgment was used by AES staff to assign a passing or failing grade to each criterion. Sites were not considered further if they failed any one criterion. The criteria used were: (1) Seismic History, (2) Geology, (3) Facility/Site (site size relative to facility footprint), (4) Redundant Electrical Power Supply, (5) Flooding Potential, (6) Prior Land Contamination, (7) Availability of Existing Site Data, (8) Threatened and Endangered Species near or on site, (9) Sensitive Properties (e.g., national parks), (10) Climate and Meteorology, and (11) Wetlands within the Facility Footprint on the site. Table 2-3 summarizes the results of the Phase I screening. Based on this screening, 10 of the 44 sites were recommended for further evaluation. Figure 2-9 shows the locations of these 10 sites.

2.3.1.3 Site Evaluation (Phase II)

A decision analysis approach known as multi-attribute analysis was used to produce a consistent, repeatable, and documented evaluation of the 10 candidate sites identified by Phase I screening. Site rankings were assigned based on 38 criteria spanning the 12 categories and the 3 site selection objectives shown in Figure 2-10. The weighting system used by AES, as shown in Table 2-4, was assigned to each objective, category, and criterion and was applied to a score of 1 to 10, which was given to each criterion for a particular site. Table 2-5 summarizes the features and drawbacks of each site. Figure 2-11 summarizes the total weighted scores for the candidate sites, with the Bonneville site having the highest score by a slim margin over the McNeil site.

2.3.1.4 Preferred Site Identification

Forty-four sites in 7 States of 54 potential sites in 9 States were passed on from Step 1 to Step 2 (Phase I) of the selection process. The Phase I selection process identified 10 candidate sites (see Figure 2-9) for detailed evaluation in Phase II. The Phase II evaluation demonstrated that all 10 sites would be technically and environmentally suitable locations for AES's proposed uranium enrichment facility, with none obviously superior to the others. AES selected the Bonneville County, Idaho, site as the proposed site for an enrichment plant because this site has the greatest amount of acreage; readily available water supply; some of the lowest estimated costs for electric power, labor, and materials; and Bonneville County and the State of Idaho have shown strong support for the proposed enrichment plant. The second highest rated site, the McNeil, Idaho, site, has a size that is only one-quarter that of the Bonneville County site and has a much closer nearest resident that is about 2.0 kilometers (1.25 miles) away vs. 7.6 kilometers (4.75 miles) for the Bonneville County site. With the larger size (which provides a greater distance to the site boundary from the proposed facility) and greater distance to the nearest resident, selection of the Bonneville County site would be expected to result in reduced air, visual, noise, human health, transportation, and potential accident impacts as compared to those at the McNeil, Idaho, site.

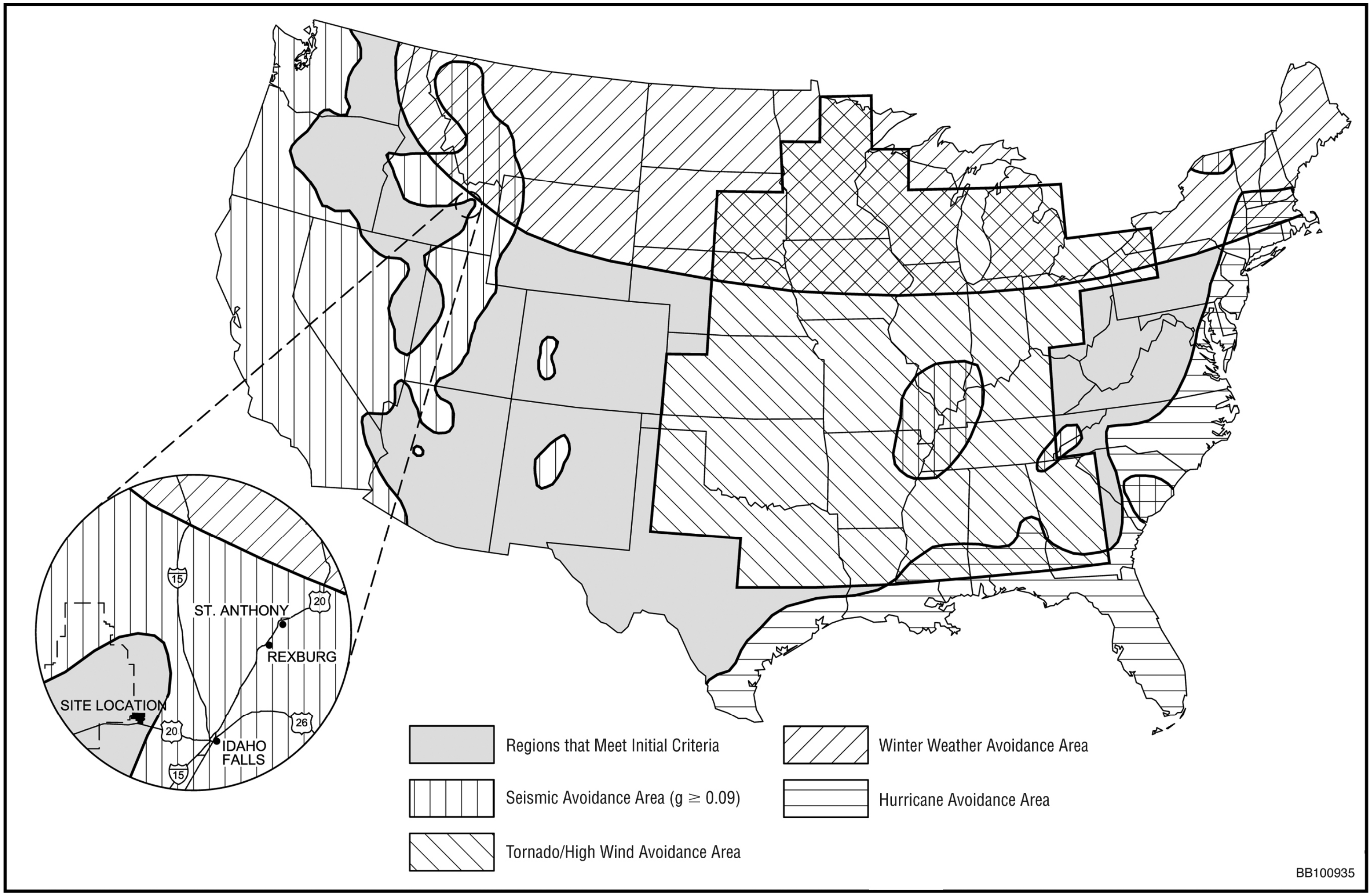

Figure 2-8 United States Regions Meeting the Original Site Selection Criteria (modified from AES, 2010a)

Table 2-3 Candidate Sites for Phase I Screening

No.	County, State	Site	Result: Basis for Exclusion
1	Bonneville, ID	Bonneville	Passed: Evaluated in Phase II
2	Bonneville, ID	McNeil	Passed: Evaluated in Phase II
3	Power, ID	Power County-1	Failed: Sensitive properties
4	Power, ID	Power County-2	Failed: Contamination
5	Bingham, ID	Blackfoot	Failed: Sensitive properties
6	Butte, ID	Atomic City	Failed: Ownership/transfer
7	Lea, NM	ELEA	Passed: Evaluated in Phase II
8	Lea, NM	Lea County-1	Failed: Data availability
9	Lea, NM	Lea County-2	Failed: Wetlands
10	Lea, NM	Lea County-3	Failed: Karst
11	Eddy, NM	Seven Rivers	Failed: Size, bisected by a public road
12	Eddy, NM	Berry Parcel	Failed: Liquefaction
13	Eddy, NM	Harroun	Failed: Liquefaction, karst, electric power, sensitive properties
14	Eddy, NM	Becker	Failed: Liquefaction, karst, contamination
15	Eddy, NM	WIPP-1	Failed: Ownership/transfer
16	Eddy, NM	WIPP-2	Passed: Evaluated in Phase II
17	Pike, OH	Portsmouth	Passed: Evaluated in Phase II
18	Pike, OH	Zahn’s Corner-1	Failed: Size, contamination, wetlands
19	Pike, OH	Zahn’s Corner-2	Failed: Wetlands, contamination
20	Aiken, SC	Savannah River Site (DOE)	Failed: Ownership/transfer, endangered species, wetlands
21	Cherokee, SC	Jobe Sand	Failed: Size
22	Laurens, SC	Copeland Stone	Failed: Sensitive properties, wetlands
23	Laurens, SC	Fleming Smith	Passed: Evaluated in Phase II
25	Greenwood, SC	Solutia	Failed: Size
26	Chester, SC	L&C Mega Site	Failed: Data availability, wetlands
27	Edgefield, SC	Gracewood	Failed: Wetlands
28	Andrews, TX	Grist	Passed: Evaluated in Phase II
29	Andrews, TX	Tom	Failed: Site characterization data
30	Andrews, TX	Parker	Failed: Site characterization data

Table 2-3 Candidate Sites for Phase I Screening (Cont.)

No.	County, State	Site	Result: Basis for Exclusion
31	Andrews, TX	Fisher	Failed: Site characterization data
32	Andrews, TX	WCS-1	Modified: To become part of WCS-2
33	Andrews, TX	WCS-2	Passed: Evaluated in Phase II
34	Martin, TX	Midland North	Failed: Site characterization data
35	Midland, TX	Midland South	Failed: Data availability
36	Amherst, VA	Amherst County-1	Failed: Floodplains, wetlands
37	Amherst, VA	Amherst County-2	Failed: Endangered species, sensitive properties
38	Appomattox, VA	Concord	Failed: Floodplains, wetlands
39	Carroll, VA	Wildwood	Passed: Evaluated in Phase II
40	Benton, WA	West Richland	Failed: Seismic, faults
41	Benton, WA	Horn Rapids (DOE)	Passed: Evaluated in Phase II
42	Benton, WA	Energy NW-1 (DOE)	Failed: Faults, contamination, ownership/transfer
43	Benton, WA	Energy NW-2 (DOE)	Failed: Contamination, ownership/transfer
44	Benton, WA	Highway 240 (DOE)	Failed: Seismic, ownership/transfer, sensitive properties

2.3.2 Alternative Sources of Low-Enriched Uranium

The NRC staff examined three alternatives to fulfill U.S. domestic enrichment needs. These alternatives were eliminated from further consideration for reasons summarized below.

2.3.2.1 Re-Activate the Portsmouth Gaseous Diffusion Facility at Piketon

In 2001, USEC closed the Portsmouth Gaseous Diffusion Plant (GDP) (in Piketon, Ohio) to reduce operating costs (DOE, 2003). USEC cited long-term financial benefits, more attractive power price arrangements, operational flexibility for power adjustments, and a history of reliable operations as reasons for choosing to continue operations at the Paducah GDP. In a June 2000 press release, USEC explained that it “clearly could not continue to operate two production facilities.” (USEC, 2000). Key business factors in USEC’s decision to reduce operations to a single production plant included long-term and short-term power costs, operational performance and reliability, design and material condition of the plants, risks associated with meeting customer orders on time, and other factors relating to assay levels, financial results, and new technology issues (USEC, 2000).

The NRC staff does not believe that there has been any significant change in the factors that were considered by USEC in its decision to cease uranium enrichment at the Portsmouth GDP. In addition, the gaseous diffusion technology is substantially more energy intensive than other enrichment technologies. The higher energy consumption results in larger indirect impacts, especially those impacts that are attributable to significantly higher electricity usage (e.g., air

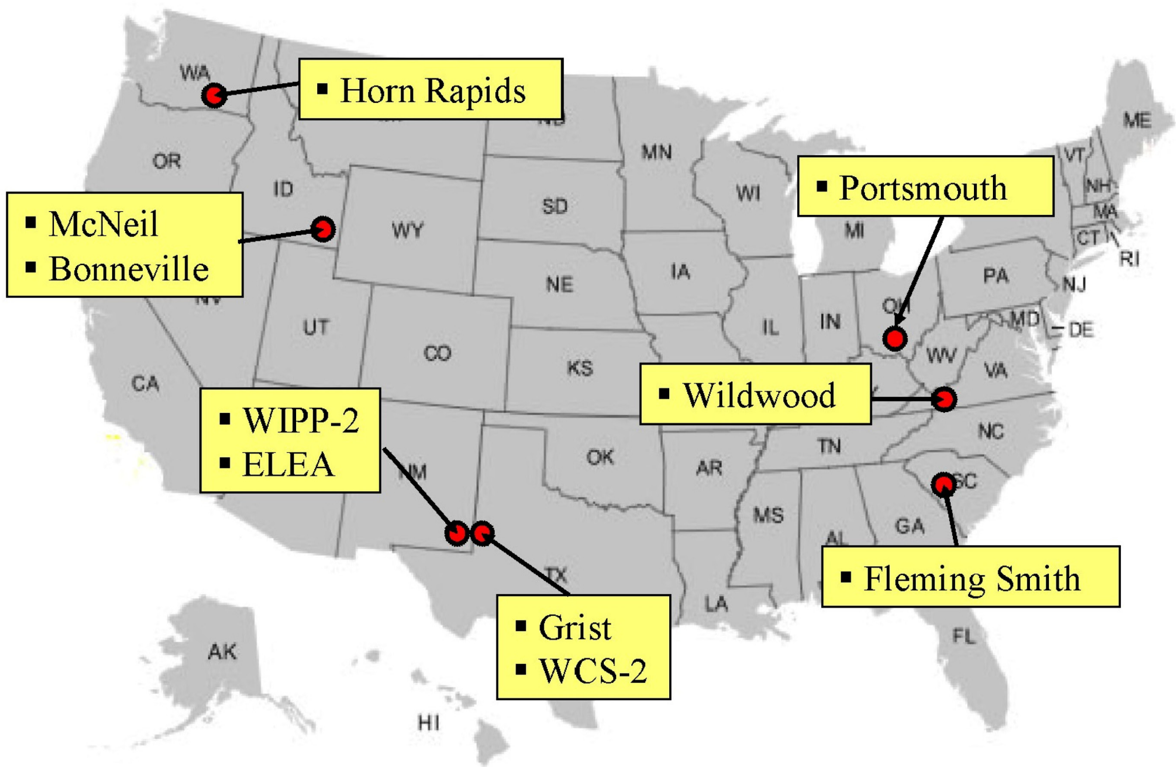

Figure 2-9 Final 10 Candidate Gas Centrifuge Uranium Enrichment Facility Site Locations (AES, 2010a)

emissions from coal-fired electricity generation plants) (DOE, 1995). The age of the existing plant also calls into question its overall reliability. Furthermore, a contract has been awarded to decommission the plant (DOE, 2010b). Therefore, this proposed alternative was eliminated from further consideration.

2.3.2.2 Downblending Highly Enriched Uranium

Under this alternative, a domestic uranium enrichment plant would not be constructed to replace existing production. Instead, an equivalent amount of SWU would be obtained from downblending highly enriched uranium from either United States or Russian nuclear warheads. This alternative was eliminated because U.S. reliance on foreign sources of enrichment services, as an alternative to the proposed action, would not meet the national energy policy objective of a "viable, competitive, domestic uranium enrichment industry for the foreseeable future" (DOE, 2000). Also, it does not meet the need for a reliable source of enriched uranium, as discussed in Section 1.3. Furthermore, as discussed in Section 1.3.1, the Megatons to Megawatts Program downblending agreement is set to expire in 2013.

2.3.2.3 Purchase Low-Enriched Uranium from Foreign Sources

There are several potential sources of enrichment services worldwide. However, U.S. reliance on foreign sources of enrichment services, as an alternative to the proposed action, would not

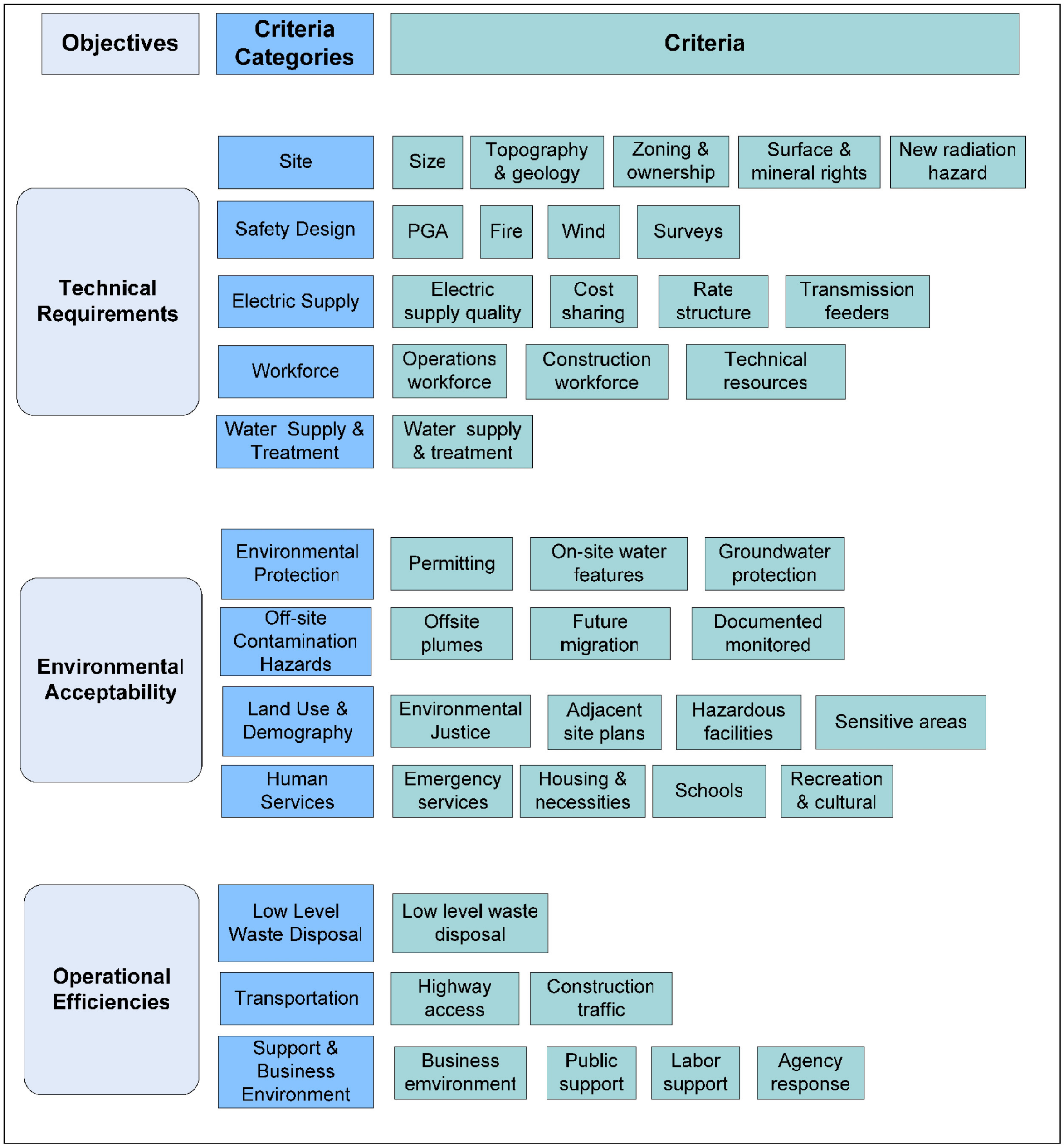

Figure 2-10 Organization of Gas Centrifuge Uranium Enrichment Facility Site Selection Objectives, Criteria Categories, and Criteria (AES, 2010a)

Table 2-4 Objectives, Categories, and Criteria with Weights and Contribution to Site Score

OBJECTIVE			CATEGORY			CRITERIA		
Objective	Weight	Contribution	Category	Weight	Contribution[a]	Criteria & Contribution	Weight	Contribution
Technical Requirements	100	0.49	Site	100	0.17	Topography & Geology	100	0.05
						Size	70	0.04
						Surface & Mineral Rights	70	0.04
						Zoning & Ownership	70	0.04
						New Radiation Hazard	5	<0.01
			Safety Design	70	0.12	Peak Ground Acceleration	100	0.06
						Fire Hazard	15	0.01
						Wind Hazard	40	0.02
						Existing Survey Data	60	0.03
			Electrical System	60	0.10	Quality	100	0.03
						Rates	90	0.03
						Cost	75	0.02
						Feeders	70	0.02
			Workforce	30	0.05	Construction Workforce	100	0.03
						Operational Workforce	65	0.02
						Technical Resources	35	0.01
			Water Treatment & Supply	20	0.04	Water Treatment & Supply	100	0.04

Table 2-4 Objectives, Categories, and Criteria with Weights and Contribution to Site Score (Cont.)

OBJECTIVE			CATEGORY			CRITERIA		
Objective	**Weight**	**Contribution**	**Category**	**Weight**	**Contribution[a]**	**Criteria & Contribution**	**Weight**	**Contribution**
Environmental Acceptability	70	0.34	Environmental Protection	95	0.10	Permitting	100	0.04
						Onsite Water Features	65	0.02
						Groundwater	100	0.04
			Offsite Contamination Hazard	40	0.04	Current Offsite Plumes	100	0.02
						Future Migration	30	0.01
						Documented Monitoring	50	0.01
			Land Use & Demography	100	0.11	Environmental Justice	100	0.04
						Hazardous Facilities	95	0.03
						Sensitive Areas	75	0.03
						Adjacent Site Plans	40	0.02
			Human Services	80	0.09	Emergency Services	100	0.03
						Housing & Necessities	90	0.03
						Schools	65	0.02
						Recreational & Cultural Options	50	0.01
Operational Efficiencies	34	0.17	Low-Level Waste (LLW) Disposal	15	0.02	LLW Disposal	100	0.02
			Transportation	35	0.04	Highway Access	100	0.02
						Construction Traffic	80	0.02
			Support & Business Environment	100	0.11	Business Environment	30	0.02
						Public Support	100	0.05
						Agencies	50	0.03
						Labor Support	30	0.02

[a] Values do not add to 1.00 in the contribution columns for category and criteria due to rounding.

Table 2-5 Candidate Sites Considered in Phase II Evaluation

Site	Location	Selection Considerations	Potential Drawbacks
Bonneville	Bonneville, ID	Remote location; near major highway; few nearby residences/activities; bounded by BLM and private land used for grazing/farming; topology and geology are favorable; simple land transfer; no surface or mineral rights issues; close to power; water from onsite wells; good workforce availability and housing; strong local and state support.	
McNeil	Bonneville, ID	Similar attributes as the Bonneville site.	Smaller than Bonneville (1000 acres [405 hectares] vs. >4000 acres [1619 hectares]); nearest resident closer than Bonneville (2.0 kilometers [1.25 miles] vs. 7.6 kilometers [4.75 miles]).
ELEA	Lea, NM	Remote location; near major highway; few nearby residences/activities; bounded by BLM and private land; favorable seismic characteristics; strong local support; privately owned/simple land transfer; most site-specific data of all 10 sites; Lea County water system capable of additional load.	Mineral leases under and adjacent to site; rights-of-way onsite (pipelines, transmission line, water line, and communication tower); workforce availability and housing not as good as other sites.
WIPP-2	Eddy, NM	Remote location; near major highway; few nearby residences/activities; bounded by BLM and private land; favorable seismic characteristics; strong local support; good regional data.	Complicated land transfer – portions owned by BLM and State of New Mexico; mineral leases under and adjacent to site; may require additional cultural resources permitting; Eddy County water system would require expansion; workforce availability and housing not as good as other sites.
Portsmouth	Piketon, OH	Adjacent to major interstate highway; DOE and USEC enrichment facilities adjacent to site; excellent utility infrastructure; good workforce availability; no surface or mineral rights.	Residents within 2 kilometers (1 mile) of the site; multiple private owners of site could affect land transfer; earthmoving required because of topography; fill may adversely affect seismic characteristics; floodplain onsite near boundary; irregular shape – small effective area compared to most other sites; site divided by road and rail line; closed landfill adjacent to site with trichloroethylene contamination.

Table 2-5 Candidate Sites Considered in Phase II Evaluation (Cont.)

Site	Location	Selection Considerations	Potential Drawbacks
Fleming Smith	Laurens, SC	Near major interstate highway; next to existing and proposed industrial developments; available electric supply and other utilities; large workforce; sufficient water capacity from existing system; strong local and state support.	Residents within 0.4 kilometer (0.25 mile) of the site; extensive earthmoving required because of topography; extensive fill may impact seismic stability; several ROWs onsite including sewer and a pressurized pipeline; wetland permit may be required.
Grist	Andrews, TX	Remote location; near major highway; few nearby residences; favorable seismic characteristics, topography, and geology; simple land transfer; surrounded by private landowners; strong local and state support; no special permitting issues.	New water lines from Gaines County would be needed; one of smallest sites at 900 acres (364 hectares); mineral rights onsite would have to be purchased; low workforce availability and housing score.
WCS-2	Andrews, TX	Similar attributes as the Grist site; second largest site at 2560 acres (1036 hectares).	New water lines from Gaines County would be needed; within 3 kilometers (2 miles) of the WCS low-level and hazardous waste facility; pipeline ROWs are present; mineral rights onsite would have to be purchased; low workforce availability and housing score.
Wildwood	Carroll, VA	Adjacent to major interstate highway and a commercial development; privately owned – simple land transfer; no surface or mineral rights.	Residents within 3 kilometers (2 miles) of the site; extensive earthmoving required because of topography; extensive fill may impact seismic stability; drainage that bisects site may have associated wetlands; irregular shape – smallest effective area of all sites; small regional airport less than 3 kilometers (2 miles) away with flight patterns over the site; water available but system capacity would require expansion; has least amount of site-specific data available.
Horn Rapids	Benton, WA	On south edge of the DOE Hanford Reservation; no surface or mineral rights; excellent utility infrastructure and workforce availability; no nearby sensitive resources or areas; AES fuel fabrication facility adjacent to the site.	Land transfer may be complicated because of DOE requirements; small regional airport about 3 kilometers (2 miles) away with flight patterns over the site; lacks strong support at the State and national levels.

Source: AES, 2010a.

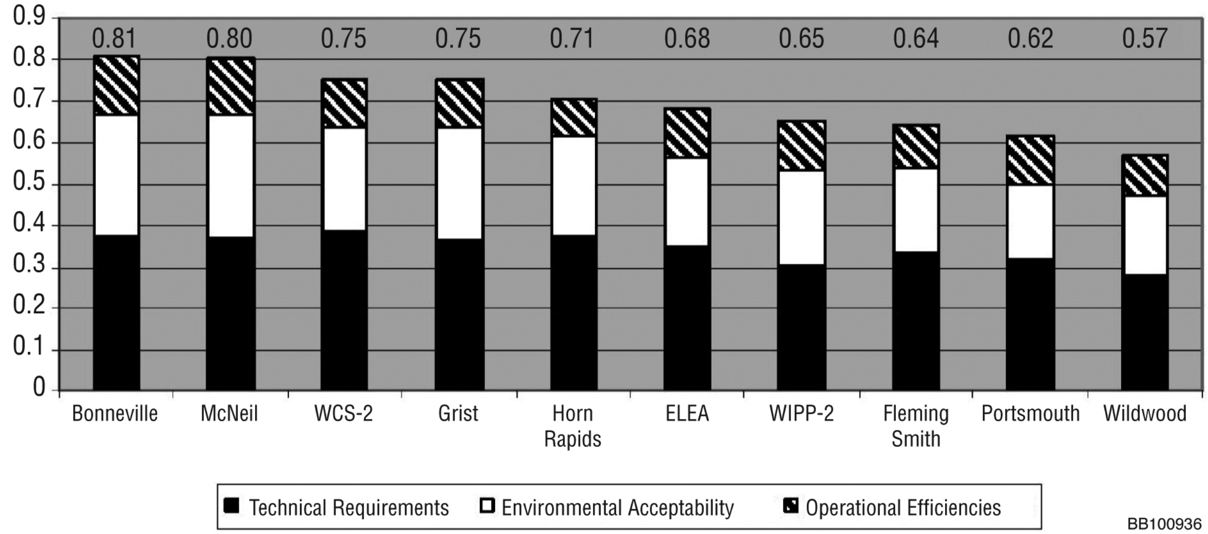

Figure 2-11 Candidate Sites Phase II Evaluation Results (modified from AES, 2010a)

meet the national energy policy objective of a "viable, competitive, domestic uranium enrichment industry for the foreseeable future" (DOE, 2000). For this reason, the NRC staff does not consider this alternative to meet the need for the proposed action, and therefore has eliminated it from further study.

2.3.3 Alternative Technologies for Enrichment

A number of different processes have been invented for enriching uranium; only three (gaseous diffusion, gas centrifuge, and laser excitation) are candidates for commercial use, and of those only the gaseous diffusion and gas centrifuge technologies have been deployed for large-scale industrial use. Other technologies – namely, electromagnetic isotope separation, liquid thermal diffusion, and early-generation laser enrichment – have proven too costly to operate or remain at the research and laboratory developmental scale, or in the case of laser-enrichment have been superseded by a more advanced technology. All of these technologies are discussed below.

2.3.3.1 Electromagnetic Isotope Separation Process

Figure 2-12 shows a sketch of the electromagnetic isotope separation process. In this process, a monoenergetic beam of ions of normal uranium travels between the poles of a magnet. The magnetic field causes the beam to split into several streams according to the mass of the isotope. Each isotope has a different radius of curvature and follows a slightly different path. Collection cups at the ends of the semicircular trajectories catch the homogenous streams. Because the energy requirements for this process proved very high – in excess of 3000 kilowatt hours per SWU – and production was very slow (Heilbron et al., 1981), electromagnetic isotope separation was not considered viable and was removed from further consideration.

2.3.3.2 Liquid Thermal Diffusion

Figure 2-13 is a diagram of the liquid thermal diffusion process, which was investigated in the 1940s. It is based on the concept that a temperature gradient across a thin layer of liquid or gas causes thermal diffusion that separates isotopes of differing masses. When a thin, vertical column is cooled on one side and heated on the other, thermal convection currents are generated and the material flows upward along the heated side and downward along the cooled side. Under these conditions, the lighter UF_6 molecules diffuse toward the warmer surface and heavier UF_6 molecules concentrate near the cooler side. The combination of this thermal diffusion and the thermal convection currents causes the lighter uranium-235 molecules to concentrate on top of the thin column while the heavier uranium-235 goes to the bottom. Taller columns produce better separation. Eventually, a facility using this process was designed and constructed at Oak Ridge, Tennessee, but it was closed after about a year of operation because of cost and maintenance concerns (Settle, 2004). Based on high operating costs and high maintenance requirements, the liquid thermal diffusion process has been eliminated from further consideration.

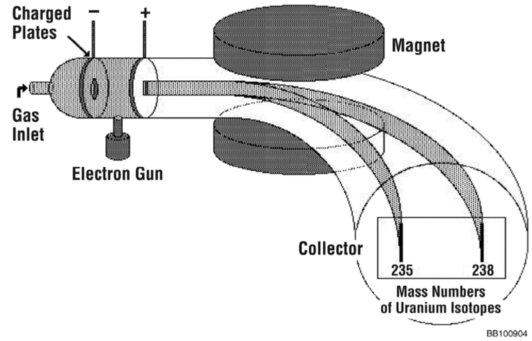

Figure 2-12 Electromagnetic Isotopic Separation Process (Milani, 2005)

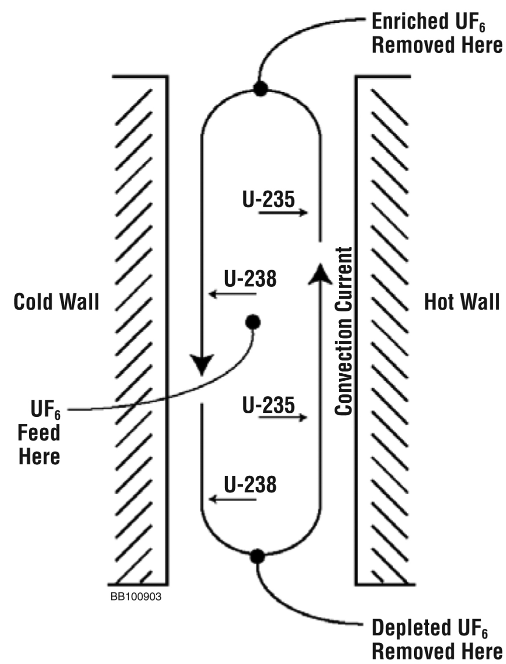

Figure 2-13 Liquid Thermal Diffusion Process (NRC, 2005b)

2.3.3.3 Gaseous Diffusion Process

The gaseous diffusion process is based on molecular effusion, a process that occurs whenever a gas is separated from a vacuum by a porous barrier. The gas flows from the high-pressure side to the low-pressure side. The rate of effusion of a gas through a porous barrier is inversely proportional to the square root of its mass. Thus, lighter molecules pass through the barrier faster than heavier ones. Figure 2-14 is a diagram of a single gas diffusion stage. The gaseous diffusion process consists of thousands of individual stages connected in series to multiply the separation factor.

Gaseous diffusion is the only enrichment technology in commercial use in the United States, but it has relatively large resource requirements. The Paducah GDP contains 1760 enrichment stages and is designed to produce UF_6 enriched up to 5.5 percent uranium-235. The design capacity of the Paducah GDP is approximately 8 million SWUs per year, but it has never operated at greater than 5.5 million SWUs. Paducah consumes approximately 2200 kilowatt hours per kilogram of SWU (DOE, 2000). DOE anticipates “the inevitable cessation of all domestic gaseous diffusion enrichment operations” due to the higher cost of aging diffusion facilities (DOE, 2001). Therefore, the gas diffusion process has been eliminated from further consideration.

2.3.3.4 Atomic Vapor Laser Isotope Separation

The Atomic Vapor Laser Isotope Separation (AVLIS) process, shown in Figure 2-15, is based on the circumstance that different isotopes of the same element, though chemically identical, have different electronic energies and absorb different wavelengths of laser light. The isotopes of most elements can be separated by a laser-based process if they can be efficiently vaporized into individual atoms or molecules. In AVLIS, uranium metal is vaporized, and the vapor stream is illuminated with a laser light of a specific wavelength that is absorbed only by uranium-235. The laser selectively adds enough energy to ionize or remove an electron from uranium-235 atoms, while leaving the other isotopes unaffected. The ionized uranium-235 atoms are then collected on negatively charged surfaces inside the separator unit. The collected material (enriched product) is condensed as a liquid on the charged surfaces and then drains to a caster where it solidifies as metal nuggets.

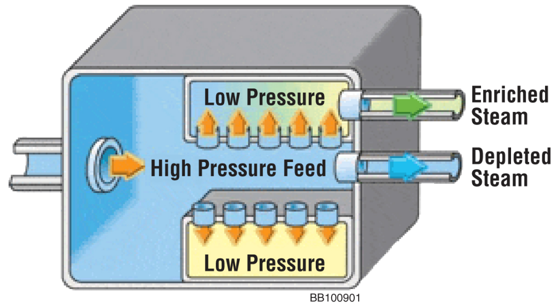

Figure 2-14 Gaseous Diffusion Stage (NRC, 2009a)

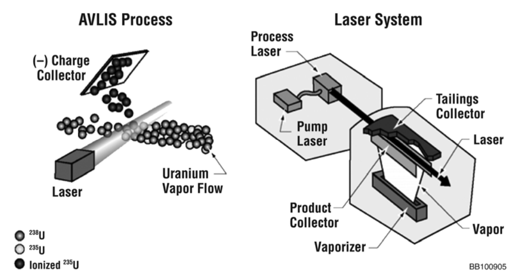

Figure 2-15 Atomic Vapor Laser Isotope Separation Process (Hargrove, 2000)

The high separation factor in AVLIS means fewer stages to achieve a given enrichment, lower energy consumption, and smaller waste volume. However, budget constraints compelled USEC to discontinue development of the U.S. AVLIS program in 1999 (USEC, 1999). Because development of the AVLIS process was not continued, and the technology has been superseded by a more advanced laser-based technology discussed in Section 2.3.3.6, AVLIS has been eliminated from further consideration.

2.3.3.5 Molecular Laser Isotope Separation

Like AVLIS, the Molecular Laser Isotope Separation (MLIS) process uses a tuned laser to excite uranium-235 molecules in the UF_6 feed gas. A second laser then dissociates excited molecules into UF_5 and free fluorine atoms. The enriched UF_5 then precipitates and is filtered as a powder from the feed gas. Each stage of enrichment requires conversion of enriched UF_5 back to UF_6. The advantages of MLIS include low power consumption and the use of UF_6 as a process gas. However, it is less efficient and up to four times more energy intensive than AVLIS. Therefore, all countries except Japan have discontinued development of MLIS. Because development of the MLIS process was not continued and the technology has been superseded by the more advanced laser-based technology discussed in Section 2.3.3.6, MLIS has been eliminated from further consideration.

2.3.3.6 Separation of Isotopes by Laser Excitation

The separation of isotopes by laser excitation (SILEX) process is a third-generation laser-based technology for enriching natural uranium. The SILEX technology, developed by Silex Systems Ltd., in partnership with GE-Hitachi Global Laser Enrichment, LLC (GLE) (and formerly, USEC), is similar to the two earlier laser-excitation technologies, MLIS and AVLIS, discussed in above in Sections 2.3.3.4 and 2.3.3.5, respectively (USEC, 2003; GLE, 2008). All three laser-based processes isolate uranium-235 by optical rather than mechanical means. The SILEX laser-based technology has several advantages over the conventional technologies of gas diffusion and gas centrifuge, including lower capital costs, lower operating costs, simpler and more versatile deployment, more flexibility in product enrichment, smaller facility footprint for comparable enrichment capacity, and reduced environmental impacts.

In laser excitation enrichment, UF_6 vapor is illuminated with a tuned laser of a specific wavelength that is absorbed only by uranium-235 atoms while leaving other isotopes unaffected. The stream then passes through an electromagnetic field to separate the ionized uranium-235 atoms from other uranium isotopes.

The SILEX technology is the world's only third-generation laser-based enrichment technology. (GLE, 2008). In a 2006 agreement with Silex Systems, General Electric (GE) acquired "the exclusive rights to complete the process development and commercial deployment of Silex's enrichment technology" (GE, 2006). GLE has submitted an application to the NRC for a proposed facility in Wilmington, North Carolina, that would be the first enrichment facility to employ the SILEX technology. This application is currently under NRC review (NRC, 2009b), and a Draft EIS was published for public comment (NRC, 2010c).

It is possible at some point in the future that after successfully obtaining a license and designing, constructing, and deploying its first SILEX-based enrichment facility, GLE could decide to license the technology to other companies. However, such a possibility is merely speculative at this time because the first full-scale commercial facility has yet to be licensed, constructed, or operated. At present, only GLE has the rights to the SILEX technology, and thus only GLE has the ability to design and build a facility using the technology. Therefore, because this alternative is not available for use by AES for the proposed EREF, it has been eliminated from further consideration.

2.4 Summary and Comparison of Predicted Environmental Impacts

Chapter 4 of this EIS presents a detailed evaluation of the environmental impacts of the proposed action and the no-action alternative. Table 2-6 summarizes and compares these environmental impacts. A common element between the two alternatives is the occurrence of preconstruction activities. It is assumed that preconstruction activities take place under both alternatives and, therefore, the impacts associated with preconstruction activities take place regardless of which alternative is selected. As a result, the comparison of alternatives presented in Table 2-6 is intended primarily to highlight the differences between the two alternatives after preconstruction activities have occurred.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Land Use	SMALL. The property to be purchased by AES for the proposed project is privately owned, contains mostly sagebrush rangeland and agricultural areas, and is bordered by similar land covers. The proposed property is zoned by Bonneville County G-1 Grazing, and a uranium enrichment facility is consistent with current zoning. Restrictions to land use would begin with the purchase of the property by AES. All grazing and agriculture would cease on the proposed property prior to construction. Similar land uses on surrounding properties would continue. Impacts on land use due to construction would be SMALL. Operation of the proposed EREF would restrict land use on the proposed property to the production of enriched uranium. The operation of the proposed EREF is not expected to alter land use on adjacent properties. Impacts on land use due to operations would be SMALL. At the end of decommissioning, the buildings and structures would be available for unrestricted use. As a result, impacts on land use due to decommissioning would be SMALL.	SMALL. AES would purchase the proposed property and restrictions on grazing and agriculture would initially occur. However, the zoning designation for the proposed property would remain G-1 Grazing whether the proposed EREF is built or not, and the land uses of grazing and farming could potentially resume. Should another domestic enrichment facility be constructed at an alternate location, land use impacts could occur and could range from SMALL to LARGE, depending on factors such as the existing land uses at the alternate location and the nature of the facility.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Historic and Cultural Resources	SMALL to MODERATE. Construction would take place on ground previously disturbed by preconstruction activities, and impacts on historic or archaeological resources would primarily occur prior to construction. There are 13 cultural resource sites (3 prehistoric, 6 historic, and 4 multi-component) in the surveyed areas of the proposed EREF property. One of these sites, the John Leopard Homestead (MW004), is located within the footprint of the proposed EREF and has been recommended as eligible for the *National Register of Historic Places*. The removal of site MW004, which has already occurred, resulted in a LARGE impact because the site no longer exists; however, because AES removed the site through professional excavation and data recovery and there are other homestead sites of this type found in the region, the impact has been mitigated to a MODERATE level. The Wasden Complex is an important group of archaeological sites, located approximately 1.6 kilometers (1 mile) from the proposed EREF site. Construction and operation of most of the proposed facility would not be visible from the Wasden Complex because a ridgeline would obscure views of the lower portions of the proposed facility. Other impacts during operations would be SMALL because no intact historic or cultural resources would	SMALL to MODERATE. The proposed EREF would not be constructed. Site MW004 would not be affected by NRC's licensing action, and Section 106 of the *National Historic Preservation Act* would not apply because no Federal action would be involved. However, the removal of site MW004, which has already occurred, resulted in a LARGE impact because the site no longer exists; but because AES removed this site through professional excavation and data recovery and there are other homestead sites of this type found in the region, the impact has been mitigated to a MODERATE level. No visual effects would occur to the viewshed for the Wasden Complex. Should another domestic enrichment facility be constructed at an alternate location, historical and cultural resource impacts could occur and could range from SMALL to LARGE. Consideration of historical and cultural resources at the alternate location would be reviewed in consultation with the appropriate SHPO.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Historic and Cultural Resources (Cont.)	remain and nearby resources would not be impacted by noise. Decommissioning would not likely affect historic and cultural resources because any areas disturbed during decommissioning would have been previously disturbed during construction. Impacts would be SMALL.	
Visual and Scenic Resources	SMALL to MODERATE. The visual environment of the proposed EREF property and of surrounding areas is predominantly rangeland and cropland. Activities such as clearing and grading of the proposed site would change the visual setting, but would not drastically alter the appearance of the area. The same is true for fugitive dust generation during construction (which would be of temporary duration) and construction traffic on the proposed property. However, because of the extent of the proposed EREF project, the type and size of equipment involved in construction, and the industrial character of buildings to be used, construction of the proposed EREF would create significant contrast with the surrounding visual environment. The proposed facility would be located approximately 2.4 kilometers (1.5 miles) from areas of public view, including US 20 and the Hell's Half Acre Wilderness Study Area (WSA). The U.S. Bureau of Land Management (BLM) gave a Visual Resource Management (VRM) Class I designation to the WSA,	SMALL. Since the proposed EREF would not be constructed, no major visual intrusions to the existing landscape would occur. The current land cover would be altered by preconstruction activities, but no large industrial structures would be constructed. The existing natural character of the area would largely remain intact. The lack of development would be consistent with BLM's VRM Class I designation for the Hell's Half Acre WSA, and no intrusions to the Wasden Complex viewshed would occur. Should another domestic enrichment facility be constructed at an alternate location, visual and scenic resource impacts could occur and could range from SMALL to LARGE. These impacts would depend on factors such as the visual setting in which the facility is to be constructed and operated and the nature of the facility.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Visual and Scenic Resources (Cont.)	which applies to areas of high scenic quality. Construction of the proposed EREF would introduce visual intrusions that are out of character with the surrounding area. While certain construction activities would have a SMALL impact (e.g., fugitive dust generation), the significant contrast posed by the buildings under construction would have a MODERATE impact. Construction and operation of most of the proposed facilities would not be visible from the Wasden Complex because a ridgeline obscures views of the proposed facility. Operations would have an impact on the surrounding visual landscape. The proposed facility is visually inconsistent with the current setting, and its operation is expected to alter visual ratings on surrounding public lands, which constitutes a MODERATE visual impact. At the end of decommissioning, the buildings and structures would be available for unrestricted use. As a result, impacts on visual and scenic resources would remain MODERATE.	

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Air Quality	SMALL. Air emissions during construction would include fugitive dust from heavy equipment working on the proposed site and engine emissions from construction equipment onsite and vehicles transporting workers and materials to the proposed site. Toward the latter portion of the construction period, the auxiliary diesel electric generators would also contribute to air emissions. Air quality impacts during construction would be SMALL for all hazardous air pollutants (HAPs) and all criteria pollutants. During operations, the proposed EREF would not be a major source of air emissions, although there is a potential for small gaseous releases associated with operation of the process that could contain uranium isotopes, hydrogen fluoride (HF), and uranyl fluoride (UO_2F_2). Also, small amounts of nonradioactive air emissions consisting of carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM), volatile organic compounds (VOCs), and sulfur dioxide (SO_2) would be released: • from auxiliary diesel electric generators to supply electrical power when power from the utility grid is not available,	SMALL. The air quality impacts associated with construction and operation of the proposed EREF would not occur. The proposed site could revert to agricultural activities, which would impact ambient air quality through the release of criteria pollutants from the operation of agricultural vehicles and equipment and the release of fugitive dusts from the tilling of soils. Should another domestic enrichment facility be constructed at an alternate location, air quality impacts could occur and could range from SMALL to LARGE. The nature and scale of air impacts resulting from the operation of similar enrichment technologies at alternative locations could be similar to those predicted for the proposed action, but the impacts on the local environments of such alternative facilities would be dependent on extant local conditions and cannot be predicted at this time.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Air Quality (Cont.)	• during building and equipment maintenance activities, and • from trucks, automobiles, and other vehicles in use onsite. Air emissions are not expected to impact regional visibility. Ambient air modeling predicts that impacts on ambient air quality from routine operation of the proposed EREF would be SMALL with respect to all criteria pollutants and all HAPs. During decommissioning, emissions could include fugitive dust and CO, NO_x, PM, VOCs, and SO_2 from transportation equipment, and the impacts of these emissions would be SMALL.	
Geology and Soil	SMALL. Construction activities could cause short-term impacts such as an increase in soil erosion at the proposed site. Soil erosion could result from wind action and rain, although rainfall in the vicinity of the proposed site is low. Compaction of soils due to heavy vehicle traffic would increase the potential for soil erosion via runoff. Impacts would be SMALL. Impacts on soils during operations at the proposed facility would also be SMALL because activities would not increase the potential for soil erosion beyond that for the	SMALL. No additional land disturbance from construction would occur, and the proposed site could revert to crop and grazing activities. Wind and water erosion would continue to be the most significant natural processes affecting the geology and soils at the proposed site. Should another domestic enrichment facility be constructed at an alternate location, geology and soil impacts could occur and could range from SMALL to LARGE. These impacts could be

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Geology and Soil (Cont.)	surrounding area. The impacts to soil quality from atmospheric deposition of pollutants during operations would be SMALL. Land disturbance associated with decommissioning could temporarily increase the potential for soil erosion at the proposed EREF site, resulting in impacts similar to (but less than) those during construction. As a result, impacts to soils due to decontamination and decommissioning activities would be SMALL.	similar to those of the proposed action, but would depend on factors such as the design of the facility, construction and operations methods used, and local geology and soil conditions.
Water Resources	SMALL. Annual maximum groundwater usage rates during construction comprise about 16 percent of the annual water right appropriation that has been transferred to the proposed property for use as industrial water. No surface water sources would be used. As a result, only SMALL impacts to water resources during construction would occur. No wastewater would be generated or discharged during the construction period. Because natural surface water bodies are absent within and near the proposed EREF site and groundwater occurs at depths of 202 meters (661 feet) to 220 meters (722 feet), water quality impacts during the construction period would be SMALL.	SMALL. Additional water use may or may not occur, depending on future plans for the property. Water resources would be unchanged. Water usage could continue at the current rate should agricultural activities resume at the proposed site, and impacts on the ESRP aquifer and downgradient water users would be SMALL. No changes to surface water quality would be expected, and natural (intermittent) surface flow of stormwater on the proposed site would continue; therefore, the impact on surface water is expected to be SMALL. Because no additional groundwater use or adverse changes to groundwater quality

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Water Resources (Cont.)	Water usage rates during operations are well within the water right appropriation. Both average and peak annual water use requirements would be less than 1 percent of the total groundwater usage from the Eastern Snake River Plain (ESRP) aquifer in Bonneville County. No process effluents would discharge to the retention or detention basins or into surface water. Therefore, liquid effluents would have a SMALL impact on water resources. Because all of the water discharged to the Cylinder Storage Pads Stormwater Retention Basins would evaporate, the basins would have a SMALL impact on the quality of water resources. The site Stormwater Detention Basin seepage would also have a SMALL impact on water resources of the area because no wastewater would be discharged to the basin. Since the usage and discharge impacts to water resources during the decommissioning phase would be similar to those during construction, the impacts to water resources would remain SMALL.	would be expected, the impact on groundwater resources would be SMALL. Should another domestic enrichment facility be constructed at an alternate location, surface water or groundwater impacts could occur and could range from SMALL to LARGE. These impacts would depend on factors such as the water usage and discharge characteristics of the facility and the nature and extent of groundwater and surface water conditions at the alternate location.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Ecological Resources	SMALL. Construction activities that could impact ecological resources include constructing the proposed EREF buildings and uranium hexafluoride (UF_6) cylinder storage pads. Most construction activities would occur in areas that would have already been disturbed by preconstruction activities. Impacts on vegetation would occur primarily from any additional vegetation clearing. Indirect impacts would include the generation of fugitive dust, spread of invasive species, changes in drainage patterns, soil compaction, erosion of disturbed areas, potential sedimentation of downgradient habitats, and accidental releases of hazardous or toxic materials (e.g., fuel spills). These activities would also result in some wildlife mortality and would cause other wildlife to relocate as a result of noise, lighting, traffic, and human presence. Collisions with construction equipment and other vehicles may cause some wildlife mortality. No rare or unique plant communities, or threatened or endangered species, have been found or are known to occur on the proposed site, although habitat on the proposed property is known to be used by greater sage-grouse (a Federal candidate species). No population-level impacts would be expected on any Federally listed or State-listed species from construction activities. Impacts of construction of the proposed facility would be SMALL.	SMALL. Most impacts on ecological resources would occur during the preconstruction phase. However, such impacts would also occur under the proposed action. The potential impacts associated with the construction, operation, and decommissioning of the proposed EREF would not occur. The land on the proposed EREF site could revert to crop and grazing activities. Because denying the license would not result in additional land disturbance on the proposed EREF property, anticipated impacts on ecological resources from the no-action alternative would be SMALL. Should another domestic enrichment facility be constructed at an alternate location, ecological impacts could occur and could range from SMALL to LARGE. The nature and scale of impacts at the alternate location would depend on factors such as the ecological resources present and type of facility.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Ecological Resources (Cont.)	Operation of the proposed EREF could result in impacts on wildlife and plant communities as a result of noise, lighting, traffic, human presence, air emissions, and retention/detention ponds. However, these impacts would be SMALL. No impacts from operations would be expected on any Federally listed or State-listed species. Impacts on greater sage-grouse would be SMALL Vegetation and wildlife that became established near the proposed facility could be affected by decommissioning activities. Impacts during decommissioning would be similar to those during construction and would be SMALL.	
Noise	SMALL. The nearest resident is located approximately 7.7 kilometers (4.8 miles) east of the proposed site. No residence is expected to experience unacceptable noise levels during construction. Noise impacts from construction may exceed established standards at some offsite locations for relatively short periods of time. However, because of the distances involved, expected levels of attenuation, and AES's commitment to appropriate mitigations, the impacts would be SMALL for human receptors. During the overlap period when partial operations begin while building construction continues, noise impacts from construction and operation are expected to be additive, but still substantially reduced from noise levels during initial construction.	SMALL. None of the noise impacts associated with construction, operation, or decommissioning of the proposed EREF would occur. Land uses on the proposed EREF site could revert to previous applications, livestock grazing and/or crop production, with concomitant SMALL noise impacts. Should another domestic enrichment facility be constructed at an alternate location, noise impacts could occur and could range from SMALL to LARGE. These impacts could be similar to those of the proposed action. However, impacts would be dependent on circumstantial factors such as

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Noise (Cont.)	Major noise sources associated with operation of the proposed facility include the six diesel-fueled emergency generators, commuter traffic, the movement of delivery vehicles, and operation of various pumps, compressors, and cooling fans. Operational noise estimates at the proposed property boundary satisfy all relevant or potentially relevant U.S. noise standards and guidance. Residents in the vicinity of US 20, who are otherwise unaffected by noise from the proposed EREF industrial footprint, would be impacted by slightly increased traffic noise. Noise impacts from operation of the proposed EREF would be SMALL. Noise sources and levels during decommissioning would be similar to those during construction, and peaking noise levels would be expected to occur for short durations. As a result, noise impacts from decommissioning would be SMALL.	local meteorologic conditions, the number and location of the nearest members of the public, and the types and extent of activities necessary to prepare the site for construction at the alternate location.
Transportation	SMALL to MODERATE. The primary impact of the proposed action would be increased traffic on nearby roads. Impacts during construction would occur from transportation of personnel, construction materials, and nonradiological waste. All traffic to and from the proposed EREF during construction and operations would use US 20. Construction activities at the proposed EREF site could result in a 55 percent increase in traffic volume on	SMALL. Traffic volumes and patterns would remain unchanged from existing conditions. The current volume of radioactive material and chemical shipments to/from facilities other than the proposed EREF would not increase. Should another domestic enrichment facility be constructed at an alternate location, transportation

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Transportation (Cont.)	US 20 (including the period when construction and operations overlap). Because traffic volume is expected to remain below the design capacity of Interstate 15 (I-15) and traffic slowdowns or delays would only be expected to occur at the entrance to the proposed EREF during access road construction and shift changes, the impacts on overall traffic patterns and volumes during construction would be SMALL to MODERATE on US 20 and SMALL on I-15. The impacts from the truck traffic to and from the proposed site during construction would be SMALL. Operations impacts would occur from the transport of personnel and nonradiological and radioactive materials to and from the proposed EREF, especially during the period when construction and operation overlap. Increased traffic during operation of the proposed facility would have a SMALL to MODERATE impact on the current traffic on US 20 (SMALL for any off-peak shift change). The impacts of truck traffic to and from the proposed site during operation would be SMALL. Annual transportation accident impacts (radiological and chemical) would be SMALL.	impacts could occur and could range from SMALL to LARGE. These impacts could be similar to those of the proposed action, depending on factors such as the existing road network and traffic patterns.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Transportation (Cont.)	Traffic during the initial portion of decommissioning would be approximately the same as for the period when construction and operations overlap. Traffic after the cessation of operations would be less than during either construction or operation. Impacts on local traffic on US 20 would be SMALL to MODERATE.	
Public and Occupational Health	SMALL. During construction, nonradiological impacts include injuries and illnesses incurred by workers as well as impacts due to exposure to chemicals or other nonradiological substances. All such potential impacts would be SMALL. No radiological impacts are expected during construction. Nonradiological impacts during operation include worker illnesses and injuries and impacts from worker or public exposure to hazardous chemicals used or present during operations, mainly uranium and HF. Due to low estimated concentrations of uranium and HF at public (proposed property boundary) and workplace receptor locations, nonradiological impacts due to exposures to hazardous chemicals (including uranium and HF) during operations would be SMALL.	SMALL. Health impacts from construction, operation, and decommissioning would not occur. Associated worker and public impacts from chemical and radioactive hazards would also not occur. Should the land be returned to grazing and agriculture, current use impacts would be expected. Should another domestic enrichment facility be constructed at an alternate location, public and occupational health impacts could occur and could range from SMALL to LARGE. These impacts could be similar to those of the proposed action, but would depend on factors such as the nature of the facility and the population density in the area and its proximity to the facility.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Public and Occupational Health (Cont.)	Assessment of potential radiological impacts from facility operations considers both public and occupational exposures to radiation, and includes exposures to workers completing facility construction during initial phases of operation. Exposure pathways include inhalation of airborne contaminants, ingestion of contaminated food crops, direct exposure from material deposited on the ground, and external exposure associated with stored UF_6 cylinders. Worker exposures would vary by job type, but would be carefully monitored and maintained as low as reasonably achievable (ALARA) and impacts would be SMALL. For a hypothetical individual member of the public at the proposed EREF property boundary and the nearest resident, the maximum annual total effective dose equivalents would be 0.014 millisievert per year (1.4 millirem per year) and 2.1×10^{-6} millisievert per year (2.1×10^{-4} millirem per year), respectively. This equates to impacts from exposure of members of the public that would be SMALL. Dose equivalents attributable to operation of the proposed EREF would be small compared to the normal background radiation range of 2.0 to 3.0 millisievert	

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Public and Occupational Health (Cont.)	(200 to 300 millirem) dose equivalent. This equates to radiological impacts during operation of the proposed EREF that would be SMALL. The nature of decommissioning activities would be similar to those during construction and operation. Impacts from occupational injuries and illnesses and chemical exposures would be SMALL. Occupational radiological exposures would be bounded by the potential exposures during operation, because the quantities of uranium material handled would be less than or equal to that during operations. An active environmental monitoring and dosimetry (external and internal) program would be conducted to maintain ALARA doses to workers and to individual members of the public. Therefore, the impacts of decommissioning on public and occupational health would be SMALL.	
Waste Management	SMALL. Construction would generate about 6116 cubic meters (8000 cubic yards) of nonhazardous solid waste, in addition to scrap structural steel, sheet metal, piping, etc., that would be recycled. About 23,000 liters (6200 gallons) and 1000 kilograms (2200 pounds) of hazardous waste would be generated annually. Disposal impacts would be SMALL because there is adequate disposal capacity at the appropriate disposal facilities.	SMALL. No EREF construction, operational, or decommissioning wastes (including sanitary, hazardous, low-level radioactive, or mixed wastes) would be generated or require disposition. Local impacts from waste management would be SMALL as under current site conditions.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Waste Management (Cont.)	Annually, during operations, generation of approximately 70,307 kilograms (154,675 pounds) of industrial, nonhazardous, nonradioactive solid waste and approximately 146,400 kilograms (322,080 pounds) of low-level radioactive waste (not including depleted UF_6) are expected. The proposed facility would also generate approximately 5062 kilograms (11,136 pounds) of hazardous wastes and 100 kilograms (220 pounds) of mixed waste annually. All wastes would be transferred to offsite licensed waste disposal facilities with adequate capacity for the proposed EREF wastes. Therefore, impacts during operations would be SMALL. Liquid process effluents would be treated and discharged by evaporation to the atmosphere. No process effluents from plant operations would be discharged to the retention or detention basins or into surface water. Impacts due to process water discharges from operations of the proposed EREF would be SMALL.	Should another domestic enrichment facility be constructed at an alternate location, waste management impacts could occur and could range from SMALL to LARGE. These impacts could be similar to those of the proposed action but would depend on factors such as the nature of the facility and availability of waste disposal sites.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Waste Management (Cont.)	The proposed EREF is expected to generate 1222 cylinders of depleted UF_6 annually, which would be temporarily stored on an outdoor cylinder storage pad. Storage of depleted UF_6 tails cylinders at the proposed site would occur for the duration of, but not beyond, the proposed facility's 30-year operating lifetime. An active cylinder maintenance program for stored cylinders such as that proposed by AES would result in a SMALL impact for cylinder storage. During decommissioning, materials eligible for recycling would be sampled or surveyed to ensure that contaminant levels would be below release limits. Radioactive material from decontamination and contaminated equipment would be packaged and shipped offsite to an appropriately licensed facility. Waste disposal would include approximately 7700 cubic meters (10,070 cubic yards) of low-level radioactive waste. Due to the availability of adequate disposal capacity, waste management impacts would be SMALL.	

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Socioeconomics	SMALL. The economic impacts of the proposed EREF project are evaluated for an 11-county region of influence (ROI) in Idaho – including Bannock, Bingham, Blaine, Bonneville, Butte, Caribou, Clark, Fremont, Jefferson, Madison, and Power Counties – which encompasses the area that is expected to be the primary source of labor for each phase of the proposed project, and where workers employed during construction and operation of the proposed EREF are expected to live and spend most of their salaries. The 11-county ROI is also the area in which a significant portion of site purchase and non-payroll expenditures are expected to occur. The impacts of the EREF on population, housing, and community services are assessed for the two-county ROI, consisting of Bingham and Bonneville Counties, where most in-migrating construction and operations workers are likely to live, and where the majority of economic impacts would occur. The impacts of facility construction and operation would be SMALL. There would be increases in regional employment, income, and tax revenue during construction and operation. Wage and salary spending and expenditures associated with materials, equipment, and supplies would produce income and employment and local and State tax revenue. Although these impacts	SMALL. Any beneficial or adverse consequences of the proposed action would not occur. Socioeconomic conditions in the ROI would remain unchanged, and the impact of no action would be SMALL. Population in the area surrounding the proposed EREF, in Bonneville and Bingham Counties, is expected to grow in accordance with current projections, with the total population in the region projected to be approximately 156,491 in 2013 and 168,331 in 2017. In addition to population growth, the social characteristics of the region, including housing availability, school enrollment, and availability of law enforcement and fire-fighting resources, are expected to change over time. However, future changes in these characteristics are difficult to quantify, and no projections of their future growth are available. Should another domestic enrichment facility be constructed at an alternate location, socioeconomic impacts could occur and could range from SMALL to LARGE. These impacts could be similar to those of the proposed action,

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Socioeconomics (Cont.)	would be SMALL compared to the 11-county economic baseline, they are generally considered to be positive. Construction would create 1687 jobs and $65.0 million in the peak year, while operations would produce 3289 jobs and $92.4 million in income in the first year of operations. In-migration into the two-county ROI during construction and operation of the facility would also impact area housing resources and community services such as schools and law enforcement, and the availability and cost of public utilities such as electricity, water, sanitary services, and roads. These impacts could be negative if significant population in-migration were to occur; however, impacts would be SMALL. Decommissioning would provide continuing employment opportunities for the existing workforce and for other residents of the 11-county ROI. Expenditures on salaries and materials would contribute to the area economy, although less than during operations, and the State would continue to collect sales tax and income tax revenues. The socioeconomic impact of decommissioning activities would be SMALL.	but would depend on the nature of the facility and on existing socioeconomic factors in the ROI associated with the alternate facility location.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Environmental Justice	SMALL. The majority of the environmental impacts on environmental resources associated with construction and operation of the proposed EREF would be mostly SMALL, and generally would be mitigated where necessary. For these resource areas, the associated impacts on all human populations would be SMALL, so there would not be any disproportionately high and adverse impacts on minority or low-income populations. Resources for which environmental impacts would be MODERATE are expected to most directly affect residents in the immediate area of the proposed EREF, but because there are no low-income or minority populations defined according to CEQ guidelines within the 4-mile area around the proposed facility, operation of the proposed facility also would not be expected to result in disproportionate impacts on low-income or minority residents, and therefore would not produce any environmental justice concerns. Impacts of decommissioning would be SMALL. Because impacts on the general population would generally be SMALL to MODERATE in other resource areas and because there are no low-income or minority populations defined according to CEQ guidelines within the 4-mile area around the proposed facility, decommissioning would not be expected to result in disproportionately high or adverse impacts on minority or low-income populations.	SMALL. The no-action alternative would not be expected to cause any high and adverse impacts; it would not raise any environmental justice issues. Therefore, any impacts would be SMALL. Should another domestic enrichment facility be constructed at an alternate location, environmental justice impacts could occur and could range from SMALL to LARGE. These impacts would depend on factors such as the nature of the impact significance levels and populations impacted by the facility at the alternate location.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Accidents	SMALL to MODERATE. A range of six hypothetical facility accidents were considered. The accidents include a criticality accident and the remaining five accidents were representative accident scenarios that varied in severity from high- to intermediate-consequence events, including accidents initiated by natural phenomena (earthquake), operator error, and equipment failure. The latter five accidents could cause varying amounts of UF_6 to be released, resulting in potential exposure to UF_6 and its reaction products with humidity in the air, UO_2F_2, and HF. All credible accidents at the proposed EREF were considered. The consequence of a criticality accident would be high (fatality) for a worker in close proximity. Worker health consequences are low to high from five scenarios involving the release of UF_6, due to uranium and/or HF chemical exposure. Radiological consequences to a maximally exposed individual (MEI) at the Controlled Area Boundary (proposed EREF property boundary) are low for all six accidents including the criticality accident. Uranium chemical exposure to the MEI is high for one accident and low for the remainder. For HF exposure to an MEI at the proposed property boundary, the consequence of three accidents is intermediate, with a low consequence estimated for the remainder. All accident scenarios predict consequences to the collective offsite public of less than one lifetime cancer fatality. Impacts	SMALL. Under the no-action alternative, potential accidents and accident consequences from operation of the proposed EREF would not occur. Should another domestic enrichment facility be constructed at an alternate location, accident impacts could occur and could range from SMALL to LARGE. These impacts could be similar to those of the proposed action, but would depend on the nature of the facility at the alternate location.

Table 2-6 Summary of Environmental Impacts for the Proposed Action and the No-Action Alternative (Cont.)

Affected Environment	Proposed Action	No-Action Alternative
	AES would construct, operate, and decommission the proposed EREF in Bonneville County, Idaho.	***The proposed EREF would not be constructed, operated, and decommissioned. Enrichment services would be met with existing domestic and foreign uranium enrichment suppliers and other planned or future facilities.***
Accidents (Cont.)	from accidents would be SMALL to MODERATE. Plant design, passive and active engineered controls, and administrative controls would reduce the likelihood of accidents.	

A standard of significance has been established for assessing environmental impacts. Based on the Council on Environmental Quality's regulations (40 CFR 1508.27), each impact is to be assigned one of the following three significance levels:

- SMALL. The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

- MODERATE. The environmental effects are sufficient to noticeably alter but not destabilize important attributes of the resource.

- LARGE. The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

These impact levels are used in the summary and comparison of alternatives in Table 2-6.

2.5 Staff Recommendation Regarding the Proposed Action

After weighing the impacts of the proposed action and comparing the proposed action and the no-action alternative, the NRC staff, in accordance with 10 CFR 51.91(d), sets forth its NEPA recommendation regarding the proposed action.

The NRC staff recommends that, unless safety issues mandate otherwise, the proposed license be issued to AES. In this regard, the NRC staff has concluded that environmental impacts are generally SMALL, and application of the environmental monitoring program described in Chapter 6 and the proposed AES mitigation measures discussed in Chapter 5 would eliminate or substantially lessen any potential adverse environmental impacts associated with the proposed action.

The NRC staff has concluded that the overall benefits of the proposed EREF outweigh the environmental disadvantages and costs based on consideration of the following:

- The need for an additional economical domestic source of enrichment services.

- The environmental impacts from the proposed action are generally SMALL, although they could be as high as MODERATE for certain aspects of the areas of historic and cultural resources, visual and scenic resources, ecological resources, and transportation and as high as LARGE for certain aspects of air quality on a temporary basis.

2.6 References

(AES, 2009) AREVA Enrichment Services, LLC. Letter from Sam Shakir (President and CEO, AES) to the U.S. Nuclear Regulatory Commission dated June 17. "Subject: Request for Exemption from 10 CFR 70.4, 10 CFR70.23(a)(7), 10 CFR 30.4, 10 CFR 30.33(a)(5), 10 CFR 40.4, and 10 CFR 40.32(e) Requirements Governing 'Commencement of Construction.'" ADAMS Accession No. ML091770390.

(AES, 2010a) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Environmental Report, Rev. 2." Bethesda, Maryland. April.

(AES, 2010b) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Safety Analysis Report, Rev. 2." Bethesda, Maryland. April.

(DNFSB, 1995) U.S. Defense Nuclear Facilities Safety Board. "Integrity of Uranium Hexafluoride Cylinders." Technical Report DNFSB/TECH-4. May 5.

(DOE, 1995) U.S. Department of Energy. "Electricity Generation and Environmental Externalities: Case Studies." DOE/EIA-0598. Energy Information Administration, Office of Coal, Nuclear Electric, and Alternative Fuels, Coal and Electric Analysis Branch. September.

(DOE, 1999a) U.S. Department of Energy. "Environmental Assessment, Disposition of Russian Federation Titled Natural Uranium." DOE/EA-1290. Office of Nuclear Energy, Science, and Technology, Washington, D.C. June.

(DOE, 1999b) U.S. Department of Energy. "Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride." DOE/EIS-0269. Office of Nuclear Energy, Science, and Technology, Washington, D.C. April.

(DOE, 2000) U.S. Department of Energy. "Report to Congress on Maintenance of Viable Domestic Uranium, Conversion, and Enrichment Industries." December.

(DOE, 2001) U.S. Department of Energy. "Effect of U.S./Russia Highly Enriched Uranium Agreement." Report to Congress. Washington, D.C. December. <http://www.ne.doe.gov/pdfFiles/HEUAgreement2001.pdf> (Accessed March 29, 2009).

(DOE, 2003) U.S. Department of Energy. "Cold Standby Program at the Portsmouth Gaseous Diffusion Plant." DOE-0634. Audit Report. Office of Inspector General, Office of Audit Services. December.

(DOE, 2004a) U.S. Department of Energy. "Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky Site." DOE/EIS-0359. Office of Environmental Management. June 2004.

(DOE, 2004b) U.S. Department of Energy. "Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site." DOE EIS-0360. Office of Environmental Management. June.

(DOE, 2010a) U.S. Department of Energy, National Nuclear Security Administration. "U.S.-Russian Highly Enriched Uranium Purchase Agreement." January. <http://www.nnsa.energy.gov/nuclear_nonproliferation/highly_enriched_uranium_disposition.htm> (Accessed January 28, 2010). ADAMS Accession No. ML101790115.

(DOE, 2010b) U.S. Department of Energy. "DOE Awards Cleanup Contract for Portsmouth Decontamination and Decommissioning." August, 16. Portsmouth Paducah Project Office. <http://www.pppo.energy.gov/pdf/Ports%20D%20%20D%20081210%209%20am%20FINAL.pdf> (Accessed December 15, 2010). ADAMS Accession No. ML103500151.

(DOE, undated a) U.S. Department of Energy. DOE Digital Photo Archive, Image ID: 2010809. <http://www.doedigitalarchive.doe.gov/index.cfm?CFID=399386&CFTOKEN=78120854> (Accessed May 6, 2010). ADAMS Accession No. ML101790118.

(DOE, undated b) U.S. Department of Energy. DOE Digital Photo Archive, Image ID:2010833. <http://www.doedigitalarchive.doe.gov/index.cfm?CFID=399386&CFTOKEN=78120854> (Accessed May 6, 2010). ADAMS Accession No. ML101790142.

(EIA, 2010) Energy Information Administration, U.S. Department of Energy. "Uranium Marketing Annual Report." U.S. Department of Energy. August. <http://www.eia.doe.gov/cneaf/nuclear/umar/umar.html> (Accessed November 15, 2010). ADAMS Accession No. ML103480627.

(GE, 2006) GE Energy. "Press Release, GE Signs Agreement with Silex Systems of Australia To Develop Uranium Enrichment Technology." Wilmington, N.C. May 22. <http://www.gepower.com/about/press/en/2006_press/052206b.htm> (Accessed June 21, 2010).

(GLE, 2008) GE-Hitachi Global Laser Enrichment, LLC. "Environmental Report for the GLE Facility." December.

(Hargrove, 2000) Hargrove, S. "Laser Technology Follows in Lawrence's Footsteps." In *Science and Technology Review*. Lawrence Livermore National Laboratory. May.<http://www.llnl.gov/str/Hargrove.html> (Accessed March 31, 2009). ADAMS Accession No. ML101790145.

(Heilbron et al., 1981) Heilbron, J.L., R.W. Seidel, and B.R. Wheaton. "Lawrence and His Laboratory: A Historian's View of the Lawrence Years." June.

(International Isotopes, 2009) International Isotopes, Inc. "License Application – Fluorine Extraction Process Depleted Uranium Hexafluoride De-conversion Plant (FEP/DUP)." December. ADAMS Accession No. ML100120736.

(Milani, 2005) Milani, K. "The Scientific History of the Atomic Bomb." Hibbing Community College. <http://www.hcc.mnscu.edu/chem/abomb/index.html> (Accessed May 5, 2010).

(NRC, 1991) U.S. Nuclear Regulatory Commission. "Policy Issue: Disposition of Depleted Uranium Tails from Enrichment Plant." SECY-91-019. January 25.

(NRC, 2002) U.S. Nuclear Regulatory Commission. "Denial of Petition for Rulemaking to Eliminate Review of Alternate Sites, Alternative Energy Sources, and Need for Power in Nuclear Power Reactor Siting and Licensing Reviews (PRM-52-2)." SECY-02-0175. September 27.

(NRC, 2005a) U.S. Nuclear Regulatory Commission. "Memorandum and Order." CLI-05-05. NRC Docket No. 70-3103. January 18. <http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2005/2005-05cli.html> (Accessed January 29, 2010).

(NRC, 2005b) U.S. Nuclear Regulatory Commission. "Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico." Final Report. NUREG-1790, Vol. 1. Office of Nuclear Material Safety and Safeguards, Washington, D.C. June. <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1790/> (Accessed July 21, 2009).

(NRC, 2006) U.S. Nuclear Regulatory Commission. "Consolidated Decommissioning Guidance, Decommission Process for Materials Licensees." NUREG-1757, Rev. 2. Office of Nuclear Material Safety and Safeguards, Washington, D.C. September.

(NRC, 2009a) U.S. Nuclear Regulatory Commission. "Enrichment Processes." <http://www.nrc.gov/images/reading-rm/photo-gallery/20080922-013.jpg> (Accessed August 20, 2009).

(NRC, 2009b) U.S. Nuclear Regulatory Commission. Letter from T. Johnson (U.S. Nuclear Regulatory Commission) to A. Kennedy (GE-Hitachi Global Laser Enrichment, LLC) dated August 6, 2009. "Subject: Acceptance of General Electric-Hitachi Global Laser Enrichment Application for a Laser-Based Uranium Enrichment Facility. ADAMS Accession No. ML091960561.

(NRC, 2010a) U.S. Nuclear Regulatory Commission. Letter from D. Dorman (U.S. Nuclear Regulatory Commission) to G. Harper (AREVA Enrichment Services, LLC) dated March 17. "Subject: Approval of AREVA Enrichment Services LLC Exemption Request Related to Requirements Governing Commencement of Construction (TAC L32730)."

(NRC, 2010b) U.S. Nuclear Regulatory Commission. "Press Release: NRC to Hold Public Meeting Jan. 14 in Hobbs, N.M., to Discuss License Review of Proposed Uranium De-Conversion Plant." <http://www.nrc.gov/reading-rm/doc-collections/news/2010/10-002.html> (Accessed January 25, 2010).

(NRC, 2010c) U.S. Nuclear Regulatory Commission. "Draft Environmental Impact Statement for the Proposed GE-Hitachi Global Laser Enrichment LLC Facility in Wilmington, North Carolina." NUREG-1938, Draft. Office of Federal and State Materials and Environmental Management Programs, Washington, D.C. June.

(OECD, 2001) Organisation for Economic Co-operation and Development. "Management of Depleted Uranium." A joint report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency.

(Settle, 2004) Settle, F. "Nuclear Chemistry, Uranium Enrichment." Kennesaw State University. <http://www.chemcases.com/nuclear/nc-07.html> (Accessed March 31, 2009). ADAMS Accession No. ML101790147.

(Sparks, 2011) Personal communication from K. Sparks (Haselwood Enterprise, Inc.) to B. Biwer and H. Avci (Argonne National Laboratory). January 26, 2011. ADAMS Accession No. ML110340433.

(USEC, 1999) USEC Inc. “USEC Inc. Suspends AVLIS Technology Development.” News release. June 9. ADAMS Accession No. ML101790149.

(USEC, 2000) USEC Inc. “USEC to Cease Uranium Enrichment at the Portsmouth, Ohio, Facility in June 2001.” News release. June 21. ADAMS Accession No. ML101790160.

(USEC, 2003) USEC Inc. “USEC Ends Funding of Research on SILEX Process.” News release. April 30. ADAMS Accession No. ML101790166.

3 AFFECTED ENVIRONMENT

This chapter describes the existing regional and local environmental conditions at and near the site of the proposed AREVA Enrichment Services, LLC (AES) Eagle Rock Enrichment Facility (EREF) before any preconstruction activities are performed and prior to the proposed action. After an initial overview of the proposed site location and activities, this chapter presents information on land use; historic and cultural resources; visual and scenic resources; climatology, meteorology, and air quality; geology, minerals, and soils; water resources; ecological resources; noise; transportation; public and occupational health; socioeconomics; and environmental justice. This information forms the basis for assessing the potential impacts of the proposed action in Chapter 4.

3.1 Site Location and Description

The proposed EREF site is located in eastern Idaho in Bonneville County, approximately 32 kilometers (20 miles) west of Idaho Falls, Idaho, along US 20 and 117 kilometers (70 miles) west of the Idaho/Wyoming border (Figure 3-1). Idaho Falls, the closest population center, is located at the cross-junction of Interstate 15 (I-15) with US 20 and US 26. Approximately 2 kilometers (1 mile) to the west of the proposed EREF property is the Idaho National Laboratory (INL), a large Federal Government-owned research laboratory that encompasses 230,321 hectares (890 square miles or 569,135 acres).

The proposed EREF property consists of approximately 1700 hectares (4200 acres) to be purchased by AES from a single landowner. The proposed EREF site would occupy approximately 186 hectares (460 acres) within this area. An additional 53 hectares (132 acres) will be disturbed during preconstruction and construction by excavation of underground utilities and by temporary use for construction facilities, material storage, and parking. The proposed site and surrounding area within the proposed property boundary consist of rangeland, nonirrigated seeded pasture, and irrigated cropland. Wheat, barley, and potatoes are grown on 389 hectares (962 acres) of the irrigated land (AES, 2010). Aside from the areas devoted to crops, the predominant plant type in the area is sagebrush steppe, which is seasonally grazed.

3.2 Land Use

This section describes the land uses in and near the proposed EREF property to be purchased by AES and the proposed EREF site within that property. This area includes the 186 hectares (460 acres) that the proposed EREF industrial site itself will occupy, plus an additional 53 hectares (132 acres) that will be temporarily disturbed during preconstruction and construction. Therefore, this is the area that would be directly affected by preconstruction, construction, operation, and decommissioning of the proposed EREF.

The following discussion focuses on the region within 8 kilometers (5 miles) of the proposed EREF site. The proposed EREF site is located in Bonneville County; however, both Jefferson County to the north and Bingham County to the west are within 8 kilometers (5 miles) of the proposed EREF site. As a result, land use in all three counties is discussed below. Special land use classification areas are also discussed.

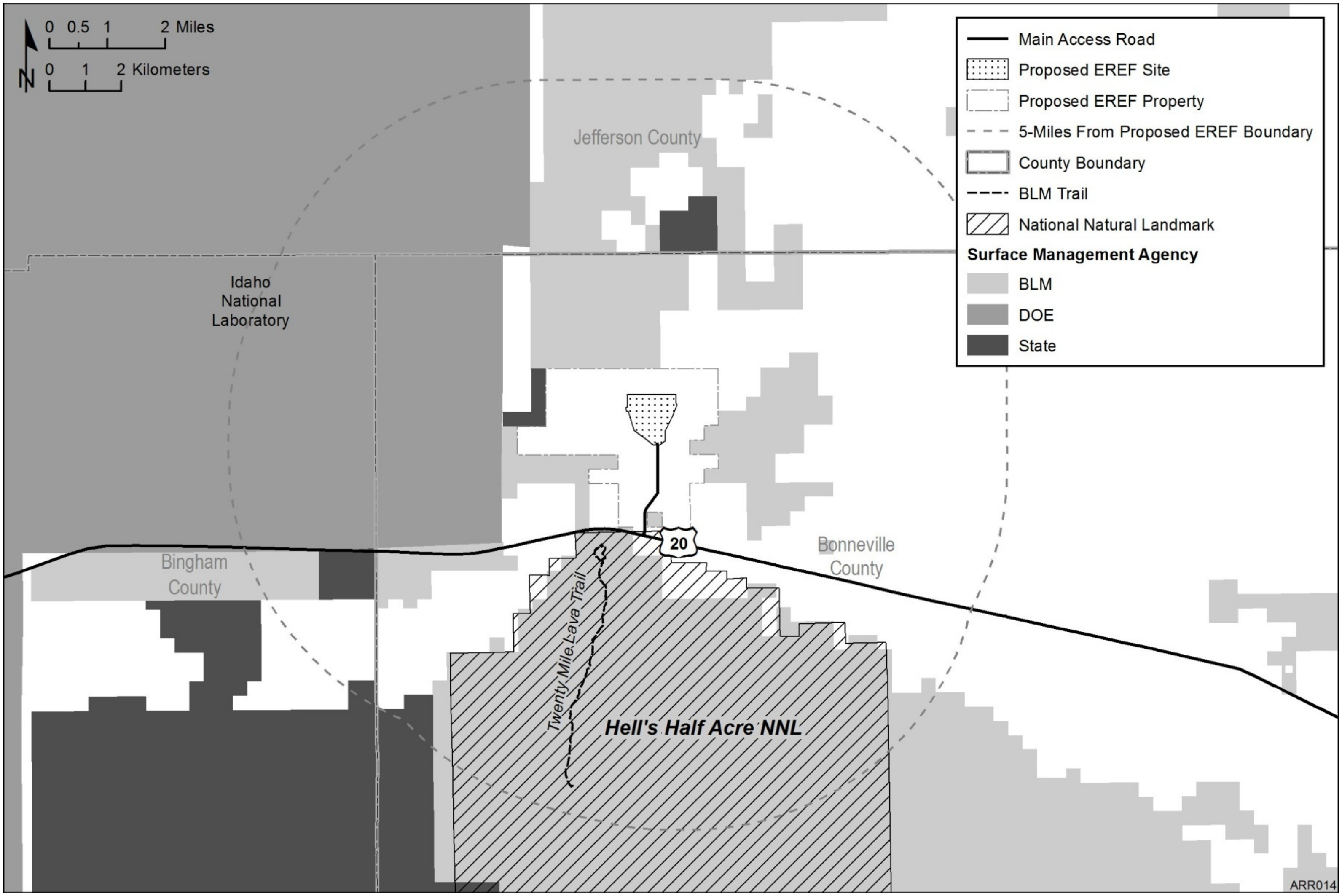

Figure 3-1 Location of Proposed Eagle Rock Enrichment Facility

3.2.1 Bonneville County and Proposed EREF Property

Bonneville County is located in southeastern Idaho. The largest community in the county is Idaho Falls, the county seat, with a population of 101,667 as of the 2000 Census. Idaho Falls is located 32 kilometers (20 miles) east of the proposed EREF site. No other large cities are found in Bonneville County. Based on the available land use data for the county, the dominant land use is cultivated crops (17 percent), with undeveloped sagebrush or woodlands being the next largest land use (14 percent). Less than 3 percent of the land in the county is developed (USGS, 2009g).

The 1700-hectare (4200-acre) parcel of land to be purchased by AES is bordered on the west by State-owned land and to the south and east by U.S. Bureau of Land Management (BLM)-managed lands as shown in Figure 3-2. The BLM land is managed for multiple uses, which include grazing and hunting (Reynolds, 2010). Also, there is private land to the northeast and south. To the north and west is the INL, which is a U.S. Department of Energy (DOE) applied engineering laboratory that covers approximately 2306 square kilometers (890 square miles). Much of the INL property is an undeveloped sagebrush-steppe environment. Laboratory complexes are scattered throughout the INL property. The nearest INL complex to the proposed EREF site is the Materials and Fuels Complex located approximately 18 kilometers (11 miles) to the west. South of the proposed EREF site is the Hell's Half Acre National Natural Landmark (NNL) and Wilderness Study Area (WSA). A lava flow occurred in this location approximately 4100 years ago. The lava flow covers 57,498 hectares (222 square miles) of the Idaho desert. (See Section 3.2.4 for more discussion of Hell's Half Acre.) Farming occurs northeast and southeast of the proposed EREF site. The nearest residence to the proposed EREF site is 8 kilometers (5 miles) to the east.

Land use within the 1700-hectare (4200-acre) parcel of land to be purchased by AES is primarily cultivated cropland (43 percent), followed by sagebrush-steppe (36 percent) and pasture/hay (7 percent), with the remainder being open space and upland grasslands (14 percent) (USGS, 2009g). A few agricultural buildings are located along US 20 near the south end of the proposed EREF property. There are no existing rights-of-way (ROWs) within the proposed EREF property. The proposed EREF property consists entirely of private land. Within the proposed property, there is a 16-hectare (40-acre) parcel of land managed by the BLM. AES has no plans to purchase the BLM parcel (AES, 2010). The 16-hectare parcel is surrounded by the proposed EREF property. Adjacent to an access road being purchased for the proposed project are two 6.5-hectare (16-acre) parcels on which the Federal Government previously held uranium land patents. The uranium leases have been relinquished (42 U.S. Code (U.S.C.) 2098 Sec. 68b). Some of the land located within the proposed property was designated as prime farmland by the U.S. Natural Resources Conservation Service (NRCS). The use of prime farmland is subject to review under the *Federal Farmland Protection Policy Act* (FPPA) (see Title 7 of the U.S. *Code of Federal Regulations* (7 CFR 658.2). Per 7 CFR 658.2 (c)(1)(i), the intent of this Act is to protect prime farmland from other uses as the result of certain Federal actions. The Act does not apply to Federal permitting or licensing actions on private lands, such as the potential licensing of the proposed EREF by the NRC. In May 2010, DOE issued a conditional commitment for a Federal loan guarantee to AES for the proposed EREF (DOE, 2010a). Issuing a loan guarantee is subject to review under the FPPA to assess the effect of the project associated with the loan guarantee on prime farmland. DOE has conducted and submitted the required farmland conversion impact analysis to the NRCS

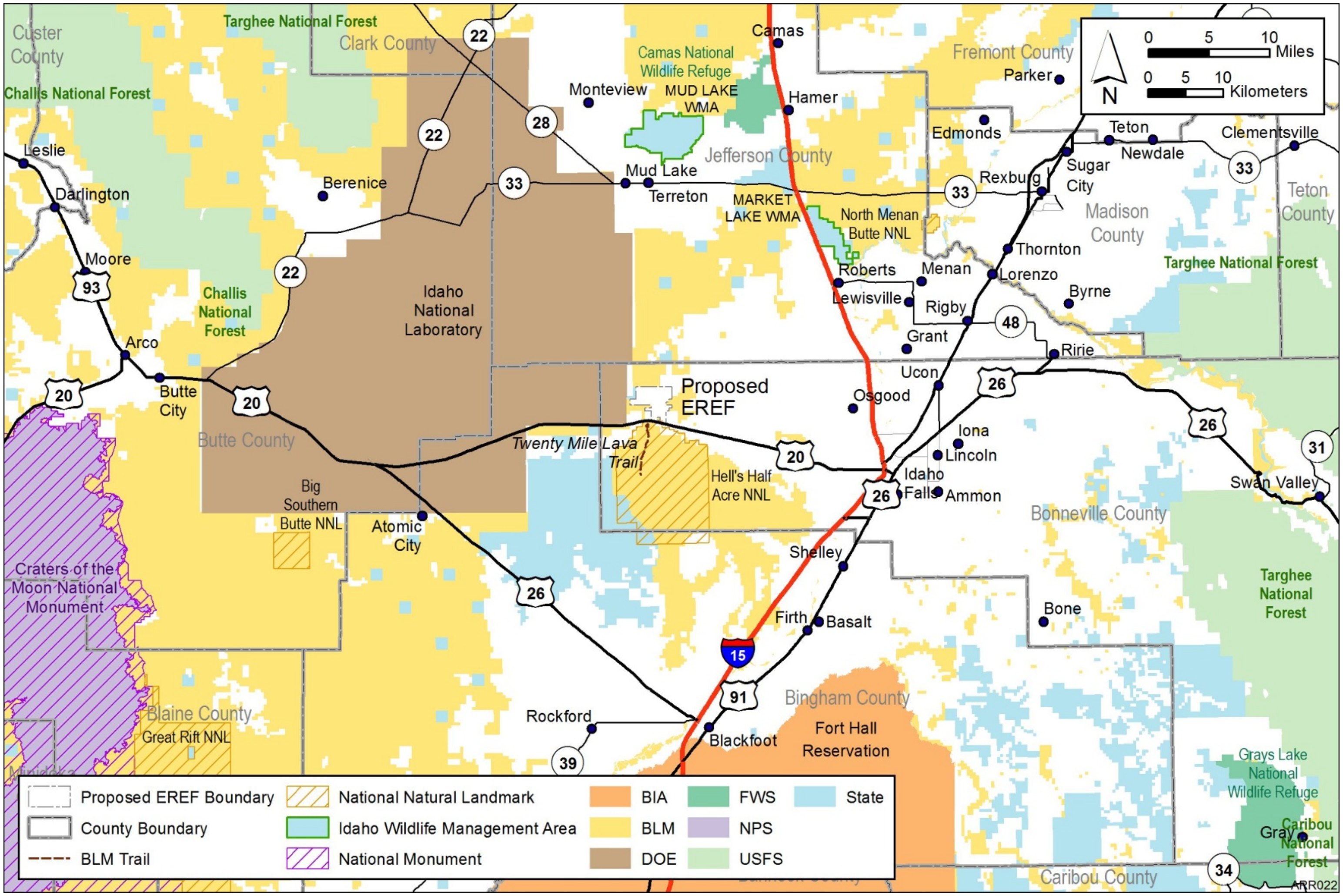

Figure 3-2 Special Land Use Classification Areas (BLM, 2009a; IDFG, 2010)

(DOE, 2010b). The issuance of the Federal loan guarantee is not a factor in the NRC's decision to issue a license.

The proposed EREF property is zoned by Bonneville County as Grazing Zone G-1. The zoning allows for manufacturing, testing, and storage of materials or products considered to be hazardous. Areas with this zoning designation are generally large tracts of open land. The purpose of the zone is to allow for certain uses and activities that should be conducted in locations removed from densely populated areas of the county. There are no building size or height restrictions within this zoning designation (Serr, 2009).

3.2.2 Bingham County

Bingham County is located approximately 6 kilometers (4 miles) west of the proposed EREF site. The county seat of Bingham County is Blackfoot, located 43 kilometers (27 miles) south of the proposed site. The population of Blackfoot was 10,419 in the 2000 Census. Atomic City, 32 kilometers (20 miles) west of the proposed EREF site, is the nearest community in Bingham County to the proposed EREF. The population of Atomic City was reported as 25 in the 2000 Census. The portion of the county within 8 kilometers (5 miles) of the proposed EREF site is zoned natural resources/agricultural (Halstead, 2009). Land use in the county consists primarily of rangeland (46.8 percent), with agricultural land (31.7 percent) and barren lands (14.9 percent) being the other main land uses (Bingham County, 2005). The primary agricultural products from Bingham County in 2002 were wheat and potatoes (USDA, 2002).

3.2.3 Jefferson County

Jefferson County is located directly north of the proposed EREF site The portion of the county that falls within 8 kilometers (5 miles) of the proposed EREF site is zoned Agricultural Forty Zone (Ag. 40 Acres) (Jefferson County, 2008). This zone allows for agricultural uses and the development of residential lots that are minimally 16 hectares (40 acres) in size (Jefferson County, 2005). Industrial uses are not permitted within this zoning designation. The nearest town in Jefferson County to the proposed site is Rigby, approximately 42 kilometers (26 miles) to the northeast. Rigby has a population of 2998 (2000 Census). Land use in Jefferson County is dominated by undeveloped sagebrush and rangeland (56 percent) and cultivated cropland and pasture (39 percent), with only minimal development (3 percent) (USGS, 2009g).

3.2.4 Special Land Use Classification Areas

There are ten special land use areas near the proposed EREF site (Figure 3-2). The closest is Hell's Half Acre WSA just south of US 20, approximately 2 kilometers (1 mile) from the proposed site. A WSA is a BLM management designation for areas that (1) have retained their naturalness, with the imprint of man's work substantially unnoticeable; (2) are large (at least 2023 hectares [5000 acres]); and (3) have outstanding opportunities for solitude or for primitive or unconfined types of recreation in at least parts of the areas. Retaining wilderness characteristics is achieved by limiting road access and not allowing mineral leasing within a WSA. The northern portion of the Hell's Half Acre WSA was named a National Natural Landmark (NNL) in 1973. National Natural Landmarks are chosen by the Secretary of the Interior to recognize some of the best examples of biological or geological resources in the nation. National Natural Landmarks are designated by the National Park Service. There are three additional NNLs in the region: Big Southern Butte NNL (51 kilometers [32 miles] to the southwest), North Menan Butte NNL (32 kilometers [20 miles] to the northeast), and Great Rift NNL (72 kilometers [45 miles] to the southwest). The 750,000-acre Craters of the Moon National Monument and Preserve is 80 kilometers (50 miles) west of the proposed EREF site; it is managed by the National Park Service and the BLM. There are two national forests located northwest of the INL property; these are the Challis National Forest (48 kilometers [30 miles] northwest) and the Targhee National Forest (48 kilometers [30 miles] north northwest). The Mud Lake Wildlife Management Area (WMA), located 35 kilometers (22 miles) north of the proposed site, and Market Lake WMA, located 32 kilometers (20 miles) northeast, are both managed for hunting by the Idaho Department of Fish and Game (IDFG). Camas National Wildlife Refuge is 43 kilometers (27 miles) north of the proposed EREF site and is managed by the U.S. Fish and Wildlife Service (FWS). Fort Hall Indian Reservation is 60 kilometers (37 miles) south of the proposed EREF site and is the property of the Shoshone-Bannock Tribes. The reservation was established in 1868 by the Fort Bridger Treaty.

3.3 Historic and Cultural Resources

This section describes the prehistoric and historic background of the area.

3.3.1 Prehistoric

The prehistory of southern Idaho is divided into the Early Prehistoric Period (13,000 B.C. to 5500 B.C.), the Middle Prehistoric Period (5500 B.C. to A.D. 700), and the Late Prehistoric Period (A.D. 700 to A.D. 1700). The Clovis and Folsom cultures are associated with the Early Prehistoric Period. These cultures relied on hunting large mammals for survival. The climate was cooler and wetter than today. Projectile points associated with the Early Prehistoric Period's Folsom culture have been found at sites within a mile of the proposed EREF site. There is evidence of more intensive use of local resources during the Middle Prehistoric Period. Grinding stones for processing plant food are commonly found on Middle Prehistoric archaeological sites. Large spear points were used during the Early Prehistoric Period. Smaller darts from the Middle Prehistoric Period suggest the hunting of smaller game. There were large climatic fluctuations during the Middle Prehistoric Period. The Late Prehistoric Period is marked by the introduction of the bow and arrow and the use of pottery. Most evidence suggests that mobility and hunting remained important parts of the subsistence strategies of the late prehistoric cultures. Sedentary seasonal farming along major rivers was more prevalent during the Late Prehistoric Period (INL, 2007).

3.3.2 Protohistoric and Historic Indian Tribes

Three tribal groups are known to have been in the vicinity of the proposed site during the protohistoric period (A.D. 1700 to 1850). They were the Shoshone, Paiute, and Bannock (Ringhoff et al., 2008). These groups engaged in seasonal rounds of foraging during which they exploited various resources. The lifeways of protohistoric tribes were greatly modified after 1700 with the introduction of horses. The increased mobility allowed by the horse expanded the ranges of these groups and altered many of their customs. These were the same tribes that were present in the historic period.

3.3.3 Historic Euro-American

Historic use of the area began in the early 1800s when trappers came into the area to collect beaver skins. More intensive use of the land began in 1852 with the establishment of Goodale's Cutoff in the northern portion of what is now the INL property. The cutoff began as a northern extension of the Oregon Trail. By 1860, the route began to be used for moving cattle and sheep from Oregon and Washington to eastern markets. From the 1860s to 1880s, numerous gold and other precious metal mines began to open in central Idaho, which led to increased traffic on Goodale's Cutoff and the creation of numerous other roads and trails through the area. Ranches were established along the Big Lost River by the 1880s where livestock was raised and then transported across what would become INL. Populations began to rise steadily with passage of the *Carey Land Act of 1894* and the *Desert Reclamation Act of 1902*, which set aside a million acres of public lands for homesteading and provided funds to aid in development of irrigation systems, respectively (INL, 2007).

By the early 20th century, the town of Powell had been established on the INL property near the intersection of the Oregon Shortline Railroad (now the Union Pacific Railroad) and the Big Lost River. The town was located near the current location of INL's Radioactive Waste Management Complex. Most of the homesteads failed by the 1920s and were abandoned due to a lack of available water resulting from extensive water use upstream of the INL property for irrigation (INL, 2007).

3.3.4 Historic and Archaeological Resources in the Vicinity of the Proposed Site

Significant archaeological sites are found in the vicinity surrounding the proposed EREF property. One of the most important sites found in the region is the Wasden Complex located approximately 1.6 kilometers (1 mile) from the proposed EREF site. The Wasden Complex is a series of lava blister caves that contain evidence of human use dating back to at least 10,000 B.C. The complex shows evidence of people hunting mammoth and a type of bison that is now extinct (INL, 2007). Complexes of this age that have direct evidence of humans hunting extinct animals are extremely rare. The complex is made up of three distinct sites. The sites contain evidence of continuous use up to the Historic Period.

The Area of Potential Effect (APE) for the *National Historic Preservation Act of 1966* (NHPA) Section 106 review of the proposed project, as defined by the U.S. Nuclear Regulatory Commission (NRC), is the 240-hectare (592-acre) portion of the proposed site that would be directly affected by preconstruction and construction activities. Archaeological surveys have been undertaken by AES's archaeological contractor for the proposed project. The contractor directly examined 381 hectares (941 acres) of the proposed EREF property (Ringhoff et al., 2008), within which the 240-hectare (592-acre) APE is included. The acreage surveyed included additional areas for expansion outside the presently proposed construction and operations areas, which are no longer deemed necessary for the proposed project. An additional 26 hectares (64 acres) was surveyed in 2009 due to changes in the project design (Estes and Raley, 2009). This brought the amount of land surveyed for historic and cultural resources to 407 hectares (1005 acres). The AES surveys identified 13 archaeological sites and 24 isolated finds within the APE. Isolated finds are isolated occurrences of cultural resource material that are not associated with subsurface remains and are not considered archaeological sites. Three of the archaeological sites were prehistoric in age, six were from the historic era, and four contained evidence from both the historic and prehistoric periods (Ringhoff et al., 2008). The prehistoric sites consisted of stone tools or evidence of stone tool manufacture. The historic sites were primarily historic trash scatters consisting of cans and glass. None of the isolated finds are considered eligible for listing on the NRHP. On the basis of the survey results, nine of the sites were recommended not eligible for listing on the *National Register of Historic Places* (NRHP). One site, the John Leopard Homestead (MW004), is recommended eligible for listing on the NRHP for its potential to provide information on the practices of historic era farmers in the region. Several other sites of this type have been previously identified on INL property north of the proposed EREF site (Gilbert, 2010). MW004 consists of several structural remains including a cistern, privy, and historic dugout house foundation. AES's archaeological contractor recommended additional research for three other sites found during the survey (MW002, MW012, and MW015). Subsequently, AES's archaeological contractor found that these three sites lacked sufficient information to be considered significant (Ringhoff et al., 2008).

The NRC conducted a file search for the 1700-hectare (4200-acre) parcel. The file search revealed that the proposed EREF property had not been previously surveyed for the presence of historic and cultural resources (i.e., prior to AES's license application); therefore, no resources were previously known. The file search identified seven previously recorded archaeological sites within one mile of the proposed EREF. Three of the sites are associated with the Wasden Complex (10BV30, 10BV31, and 10BV32) and are all eligible for listing on the NRHP. 10BV30 is known as Owl Cave and contains some of the only known evidence of early prehistoric peoples in association with extinct mammoth bones. 10BV31 is known as Coyote Cave and also contains extensive evidence of human use. The final site associated with the Wasden Complex is 10BV32, which is also a collapsed lava tube. A fourth site (10BV47) consisted of a fluted spear point and associated materials and is considered eligible for listing on the NRHP. No information was available for the remaining three sites (10BV83, 10BV84, and 10BV87).

3.4 Visual and Scenic Resources

This section describes the visual and scenic resources in the vicinity of the proposed EREF.

The proposed EREF site is on undeveloped land 32 kilometers (20 miles) west of Idaho Falls, Idaho. The main portion of the proposed facility would be located approximately 3 kilometers (1.7 miles) north of US 20 (Figure 3-3). The tallest structures at the proposed facility would be approximately 20 meters (65 feet) high. The area is gently rolling, sagebrush semi-desert, with some high points (Figure 3-4). The tallest vegetation on the proposed property is sagebrush that stands approximately 1 meter (3 feet) tall. The highest point in the vicinity of the proposed project is Kettle Butte, which is located 1.2 kilometers (0.75 mile) east of the proposed EREF (Figure 3-5). Larger buttes are visible in the distance. The eastern portion of the proposed EREF site is currently used for agriculture. Single-story agriculture storage structures are located adjacent to US 20 on the proposed property in the vicinity of the proposed EREF site (Figure 3-6). The nearest residence is 7.7 kilometers (4.8 miles) east of the proposed site along US 20.

Figure 3-3 Photo of the Proposed EREF Site Area (AES, 2010)

Figure 3-4 Center of Proposed EREF Site Area Facing South (AES, 2010)

Figure 3-5 Photo from US 20 Facing North
(Note butte in distance.) (Argonne staff photo)

Figure 3-6 Agricultural Sheds near Proposed EREF Site Area (AES, 2010)

Figure 3-7 Hell's Half Acre National Natural Landmark (Argonne staff photo)

The lands immediately surrounding the proposed property to the west, north, and east are primarily covered in sagebrush semi-desert. The land to the west and north is managed by BLM and currently used for grazing and multiple use, a BLM land management designation (Reynolds, 2010). The land to the south of US 20 is a mix of private and BLM-managed land. Some of the private land to the southeast is under cultivation. Much of the land south of the proposed site is the remains of a 4000-year-old lava flow, which is managed by the BLM as Hell's Half Acre WSA (Figure 3-7). See Section 3.2.4 for a description of WSA and NNL.

Another visually sensitive resource in the vicinity of the proposed project is the Wasden Complex, a significant archaeological complex. See Section 3.3.4 for a discussion of the Wasden Complex.

BLM has developed a visual resource management (VRM) system to manage the resources under its control (BLM, 2009b). Even though the BLM's VRM system is officially applicable only to BLM land, it does provide a useful tool for generally inventorying and managing visual resources. The system has two main components. The first is the visual resource inventory (VRI), which attempts to establish the inherent visual qualities of an area, assess whether the public has any concerns related to scenic quality for a location, and determine if there are key observation points for a given location. The inventory characterizes the visual appeal of a location and is discussed further below. The second component of the system is the VRM rating, which reflect the management decisions made by the BLM defining how they will manage the visual resources in a given location. There are four levels of VRM rating, designated as VRM Classes I to IV, with VRM Class I being the most restrictive and protective of the visual landscape and IV being the least restrictive. VRM Class I areas are managed to preserve their existing visual character. VRM II areas are managed to retain their existing visual character; VRM III areas are managed to partially retain their existing visual character; and VRM IV areas are those that allow major modification of the existing visual character of the landscape.

The Hell's Half Acre WSA has a VRM rating of I, which indicates that the BLM has decided to manage the area to retain its existing character. Under VRM I, the level of change must not attract viewer attention. The lands surrounding the WSA and the property to be purchased by AES are designated as VRM II by the BLM. They are managed to retain their existing visual character. Changes in the characteristics of the location should be low and should not attract the attention of a viewer (BLM, 2009b).

The BLM VRI process involves evaluating the visual landscape to determine the (1) sensitivity of the location for visual intrusions, (2) scenic qualities of the location, and (3) distance from which the location would be viewed. Sensitivity refers to the public's concern or expectation for scenic quality. Sensitivity is based on the types of users that would view the location (e.g., recreational users, commuters, or workers), the amount of use, public interest, and adjacent land uses. Distance considerations are a factor when determining visual resource inventory values and associated impacts. The proposed EREF site is located within 3 kilometers (2 miles) of US 20, which would place it in the foreground-middleground zone where visual intrusions are very obvious, as opposed to the distant background where they are less obvious. Visual intrusions in this zone typically have the greatest apparent contrast because they are highly visible from key observation points.

Sensitivity is an important factor in the VRI process because it addresses the expectation for pristine environments. The proposed EREF property is in a relatively undeveloped setting. US 20 is most heavily used by workers commuting to INL. Other people traveling US 20 include farmers going to their fields and tourists visiting the Hell's Half Acre WSA. The public has not expressed any opinions indicating a preference for or against maintaining the current visual situation (see Appendix A). Uses for adjacent land in the immediate vicinity of the proposed property include farming and the Hell's Half Acre WSA. Most of the area surrounding the proposed EREF site is undeveloped sagebrush semi-desert. Industrial developments are found on INL, but none of them are visible from the proposed site. Sensitivity to changes in the visual landscape would be expected to be low for workers and farmers using the area and moderate to high for those using the Hell's Half Acre WSA.

The VRI process measures the scenic quality of an area through application of the scenic quality rating criteria, which cover landforms, vegetation, water, color, adjacent scenery, scarcity, and cultural modification. The scenic quality criteria applied to a landscape are presented in Table 3-1. Examples of how to apply the criteria are presented in Table 3-2. The landform is rolling desert landscape with large open vistas (Rating 1). The vegetation is primarily sagebrush semi-desert (Rating 1). No water sources are evident from the proposed site (Rating 0). The color range in the proposed site area is various hues of green from the sagebrush environment and the agricultural fields (Rating 1). Adjacent scenery is similar to that found in the proposed site area and has little influence on the visual quality (Rating 1). Although the proposed site is adjacent to the unique geologic features associated with Hell's Half Acre WSA, the land occupied by the proposed project is not unique (Rating 1). Currently, very little by way of cultural modifications are visible in the proposed site area. Storage sheds,

Table 3-1 Scenic Quality: Explanation of Rating Criteria

Landform	Topography becomes more interesting as it gets steeper, more massive, or more severely or universally sculptured. Outstanding landforms may be monumental (e.g., Grand Canyon in Arizona, Sawtooth Mountain Range in Idaho, Wrangell Mountain Range in Alaska) or exceedingly artistic and subtle (e.g., certain badlands, pinnacles, arches, and other extraordinary formations).
Vegetation	Ratings give primary consideration to the variety of patterns, forms, and textures created by plant life. They consider short-lived displays when they are known to be recurring or spectacular. They also consider smaller-scale vegetative features that add striking and intriguing detail elements to the landscape (e.g., gnarled or wind-beaten trees and joshua trees).
Water	Ratings consider ingredients that add movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.
Color	Ratings consider the overall color(s) of the basic components of the landscape (e.g., soil, rock, vegetation) as they appear during seasons or periods of high use. Key factors to use when rating "color" are variety, contrast, and harmony.
Adjacent Scenery	Ratings consider the degree to which scenery outside the unit being rated enhances the overall impression of the scenery within the rating unit. The distance from which adjacent scenery influences scenery within the rating unit normally ranges from zero to 8 kilometers (5 miles), depending on the characteristics of the topography, vegetative cover, and other such factors. This criterion is generally applied to units that would normally score very low, but for which the influence of the adjacent unit would enhance the visual quality and raise the score.
Scarcity	This criterion provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region. It also covers cases for which a separate evaluation of each of the key criteria does not give a true picture of the overall scenic quality of an area. It is often the case that a number of rather unspectacular elements, in the proper combination, produce the most pleasing and memorable scenery. The scarcity criterion can be used to recognize this type of area and give it the added emphasis it needs.
Cultural Modifications	Cultural modifications in the landform, water, and vegetation, as well as the addition of structures, should be considered. They may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit. They should be rated accordingly.

Source: BLM, 2007.

Table 3-2 Scenic Quality Inventory and Evaluation Chart

Key Factors	Rating Criteria and Score		
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops; or severe surface variation or highly eroded formations, including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing, such as glaciers. 5	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in the size and shape of landforms; or detail features that are interesting but not dominant or exceptional. 3	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. 1
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns. 5	Some variety of vegetation, but only one or two major types. 3	Little or no variety or contrast in vegetation. 1
Water	Clear and clean appearing, still, or cascading white water, any of which is a dominant factor in the landscape. 5	Flowing, or else still but not dominant in the landscape. 3	Absent, or else present but not noticeable. 0
Color	Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water, or snow fields. 5	Some intensity or variety in colors and contrasts of the soil, rock, and vegetation, but not a dominant scenic element. 3	Subtle color variations, contrast, or interest; generally mute tones. 1
Adjacent Scenery	Adjacent scenery greatly enhances visual quality. 5	Adjacent scenery moderately enhances overall visual quality. 3	Adjacent scenery has little or no influence on overall visual quality. 0
Scarcity	One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. 5+	Distinctive, although somewhat similar to others within the region. 3	Interesting within its setting, but fairly common within the region. 1
Cultural Modification	Modifications add favorably to visual variety while promoting visual harmony. 2	Modifications add little or no visual variety to the area and do not introduce discordant elements. 0	Modifications add variety but are very discordant and promote strong disharmony. -4

Source: BLM, 2007.

agricultural crops, and US 20 are the only visible cultural modifications (Rating 0). The overall scenic quality rating is 5. According to the BLM VRI criteria, an A or high quality classification is for a rating of 19 or more. For a rating of 12 to 15, the area is considered a B, and a rating of 11 or less is a C (BLM 2009). The scenic resource inventory rating for the landscape near the proposed EREF is a C, which means that the proposed EREF site does not contain a high level of scenic quality.

3.5 Climatology, Meteorology, and Air Quality

This section describes the climatology, meteorology, and air quality of the proposed EREF site and vicinity.

3.5.1 Climatology

3.5.1.1 Idaho

Idaho lies 480 kilometers (300 miles) east of the Pacific Ocean, but is nevertheless influenced by maritime air carried east by the prevailing westerly winds. The maritime influence is strongest in the northern part of the State with wet winters and dry summers. Eastern Idaho's climate is more continental in character than the western and northern portions of the State and is instead characterized as a semiarid steppe with dry winters and wet summers. Temperature patterns in the State are influenced by latitude and elevation. Precipitation patterns in Idaho are complex, with most of the moisture coming from the Pacific Ocean. Snowfall is affected by elevation and moisture availability with major mountain ranges accumulating deep snow in the winter. Floods occur most often during the spring snowmelt, but there are out-of-season floods. Fog events are extremely variable in frequency. Windstorms are not uncommon, but Idaho has no hurricanes and an extremely small incidence of tornadoes. The annual percentage of possible sunshine ranges from about 50 percent in the north to about 70 percent in the south, with lower frequencies in the winter and up to near 80 percent during July and August in the east and north (NCDC, 2009a).

3.5.1.2 Proposed EREF Site

The proposed EREF site lies in the middle of the Eastern Snake River Plain (ESRP), a broad, flat river valley running southwest to northeast for about 80 kilometers (50 miles). The average elevation of the valley is about 1524 meters (5000 feet) mean sea level (MSL), and it is bordered by mountain ranges rising to about 3353 meters (11,000 feet) MSL. The orientations of the valley and the bordering mountains have a significant impact on the wind flow patterns at the proposed EREF site. Air masses typically move from west to east and lose their moisture over the mountains to the west before reaching the ESRP. Thus, rainfall is generally light and the region is semiarid. The temperature regime is moderate. There is little cloud cover and generally large diurnal temperature variation (AES, 2010).

3.5.2 EREF Site Meteorology

Four National Weather Service (NWS) stations in the vicinity of the proposed EREF produce meteorological data that are generally representative of conditions at the proposed EREF site:

- Kettle Butte (KET),

- Idaho National Laboratory (MFC),

- Idaho Falls 46 West (ID46W), and

- Idaho Falls 2 ESE (ID2ESE), an urban location.

These stations are all located in the ESRP, and are shown in Figure 3-8. These are the closest NWS monitoring stations to the proposed EREF site; weather data collected at these sites is therefore most representative of weather that can be expected at the proposed EREF site.

3.5.2.1 Temperature

Figure 3-9 presents monthly mean temperature data for all four meteorological stations. Temperature trends throughout the year are similar at all four stations. During July and August, the monthly average temperatures at MFC and KET are higher than at the other two stations, and the monthly average temperature is always lowest at ID46W (AES, 2010).

Table 3-3 tabulates more detailed, long-term data from NCDC for the ID46W (48 years of data) and ID2ESE (50 years of data) sites. Both stations show monthly average temperatures as being lowest in January and highest in July.[1] The smallest daily temperature range at both stations occurs in winter and the largest in summer, due to the more intense solar radiation experienced in summer. The urban ID2ESE station experiences a smaller daily variation in temperature than the rural ID46W station. The highest and lowest temperatures recorded at ID2ESE are 38°C (100°F) and –37°C (–34°F), and are 38°C (101°F) and –44°C (–47°F) at ID46W (AES, 2010).

3.5.2.2 Precipitation and Relative Humidity

<u>Precipitation</u>

Air masses approaching the proposed EREF site from the west must cross high mountain ranges, making the annual precipitation light. Table 3-4 presents normal and extreme precipitation data collected at the ID2ESE and ID46W monitoring stations. Showers and thundershowers occur in the summer. Spring and fall precipitation are generally showers or steady rain. Winter precipitation is usually snow (AES, 2010; NOAA, 2004a,b).

Annual average precipitation at ID2ESE is about 361 millimeters (14.2 inches) with a peak in May. The maximum monthly recorded precipitation is 116 millimeters (4.56 inches) in May 1993. Annual average precipitation at ID46W is less, about 224 millimeters (9 inches). The maximum monthly recorded precipitation is 118 millimeters (4.64 inches) in June 1995. There have been at least 10 months with no recorded precipitation in the 30-year period of record.

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[1] The monthly average temperature is –6.1°C (21.1°F) in January and 20.4°C (68.7°F) in July at ID2ESE, and –8.8°C (16.2°F) in January and 19.8°C (67.6°F) in July at ID46W.

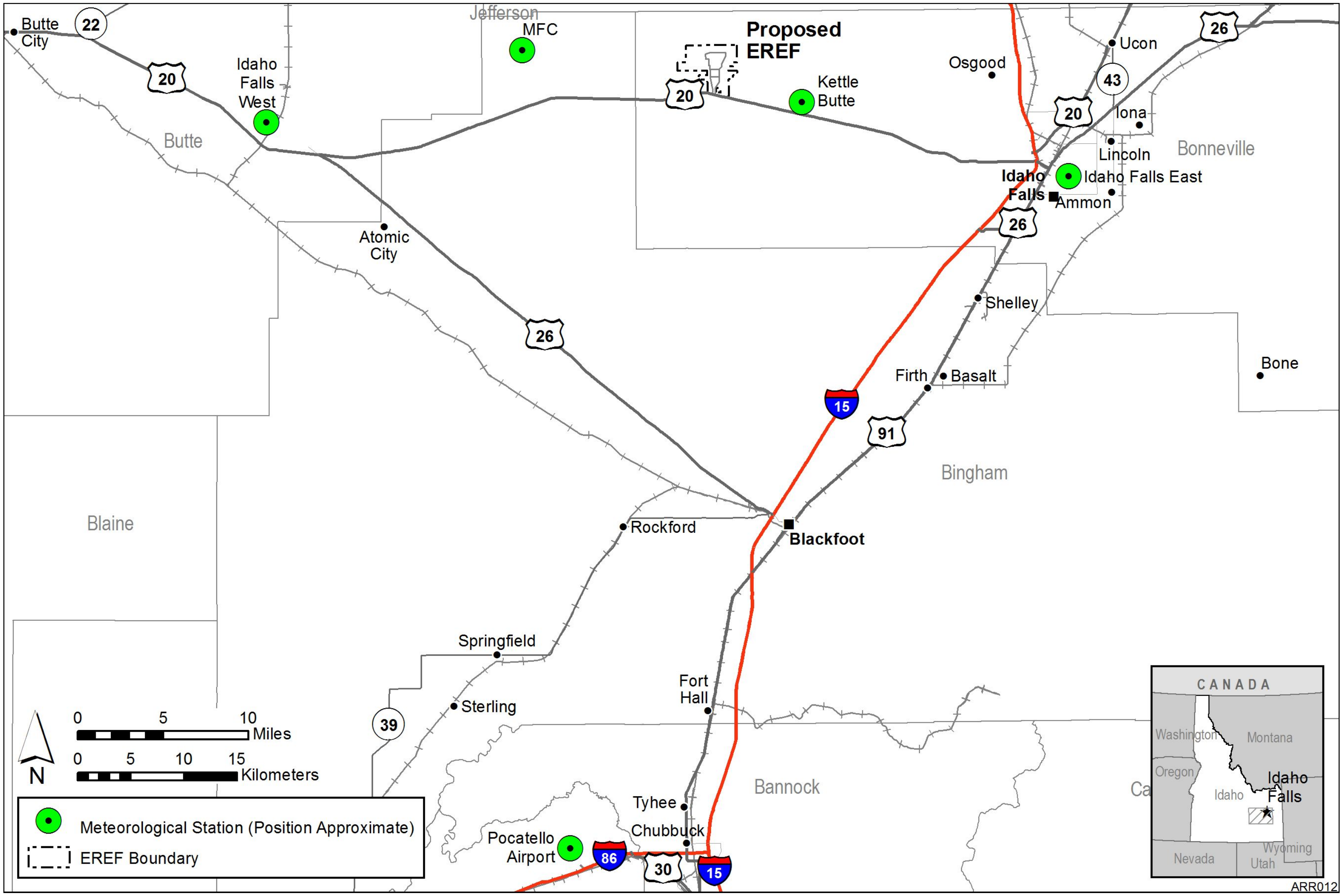

Figure 3-8 Meteorological Monitoring Stations near the Proposed EREF Site

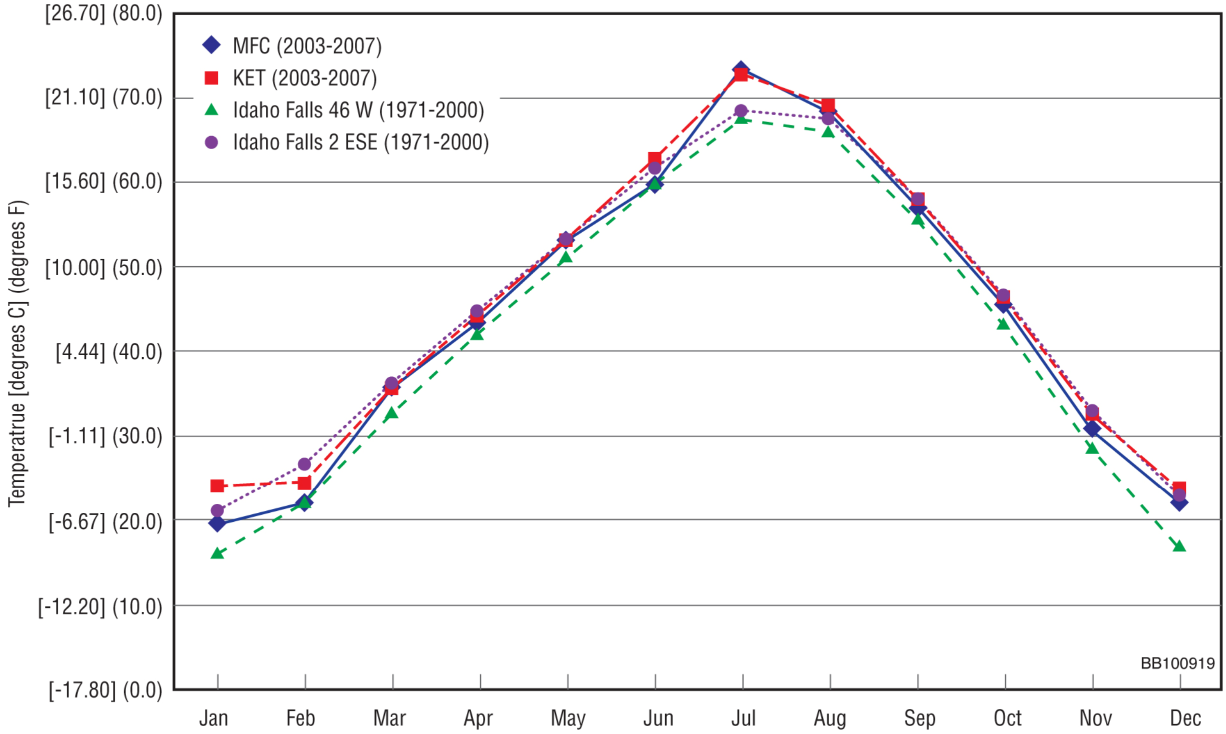

Figure 3-9 Monthly Mean Temperatures in the Vicinity of the Proposed EREF Site (AES, 2010)

Figure 3-10 compares monthly mean precipitation at the four nearby stations (the data for MFC and KET are from 2003 to 2007 and are not concurrent with the 1971–2000 record for the other two sites. All four stations have higher precipitation in the spring (April–June) with a second increase in October at MFC and KET. IDESE2 always has the highest precipitation (AES, 2010; NOAA, 2004a,b).

Based on hourly data for KET and MFC for 2003–2007, precipitation occurs only 3 percent of the time and is mostly less than 2.5 millimeters (0.1 inch) (AES, 2010).

Annual average snowfall at ID2ESE is 833 millimeters (32.8 inches) with a highest daily snowfall of 254 millimeters (10 inches) that has occurred at least twice during the 39 years from January 1950 through December 1988. The highest monthly snowfall was 572 millimeters (22.5 inches) in December 1994. Annual average snowfall at ID46W is 637 millimeters (25.1 inches) with a highest daily snowfall of 218 millimeters (8.6 inches). The highest monthly snowfall was 566 millimeters (22.3 inches) in December 1971 (NOAA, 2004a,b).

<u>Relative Humidity</u>

Table 3-5 presents monthly and annual average relative humidity data for ID46W for the period 1956–1961. Relative humidity is higher in the winter and lower in the summer. Values of 100 percent have been observed in all months except July. During the day, the highest relative humidity generally occurs near sunrise, and the lowest in mid-afternoon (Clawson et al., 1989).

Table 3-3 Mean, Average, and Extreme Temperatures near the Proposed EREF Site

Station	Temperature[a]	POR[b]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Idaho Falls 2 ESE (ID2ESE)	Extreme highest	1952–2001	55.0	63.0	75.0	85.0	92.0	100.0	100.0	100.0	95.0	87.0	73.0	60.0	100.0
			12.8	17.2	23.9	29.4	33.3	37.8	37.8	37.8	35.0	30.6	22.8	15.6	37.8
	Mean maximum	1971–2000	29.7	36.6	47.6	58.7	67.9	77.8	86.0	85.8	75.1	61.4	43.0	31.3	58.4
			–1.3	2.6	8.7	14.8	19.9	25.4	30.0	29.9	23.9	16.3	6.1	–0.4	14.7
	Average	1971–2000	21.1	26.7	36.2	45.0	53.3	61.9	68.7	67.9	58.2	46.8	33.1	22.4	45.1
			–6.1	–2.9	2.3	7.2	11.8	16.6	20.4	19.9	14.6	8.2	0.6	–5.3	7.3
	Mean minimum	1971–2000	12.5	16.8	24.8	31.3	38.7	46.0	51.4	49.9	41.3	32.2	23.2	13.4	31.8
			–10.8	–8.4	–4.0	–0.4	3.7	7.8	10.8	9.9	5.2	0.1	–4.9	–10.3	–0.1
	Extreme lowest	1952–2001	–29.0	–34.0	–15.0	9.0	20.0	28.0	34.0	31.0	18.0	7.0	–12.0	–29.0	–34.0
			–33.4	–36.7	–26.1	–12.8	–6.7	–2.2	1.1	–0.6	–7.8	–13.9	–24.4	–33.7	–36.7
Idaho Falls 46 W	Extreme highest	1954–2001	51.0	60.0	73.0	86.0	91.0	100.0	101.0	101.0	96.0	87.0	67.0	57.0	101.0
			10.6	15.6	22.8	30.0	32.8	37.8	38.3	38.3	35.6	30.6	19.4	13.9	38.3
	Mean maximum	1971–2000	27.9	34.0	44.8	56.9	66.3	76.8	86.6	85.7	74.6	60.9	41.4	29.4	57.1[c]
			–2.3	1.1	7.1	13.8	19.1	24.9	30.3	29.8	23.7	16.1	5.2	–1.4	13.9
	Average	1971–2000	16.2	22.1	32.8	42.4	51.2	60.0	67.6	66.2	55.7	43.4	28.7	17.1	42.0
			–8.8	–5.5	0.4	5.8	10.7	15.6	19.8	19.0	13.2	6.3	–1.8	–8.3	5.6
	Mean minimum	1971–2000	4.5	10.2	20.7	27.9	36.1	43.2	48.5	46.7	36.8	25.9	15.9	4.8	26.8[c]
			–15.3	–12.1	–6.3	–2.3	2.3	6.2	9.2	8.2	2.7	–3.4	–8.9	–15.1	–2.9
	Extreme lowest	1954–2001	–40.0	–36.0	–28.0	6.0	13.0	23.0	28.0	24.0	12.0	1.0	–24.0	–47.0	–47.0
			–40.0	–37.8	–33.3	–14.4	–10.6	–5.0	–2.2	–4.4	–11.1	–17.2	–31.1	–43.9	–43.9

[a] For each temperature, the first line gives the temperature in °F, the second in °C.
[b] POR: Period of Record.
[c] Average of the twelve monthly means.
Source: NOAA, 2004a,b.

Table 3-4 Monthly Precipitation near the Proposed EREF Site

Station	Total[a]	POR[b]	Monthly Precipitation												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Idaho Falls 2 ESE	Highest	1952–2001	2.38	3.13	4.30	2.82	4.56	3.16	2.13	2.66	2.81	2.49	3.20	3.18	
			60.45	79.50	109.22	71.63	115.82	80.26	54.10	67.56	71.37	63.25	81.28	80.77	
	Average	1971–2000	1.25	1.01	1.33	1.27	2.01	1.18	0.74	0.93	0.94	1.12	1.17	1.26	14.21
			31.75	25.65	33.78	32.26	51.05	29.97	18.80	23.62	23.88	28.45	29.72	32.00	360.93
	Lowest	1952–2001	0.22	0.00	0.04	0.20	0.33	0.15	0.00	0.07	0.00	0.00	0.00	0.00	
			5.59	0.00	1.02	5.08	8.38	3.81	0.00	1.78	0.00	0.00	0.00	0.00	
Idaho Falls 46 W	Highest	1954–2001	1.20	2.36	2.03	1.99	2.34	4.64	2.29	1.13	2.08	1.67	1.74	1.91	
			30.48	59.94	51.56	50.55	59.44	117.86	58.17	28.70	52.83	42.42	44.20	48.51	
	Average	1971–2000	0.64	0.62	0.69	0.79	1.24	1.08	0.66	0.44	0.73	0.57	0.69	0.67	8.82
			16.26	15.75	17.53	20.07	31.50	27.43	16.76	11.18	18.54	14.48	17.53	17.02	224.03
	Lowest	1954–2001	0.01	0.00	0.00	0.00	0.31	0.01	0.00	0.02	0.00	0.00	0.00	0.00	
			0.25	0.00	0.00	0.00	7.87	0.25	0.00	0.51	0.00	0.00	0.00	0.00	

[a] For each statistic, the first line gives the precipitation in inches, the second in millimeters.
[b] POR: Period of Record.
Source: NOAA, 2004a,b.

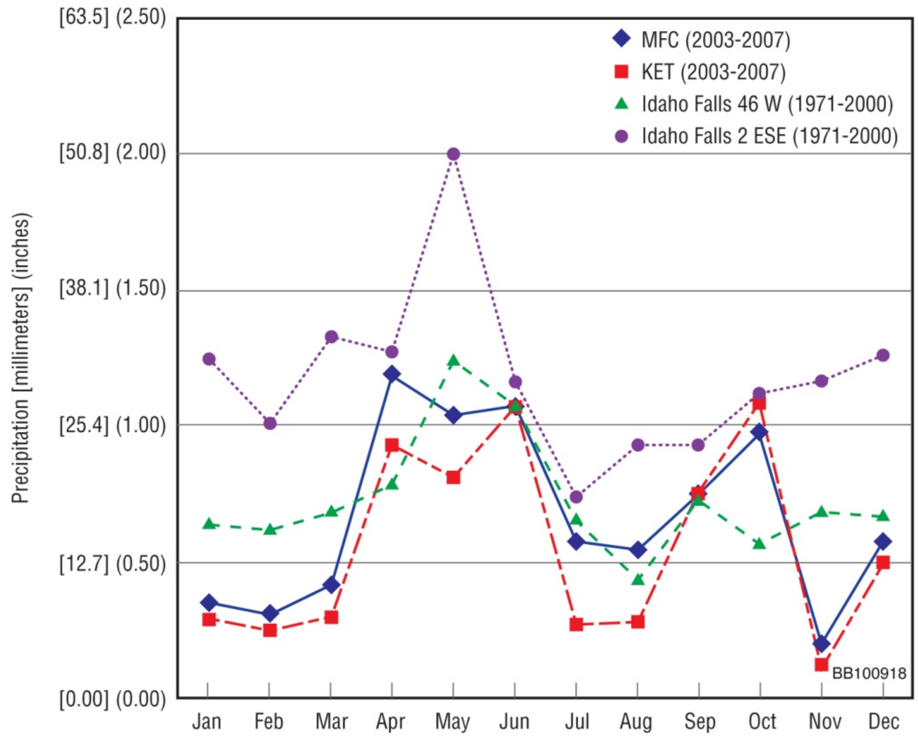

Figure 3-10 Monthly Mean Precipitation in the Vicinity of the Proposed EREF Site (AES, 2010; NOAA, 2004a,b)

3.5.2.3 Winds, Atmospheric Stability, and Temperature Inversions

Winds

Several phenomena influence the wind patterns at the proposed EREF property. It is in the region of prevailing westerly winds that are channeled by the topography within and surrounding the ESRP to produce predominantly west-southwest or southwesterly winds. Some of the highest wind speeds are observed under these conditions. Drainage winds[2] also affect the wind flow at the proposed EREF site. On clear nights, air near the ground, including mountain slopes, cools rapidly and sinks downslope into the valley floor. On sunny days, an opposite flow develops as the air near the surface heats and rises.

This flow upslope is generally weaker than the downslope flow and is often masked by the channeled prevailing westerlies.

[2] Drainage winds, also sometimes called katabatic winds or fall winds, are winds that carry high-density air masses down the slope of a mountain from higher elevations. The air masses involved are generally cold with low relative humidity and can greatly influence local air circulation patterns.

Figure 3-11 presents an annual wind rose[3] for MFC based on data for 2004 to 2008. This wind rose clearly shows the channeling effect of local topography with winds predominately from the southwest and northeast.

Table 3-5 Relative Humidity at ID46W

Month[a]	Average Relative Humidity (%)
January	68
February	70
March	58
April	44
May	46
June	36
July	30
August	31
September	38
October	48
November	60
December	68
Annual	50

[a] Based on 1956–1961.
Source: Clawson et al., 1989.

Table 3-6 presents average monthly and annual wind speeds for ID46W and MFC. The ID46W data were taken at 6 meters (20 feet) above the ground, and the MFC data were taken at 10 meters (33 feet) above the ground. Since wind speed changes with height, extensive direct comparisons between monitoring stations are problematic. Average wind speeds are generally highest in the spring and lowest in winter. The KET site which has the highest monitor also has the highest wind speeds for each month and for the year. Table 3-7 shows the peak winds and the concurrent direction by month. At both sites, March is the month with the highest hourly wind speeds that range between 41 and 51 miles per hour (18 and 23 meters per second). The highest hourly winds blow from the southwest.

Atmospheric Stability

Atmospheric stability plays an important role in dispersing atmospheric emissions. Vertical motions and pollution dispersion are enhanced in unstable atmospheres and suppressed in stable atmospheres. Stability is usually classified by the Pasquill-Gifford stability classes ranging from A though G, which depend on solar insolation, wind speed, and cloud cover.

A-stability (most unstable) occurs in low winds with high incoming levels of solar radiation typically during the daytime. E-stability (slightly stable) and F-stability (moderately stable) conditions arise on clear nights with little wind. G-stability (extremely stable) generally occurs infrequently with very light winds and clear skies and is often included with F-stability. D-stability (neutral) conditions occur with higher wind speeds and/or greater cloud cover during both day and night.

Table 3-8 shows the frequency of unstable, neutral, and stable conditions for the station nearest the proposed site (Doty et al., 1976). The frequency data are presented as ranges rather than as point estimates. The best dispersion (unstable conditions) occurs 16–25 percent of the time, and poor dispersion (stable conditions) occurs 26–35 percent of the time.

[3] A *wind rose* summarizes wind speed and direction graphically as a circle displaying series of radial bars pointing in different directions. The direction of a bar shows the direction *from* which the wind blows. Each bar is divided into segments. Each segment represents wind speeds in a given range of speeds; for example, 6–8 meters per second. The length of a given segment represents the percentage of the summarized hours that winds blew from the indicated direction with a speed in the given range.

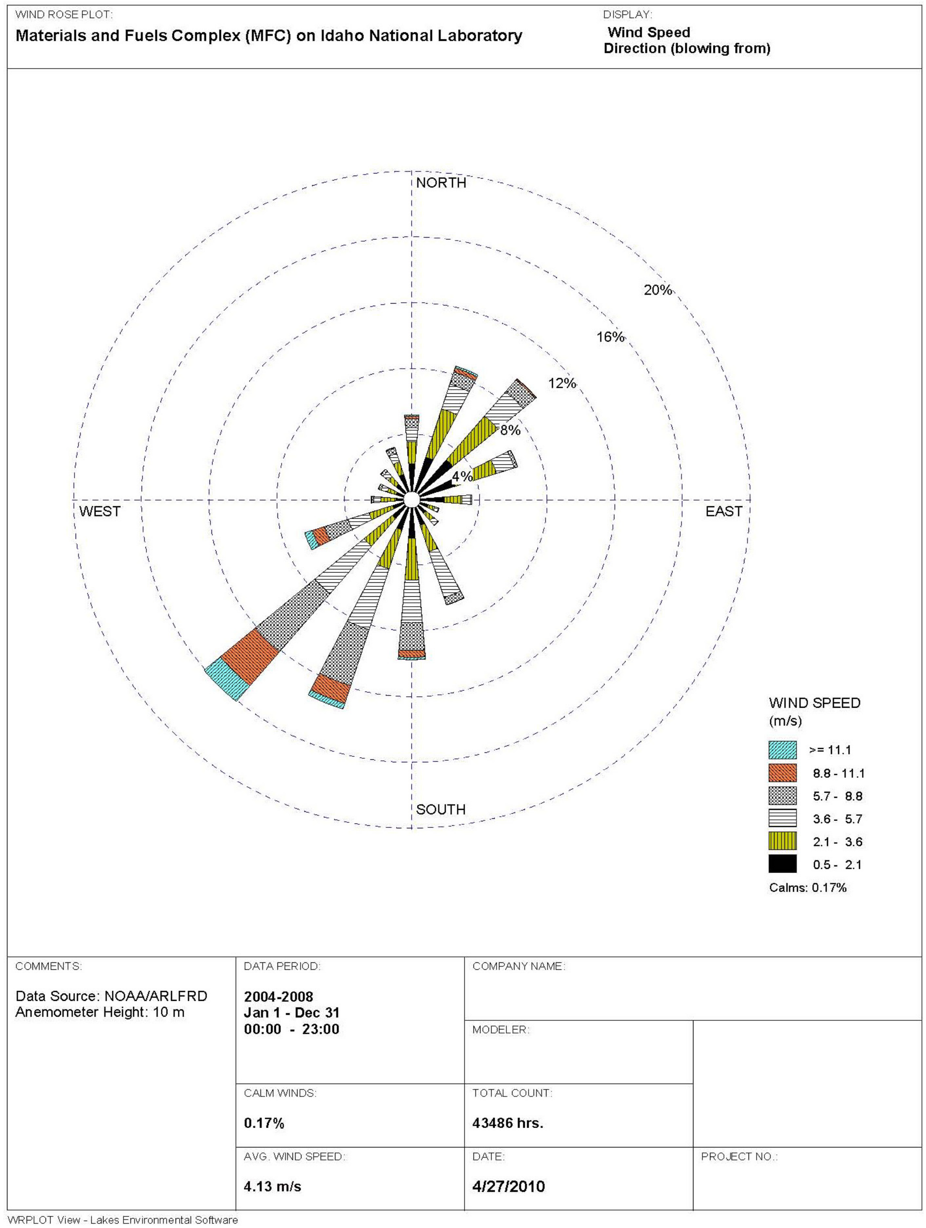

Figure 3-11 Wind Rose for MFC (data from Hukari, 2009)

Inversions

Normally, the temperature in the atmosphere decreases with altitude. A temperature inversion occurs when there is an increase in temperature of the air mass with increasing elevation above the ground (see Atmospheric Stability text box). Inversions limit vertical dispersion, causing pollutants to be trapped close to the ground. The length of time an inversion lasts (its persistence) is important for determining its impact on dispersion, and thus the ambient air quality in the area impacted by the inversion.

Table 3-9 summarizes inversion persistence for the MFC site for 1953 to 1960. The longest inversion for the 8-year period lasted 66 hours, and every month had at least one inversion lasting longer than 13 hours (Clawson et al., 1989).

Table 3-6 Average Monthly and Annual Wind Speeds near the Proposed EREF Site

	Wind Speed [mi/hr (m/sec)]	
Month	**ID46W[a]**	**MFC[b]**
January	5.6 (2.5)	7.2 (3.2)
February	6.9 (3.1)	7.3 (3.2)
March	8.7 (3.9)	9.6 (4.3)
April	9.3 (4.2)	10.9 (4.9)
May	9.3 (4.2)	10.7 (4.8)
June	8.9 (4.0)	10.7 (4.8)
July	8.0 (3.6)	9.8 (4.4)
August	7.7 (3.4)	9.9 (4.4)
September	7.2 (3.2)	9.0 (4.0)
October	6.8 (3.0)	8.5 (3.8)
November	6.4 (2.9)	8.6 (3.9)
December	5.2 (2.3)	8.4 (3.8)
Annual	7.5 (3.4)	9.1 (4.1)

[a] 6-meter (20-foot) level for April 1950 to October 1964.
[b] 10 meters (33 feet) for 2004 to 2008.
Source: ID46W: Clawson et al., 1989; MFC: Hukari, 2009.

3.5.2.4 Severe Weather Conditions

The National Climatic Data Center (NCDC) storm event database tabulates storm events by county (NCDC, 2009b). Table 3-10 presents data from this database on various storm events in the four-county region comprised of Bonneville, Bingham, Butte, and Jefferson Counties. The proposed EREF property is entirely within Bonneville County but lies at the approximate centroid of these four counties. The following paragraphs discuss the most frequent storm events and identify additional classes of events documented in INL data (Clawson et al., 1989). There were no droughts, dust storms, hurricanes, tropical storms, waterspouts, or temperature-extreme events recorded in the NCDC data.

<u>**Thunderstorms and High Winds**</u>

NCDC (2009b) lists 236 thunderstorms and high wind days, or about 4.0 thunderstorms and high wind days per year, as having occurred during the period January 1, 1950, through December 31, 2008, in the four-county region. There may be several thunderstorms during a thunderstorm day. Storms can occur throughout the year but are most prevalent in the March to October period. Strong winds, hail, and tornadoes can accompany severe storms, but thunderstorms tend to be less severe than those east of the Rocky Mountains, as the associated precipitation often evaporates before reaching the ground (a meteorological phenomenon known as virga). Winds greater than 94 kilometers per hour (58 miles per hour) occurred on 147 of the days. Hail accompanied thunderstorms on 8 days.

<u>**Tornadoes**</u>

NCDC (2009b) lists 40 tornadoes during the period in the four-county region, giving an annual incidence of 0.68. One F2 tornado[4] was sighted during the period on April 7, 1978. It caused

[4] The Fujita six-point scale (F0 to F5) is used to rate the intensity of a tornado based on the damage it inflicts to structures and vegetation from the lowest intensity, F0, to the highest, F5. Fujitia scale categories are based on estimated (not measured) sustained wind speeds compared against observed structural damage. The enhanced Fujitia scale replaced the original Fujita scale in February 2007. The enhanced Fujita scale still uses six categories of tornado intensity (EF0 to EF5) but defines those categories differently. Overall, most tornadoes (around 77 percent) in the United States are EF0 or EF1 and about 95 percent are below EF3 in intensity. Approximately 0.1 percent of all tornadoes each EF5 status with sustained winds in excess of 200 mph (NOAA, 2008). For additional information about the Fujitia scales, see the NOAA Web site at http://www.spc.noaa.gov/efscale.

Table 3-7 Highest Hourly Wind Speed and Direction near the Proposed EREF Site

Month	ID46W[a] Speed [mi/hr(m/sec)]	ID46W[a] Direction	MFC[b] Speed [mi/hr(m/sec)]	MFC[b] Direction
January	48 (21)	WSW	37 (17)	SSW/NNE[c]
February	36 (16)	SW	32 (14)	NNE
March	51 (23)	WSW	41 (18)	SW
April	39 (17)	WSW	11 (17)	SW
May	41 (18)	SW	34 (15)	SW
June	36 (16)	SW	35 (16)	SW
July	35 (16)	WSW	38 (17)	SW
August	40 (18)	WSW	36 (16)	SW
September	42 (19)	WSW	30 (13)	SSW
October	44 (20)	WSW	33 (15)	SSW
November	40 (18)	WSW	35 (16)	SW
December	43 (19)	SW	39 (17)	SSW
Annual	51 (23)	WSW	41 (18)	SW

[a] 6-meter (20-foot) level for April 1950 to October 1964.
[b] 10 meters (33 feet) for 2004 to 2008.
[c] Almost equal number of hours in both directions.
Source: ID46W: Clawson et al., 1989; MFC: Hukari, 2009.

$2.5 million in damage and one injury. Twenty of the tornadoes were F1 in strength; the remainder were F0.

In addition to tornadoes, 12 funnel clouds, violent atmospheric vortices that do not reach the ground, were sighted during the period in the four-county region.

Table 3-8 Stability Class Distribution near the Proposed Site

Stability	Frequency (%)
Unstable	16–25
Neutral	56–65
Stable	26–35

Source: Doty et al., 1976.

Airborne Dust and Sand

NCDC (2009b) lists no dust storms during the period in the four-county region. However, since the proposed EREF site is in a semiarid area, blowing and drifting dust could be a nuisance when winds are strong. Vehicles and construction equipment could also contribute to airborne dust.

Table 3-9 Inversion Persistence at MFC[a]

Month	Average Hours per Day	Max Hours per Day	Longest Duration (hr)
January	17.0	24	46
February	15.7	23	24
March	13.5	18	20
April	11.8	14	14
May	10.8	15	13
June	10.2	13	15
July	10.7	15	15
August	11.7	14	14
September	12.8	15	18
October	14.3	17	17
November	15.1	21	21
December	16.8	24	66

[a] Based on January 1953 to December 1960.
Source: Clawson et al., 1989.

Table 3-10 Storm Events in the Vicinity of the Proposed EREF Site

	Type and Number of Storm Event[a,b]								
County	Thunderstorms and High Winds	Tornados	Precipitation[c]	Snow and Ice[d]	Lightning	Funnel Cloud	Flood	Hail	Fog
Bonneville	48 (5)	5 (4)	6	4	4	4	3	22	1
Bingham	87 (20)	15 (8)	4	0	5	5	5	28	1
Butte	52 (1)	7 (2)	0	0	0	3	1	23	0
Jefferson	49 (3)	13 (9)	0	0	0	0	0	19	0
Total	236 (29)	40 (23)	10	4	9	12	9	92	2

[a] Period of Record: January 1, 1950, to May 31, 2009.
[b] Numbers in parentheses are number of events associated with property damage.
[c] All events were heavy rains.
[d] All events were snow.
Source: NCDC, 2009b.

<u>Dust Devils</u>

Dust devils are small rotating updrafts over hot land surfaces. Dust devils are common in the summer at the proposed EREF site when intense solar heating of the ground makes dust devil formation possible. Because of their relatively weak wind speeds and short duration, they rarely damage people or property (Clawson et al., 1989).

<u>Blowing Snow</u>

Blowing snow occurs when snow is picked up from the ground and entrained in the air by high winds. Blowing snow can reduce visibility and accumulate into drifts on the downwind side of buildings and other obstacles. The flat terrain around the proposed EREF is not conducive to the formation of snowdrifts. However, at INL to the immediate west, drifts may occasionally render parking lots and roads impassable and cause traffic to be rerouted (Clawson et al., 1989).

<u>Floods</u>

Of the nine listed flood events listed in NCDC (2009b), one was an urban event, one was a small stream event, three were combined urban/small stream events, and four were flash flood events.

<u>Lightning</u>

Lightning strikes can cause injury, death, and property damage. Of the nine events listed in NCDC (2009b) for the four-county region, none caused injury or death and five resulted in property damage. NOAA (2009) gives a lightning strike density for this area of 0.1 to 1 per square kilometer per year, a value at the lower end of the strike density range. The analysis presented in AES (2010) uses a more conservative density of one flash per square kilometer per year to estimate a lightning strike frequency of 0.75 flashes per square kilometer per year for the proposed EREF industrial complex (including the Cylinder Storage Pad).

3.5.2.5 Mixing Heights

The mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs, primarily through the action of atmospheric turbulence. When the mixing height is low (i.e., very little vertical motion), ground-level pollutant concentrations will be relatively high because the pollutants are prevented from dispersing upward. Mixing heights commonly go through large diurnal variations due to solar heating and surface cooling. Mixing heights are generally lowest late at night or early in the morning and highest during mid to late afternoon. Afternoon mixing heights display a large seasonal variation, and mixing heights in summer are typically higher than those in winter.

Table 3-11 presents seasonal and annual mixing heights estimated at INL (Clawson et al., 1989). The mixing height is greatest on summer afternoons and least on summer mornings. The average annual mixing height is 370 meters (1210 feet) in the morning and 2090 meters (6860 feet) in the summer.

3.5.3 Air Quality

There are several U.S. Environmental Protection Agency (EPA) programs authorized by the *Clean Air Act* and its amendments that define the regulatory environment for air emission sources at the proposed EREF property. The Idaho Department of Environmental Quality (IDEQ) has authority to administer these programs in the State. The major programs are summarized below.

Table 3-11 Estimated Seasonal and Annual Mixing Heights in the Vicinity of the Proposed EREF Site

Season	Estimated EREF Average Mixing Heights [m (ft)] Morning	Afternoon
Spring	480 (1600)	2330 (7640)
Summer	260 (850)	2900 (9510)
Autumn	330 (1100)	1550 (5100)
Winter	400 (1300)	730 (2400)
Annual	370 (1210)	2090 (6860)

Source: Clawson et al., 1989.

EPA's National Ambient Air Quality Standards (NAAQS) set maximum levels of air pollutants in the ambient air deemed to provide protection for human health and welfare. Areas where these standards are not being met are designated as nonattainment areas. When a nonattainment area attains the standard, it becomes a maintenance area. States must develop Federally approved plans specifying how the NAAQS will be attained and maintained. NAAQS are shown in Table 3-12.

Sulfur dioxide (SO_2) is a gas emitted largely by stationary internal or external combustion sources burning fossil fuels. Particulate matter (PM) includes solid matter and liquid droplets in the atmosphere. Particles with aerodynamic diameters below 10 micrometers (1 micrometer is about 0.000039 inch) constitute PM_{10}. Smaller particles with diameters below 2.5 micrometers constitute $PM_{2.5}$. Carbon monoxide (CO) is a gas produced primarily by the incomplete combustion of carbon in fuels; vehicles and stationary internal combustion engines emit most of the carbon monoxide. Nitrogen dioxide (NO_2) is a gas formed primarily when using fuels containing nitrogen, or when the temperatures of combustion are high enough to thermally degrade the otherwise inert nitrogen molecules in the stream of ambient air used to support the combustion. In the presence of sunlight, NO_2 reacts with volatile organic compounds (VOCs) in the atmosphere to produce ozone (O_3). Lead is a metal that can be emitted by some stationary combustion sources (as the stable oxide).[5]

In areas with pollutant levels below the NAAQS, the Prevention of Significant Deterioration (PSD) Program (40 CFR 52.21) places limits on the total allowable increases in ambient pollutant levels above established baseline levels for SO_2, NO_2, and PM_{10}. This prohibits "polluting up to the limits" specified in the NAAQS for these pollutants. Under these regulations, the allowable increases are smallest in Class I areas (e.g., national parks and wilderness areas) where the air quality value of visibility must be preserved. The rest of the country is subject to larger Class II increments.

[5] Until 1976, a major source of lead in the atmosphere resulted from the combustion of leaded gasoline. Tetraethyl lead was used as an anti-knock and octane-boosting gasoline additive between the years 1930 and 1976.

Table 3-12 National Ambient Air Quality Standards[a]

Pollutant[b]	Averaging Time	Standard Value		Standard Type[c]
SO_2	3 h	0.5 ppm	(1300 $\mu g/m^3$)	S
	24 h	0.14 ppm	(365 $\mu g/m^3$)	P
	Annual arithmetic mean	0.030 ppm	(80 $\mu g/m^3$)	P
NO_2	Annual arithmetic mean	0.053 ppm	(100 $\mu g/m^3$)	P, S
CO	1 h	35 ppm	(40 mg/m^3)	P
	8 h	9 ppm	(10 mg/m^3)	P
O_3	1 h	0.12 ppm[d]	(235 $\mu g/m^3$)	P, S
	8 h	0.075 ppm	(157 $\mu g/m^3$)	P, S
PM_{10}	24 h	150 $\mu g/m^3$		P, S
$PM_{2.5}$	24 h	35 $\mu g/m^3$ [e]		P, S
	Annual	15.0 $\mu g/m^3$		P, S
Lead	Calendar quarter[f]	1.5 $\mu g/m^3$		P, S

[a] Refer to 40 CFR Part 50 for detailed information on attainment determination and reference method for monitoring (refer to http://www.gpoaccess.gov/cfr/index.html).

[b] CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; $PM_{2.5}$ = particulate matter ≤ 2.5 μm; PM_{10} = particulate matter ≤10 μm; and SO_2 = sulfur dioxide.

[c] P = primary standards, which set limits to protect public health; S = secondary standards, which set limits to protect welfare and quality of life.

[d] On June 15, 2005, the 1-hour O_3 standard was revoked for all areas except the 8-hour O_3 nonattainment Early Action Compact areas (those do not yet have an effective date for their 8-hour designations). The 1-hour standard will be revoked for these areas 1 year after the effective date of their designation as attainment or nonattainment for the 8-hour O_3 standard.

[e] Effective December 17, 2006, EPA revoked the annual PM_{10} standard of the current 50 $\mu g/m^3$ and revised the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$.

[f] On October 15, 2008, the EPA revised the lead standard from a calendar-quarter average of 1.5 $\mu g/m^3$ to a rolling 3-month average of 0.15 $\mu g/m^3$.

Source: 40 CFR Part 50; 40 CFR 52.21 (for PSD).

Idaho has promulgated State Ambient Air Quality Standards (SAAQS) under analogous State authority (see *Idaho Administrative Procedures Act* [IDAPA] 58.01.01.577).[6] Standards for SO_2, NO_2, CO, 1-hour O_3, PM_{10}, and lead are substantively identical to the NAAQS. However, Idaho has not established standards for 8-hour O_3 or $PM_{2.5}$. The State has also adopted standards for fluorides.[7] EPA has granted IDEQ authority to implement the Federal program.

Section 112 of the *Clean Air Act* specifies a list of 188 air toxics. EPA has issued National Emission Standards for Hazardous Air Pollutants (NESHAP) requiring control of sources of these pollutants. These standards are based on an emission control technology, rather than being derived from a health-based approach; but an assessment of the health risk remaining after the emission controls are in place is still required.

3.5.3.1 Regional Air Quality

IDEQ (2007a) summarizes Idaho ambient air monitoring data through 2007: most areas of the State are well within the NAAQS. Isolated areas are nonattainment for PM_{10} and are areas of concern for $PM_{2.5}$. One area in the far western part of the State is a maintenance area for CO and PM_{10}. The locations of the above noted areas, as well as the Class I areas, are shown on Figure 3-12.

Ambient air quality data for Bonneville County for calendar year 2008 include the following: CO, 35 ppm (1-hour average), 9 ppm (8-hour average); NO_2, 0.053 ppm (annual mean).

3.5.3.2 Criteria Pollutant Emissions

Table 3-13 presents 2005 emissions of criteria pollutants from the four counties including and surrounding the proposed EREF site (Bingham, Bonneville, Butte, and Jefferson) (IDEQ, 2009). Emissions of all pollutants are dominated by nonpoint and mobile sources. There were 11 facilities in the point emissions inventory in Bingham, Butte, and Jefferson Counties. (These are traditional stationary sources rather than mobile or area source like wind-blown dust.) Eight were associated with activities at INL located in Bingham, Butte, and Jefferson Counties, and the other three were food processing facilities.

Table 3-14 presents 2005 emissions of air toxics in excess 9.1 metric tons per year (i.e., >10 tons per year) from the four counties surrounding the proposed EREF. (Single sources emitting 10 tons per year or more of an air toxic are defined as major and are subject to more stringent emission limits than smaller sources.) Other inventoried air toxics were emitted in lesser amounts.

Idaho does not require sources to report emissions of greenhouse gases. In response to the *Consolidated Appropriations Action of 2008* (Public Law 110-161), EPA promulgated final mandatory greenhouse gas reporting regulations on October 30, 2009, that became effective in December 2009 (EPA, 2009a). The rules are applicable to major sources of CO_2, defined as

[6] Idaho regulations, "Rules for the Control of Air Pollution in Idaho," can be accessed at http://www.deq.idaho.gov/air/data_reports/monitoring/overview.cfm.

[7] There is no Federal standard for fluorides. Idaho SAAQS for fluoride include 80 ppm monthly, 60 ppm bimonthly, and 40 ppm annual arithmetic mean. See IDAPA 58.01.01.577.06.

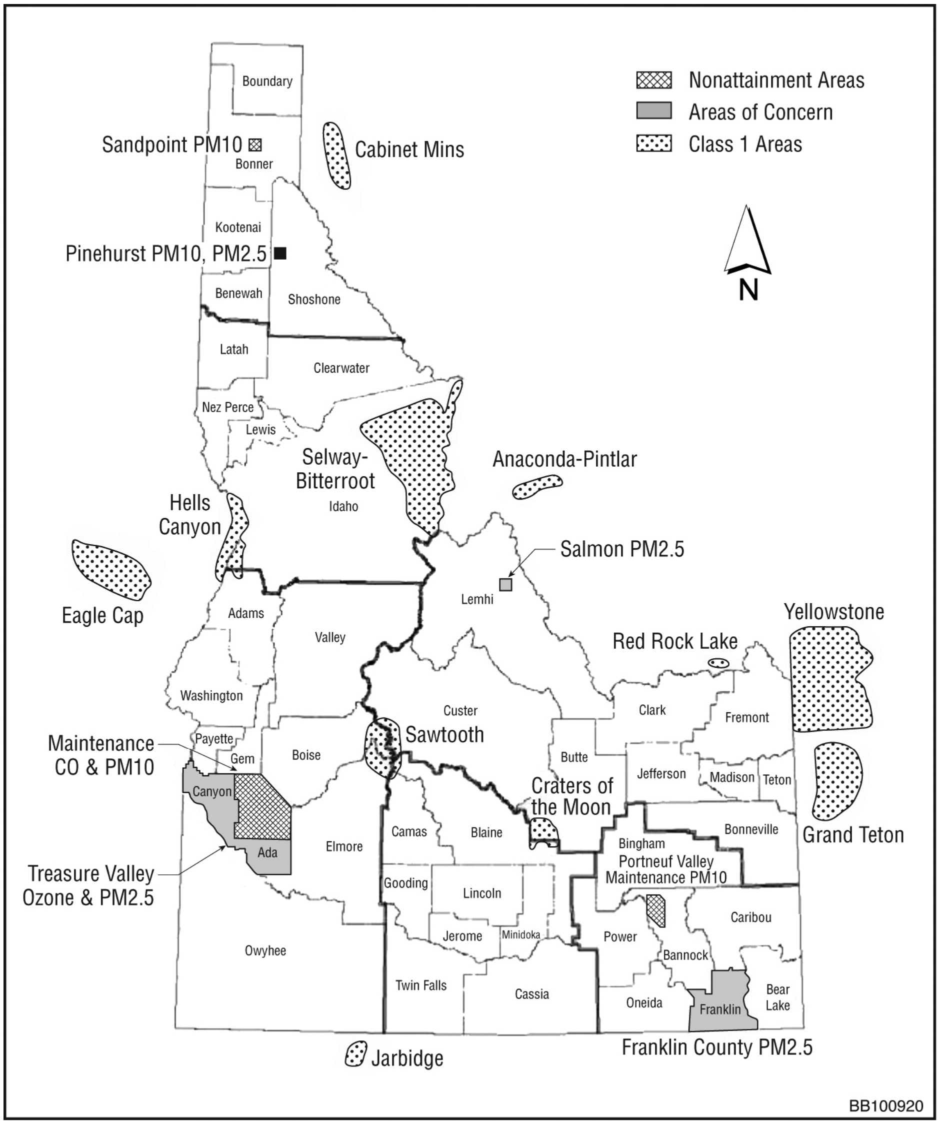

Figure 3-12 Idaho Air Quality Planning Areas (IDEQ, 2007b; Richards, 2009a,b)

Table 3-13 Emissions from the Four Counties Closest to the Proposed EREF Site[a]

2005 Annual Emissions [10^3 metric tons/yr (10^3 tons/yr)]					
PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO	VOC
69 (76)	0.58 (0.64)	1.3 (1.4)	7.1 (7.8)	65 (72)	12 (13)

[a] Bingham, Bonneville, Butte, and Jefferson Counties.
Source: IDEQ, 2009.

Table 3-14 Air Toxics Emissions from the Four Counties Closest to the Proposed EREF Site[a,b]

Pollutant	2005 Annual Emissions [metric tons/yr (tons/yr)]
Formaldehyde	220 (240)
Methanol	56 (62)
Benzene	200 (220)
Methyl bromide	44 (49)
Chloromethane	1000 (1100)
Hydrogen cyanide	12 (14)
Acetaldehyde	110 (120)
Methyl ethyl ketone	17 (18)
Trichloroethylene	210 (231)
2,4-D	25 (28)
Styrene	14 (15)
1,3-Butadiene	38 (42)
Acrolein	49 (54)
Methyl isobutyl ketone	40 (44)
Toluene	170 (190)
Chlorobenzene	10 (11)
Hexane	53 (58)
Tetrachloroethylene	53 (58)
Carbonyl sulfide	27 (30)
1,3-Dichloropropene	160 (180)
Xylene (mixed isomers)	57 (63)
Trifluralin	9.5 (10)
Hydrochloric acid	11 (12)
Hydrofluoric acid	28 (31)
Chlorine	11 (12)

[a] Bingham, Bonneville, Butte, and Jefferson Counties.
[b] Only pollutants with total emissions above 9 metric tons/yr (10 tons/yr) are listed.
Source: IDEQ, 2009.

those emitting more than 25,000 tons per year, and require annual reporting of greenhouse gas emissions directly to EPA.

3.5.3.3 Nonattainment and Maintenance Areas

Information in the section was compiled from IDEQ (2007a,b) and Richards (2009a,b). The areas discussed are shown in Figure 3-12.

The proposed EREF site is not located in, or in close proximity to, a nonattainment or maintenance area for any NAAQS.

There are no nonattainment or maintenance areas for lead, sulfur dioxide, or nitrogen dioxide.

Idaho is in attainment for CO, while a portion of Ada County remains a maintenance area.

The areas of Sandpoint and Pinehurst in far northern Idaho present PM issues. Idaho will submit a maintenance plan to EPA for Sandhurst this year. Pinehurst remains nonattainment for PM_{10}. A portion of Ada County and Bannock County (the Portneuf Valley) are maintenance areas for PM_{10}. Portneuf Valley, the closest nonattainment or maintenance area to the proposed EREF site, is located about 56 kilometers (35 miles) south. The Fort Hall area in Power County next to the Portneuf Valley is also designated as nonattainment for PM_{10}.

All of Idaho was designated attainment/unclassifiable for $PM_{2.5}$ in 2007. The State will probably recommend that EPA designate Pinehurst County and a portion of Franklin County as nonattainment for $PM_{2.5}$ (IDEQ, undated).

There are no nonattainment or maintenance areas for ozone in Idaho. However, Treasure Valley is close to the new standard and may go into nonattainment when the 2008 monitoring data are analyzed.

The U.S. Department of Energy (DOE) conducts ambient air monitoring for PM_{10} and NO_2 at various locations within and surrounding its INL, which is located proximate to the proposed EREF site (DOE, 2005).[8] PM_{10} monitoring is performed at the INL site boundary and in the surrounding communities of Rexburg, Blackfoot, and Atomic City. In 2003, 60 samples collected at Rexburg ranged from 0.42 to 153.9 micrograms per cubic meter, 60 samples collected at Blackfoot ranged from 1.3 to 173.7 micrograms per cubic meter, and 59 samples collected at Atomic City ranged from 0.7 to 73.0 micrograms per cubic meter. NO_2 monitoring is performed at two locations on INL. In 2003, both locations showed NO_2 levels well below the ambient standard of 0.053 ppm (53 parts per billion [ppb]). Quarterly mean concentrations at the first location ranged from 2.9 to 3.9 ppb with an annual mean of 3.5 ppb. Quarterly mean values at the second monitoring station ranged from 7.4 to 10.7 ppb with a mean annual concentration of 9.1 ppb (based on two quarters of data).

[8] The INL monitoring sites are used to measure INL's impact on its local environment and to demonstrate INL's compliance with applicable regulations, DOE orders, standards, and permit conditions. They are not part of the official monitoring network maintained by the State of Idaho with which conformance to NAAQS is demonstrated and ambient air quality status is established.

In 2006, the last year for which full yearly data are available,[9] PM_{10} 24-hour samples collected at the above three monitoring stations showed the following concentration ranges: Rexburg, 0.0–44.8 micrograms per cubic meter; Blackfoot, 0.3–50.1 micrograms per cubic meter; and Atomic City, 0.0–66.1 micrograms per cubic meter (DOE, 2007). These data indicate that the counties surrounding the proposed EREF site were in attainment with all NAAQS over the period the monitoring was performed.

3.5.3.4 Prevention of Significant Deterioration (PSD)

Figure 3-12 shows the Class I areas in and around Idaho. These areas are of special concern because of the small air quality increments that apply in them and because sources impacting them may need to consider visibility impacts and "air quality-related values." The following are the closest Class I areas to the proposed EREF site (NPS, 2007):

- Craters of the Moon National Monument and Preserve, about 75 kilometers (47 miles) to the west;

- Red Rock Lakes National Wildlife Refuge, about 95 kilometers (59 miles) to the north-northeast;

- Yellowstone National Park, about 105 kilometers (65 miles) to the northeast; and

- Grand Teton National Park, about 105 kilometers (65 miles) to the east.

All areas are Class II unless they are one of the listed Class I areas; no areas have requested redesignation to Class III. The proposed EREF site is not one of these Class I areas and retains the PSD Class II designation.

3.5.3.5 Conformity

Actions involving major Federal involvement may need to demonstrate that they conform to the State's implementation plan. Conformity applies only if the action will take place in a nonattainment or maintenance area. Since the proposed EREF site is not in such an area, conformity would not apply.

3.6 Geology, Minerals, and Soils

This section describes the regional and local geology and identifies the characteristics of the soil, mineral, and energy resources at the proposed EREF site. While the NRC staff's process for reviewing the license application includes an examination of the applicant's seismic and volcanic hazards assessment and the structural design of the proposed EREF, the discussion of geology in this section is not intended to support a detailed safety analysis. The NRC staff documented its analysis of seismic and volcanic hazards in its Safety Evaluation Report (SER) (NRC, 2010).

[9] PM_{10} monitoring was discontinued at these three locations in March 2007 because the results were no longer required to demonstrate INL compliance.

Figure 3-13 shows a geologic time scale to depict when different geologic units formed, as described in the following sections.

3.6.1 Regional Geology

The proposed EREF site is located on the East Snake River Plain (ESRP), within the ESRP physiographic province (Figure 3-14). The ESRP is an east-northeast trending 600-kilometer (373-mile)-long and 100-kilometer (62-mile)-wide topographic depression extending from Twin Falls to Ashton, Idaho. The predominant physiographic features of the ESRP province are Quaternary-age volcanic landforms: basaltic lava flows, shield volcanoes, and rhyolitic domes. These landforms, along with other eruptive features (e.g., dikes and pyroclastic domes), are concentrated along a northeast-trending axial volcanic zone. That zone constitutes the topographically high central axis of the ESRP. The ESRP is bounded on the north and south by the north-to-northwest trending mountains of the northern Basin and Range physiographic province. The mountain peaks, reaching heights of 3660 meters (12,000 feet), are separated by basins filled with terrestrial sediments and volcanic rocks. The basins are 5 to 20 kilometers (3 to 12 miles) wide and grade onto the ESRP. The Yellowstone Plateau lies to the northeast of the ESRP (Hughes et al., 1999; DOE, 2005).

The upper 1 to 2 kilometers (0.62 to 1.2 miles) of the ESRP is composed of numerous basaltic lava flows with intercalated sediment. Several volcanic rift zones, each with a northwestern trend, cut across the ESRP and have been identified as the source areas for these lava flows (Figure 3-15). The volcanic rift zone orientations are the result of basalt dikes that intruded perpendicular to the northeast-southwest direction of crustal extension associated with the Basin and Range province, located to the north and south of the ESRP. Widespread basaltic volcanic activity occurred intermittently on the ESRP throughout the Pleistocene and Holocene. The most recent episode of basaltic volcanism occurred about 2000 years ago in the Great Rift volcanic rift zone to the west. Volcanism on the ESRP is a result of the movement of the North American tectonic plate southwestwardly over the Yellowstone mantle plume or hotspot (Hughes et al., 1999; DOE, 2005; Anderson et al., 1996; Smith, 2004).

Figure 3-16 shows the stratigraphy of the ESRP in the vicinity of the proposed EREF site. The ESRP is underlain by Quaternary and Tertiary age basaltic lava interbedded with poorly consolidated sedimentary materials to depths of 2 kilometers (1.2 miles). The thickness of most individual basalt flows in the upper part of the section ranges from 5 to 25 meters (16 to 82 feet), and their lengths extend up to 48 kilometers (30 miles). Sediments consist of materials deposited by streams (silts, sands, and gravels), lakes (clays, silts, and sands), and wind (silts and sands) that accumulated on the ESRP between volcanic events. During long periods of inactivity, sediments accumulated to thicknesses greater than 60 meters (197 feet). These interbedded sequences are collectively known as the Snake River Group. Underlying the Snake River Group is a thick sequence of Tertiary rhyolitic (silicic volcanic) rocks that erupted when the area was over the Yellowstone hotspot, more than 4 million years ago. The last 4 million years have been a period of crustal subsidence within the ESRP as it isostatically adjusts to the mass of dense mantle-derived basalt (gabbro) that now comprises the middle crust. Because temperatures in the upper mantle below the ESRP remain relatively high, partial melting of mantle material continues to produce basaltic magmas that rise to the surface and erupt as lavas that fill the subsiding basin (Hughes et al., 1999; DOE, 2005; Ackerman et al., 2006; Smith, 2004).

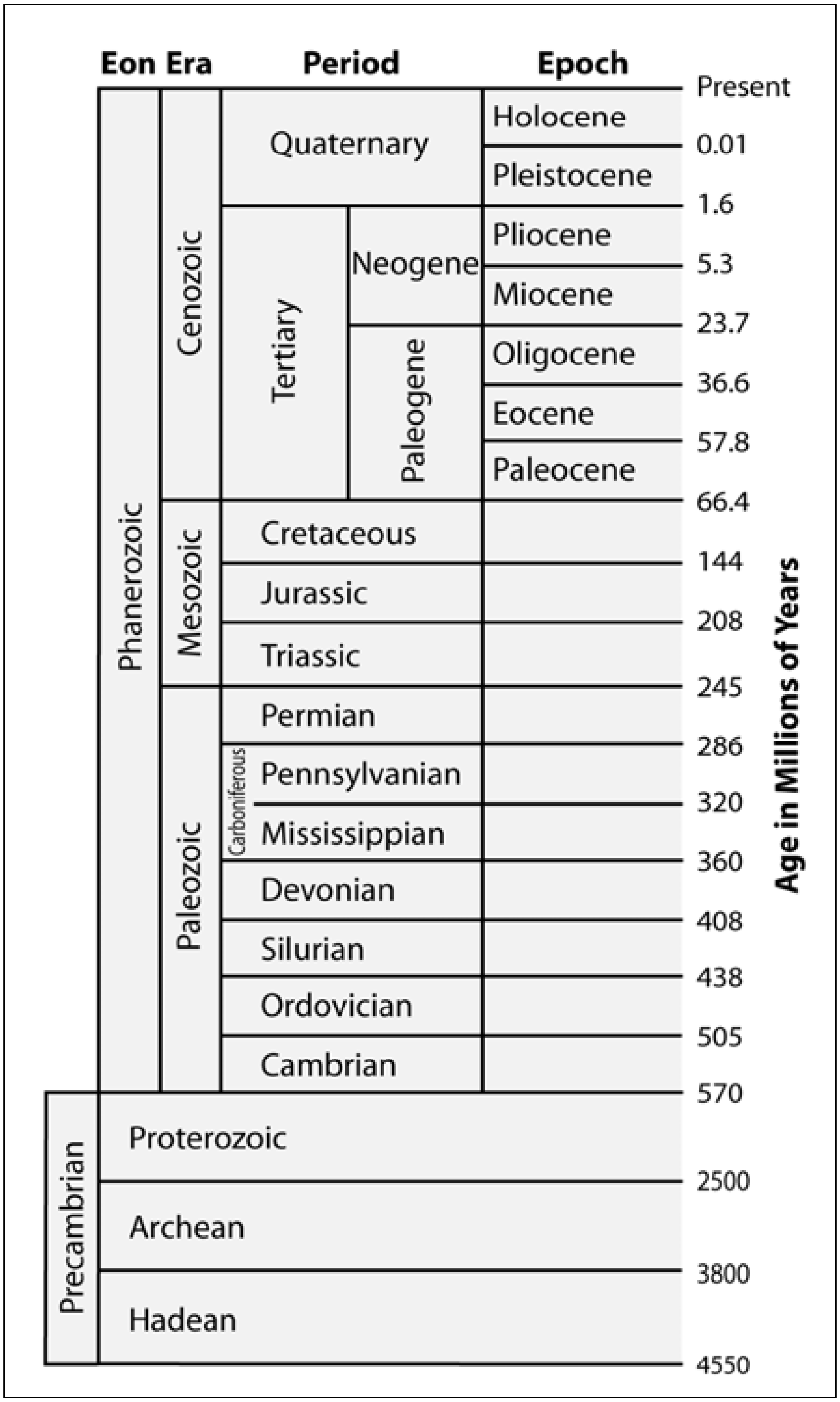

Figure 3-13 Geologic Time Scale (USGS, 2009a)

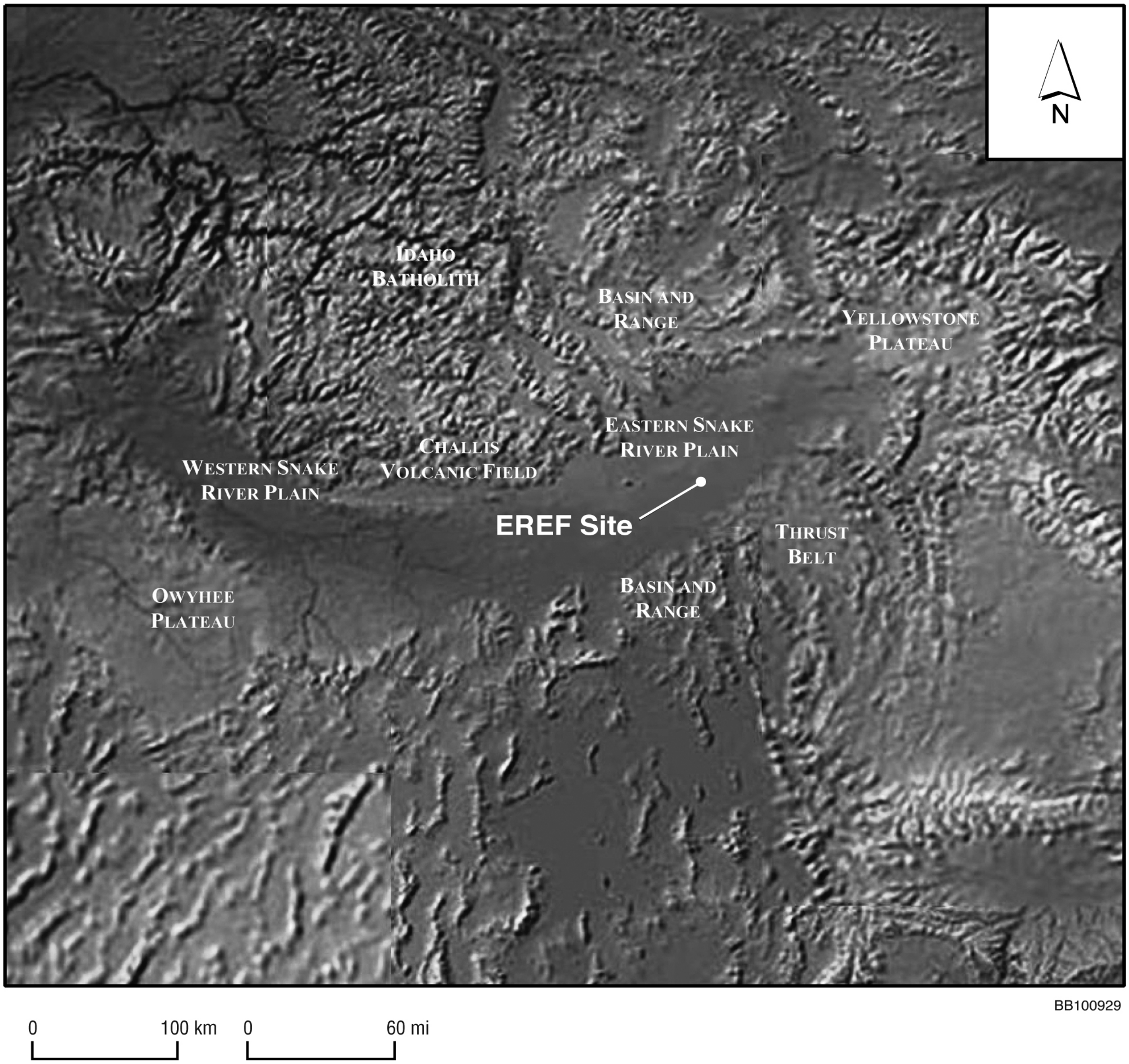

Figure 3-14 Regional Physiography (AES, 2010)

During the late Pleistocene to late Holocene (recent), surficial processes such as glacial outburst flooding, range fires, and eolian erosion and deposition have contributed significantly to the appearance of the ESRP landscape. Extensive eolian deposition has produced thick blankets of loess across the ESRP and the areas to the southeast. These processes continue to modify the landscape today.

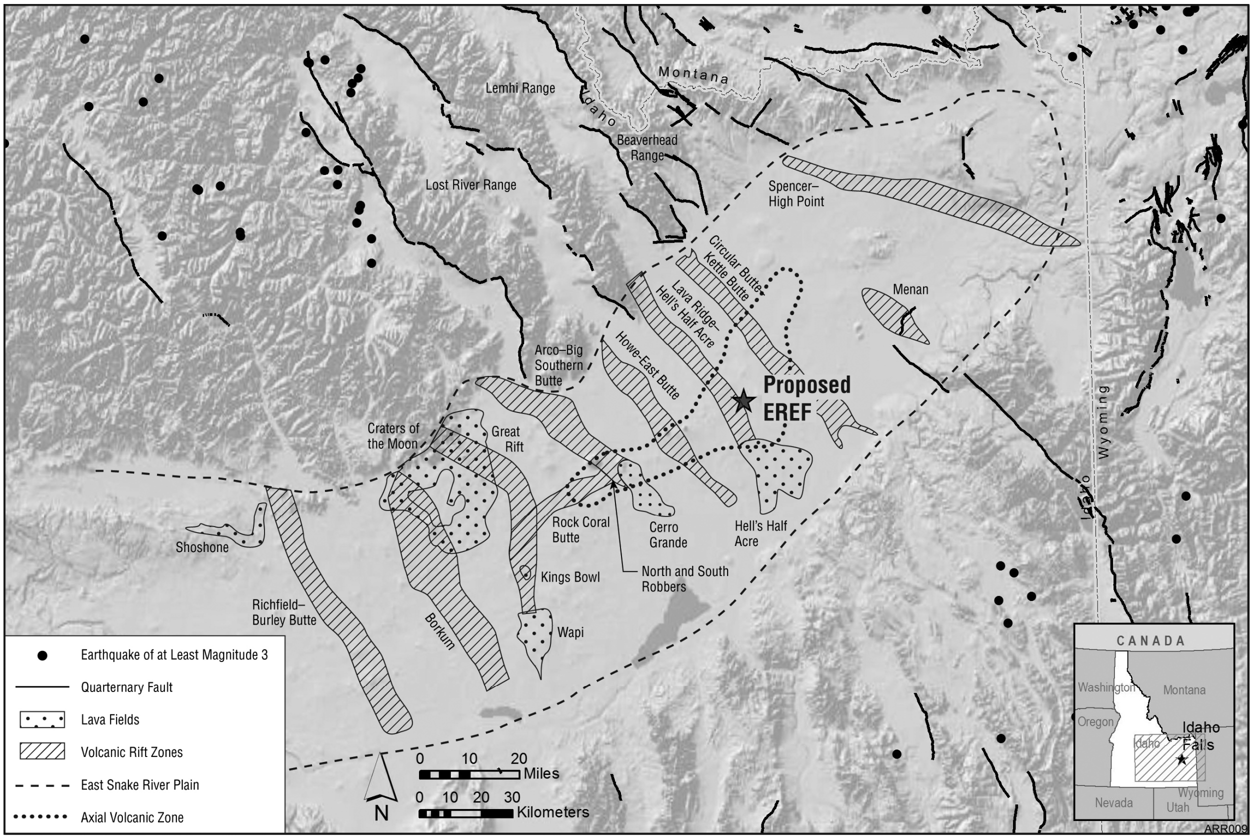

Figure 3-15 Lava Fields and Volcanic Rift Zones of the ESRP (modified from Payne, 2006; Quaternary fault and earthquake data from USGS and IGS, 2006)

3.6.1.1 Seismic Setting, Earthquakes, and Volcanic Activity

Seismic Setting

The proposed EREF site is situated on the axial volcanic zone, a northeast-to-southwest trending volcanic ridge that stretches across the middle of the ESRP (Figure 3-15). The ESRP is thought to mark the track of the Yellowstone hotspot, which is currently located beneath Yellowstone National Park in Wyoming. The hotspot was centered near the proposed EREF site about 4 to 10 million years ago (Smith, 2004).

Earthquakes

Most earthquakes with the potential to affect the proposed EREF occur along the normal faults in the Basin and Range province north of the ESRP (Figure 3-15). These faults are capable of magnitudes of 7 or greater on the Richter scale and have recurrence intervals on the order of thousands or tens of thousands of years. Earthquakes within the Basin and Range province indicate extension in a predominantly northeast-southwest direction. Crustal extension began in this area in the Middle Miocene, about 16 million years ago. The ESRP itself is less seismically active, although very low level seismic activity is common. Seismic history and geologic conditions indicate that earthquakes with a magnitude of more than 5.5 and the associated

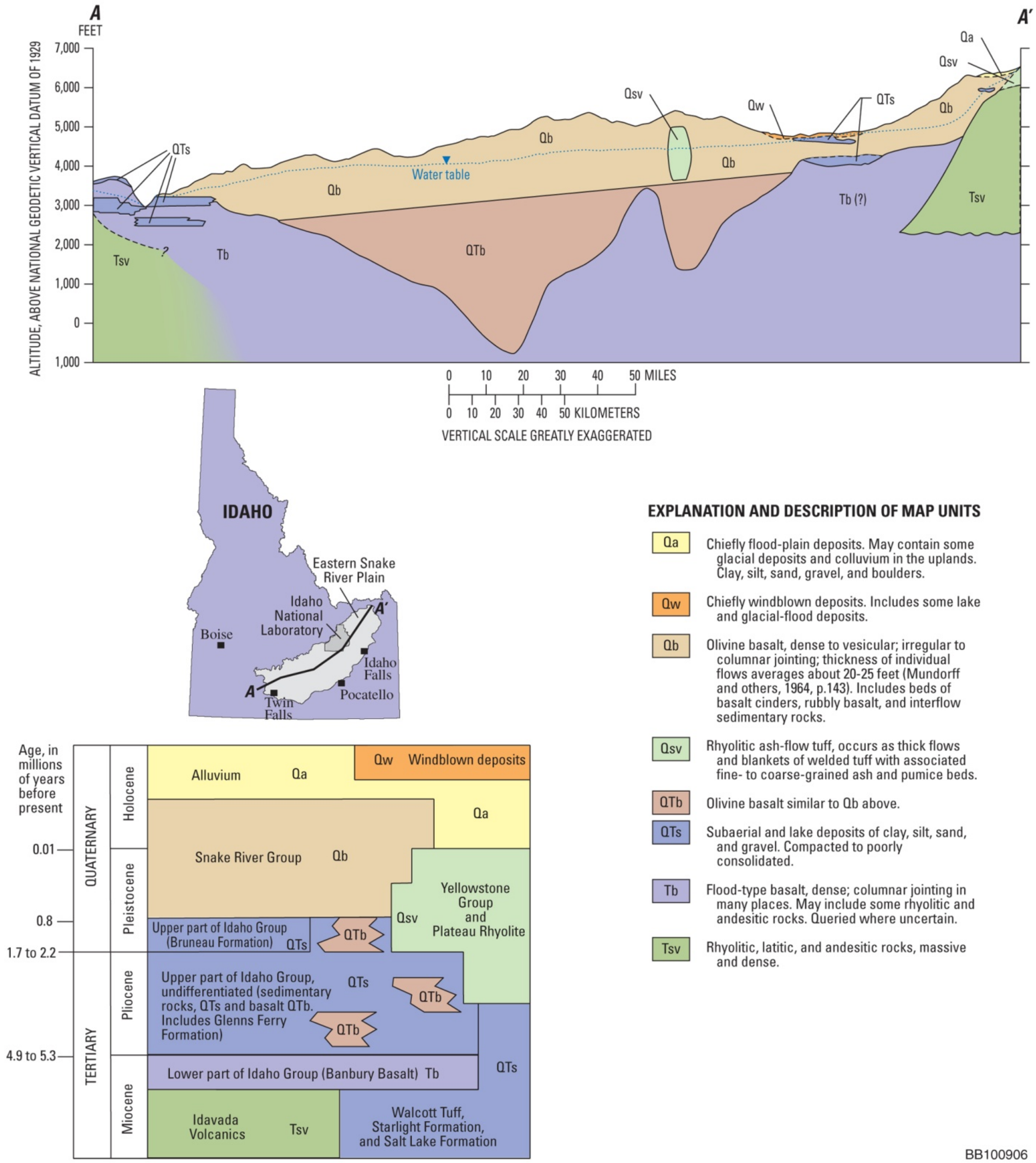

Figure 3-16 General Stratigraphy of the ESRP (adapted from Ackerman et al., 2006)

strong ground shaking and surface rupture would probably not occur within the ESRP; however, moderate to strong ground shaking from earthquakes in the Basin and Range province could be felt at the proposed EREF site (DOE, 1996; Hughes et al., 1999; Weston Geophysical Engineers, 2008).

Figure 3-17 shows the peak horizontal acceleration in the ESRP region as a percentage of the acceleration of gravity, g, which has a 10 percent probability of being exceeded over a 50-year period. The peak horizontal acceleration ranges from 0 g (insignificant ground-shaking) to 1 g (strong ground-shaking). The highest ground-shaking hazard in the region occurs to the north of the ESRP and along the Intermountain Seismic Belt to the west, with the highest probable peak acceleration (greater than 0.30, or 30 percent of g) occurring in western Wyoming. In the region of the proposed EREF property on the ESRP, the probable peak acceleration is low, in the range of 0.05 g to 0.07 g (equal to or less than 7 percent of g), because the region is underlain by hard rock and seismically active areas are at some distance away.[10]

A probabilistic seismic hazard study conducted by Weston Geophysical Engineers (2008) determined that the peak horizontal accelerations for annual probabilities of once in 1000 (10^{-3}), 10,000 (10^{-4}), and 100,000 (10^{-5}) years would be 0.063g, 0.15g, and 0.30g, respectively.[11] These estimates are in agreement with similar studies conducted at INL by DOE (1996) and Payne et al. (2000). Similar levels are now part of the seismic design criteria for new facilities at INL (Payne, 2008). Additional information on seismic hazards is provided in the SER (NRC, 2010).

Volcanic Activity

Early volcanism associated with the Yellowstone hotspot produced large-volume silicic eruptions that were followed by predominantly basaltic volcanism. Currently, basaltic volcanism occurs within the several northwest-trending volcanic rift zones and the axial volcanic zone (Figure 3-15). The most recent and closest volcanic eruption occurred at Craters of the Moon National Monument, 43.5 kilometers (27 miles) southwest of the proposed site, about 2000 years ago (Payne, 2006).

Using the probabilistic approach of Hackett et al. (2002), a recent volcanic hazard analysis determined that the major volcanic hazard at the site of the proposed EREF is the inundation and burning of facilities by basaltic lava flows in the event of an eruption within the volcanic rift zones of the ESRP (Figure 3-15). Hazards associated with basalt flows are listed in Table 3-15. The mean annual probability of a basaltic eruption that could impact the proposed EREF is

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[10] Seismic waves during an earthquake cause ground-shaking that radiates outward from the rupturing fault. Shaking intensity is mainly a function of an earthquake's magnitude and the distance from the fault, but can be amplified by other factors, such as the softness of the ground (soft rocks and sediments versus hard rock) and the total thickness of sediments below the area. Shaking tends to be stronger in soft rocks and sediments and increases with increasing thickness of underlying sediments (Field et al., 2001).

[11] Peak horizontal acceleration is expressed as a percentage of gravity (g), a common value of acceleration equal to 9.8 m/s^2, the acceleration due to gravity at the earth's surface. Peak horizontal acceleration values range from 0 (insignificant ground shaking) to 1.0 (very strong ground shaking).

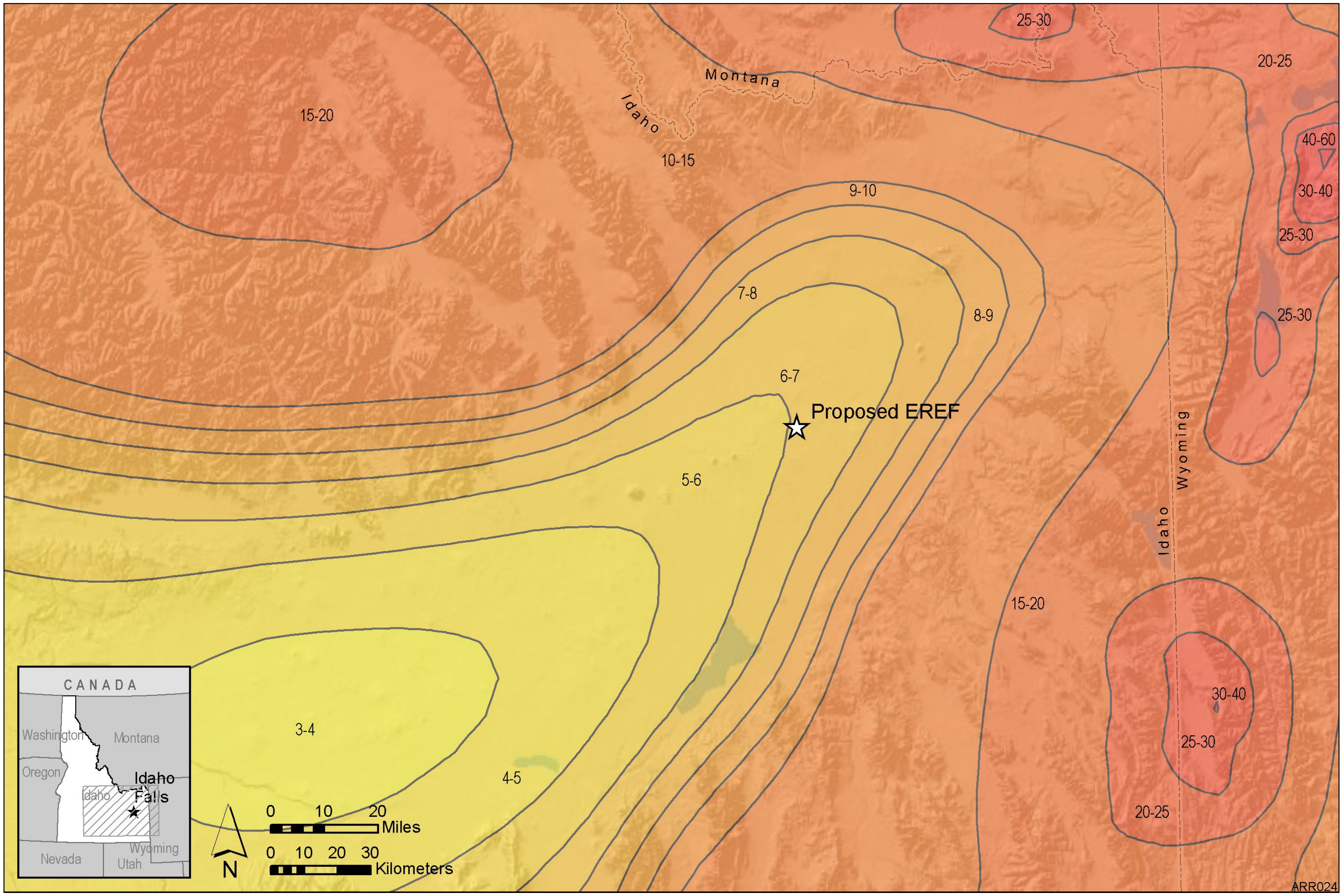

Figure 3-17 Peak Horizontal Acceleration (as a percent of g) near the ESRP (USGS, 2008a)

about 3.7×10^{-6} (with estimated upper and lower bounds ranging from 10^{-5} to 10^{-7}). The proposed EREF site lies within a shallow topographic basin with an area of about 230 square kilometers (89 square miles). The basin is larger than the median and mean areas of lava flows measured within the INL site (to the northwest), and it is estimated that 70 percent of lava flows erupted from a vent within the basin would reach the proposed EREF site. Eruptions along the axial volcanic zone, however, would likely inundate the entire topographic basin, including the proposed EREF site (AES, 2010).

Sources of more explosive silicic volcanism include: the potentially new or reactivated caldera volcanoes on the ESRP; the Yellowstone Plateau volcanic field, about 230 kilometers (143 miles) to the northeast; and ash-fall deposits from the volcanoes of the Cascade range, more than 700 kilometers (435 miles) west. The estimated recurrence of silicic volcanism within the volcanic axial zone is 4.5×10^{-6} per year. Hazards associated with silicic volcanism are considered to be less important than for basaltic volcanism in the area of the proposed EREF since the spatial distribution of Quaternary rhyolite flows in the area (e.g., at INL) generally impacts smaller areas than basalt flows. Pyroclastic flows and ash-fall deposits are also considered to pose no significant hazard in the area of the proposed EREF (AES, 2010). The annual probabilities calculated for the proposed EREF site are consistent with those made by Hackett et al. (2002) for facilities in the southwestern portion of INL. Additional information on volcanic hazards is provided in the SER (NRC, 2010).

3.6.1.2 Mineral and Energy Resources

AES has not found any abandoned drill holes or former or existing production wells to indicate petroleum was drilled for or produced within the site of the proposed EREF. The NRC staff verified during a site visit that there are no current mining operations at the proposed EREF site. According to information collected by the Idaho Geological Survey (IGS) and U.S. Geological Survey (USGS), the top nonfuel minerals in Idaho are, in descending order of value, molybdenum concentrates, construction sand and gravel, phosphate rock, silver, crushed stone, lead, and portland cement. These minerals accounted for more than 96 percent of the State's total nonfuel mineral production in 2006 (USGS, 2008b). Figure 3-18 shows the potential mineral resources in Idaho. According to the USGS survey (USGS, 2008b), suitable mineral resources exist in Bonneville County for the extraction of construction sand and gravel, pumice and pumicite, and crushed stone for aggregate. The nearest quarrying operations for sand and gravel, pumice, and crushed stone are those at INL.

Idaho has limited petroleum resources; however, there is interest in the production potential of the Overthrust Belt in southeastern Idaho and the Tertiary basin sediments in the far western portion of the Snake River Plain. An oil and gas well was recently drilled on private land near Gray's Lake in southeastern Idaho, about 100 kilometers (62 miles) from the proposed EREF site. Geothermal potential is high in Idaho. The first geothermal power plant, located at the Raft River site about 150 kilometers (93 miles) southwest of the proposed EREF site, began commercial operation in November 2007, with a 25-year, 13-megawatt full output purchase agreement with Idaho Power. Further exploration at Raft River is planned (Gillerman and Bennett, 2008).

Table 3-15 Hazards Associated with Basaltic Volcanism on the ESRP

Phenomenon	Relative Frequency	Size or Area of Influence	Hazard Level
Lava flow	Common	0.1 to 400 km^2 (0.039 to 154 mi^2) in area; up to 32 km (20 mi) in length based on sizes of ESRP lava flows of the past 400,000 years	Significant hazard; typical basaltic phenomenon; lava from fissures or shield volcanoes may inundate large areas downslope of vents and burn structures in its path
Ground deformation: fissuring, faulting, and uplift	Common; associated with virtually all shallow magma intrusion and eruption	Fissuring could affect areas of 10 km^2 (3.9 mi^2); minor tilting and broad uplift in areas to 40 km^2 (15 mi^2)	Significant hazard due to shallow dike intrusion; "dry" intrusion may occur without lava flows, affecting smaller areas than for lava inundation
Volcanic earthquakes	Common; associated with magma intrusion before and during eruption	Maximum Richter scale magnitude of 5.5, with most events less than 3.0; ground vibration may affect facilities within 25 km (16 mi)	Low to moderate hazard; swarms of shallow earthquakes (less than 4-km [2.5-mi] focal depth) occur as dikes propagate underground
Gas release (toxic and corrosive vapors)	Common; associated with fissuring and lava eruption	Restricted to near-vent areas; may affect areas of several square kilometers downwind	Low hazard; local plume of corrosive vapor downwind from eruptive vent or fissure; cooled vapor may collect in local topographic depressions
Tephra fall (volcanic ash and bombs)	Common	Restricted to near-vent areas; may affect areas of several square kilometers downwind	Low hazard; basaltic eruptions are inherently nonexplosive and may form small tephra cones but little fine ash to be carried downwind
Base surge (ground-hugging blast of steam and tephra)	Rare	Effects limited to radius of several kilometers from vent; less than 10 km^2 (3.9 mi^2)	Low hazard due to depth of water table (greater than 200 m [656 ft]); steam explosions due to interaction between ascending magma and shallow groundwater
Pyroclastic flow (ground-hugging flow of hot, pyroclastic material)	Extremely rare	Near vent; affected area less than 1 km^2 (0.39 mi^2)	Very low hazard; as per tephra fall but affecting even smaller areas

Source: modified from Hackett et al., 2002.

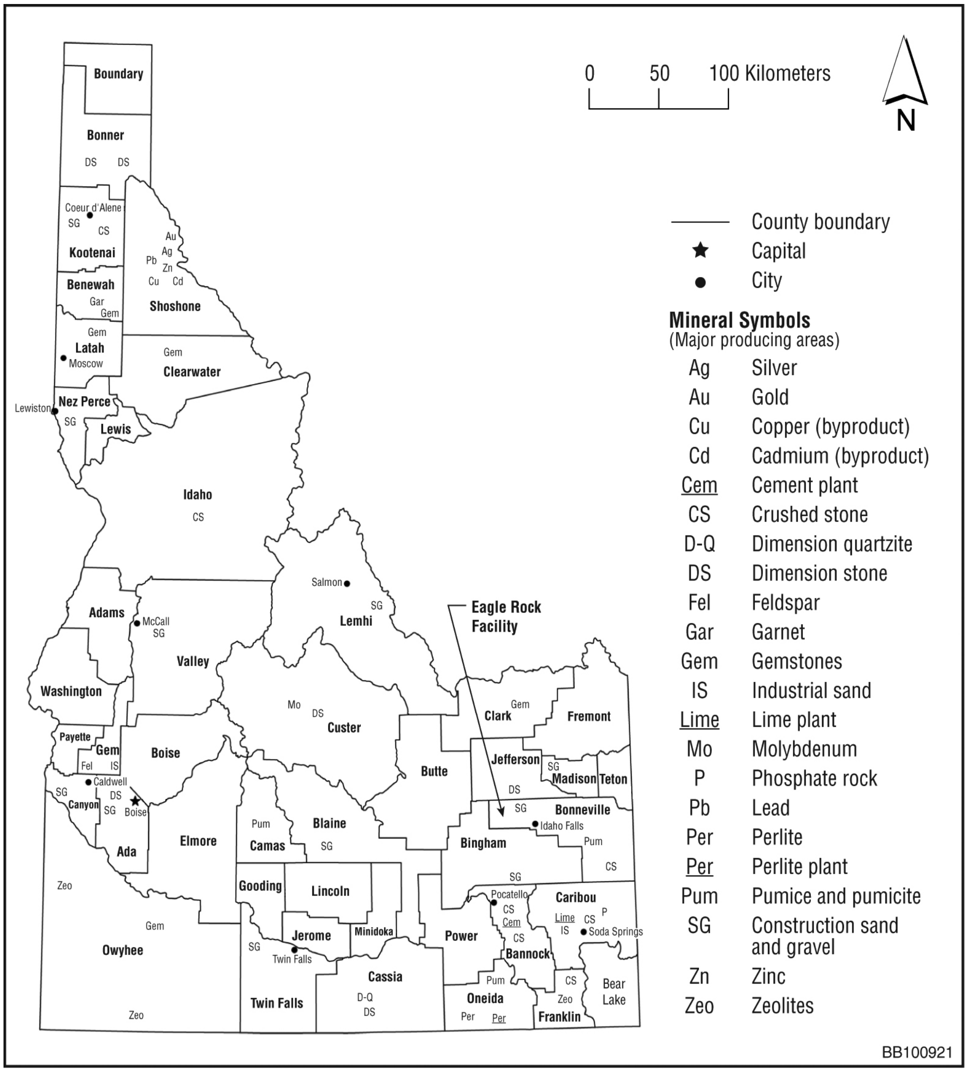

Figure 3-18 Idaho Mineral Resources (modified from USGS, 2008b)

3.6.2 Site Geology

The proposed EREF site is located in a shallow topographic depression within the axial volcanic zone between the Lava Ridge-Hells Half Acre and the Circular Butte-Kettle Butte rift zones (Figure 3-15). The surface is relatively flat and gently sloping, with small ridges and areas of rock outcrop. Elevations range from about 1556 meters (5105 feet) to about 1600 meters (5250 feet).

The axial volcanic zone is underlain by numerous basalt lava flows erupted from fissures and small shield volcanoes over the past 4 million years. Basaltic rock outcrops of the Quaternary age Snake River Group cover a portion of the proposed site (especially in the northwestern and southern parts) and occur as low irregular ridges, small areas of blocky rubble with thin soils, and erosional surfaces in intermittent stream drainages. The basalts are strongly vesicular and show a range of oxidation and secondary mineral formation; some show columnar jointing.

Geologic mapping in the area suggests that the basalt flows at the proposed site originated from the volcanic vent at Kettle Butte (AES, 2010; Kuntz et al., 1994).

Rock cores drilled at the proposed site identify numerous basalt flows, ranging in thickness from less than 0.6 to 15 meters (less than 2 to 50 feet). Rock cores sampled across the proposed EREF site indicate the depth to bedrock (basalt) ranges from 0 (at outcrop locations) to 6.6 meters (0 to 21.5 feet) (Figure 3-19). In one core (GW-1), thin, vesicular pahoehoe flows occur at depths of 95, 131, 152, 157, and 209 meters (310, 430, 500, 515, and 685 feet). The tops of these flows are generally characterized by the presence of black, fine-grained to glassy crusts a few centimeters thick, with stretched vesicles, pervasive matrix oxidation, and olivine phenocrysts. Within a few meters of the lava-flow tops is a highly vesicular zone with closely spaced, vertically oriented cooling fractures. In thicker flows, the fractured lava grades downward into finely vesicular and nonvesicular (massive) lava of the flow interior (AES, 2010).

3.6.3 Site Soils

Figure 3-20 presents a soil map of the proposed EREF site. Unconsolidated surficial material at the proposed site consists mainly of Pleistocene age loess deposits rather than soil developed *in situ*. The loess, composed of silt and sandy silt, is massive or faintly bedded and moderately to well-sorted. Small angular to subrounded basalt gravel is sparsely present (Scott, 1982).

The U.S. Department of Agriculture soil survey for Bonneville County categorizes most of the soils at the proposed EREF site as Pancheri silt loam, with slopes ranging from 0 to 8 percent. The Pancheri series consists of deep to very deep, well-drained soils that formed in loess-covered lava plains where the mean annual precipitation is about 25 centimeters (10 inches). Other soils at the proposed site include the Pancheri- and Polatis-rock outcrop complexes, which are moderately deep, well-drained, silt loams occurring on steeper slopes (up to 25 percent) of basalt outcrops. Basalt outcrops occur as low irregular ridges of blocky rubble that cover about 28 percent of the total area of the proposed EREF site and as erosional surfaces within intermittent stream drainages (NRCS, 2009).

Soils of the Pacheri silt loam (0 to 4 percent slope), which cover about 63 percent of the proposed EREF site, are classified as prime farmland (if irrigated) by the U.S. Natural Resources Conservation Service (NRCS) (NRCS, 2009).

3.6.4 Soil Radiological and Chemical Characteristics

3.6.4.1 Soil Radiological Characteristics

Ten surface soil samples were collected from various locations across the proposed EREF site as part of the initial characterization of soils (Figure 3-21). Samples were analyzed for uranium, thorium, and their daughter products. Potassium-40, a naturally occurring radionuclide, and cesium-137, produced by past weapons testing, were also measured. Table 3-16 presents the results of these measurements. The measured radionuclides are all naturally occurring, except for cesium-137, which is ubiquitous in the environment. Cesium-137 concentrations fall within the low end of the concentration range reported by the IDEQ for soil monitoring by *in situ* gamma spectrometry in and around the INL in 2006 and 2007 and well below the IDEQ action level of 6.8 picocuries per gram (IDEQ, 2006a, 2007c).

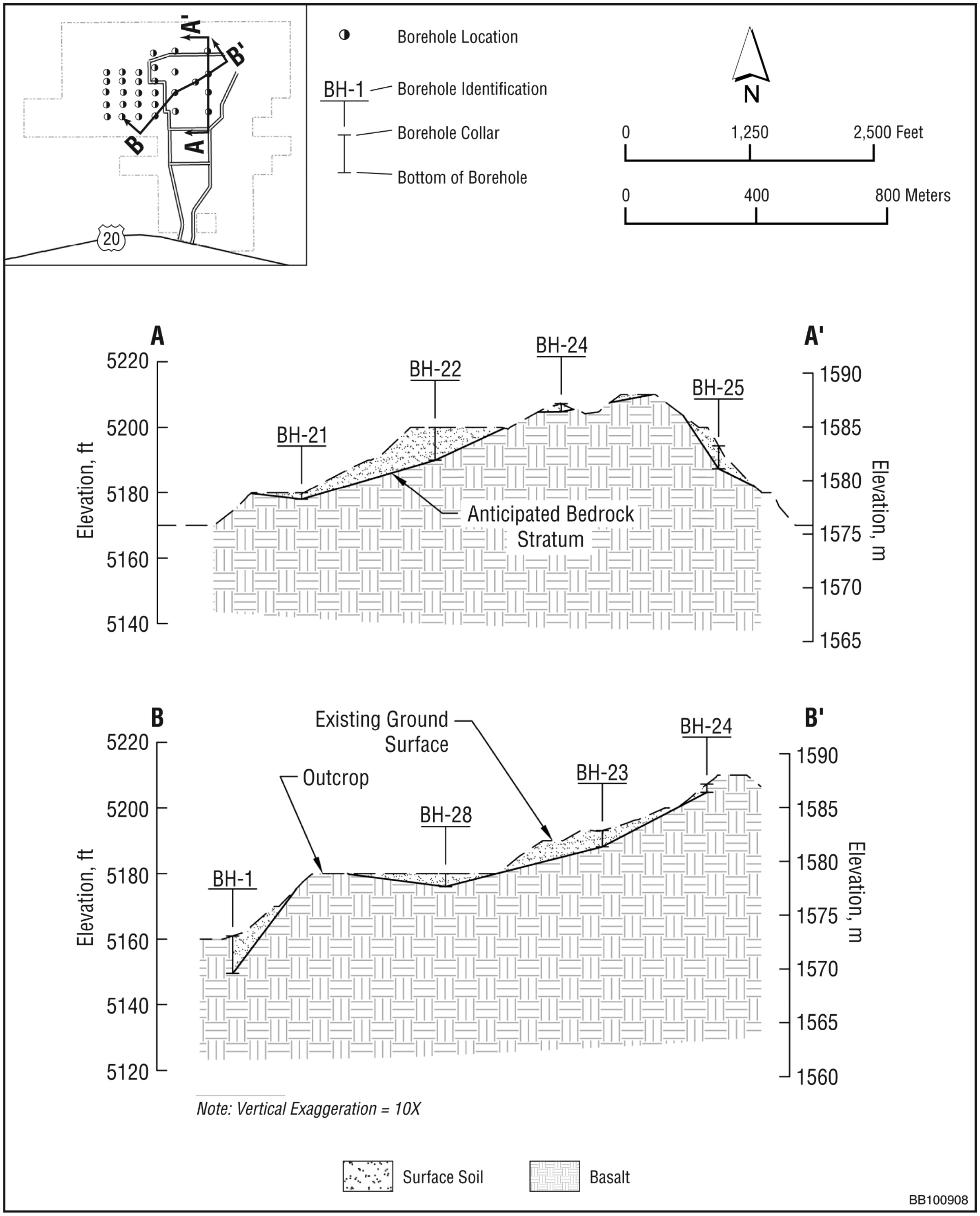

Figure 3-19 Cross Sections Showing Depth to Basalt at the Proposed EREF Site (AES, 2010)

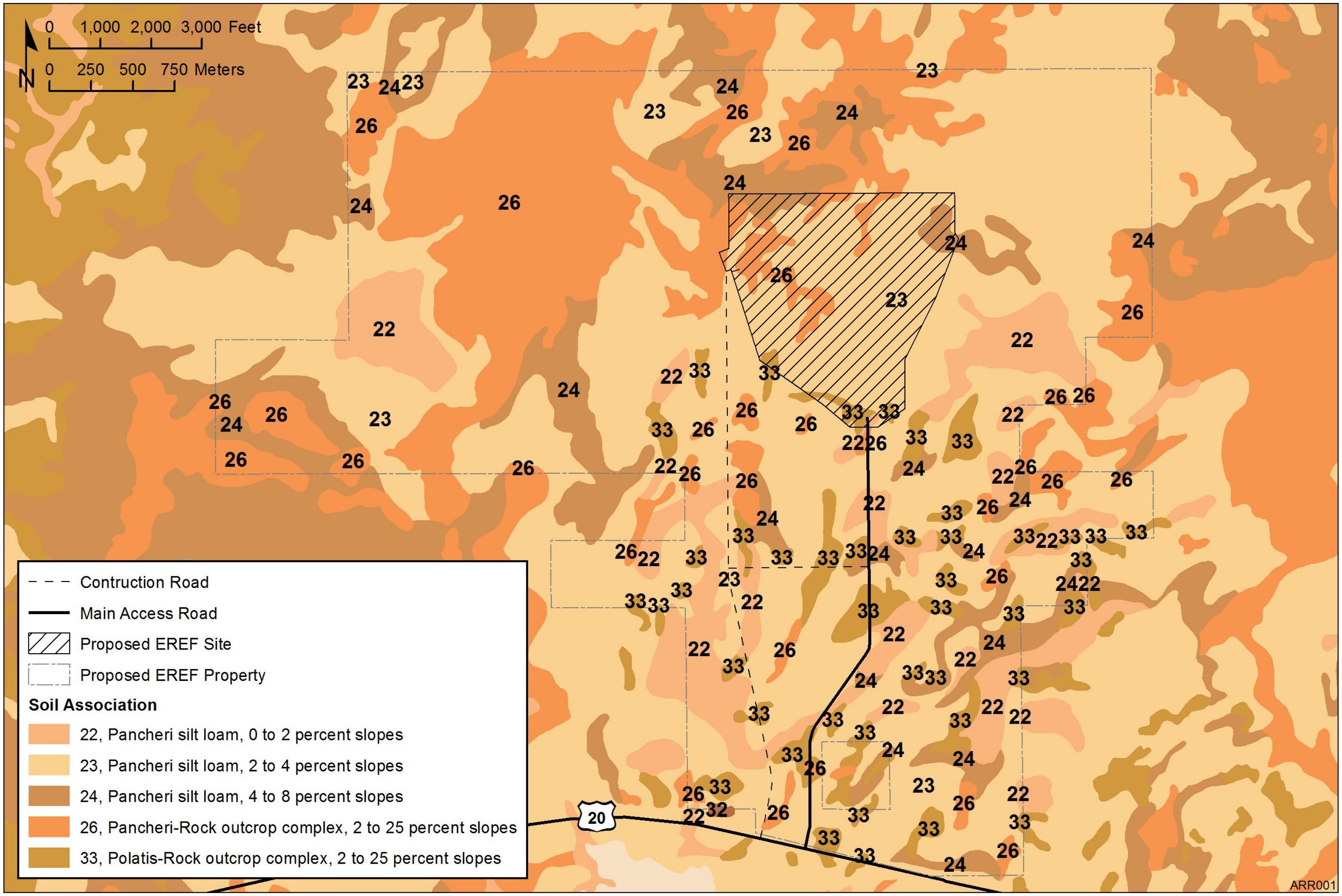

Figure 3-20 Soil Map of the Proposed EREF Site and Surrounding Area (based on data from NRCS, 2009)

3.6.4.2 Soil Chemical Characteristics

The surface soil samples collected at the proposed EREF site were also analyzed for nonradiological constituents, including metals, pesticides, herbicides, phosphorous, fluoride, VOCs, and semivolatile organic compounds (SVOCs) (AES, 2010). Samples were also tested for percent moisture content. The results of the analyses for metals, fluoride, and moisture content in soils are summarized in Table 3-17. All metals fall within the range of background concentrations in surface soils reported for INL. Mercury was not detected in any of the samples. Moisture content varied from 9.1 to 16.5 percent.

VOCs were detected in only one of the 10 samples analyzed. Sample SS1, located within one of the crop circles in the northeastern portion of the proposed EREF property (Figure 3-21), had detectable levels of three VOCs: 1,3,5-trimethylbenzene, 1,3-dichlorobenzene, and tetrachloroethene (Table 3-18). The compound 1,3-dichlorobenzene has applications as a fumigant and insecticide/pesticide; its presence is likely related to the farming activities at the proposed site. The compounds 1,3,5-trimethylbenzene and tetrachloroethene are typically used as solvents; the source of these two VOCs is not clear. All compounds were detected at levels well below EPA's regional screening levels for industrial soils (EPA, 2009a).

Three SVOCs were detected in four soil samples (SS2, SS4, SS9, and SS10) from the north-central and south-central portions of the proposed property (Figure 3-21). These samples had detectable levels of benzo(a)pyrene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd)pyrene (Table 3-18). These are a few of the many polycyclic aromatic hydrocarbons (PAHs) that are found in the environment, usually as a result of the incomplete combustion or pyrolysis of organic matter, such as fossil fuels (IPCS, 2009). All compounds were detected at levels well below EPA's regional screening levels for industrial soils (EPA, 2009a).

Of all the pesticides and herbicides tested, only chlorpropham (a pesticide) was detected in four samples from the north-central portion of the proposed property (Table 3-18; Figure 3-21). Concentrations of chlorpropham were well below EPA's regional screening levels for industrial soils (EPA, 2009a).

3.7 Water Resources

3.7.1 Surface Water Features

3.7.1.1 Rivers, Streams, and Lakes

The proposed EREF site is located in the American Falls sub-basin (HUC 17040206), immediately west of the Idaho Falls sub-basin (HUC 17040201), on the easternmost edge of the Snake River Plain in southeast Idaho (USGS, 2009b; IDEQ, 2006b; Shumar, 2004) (Figure 3-22). These sub-basins encompass a portion of the South Fork Snake River from Heise (about 32 kilometers [20 miles] northeast of Idaho Falls) to Henry's Fork and a section of the Snake River from the Henry's Fork confluence through the diversion dams south of Idaho Falls to the American Falls Reservoir. The Snake River is about 32 kilometers (20 miles) to the east of the proposed EREF site; it generally flows from the northeast to the southwest. The largest surface water bodies downgradient of the proposed site are on the Snake River – the American Falls Reservoir and Lake Wolcott, about 79 kilometers (49 miles) and 127 kilometers

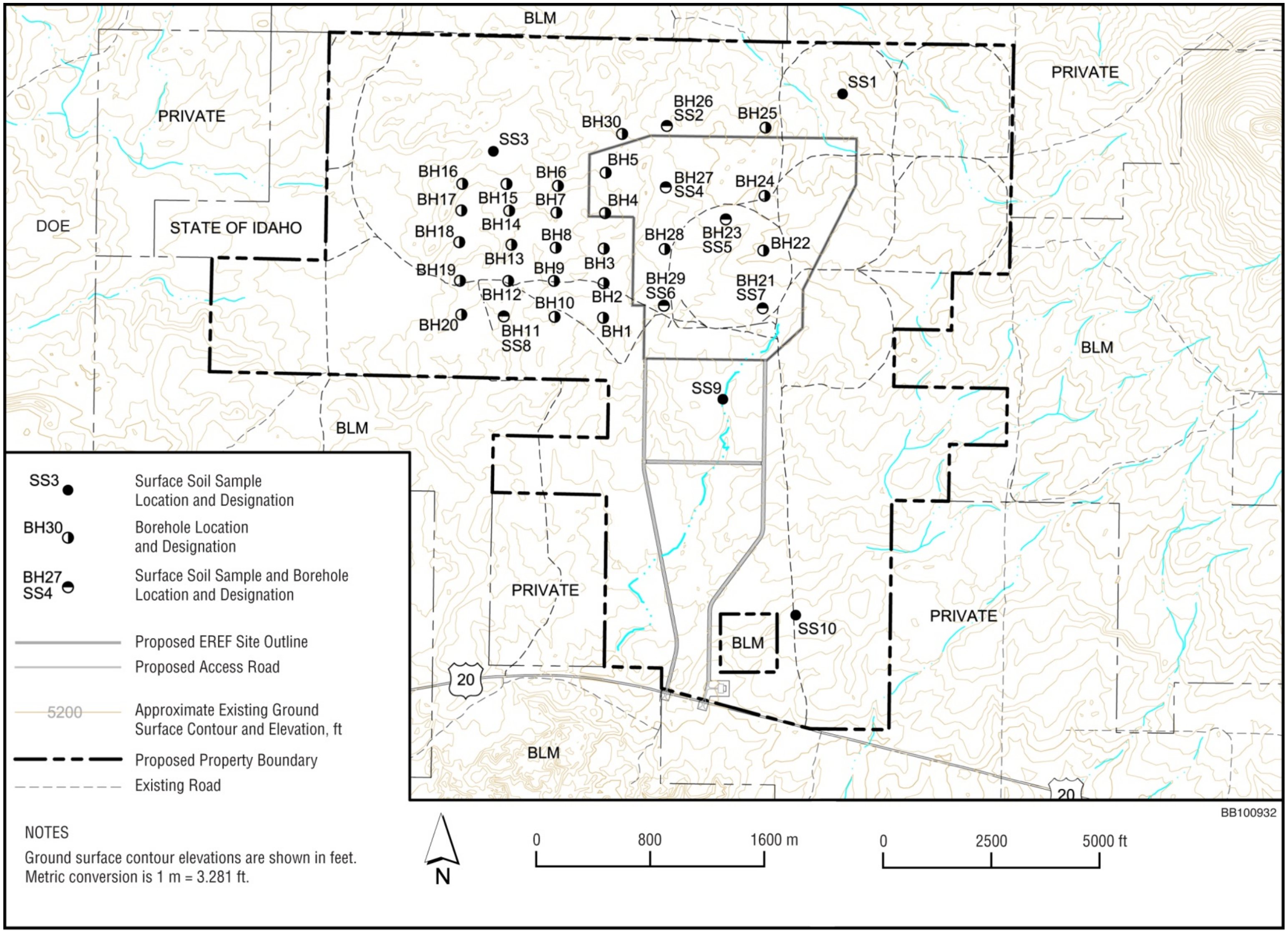

Figure 3-21 Surface Soil and Borehole Sample Locations (AES, 2010)

Table 3-16 Radiochemical Analyses of Proposed EREF Property Surface Soil

	Measured Concentrations[a]		Representative Soil Concentrations[b]	
Radionuclides	**Bq/kg**	**pCi/kg**	**Bq/kg**	**pCi/kg**
Actinium-228 Thorium-228	38 ± 3.2	1020 ± 87.8	–[c]	–
Cesium-137	10 ± 4.4	288 ± 118	252[d]	6800[d]
Potassium-40	660 ± 57	17,900 ± 1540	400	10,800
Thorium-228	47 ± 4.8	1270 ± 131	–	–
Thorium-230	46 ± 5.0	1250 ± 136	–	–
Thorium-232	44 ± 3.5	1190 ± 92.0	37	999
Uranium-234	29 ± 2.5	784 ± 68.3	–	–
Uranium-235	3.3 ± 1.8	90.1 ± 48.9	–	–
Uranium-238	30 ± 2.7	805 ± 73.0	66	1782

[a] Concentrations noted as mean ± standard deviation; n=10 for all radionuclides but cesium-137 for which n=9. Source: AES, 2010.
[b] Representative soil concentrations are taken from Table 4.3 of the National Council on Radiation Protection (NRCP) Report No. 94 (NCRP, 1998).
[c] A dash indicates value is not available from NRCP, 1998.
[d] Value from the IDEQ INL Oversight Program (Jones, 2009).

(79 miles), respectively, to the southwest of the proposed EREF site (Figure 3-22). There is an extensive network of canal systems that conveys water to agricultural areas near Idaho Falls.

Major land uses within the American Falls sub-basin are dryland and irrigated agriculture and livestock grazing. All water bodies within the sub-basin support cold water aquatic life; water supplies for domestic, agricultural, and industrial use; wildlife habitat; and recreation. The American Falls Reservoir provides water for irrigation and electricity generation. The Snake River and the American Falls Reservoir are designated sources of domestic water supply (IDEQ, 2006b). The EPA has classified 17 waters within the sub-basin as impaired, mainly because of sedimentation and siltation problems (EPA, 2010a).

There are no rivers, streams, or lakes within the proposed EREF property; however, a few small drainage features occur in the northeastern corner and in the southern portion of the proposed site (Figure 3-23). None of these features are regulated under Section 404 of the *Clean Water Act* (Joyner 2008). The drainage features in the northeastern corner are less visible in the field because they occur within the irrigated crop circles where the natural topography has been smoothed for crop production. Ephemeral drainage features in the southern portion of the proposed property were formed from natural erosional processes during snowmelt or episodic rain events, and they also drain water from irrigated agricultural areas. Most of these drainages lose water to infiltration and evapotranspiration; the potential for ponding of water is low

Table 3-17 Metals, Soluble Fluoride, and Percent Moisture in Proposed EREF Property Surface Soil

Analyte	Soil Concentrations (mg/kg)[a]										Detection Limit (mg/kg)	Background[b] (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10		
Arsenic	5.5	7.7	5.5	7.1	6.6	7.3	6.7	7.1	6.9	6.5	1.3–1.8	3.7–24.4
Barium	160	180	180	200	170	170	200	170	170	190	0.50	87−255
Cadmium	0.56	0.61	ND[c]	0.69	0.59	0.58	0.74	0.57	0.6	0.55	0.50	1.3−2.8
Chromium (III)	21	20	20	25	23	21	23	21	22	25	0.50	14−27
Lead	15	16	14	18	16	16	17	16	16	18	0.60–0.81	9−28
Selenium	0.26	0.19	0.15	0.17	0.42	0.2	0.15	0.16	0.16	0.13	0.05	0.3−16.7
Silver	ND	ND	ND	0.7	ND	ND	ND	0.7	ND	ND	0.5–0.8	2.7−2.8
Total mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	0.05−0.06
Soluble fluoride	12	ND	ND	ND	10	ND	10	ND	ND	ND	5	–[d]
Percent moisture	15.9	12.2	9.1	12.2	15.7	11.1	15.7	11.8	16.5	10.5	0.1	–

[a] Source: AES, 2010.
[b] Background values from ranges of mean background levels compiled by Westinghouse Idaho Nuclear Company, Inc. (1994) for surface soils at INL.
[c] ND = not detected (the detection limit, i.e., the lowest measurable level, is reported in far right column).
[d] Dash indicates no data were reported.

(NRCS, 2009). One drainage feature conveys water offsite. It starts in the south-central part of the proposed property within the footprint of the proposed EREF and runs southward toward US 20 (Figure 3-22). A series of small ponds to the north of US 20 were used at one time to collect and store water from this drainage for agricultural uses, but they are no longer in use and are currently dry. The NRC staff confirmed that a culvert at US 20 conveys water from this drainage to the south away from the roadway but does not connect to offsite resources or larger drainages.

3.7.1.2 Wetlands

There are no wetlands on the proposed EREF property (Joyner, 2008). The closest wetland is the Market Lake WMA, near Roberts, about 32 kilometers (20 miles) to the northeast. No commercial or sport fisheries are located on the proposed property; the nearest fisheries (trout) are on the Upper Snake River (Idaho Fish and Game Fisheries Region 7) along Henry's Fork (in Bonneville County) and the South Fork (IDFG, 2009c).

3.7.1.3 Floodplains

The proposed EREF property is not located within any 100-year or 500-year floodplains (FEMA, 2010). There are no reservoirs, levees, or surface water that could cause flooding of the proposed EREF. The Snake River is the closest river to the proposed EREF site. It is located about 32 kilometers (20 miles) to the east. Its headwater is a spring near the southern boundary of Yellowstone National Park in the northwestern corner of Wyoming. The USGS

Table 3-18 VOCs, SVOCs, and Pesticides Detected in Proposed EREF Property Surface Soil

Analyte	Soil Concentrations (mg/kg)										Regional Screening Level (mg/kg)[a]
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
VOCs											
1,3,5-Trimethylbenzene	0.0067	ND[b]	ND	ND	ND	ND	ND	ND	ND	ND	200
1,3-Dichlorobenzene	0.0082	ND	ND	ND	ND	ND	ND	ND	ND	ND	10,000[c]
Tetrachloroethene	0.0086	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7
SVOCs											
Benzo(a)pyrene	ND	0.014	ND	0.035	ND	ND	ND	ND	0.059	0.014	0.21
Dibenzo(a,h)anthracene	ND	0.012	ND	0.024	ND	ND	ND	ND	0.038	0.0099	0.21
Ideno(1,2,3-cd)pyrene	ND	0.025	ND	0.081	ND	ND	ND	ND	0.146	0.024	2.1
Pesticide											
Chlorpropham	ND	ND	ND	0.0074	ND	0.0055	ND	0.0110	ND	ND	120,000

[a] Regional screening levels (RSLs) based on carcinogenic target risk for industrial soils, except for 1,3,5-trimethylbenzene and chlorpropham which are based on a noncancerous hazard index. Source: EPA, 2009a.
[b] ND = not detected.
[c] RSL not available for 1,3-dichlorobenzene; value provided is for 1,2-dichlorobenzene.
Source: AES, 2010.

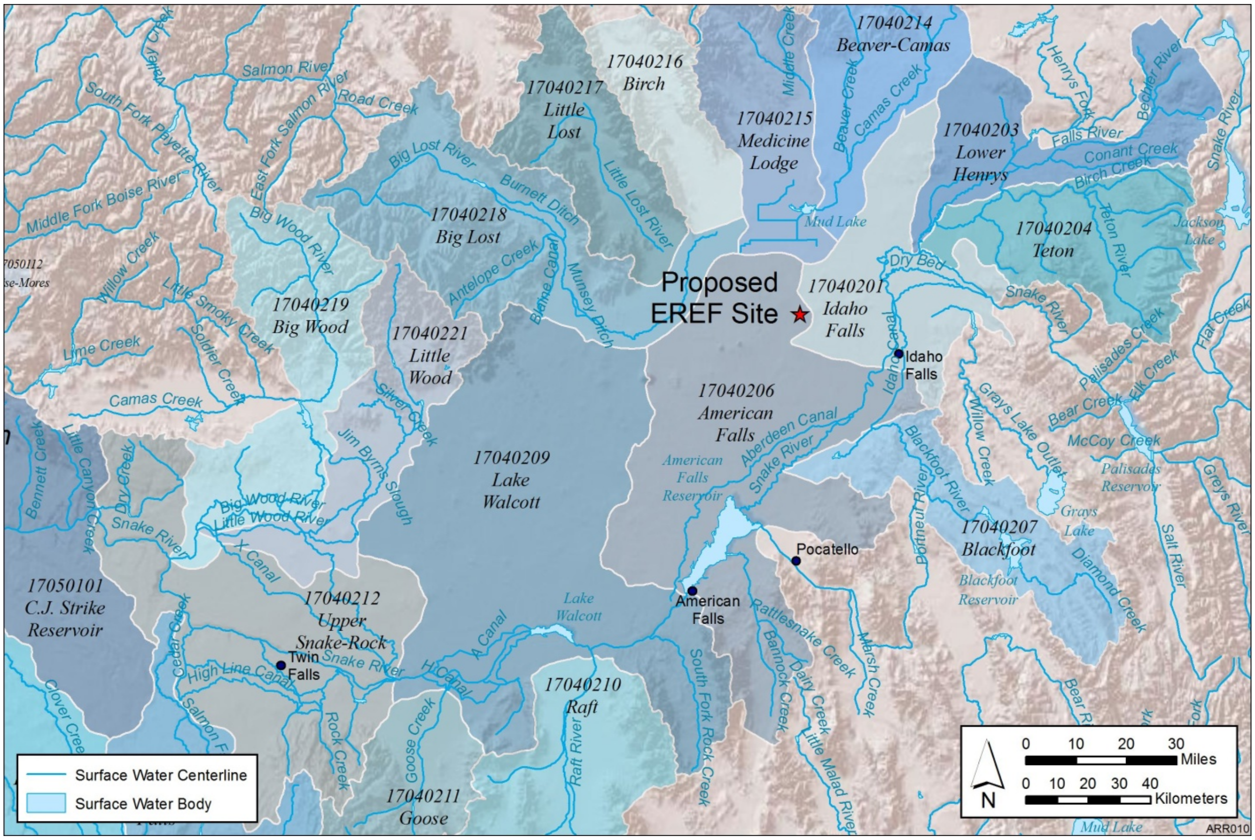

Figure 3-22 USGS-Designated Sub-basins within the Eastern Snake River Plain (adapted from Seaber et al., 2007)

station (13057155) on the Snake River above Eagle Rock (about 13 kilometers [8 miles] upstream of Idaho Falls) has an average daily flow of 162 cubic meters per second (5738 cubic feet per second), as measured between water years 1987 and 2008 (USGS, 2009c). During this period, monthly averages ranged from 87 cubic meters per second (3070 cubic feet per second) in December to 337 cubic meters per second (11,900 cubic feet per second) in June (USGS, 2009d). Annual average and peak flows at the Snake River above Eagle Rock station are shown in Figure 3-24. Annual peak flows tend to be about two to three times the average flow rates. The maximum flow rate at this site, 1376 cubic meters per second (48,600 cubic feet per second), occurred during a storm on June 16, 1997 (USGS, 2009e).

According to the NCDC, southeastern Idaho has been in a drought since 2000. From 1988 through 2000, the average annual flow recorded at the Snake River above Eagle Rock station was 164 cubic meters per second (5793 cubic feet per second); since 2000, the average annual flow at the station has been reduced to 127 cubic meters per second (4501 cubic feet per

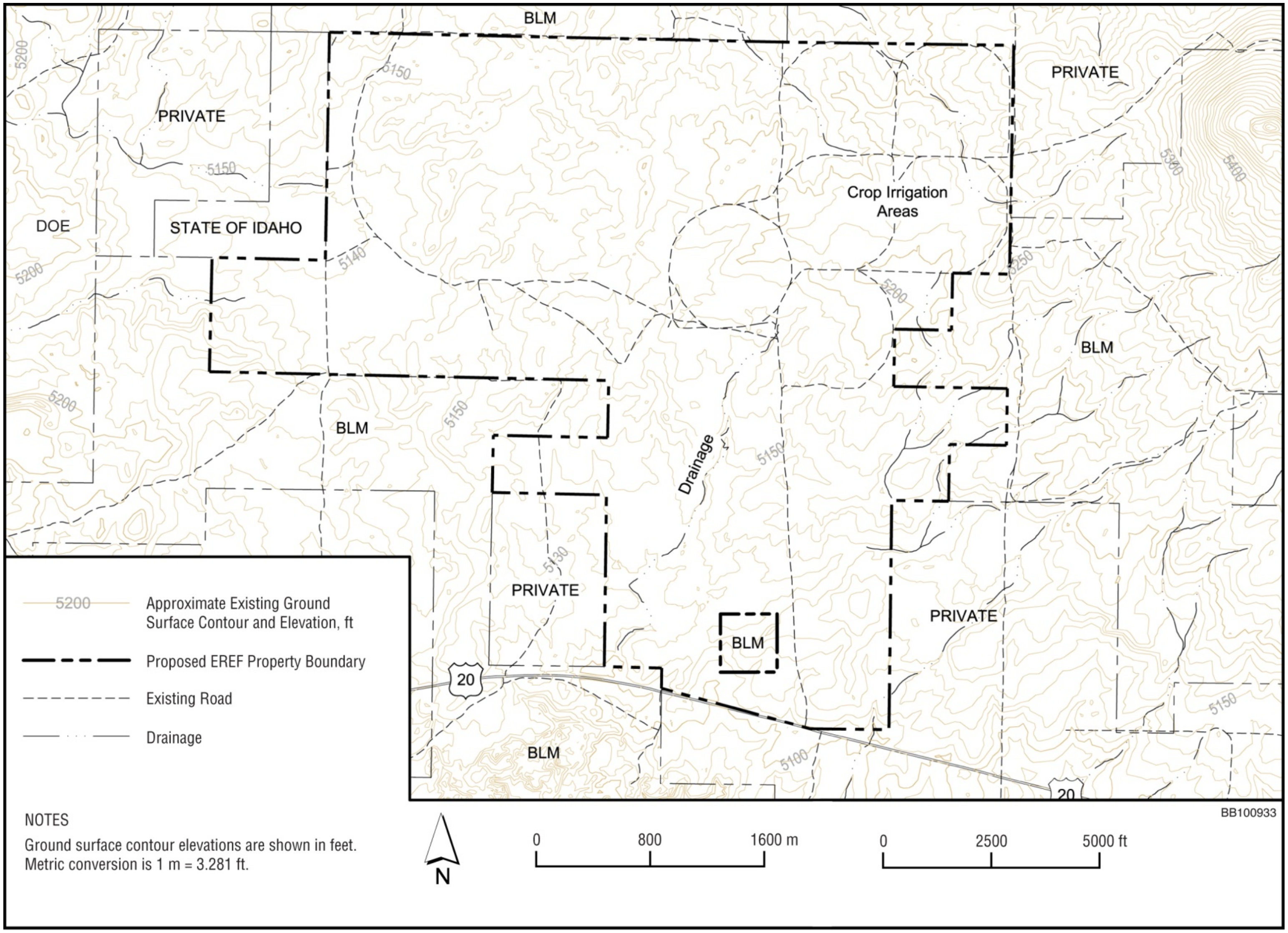

Figure 3-23 Drainage Features in the Vicinity of the Proposed EREF Site (AES, 2010)

second) (USGS, 2009e). Recent data from NCDC (2009c) indicate some improvement in the region's drought conditions.[12]

3.7.2 Groundwater Resources

3.7.2.1 Regional Hydrogeology

Because the climate in southeastern Idaho is cold and semiarid, natural soil development due to the growth and decomposition of vegetation is minimal on the ESRP. Surface soils are predominantly of eolian (wind) origin; soil cover is variable, ranging from nonexistent in areas of recent volcanism to tens of meters thick in areas of loess (wind-blown silt) accumulation. Thin soils and basalt outcrops are common in many areas along ridge lines and wind-swept areas (Hughes et al., 1999; Lindholm, 1996; Whitehead, 1994).

Soil types on the ESRP fall into six orders of lightly weathered soils typical of arid climates: alfisols, aridisols, entisols, inceptisols, mollisols, and vertisols (based on the taxonomy of USDA, 2010a). Most of these soils fall into the silt-loam textural class: 0 to 27 percent clay, 55 to 80 percent silt, and 10 to 35 percent sand. The mineralogy of soils at the INL reported by Nimmo et al. (2004) includes quartz, plagioclase, olivine, calcite, dolomite, and clay minerals; these are likely typical of the soils on the ESRP. Data summarized for INL by Nimmo et al. (2004) indicate that saturated hydraulic conductivities range from about 5.0×10^{-4} centimeters per second (1.6×10^{-5} feet per second) to 1.0×10^{-2} centimeters per second (3.3×10^{-4} feet per second), although reported ranges in the literature span over six orders of magnitude from 1.1×10^{-8} centimeters per second (3.6×10^{-10} feet per second) to 1.2×10^{-2} centimeters per second (3.9×10^{-4} feet per second). Porosities ranged from 0.42 to 0.55, and moisture contents from about 5 percent to 30 percent were also reported.

The vadose zone below the ESRP is spatially heterogeneous, ranging in thickness from 60 meters (197 feet) to 300 meters (984 feet). It is made up of unconsolidated alluvium and basalts of the Snake River Group (Section 3.6.1). Perched water zones are common throughout the ESRP, especially near rivers, canals, or other sources of surface water. Water within the vadose zone moves (1) by diffusion that is predominantly vertical and driven by gravity and (2) by preferential flow that is both vertical and horizontal and influenced by the presence and orientation of pores and fractures within the basalts and by the interlayers of sediment between basalt flows (Nimmo et al., 2004; Smith, 2004).

The groundwater system underlying the Snake River Plain in the vicinity of the proposed EREF site (and the source of its potable and process water supply) is the ESRP aquifer. The ESRP aquifer underlies an area of 26,000 square kilometers (10,040 square miles) and is up to 400 meters (1312 feet) thick, but it is most productive in the upper 90 to 150 meters (300 to 500 feet). Water volume in the ESRP aquifer is about 100 billion cubic meters (81 million acre-feet). The aquifer is largely unconfined; groundwater flows southwestwardly

[12] The NCDC uses the Palmer Drought Severity Index (PDSI) as a measure of long-term drought conditions. The PDSI takes into account precipitation, temperature, and soil moisture. Numbers range between –6.0 and +6.0, with negative numbers representing drier-than-normal conditions and positive numbers representing wetter-than-normal conditions (zero is normal). For the week ending February 20, 2010, the ESRP had a near-normal PDSI between –1.9 and +1.9 (NOAA, 2010).

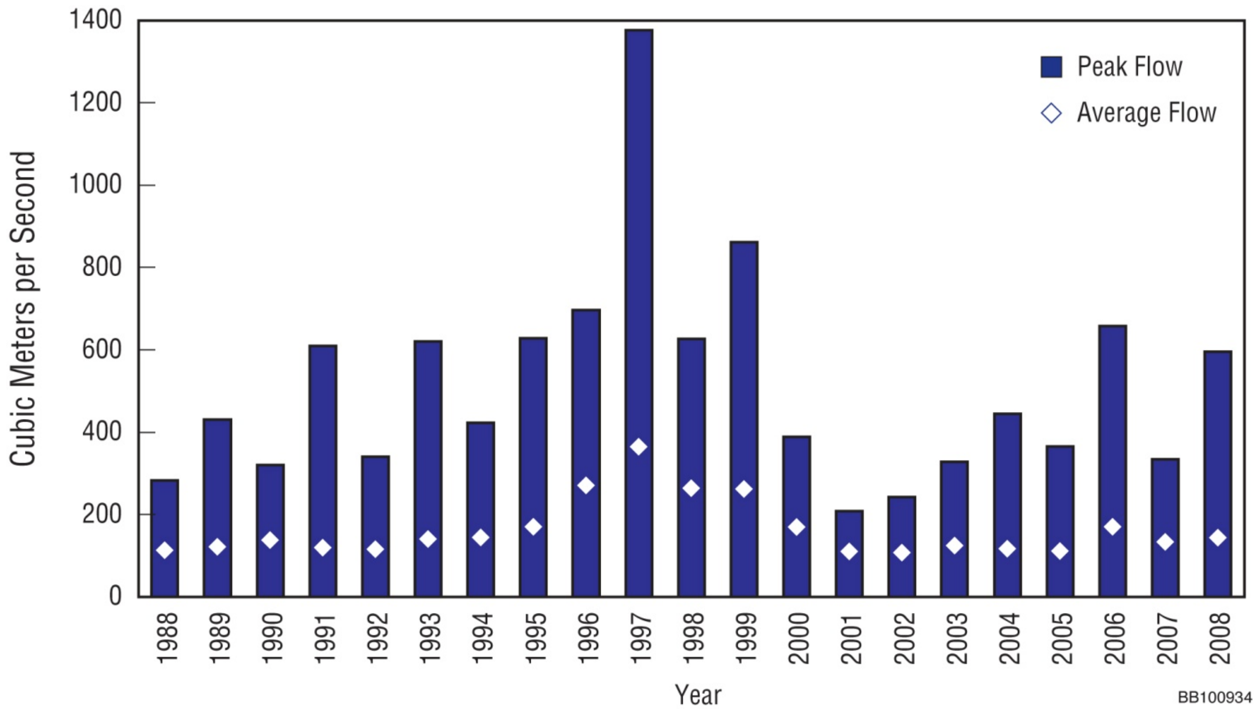

Figure 3-24 Annual Average and Peak Flows at the Snake River above Eagle Rock Station (Source: based on data from USGS, 2009e,f)

from recharge areas on the Yellowstone Plateau (and from precipitation- and surface-water-irrigated areas on the Snake River Plain) at an average gradient of 1.9 meters per kilometer (or 0.0019) and discharges to the Snake River through a series of springs between Twin Falls and King Hill. Flow velocities average about 3 meters per day (10 feet per day) (Smith, 2004; Wood and Low, 1988; Lindholm, 1996). Figure 3-25 shows groundwater flow contours for the ESRP aquifer based on data from the Idaho Department of Water Resources' (IDWR's) map service (IDWR, 2010).

3.7.2.2 Site Hydrogeology

Well logs show that most of the basalt bedrock below the proposed EREF site is fractured to some degree, although massive zones with few or no fractures (indicating basalt flow interiors) are also present. Flow interiors typically contain narrow vertical fractures; flow tops and bottoms have large vertical and horizontal fractures and are also marked by the presence of scoria, cinder, red oxidation, and increased vesicles. Massive zones in wells GW-1 and GW-4 (shown in Figure 3-26) are up to 3 meters (10 feet) in thickness. Three well-developed sedimentary interbeds, with thicknesses ranging from 1.2 to 2.4 meters (4.0 to 8.0 feet), were observed in GW-1 at depths of 18.3 meters, 59.4 meters, and 122.5 meters (60 feet, 195 feet, and 402 feet) (AES, 2010).

Field tests indicate that the aquifer is unconfined or semi-confined. Estimates of hydraulic conductivity (flow velocity) range from 0.007 meter per second (0.023 foot per second) to 0.015 meter per second (0.05 foot per second). Hydraulic conductivities are highest in the fractured basalt and lowest in sedimentary interbeds and massive zones within the basalt flow

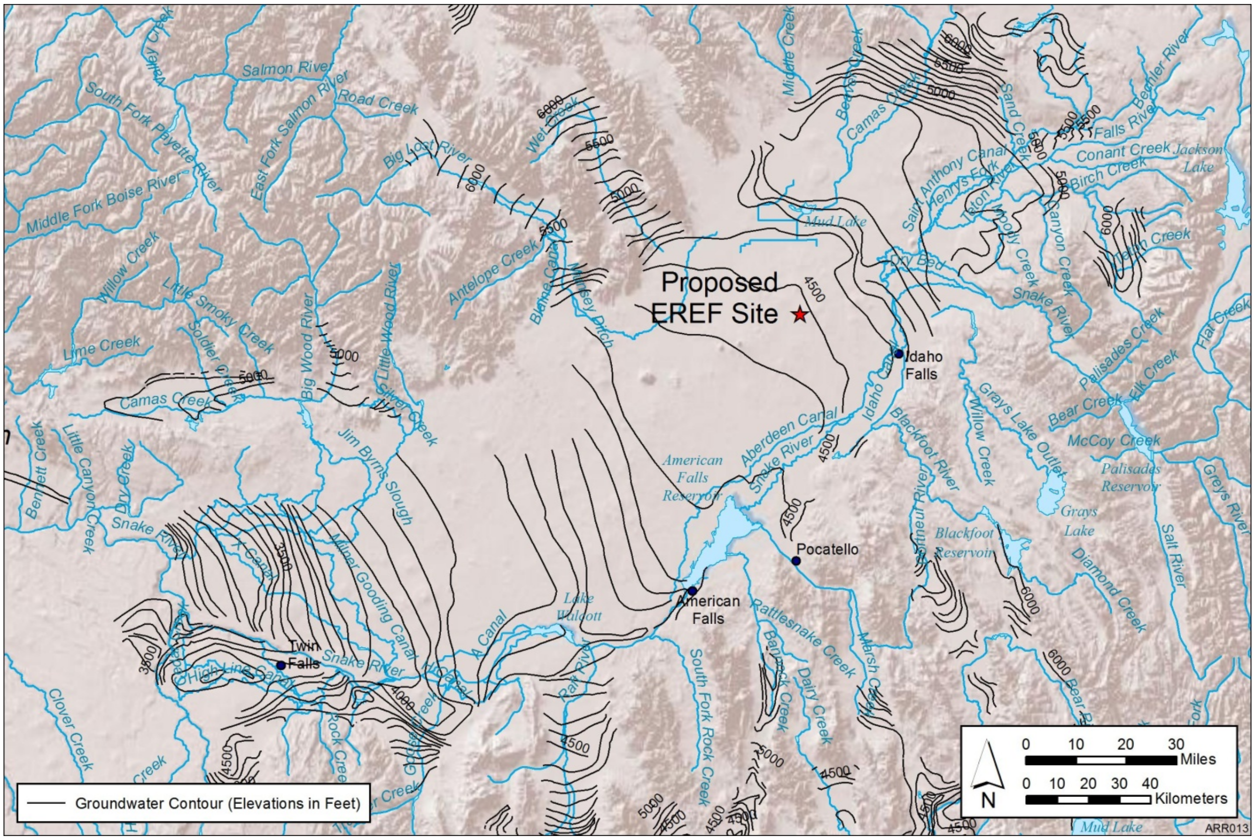

Figure 3-25 Groundwater Flow Contours for the ESRP Aquifer (IDWR, 2010)

interiors. Sedimentary interbeds and massive basalt zones, therefore, significantly impede the downward movement of water and may cause perching above the water table or lateral flow (AES, 2010).

About 60 percent of the ESRP aquifer recharge comes from irrigation water; other sources of recharge include small aquifers in valleys along the plain's edge (about 18 percent), infiltration from rivers and canals (about 13 percent), and precipitation (rain and snow) (about 9 percent) (IWRB, 2009). Although low-permeability layers are present in the vadose zone, little or no perching of groundwater has been observed below the proposed site. Depth to groundwater in onsite wells ranges from 201.5 meters (661 feet) to 220.0 meters (722 feet) below the ground surface. Groundwater flow below the proposed EREF site is consistent with the regional groundwater flow, from the northeast to the southwest, with a hydraulic gradient that drops 1.3 meters (4.3 feet) over a distance of 2260 meters (7460 feet) between wells GW-5 and GW-1 (about 0.0006) (Figure 3-26).

3.7.2.3 Groundwater Use

<u>Snake River Plain Aquifers</u>

The aquifers of the Snake River Plain are located in the basalt flows that formed the 40,404-square-kilometer (15,600-square-mile), crescent-shaped lobe in southern Idaho

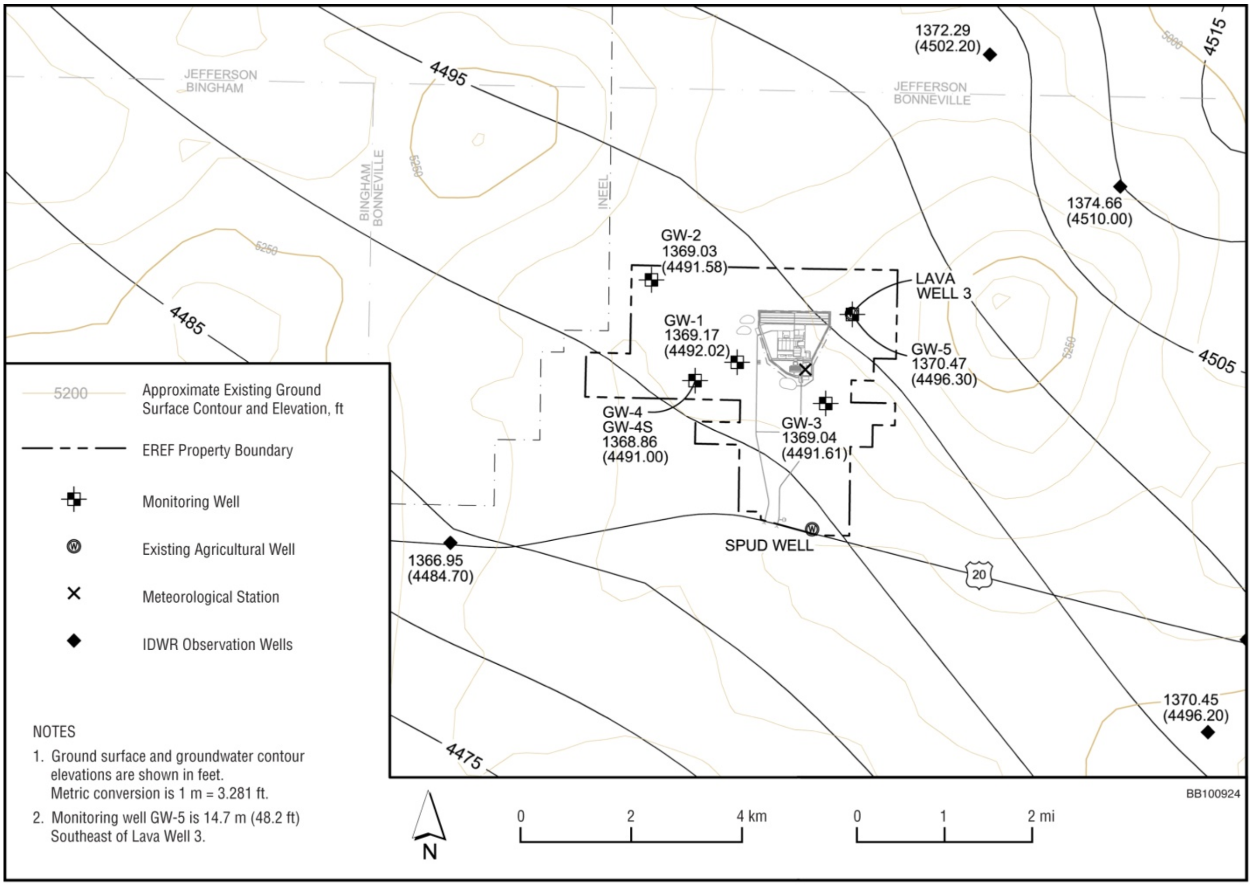

Figure 3-26 Groundwater Potentiometric Surface Map for the Proposed EREF Property (AES, 2010)

(Figure 3-27). The eastern half of the plain (the ESRP aquifer) consists of basalt flows with thicknesses up to 610 meters (2000 feet) that are overlain by and interbedded with unconsolidated sedimentary deposits. The western half is composed predominantly of unconsolidated sedimentary deposits with some basalt flows that are less thick than those making up the eastern half. The saturated thickness of the eastern half is much greater than that of the western half (Maupin and Barber, 2005). About 86 percent of the groundwater flowing through the Snake River Plain aquifers eventually discharges to the Snake River. The balance (about 14 percent) is withdrawn for irrigation, drinking water, and commercial and livestock use (IDEQ, 2005). In 2005, total water withdrawals – of both surface water and groundwater – in Bonneville County were 3.3 million cubic meters (882 million gallons per day or 988 thousand acre-feet per year). Groundwater withdrawn from the ESRP aquifer was about 19 percent of the total water withdrawn that year (USGS, 2010). The largest usage of groundwater in 2005 was for crop irrigation (at 96 percent). The second largest usage was for the public and domestic water supply (at 3.5 percent).

Public Water Supply and Water Rights

The ESRP aquifer was designated a sole source aquifer in 1991. A sole source aquifer is defined as one that supplies at least 50 percent of the drinking water in the petitioned area and

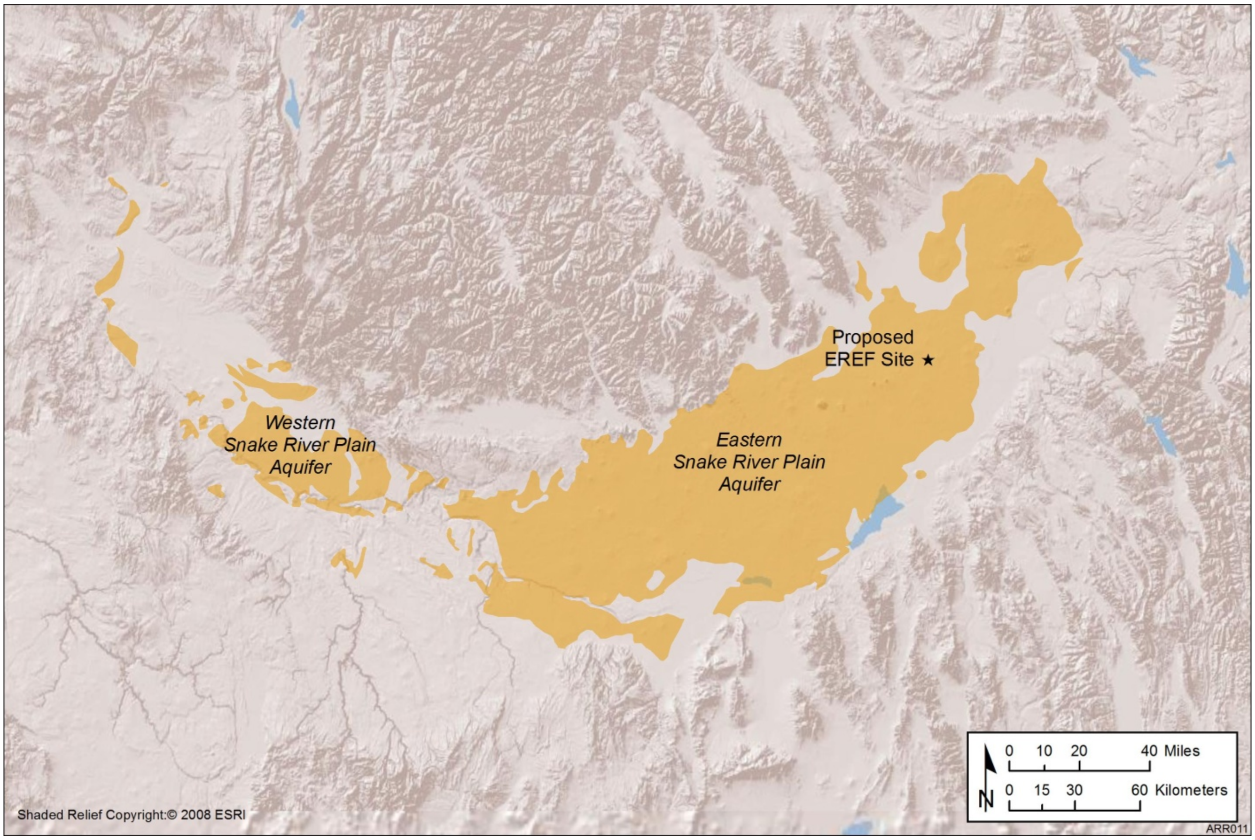

Figure 3-27 Snake River Plain Aquifers (modified from Maupin and Barber, 2005)

for which there is not a reasonably available alternative source to supply drinking water to all those who depend on the aquifer (EPA, 2009c). Currently, the ESRP aquifer is the sole source of drinking water for populations in southeast and south-central Idaho. The largest municipalities on the ESRP are Idaho Falls (Bonneville County) and Pocatello (Bannock County). The City of Idaho Falls operates a system of groundwater wells that meet an average daily usage of about 76,000 cubic meters (20 million gallons), with a maximum daily usage of about 220,000 cubic meters (58 million gallons). The City of Pocatello obtains its drinking water from the ESRP and Portneuf aquifers. Its municipal system meets an average daily usage of about 49,160 cubic meters (13 million gallons), with a maximum daily usage of about 130,700 cubic meters (34 million gallons) (IDC, 2009).

The proposed EREF would use groundwater appropriated by a 1961 water right that would transfer to AES with the purchase of the proposed EREF property. The transfer approval notice (for Water Right No. 35-2642) specifies an annual industrial diversion rate of 1713 cubic meters per day (452,527 gallons per day) and an annual irrigation diversion rate (from April 1 to October 31) of 147 cubic meters per day (38,833 gallons per day) (Carlsen, 2009). The primary point of diversion would be the existing onsite agricultural well (Lava Well; Figure 3-25) and an additional well installed to supply potable water.

3.7.2.4 Groundwater Quality

The upper portion of the ESRP aquifer has a predominantly calcium bicarbonate composition and is of high quality when compared with drinking water standards. The concentrations of minor elements and metals in the aquifer are generally low due to its neutral to slightly alkaline pH and moderately reducing conditions (Lindholm, 1996; Wood and Low, 1988).

Currently, there are two agricultural wells (Lava Well 3 and Spud Well), five deep aquifer monitoring wells (GW-1 through GW-5), and one shallow perched water well (GW-4S) at the proposed EREF site (Figure 3-25). Well GW-4S has been dry since it was installed. Water from monitoring wells GW-1 through GW-5 were sampled following their completion in May and July 2008 and then again in October 2008. The agricultural wells were sampled in March, May, and October 2008. Samples from all wells were analyzed for metals (dissolved and total[13]), total organic carbon, VOCs, SVOCs, PCBs, total petroleum hydrocarbons, pesticides, and herbicides (AES, 2010). Analytes were compared to the EPA's maximum contaminant levels (MCLs) and secondary MCLs (SMCLs),[14] since these represent stringent limits for potable water supplies (EPA, 2010b).

Total dissolved solids in onsite well samples were found in the range of 200 to 260 milligrams per liter, less than the EPA MCL of 500 milligrams per liter. Dissolved metal concentrations were also detected at levels below their corresponding MCL. Except for aluminum and iron, which were found in samples from the agricultural wells, total metal concentrations were below the EPA MCLs. Aluminum and iron concentrations likely resulted from the presence of suspended particles, which do not dissolve in the slightly alkaline pH of the aquifer.

No VOCs, SVOCs, PCBs, pesticides, or herbicides were detected in groundwater samples collected in March, May, and July 2008. October 2008 samples from some monitoring wells contained low levels of plasticizers (bis[2-ethylhexyl]phthalate and diethylphthalate) and trace amounts of chloroform. Low levels of lubricating oil were also detected in samples from some wells. These concentrations likely resulted from contamination introduced by sample handling (e.g., collecting or laboratory analysis) and drilling (in the case of the lubricating oil) and do not represent contamination within the aquifer.

Radiological analyses (gamma spectroscopy, gross alpha and beta, and tritium) were also performed on groundwater samples collected in 2008. Radium-224 and -228 and uranium-234, -235, and -238 were detected in some monitoring wells. Radium-228 and uranium-234, -235, and -238 were all below their respective EPA MCLs (5 picocuries per liter and 20 picocuries per liter). Detectable levels of gross beta were found in some monitoring wells, but in each case, they were less than the EPA MCL of 15 picocuries per liter. Tritium was detected in one well (GW-3) at a concentration of 530 picocuries per liter in May 2008. The EPA MCL for beta particle and photon radioactivity from radionuclides (like tritium) in drinking water is 4 millirem

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[13] Total metals in groundwater consist of those metals that are dissolved as free ions and metal complexes and those that are suspended (and filterable) as adsorbed or precipitated particles.

[14] The *Safe Drinking Water Act* defines primary drinking water standards or MCLs as the maximum permissible level of a contaminant in public drinking water. Secondary drinking water standards or SMCLs are for contaminants that are not threatening to health but could give rise to undesirable aesthetic (e.g., taste or odor), cosmetic (e.g., skin discoloration), or technical (e.g., corrosivity) effects.

per year; the average concentration of tritium that would yield this level of radioactivity is about 20,000 picocuries per liter (EPA, 2002). The concentration of tritium (530 picocuries per liter) detected in well GW-3 represents about 3 percent of that concentration.

3.8 Ecological Resources

This section describes the ecological resources, including plant communities; wildlife; rare, threatened, and endangered species; wetlands; and environmentally sensitive areas, of the proposed EREF site and property and surrounding areas. Surveys were conducted by AES in June and October 2008 for vegetation on the property and in May, June, and October 2008, January and April 2009, and April 2010 for wildlife. Ecological surveys also have been conducted at INL, a 2305-square-kilometer (890-square-mile) DOE laboratory about 1.6 kilometers (1 mile) west of the property, for more than 50 years.

3.8.1 Plant Communities

The EPA through its Western Ecology Region has developed, in cooperation with the U.S. Forest Service and the National Resource Conservation Service (formerly the Soil Conservation Service), a common framework for describing, classifying, and mapping ecological regions of the United States. The ecological regions mapped are typically geographically large.

These geographically distinct areas are associated with clearly observable groupings of plant and animals that live there under specific environmental conditions. The EREF property is located in what is called the Snake River Plain (Ecological Region 12), an area that covers about 51,023 square kilometers (19,700 square miles) (McGrath et al., 2002). The region is further divided into ten sub-regions, three of which are associated with the area ecology and/or the EREF property. These sub-regions are the: (1) 12b Lava Fields, (2) 12g East Snake River Basalt Plain, and (3) 12e Upper Snake River Plain. The approximate size of the sub-regions is 1100, 6400 and 1500 square miles, respectively. The Snake River Plain is also referred to as the Sagebrush Steppe, and in its more native state (12g) is characterized by large expanses of sagebrush and a variety of native grasses with saltbush and shad scale found in the saltier soils. The major difference between the 12g and 12e types is that the latter typically has deeper soils and where irrigation is available is used for the production of pastures and small grains such as wheat, potatoes, sugar beets, beans, and alfalfa. Type 12b is the lava field and can be found at the Craters of the Moon National Monument and Preserve.

A fairly large part of this ecological region is located in within the BLM's Upper Snake land unit managed out of its field office in Idaho Falls, Idaho. The boundaries of the Upper Snake unit total about 11,100 square miles or 7.1 million acres and roughly correspond to the same ecological sub-regions described under the EPA mapping system for the sagebrush steppe region. About 4000 square miles or 2.6 million acres (36.1 percent) are privately held lands, about 2800 square miles or 1.8 million acres (25.3 percent) are managed by BLM, about 2600 square miles or 1.7 million acres (23.4 percent) are managed by the U.S. Forest Service, and about 600 square miles or 0.4 million acres (5.3 percent) are owned by the State of Idaho. The nearby INL contains about 900 square miles or 0.6 million acres (8.0 percent). Together these land groupings total over 90 percent of the 7.1-million-acre BLM land management unit.

The BLM is tasked with the management of the rangeland under its control for multiple uses. Principal activities managed include grazing, wildlife habitat, hunting, and recreation, and this is performed under a comprehensive range management plan (RMP). Periodically the BLM reevaluates its current management plan and revises it. Revising an RMP is considered to be a major Federal action and requires that the BLM prepare an EIS. On February 28, 2008, the BLM published in the *Federal Register* a Notice of Intent to prepare an EIS to revise the Upper Snake RMP (73 FR 10802) and has completed a Final Public Scoping Report. The RMP planning process is a cooperative effort involving, in part, the DOE, EPA, U.S. Forest Service, the FWS, and a number of Idaho government agencies including the Department of Fish and Game, Department of Agriculture, and Department of Parks and Recreation.

The BLM Field Office estimates that 98 percent of the RMP area consists of sagebrush steppe and that the largest single land use for the public lands is livestock grazing. The BLM received 684 comments that were then grouped into seven planning issues. The seven planning issues identified are now being used to develop alternatives to be evaluated in the EIS. Two of the seven issues listed relate directly to the scope of the AES EIS and include impacts to the long-range health of the Sagebrush Steppe and its wildlife and plant communities and the resolution of conflicts over livestock grazing.

In 1995, the National Biological Service listed the Sagebrush Steppe ecosystem as a critically endangered ecosystem across its entire range (BLM/DOE, 2004) and has experienced more than a 98 percent decline since European settlement. The INL Sagebrush Steppe Ecosystem Reserve was established in 1999. This reserve is significant in many respects, not the least of which is the fact that it is currently the largest non-grazed reserve of sagebrush steppe in the region with approximately 40 percent of the area not having been grazed for over 50 years, and is the closest example of what the sagebrush steppe looked like before European settlement. The site maintains a long-term management plan that is jointly implemented and administered by DOE and the BLM in consultation with the FWS and the Idaho Department of Fish and Game. The most recent management plan was finalized in May 2004 (Final Management Plan EA ID-074-02-067 Finding of No Significant Impact) with a preferred alternative of multiple land use with a continued emphasis on natural resource protection and controlled livestock grazing principally on the BLM land within the boundaries of INL.

Large areas of the INL site support high-quality, relatively undisturbed sagebrush steppe habitat, and are included in the INL Sagebrush Steppe Ecosystem Reserve (BLM/DOE, 2004). Species diversity is high because of the reduced level of disturbances, such as grazing. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) are the dominant shrubs in this habitat; other frequently occurring shrubs include green rabbitbrush (*Chrysothamnus viscidiflorus*), winterfat (*Krascheninnikovia lanata*), prickly phlox (*Leptodactylon pungens*), and spiny hopsage (*Grayia spinosa*) (BLM/DOE, 2004). Perennial grasses commonly occurring in this habitat include thick-spiked wheatgrass (*Elymus lanceolatus*), Indian ricegrass (*Achnatherum hymenoides*), needle-and-thread (*Hesperostipa comata*), and Sandburg bluegrass (*Poa secunda*), while fernleaf biscuitroot (*Lomatium dissectum*), threadstock milkvetch (*Astragalus filipes*), Hoods phlox (*Phlox hoodii*), and hoary aster (*Machaeranthera canescens*) are commonly occurring forbs. Some areas of former sagebrush habitat on INL have been converted to grassland due to wildfire.

The EREF property is located within both the 12g East Snake River Basalt Plain and the 12e Upper Snake River Plain or Sagebrush Steppe ecoregions. Figure 3-28 shows the land cover types in the region around the EREF property, while Figure 3-29 provides cover types on the EREF property and immediate vicinity (Landscape Dynamics Lab, 1999). The property is transitional in that the western part of the property (Figure 3-30); 429 hectares (1060 acres) is sagebrush steppe whereas the remainder of the property managed as either nonirrigated pasture (882 hectares [2180 acres]) or as irrigated cropland (389 hectares [962 acres]) (AES, 2010). Immediately to the east of the property, the land is intensively managed as agricultural lands and falls within the 12g East Snake River Basalt Plain ecoregion.

As shown in Table 3-19, 34 plant species were identified within the sagebrush steppe community. The dominant species in this community on the EREF property are the shrubs Wyoming big sagebrush (approximately 16 percent areal cover), dwarf goldenbush (*Ericameria nana*) (approximately 17 percent areal cover), and Sandberg bluegrass (*Poa secunda*), a native perennial bunchgrass (approximately 11 percent areal cover) (AES, 2010). Only 8 of the 14 commonly occurring species in high-quality INL sagebrush steppe habitats were found on the EREF property. The total areal cover of all plants, excluding mosses, is about 60 percent. The total areal cover of shrubs is about 34 percent, of grasses about 20 percent, and forbs about 6 percent. The sagebrush steppe community has been impacted for many years by grazing, resulting in soil disturbance and reduced cover of herbaceous species. Four of the 34 species (12 percent) identified in this community were non-native, including cheatgrass, a highly invasive annual species which currently covers about 4 percent of the sagebrush steppe habitat. The density of Wyoming big sagebrush ranges from 6000 plants per hectare (2428 per acre) for short shrubs, those less than 40 centimeters (15.7 inches) in height, to 6900 plants per hectare (2792 per acre) for taller shrubs, those at least 40 centimeters (15.7 inches) in height.

The other predominant plant community type at the EREF property is nonirrigated pasture, which represents the remnant of sagebrush steppe that was mechanically modified to develop improved grazing (AES, 2010). Modification included the removal of shrubs from most of the area composing this community; grasses, such as crested wheatgrass (*Agropyron cristatum*), a non-native perennial bunchgrass, were planted. The remaining shrubs are primarily located at rock outcrops. The dominant species in the pasture community on the property are crested wheatgrass (about 34 percent areal cover) and cheatgrass (approximately 12 percent areal cover) (AES, 2010), both non-native species. This community has much lower species diversity than the native sagebrush steppe community. A total of only 17 plant species have been identified within this community. The total areal cover of all plants is about 55 percent. The total areal cover of grasses is about 47.5 percent, of forbs about 7 percent, and shrubs about 0.5 percent. Seven of the 17 species (41 percent) identified in this community are non-native. Bur buttercup (*Ranunculus testiculatus*), a non-native forb, occurs frequently in this community (about 5 percent areal cover). Other non-native species include alfalfa (*Medicago sativa*), tansymustard (*Descurainia sophia*), goats beard (*Tragopogon dubius*), and Canada thistle (*Cirsium arvense*), all at less than 1 percent cover.

3.8.2 Wildlife

The wildlife species observed or determined to be present, based on evidence observed, on the EREF property are presented in Table 3-20. A total of 27 wildlife species were identified in the sagebrush steppe community. Sagebrush obligate species, which depend on sagebrush during

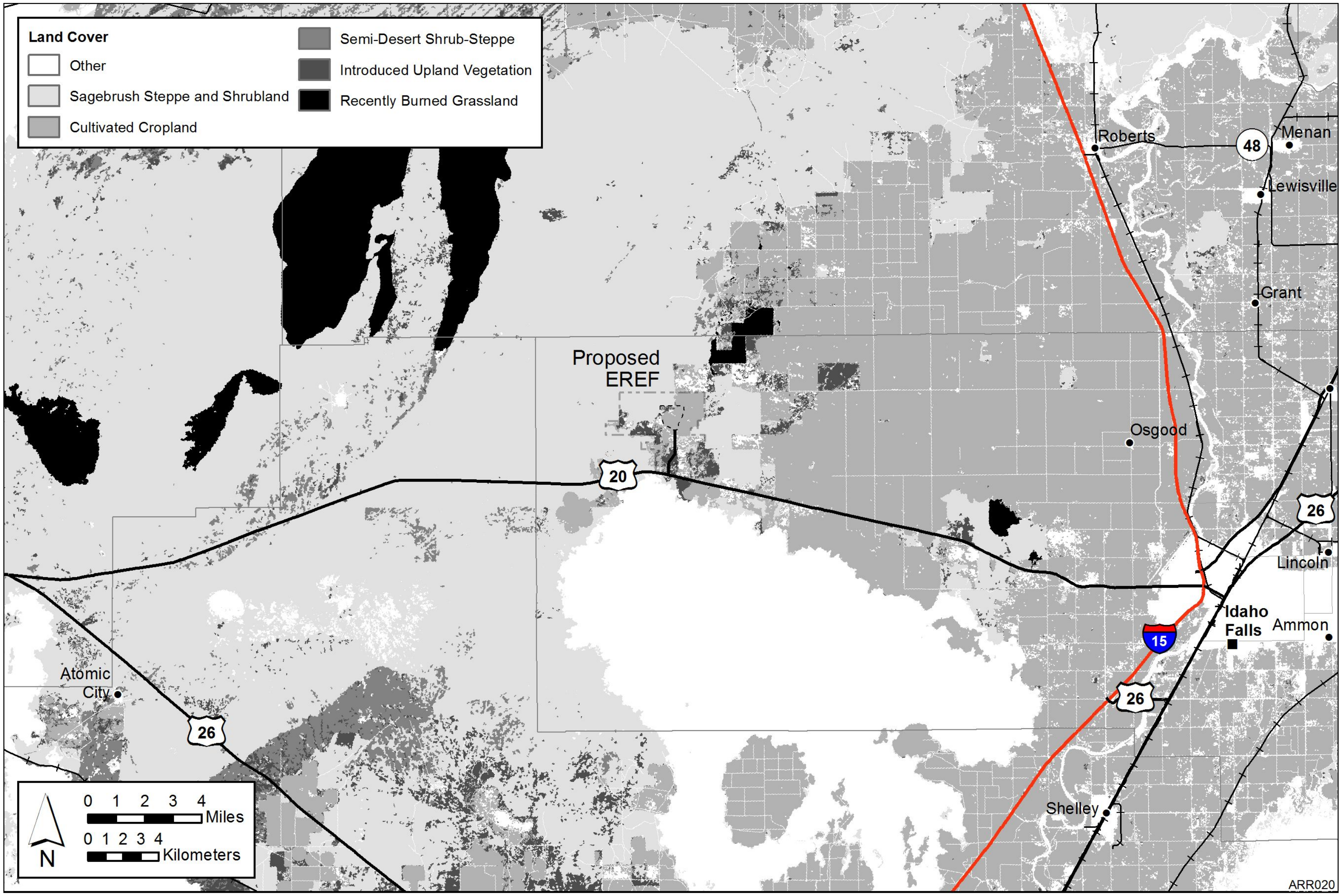

Figure 3-28 Land Cover Types of the Region (data from Landscape Dynamics Lab, 1999)

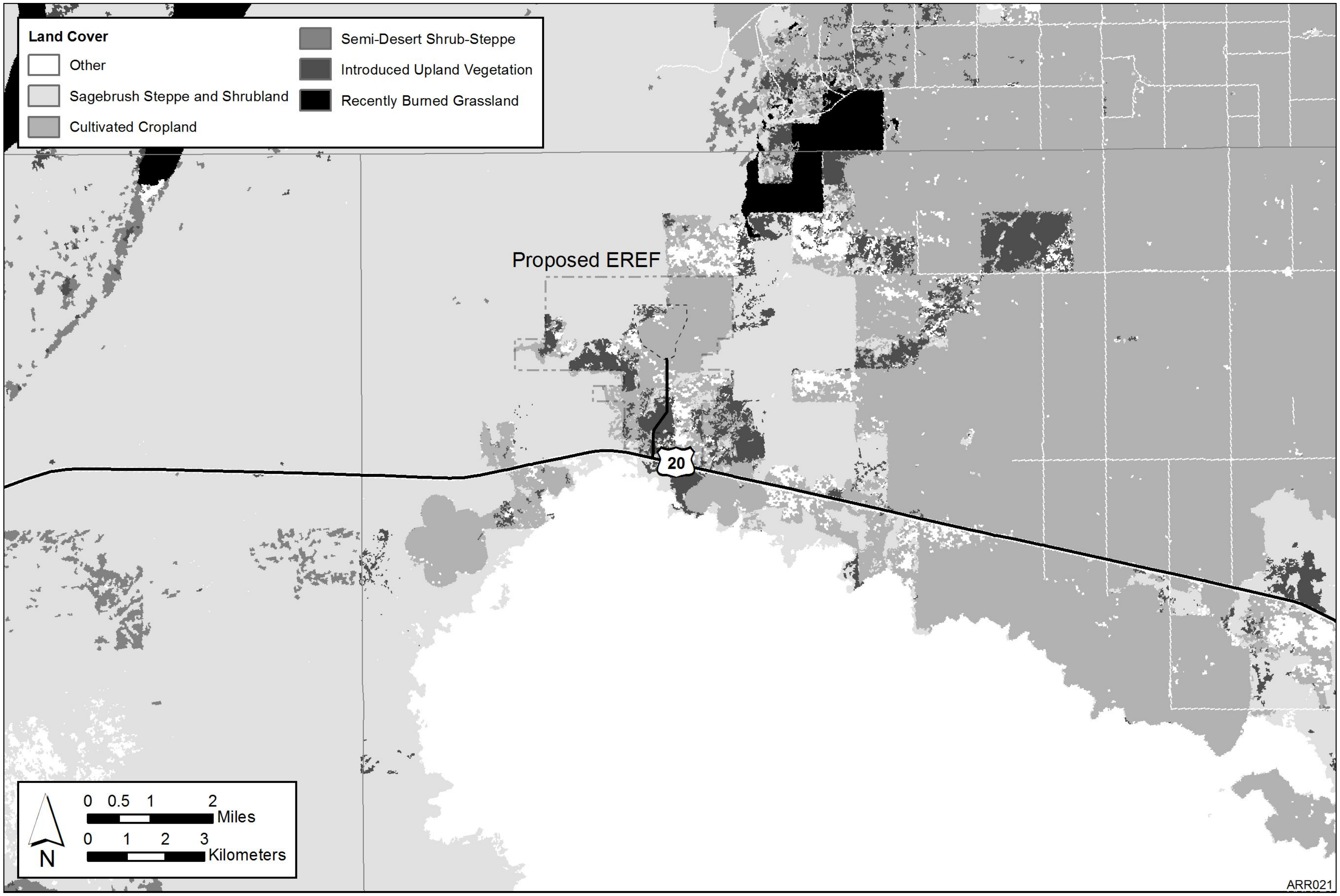

Figure 3-29 Land Cover Types of the Proposed EREF Property (data from Landscape Dynamics Lab, 1999)

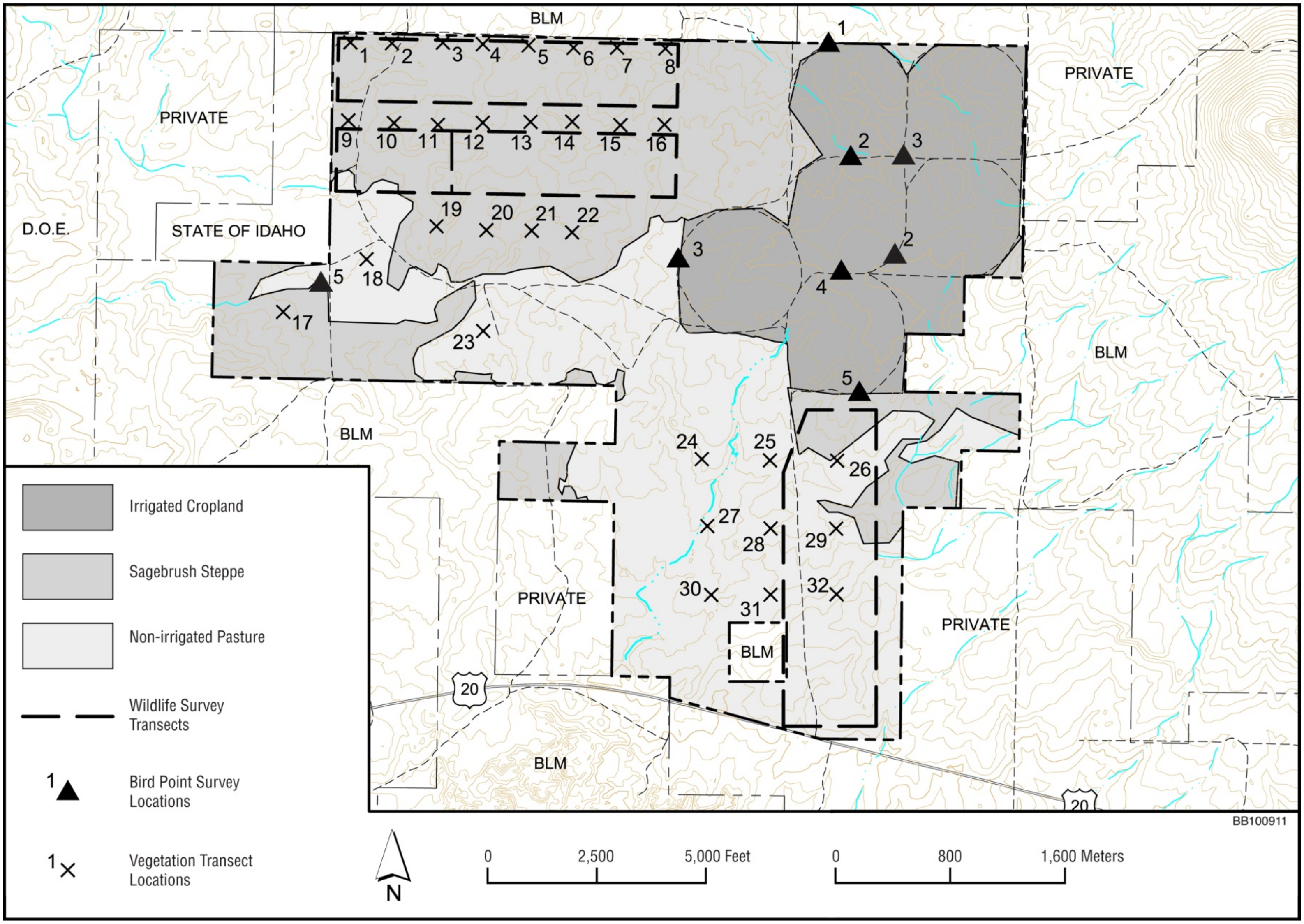

Figure 3-30 Vegetation Types of the Proposed EREF Property (AES, 2010)

Table 3-19 Plant Species Identified on the Proposed EREF Property and Percent Areal Cover

Scientific Name[a]	Common Name	Plant Community	
		Sagebrush Steppe	Nonirrigated Pasture
Shrubs			
Artemisia tridentata ssp. *wyomingensis*	Wyoming big sagebrush	16.00	0.18
Artemisia tripartita	Threetip sagebrush	0.30	–[b]
Atriplex nuttallii	Nuttall's saltbush	0.10	–
Ericameria nauseosa	Rubber rabbitbrush	–	0.18
Ericameria nana	Dwarf goldenbush	17.00	0.18
Krascheninnikovia lanata	Winterfat	0.09	–
Grasses			
*Agropyron cristatum**	Crested wheatgrass	0.60	33.60
*Bromus tectorum**	Cheatgrass	4.00	11.90
Elymus elymoides	Squirreltail	0.09	–
Elymus lanceolatus	Thick-spike wheatgrass	1.00	–
Hesperostipa comata	Needle-and-thread	0.02	–
Hordeum jubatum	Foxtail barley	3.00	0.05
Achnatherum hymenoides	Indian ricegrass	0.04	–
Poa secunda	Sandberg bluegrass	11.00	1.90
Forbs			
Agoseris glauca	False dandelion	–	0.80
Allium textile	Textile onion	0.10	–
Arabis lignifera	Desert rockcress	0.20	–
Astragalus curvicarpus	Curvepod milkvetch	0.20	–
Castilleja sp.	Indian paintbrush	0.07	–
Chenopodium leptophyllum	Slimleaf goosefoot	0.04	–
*Cirsium arvense**	Canada thistle	–	0.05
Crepis acuminata	Hawksbeard	0.10	–
Cryptantha interrupta	Bristly cryptantha	0.10	–
Delphinium andersonii	Anderson's larkspur	0.02	–
*Descurainia sophia**	Tansymustard	1.00	0.14
Erigeron pumilus	Shaggy fleabane	0.40	0.41

Table 3-19 Plant Species Identified on the Proposed EREF Property and Percent Areal Cover (Cont.)

Scientific Name	Common Name	Plant Community	
		Sagebrush Steppe	Nonirrigated Pasture
Lappula occidentalis	Flatspine stickseed	0.50	0.05
Lepidium sp.	Pepperwort	0.09	–
Lomatium dissectum	Fernleaf biscuitroot	0.30	–
Medicago sativa[a]	Alfalfa	–	0.14
Oenothera caespitosa	Desert evening primrose	0.02	–
Packera cana	Woolly groundsel	0.02	0.05
Phlox hoodii	Hood’s phlox	0.60	0.05
Phlox longifolia	Longleaf phlox	2.00	–
Ranunculus testiculatus[a]	Bur buttercup	0.02	5.00
Schoenocrambe linifolia	Flaxleaf plainsmustard	0.30	–
Sphaeralcea munroana	Orange globemallow	0.02	–
Tragopogon dubius[a]	Goat’s beard	–	0.09
Cacti			
Opuntia polyacantha	Prickly pear	0.20	–

[a] Non-native species.
[b] Dash = not observed.
Source: AES, 2010; native status from USDA, 2010b.

at least some portion of the year for survival, that are known to occur on the property include greater sage-grouse (*Centrocercus urophasianus*), sage thrasher (*Oreoscoptes montanus*), Brewer’s sparrow (Spizella breweri), sage sparrow (*Amphispiza belli*), and pronghorn antelope (*Antiliocapra americana*).

Fifteen wildlife species were observed in the nonirrigated pasture habitat and 10 in the irrigated crops area. No small-mammal trapping was conducted on the property; however, small mammals common in similar habitats at INL include black-tailed jack rabbit (*Lepus californicus*), mountain cottontail (*Sylvilagus nattallii*), pygmy rabbit (*Brachylagus idahoensis*), Townsend’s ground squirrel (*Spermophilus townsendii*), least chipmunk (*Tamias minimus*), Great Basin pocket mouse (*Perognathus parvus*), Ord’s kangaroo rat (*Dipodomys ordii*), western harvest mouse (*Reithrodontomys megalotis*), deer mouse (*Peromyscus maniculatus*), bushy-tailed woodrat (*Neotoma cinerea*), and montane vole (*Microtus montanus*) (S.M. Stoller Corporation, 2001).

Table 3-20 Wildlife Species Occurring on the Proposed EREF Property[a]

Scientific Name	Common Name	Sagebrush Steppe	Nonirrigated Pasture	Irrigated Cropland
Amphibians				
Ambystoma tigrinum	Tiger salamander	–[b]	X	–
Reptiles				
Phrynosoma douglassi	Short-horned lizard	X	–	–
Birds				
Ammodramus savannarum	Grasshopper sparrow	X	–	–
Amphispiza belli	Sage sparrow	X	–	–
Asio flammeus	Short-eared owl	X	–	–
Buteo jamaicensis	Red-tailed hawk	–	–	–
Centrocercus urophasianus	Greater sage-grouse	X	–	–
Charadrius vociferus	Kildeer	–	X	–
Circus cyaneus	Northern harrier	X	X	X
Corvus brachyrhynchos	American crow	X	X	X
Eremophila alpestris	Horned lark	X	X	X
Euphagus cyanocephalus	Brewer's blackbird	X	–	–
Falco mexicanus	Prairie falcon	X	–	–
Molothrus ater	Brown-headed cowbird	X	X	–
Numenius americanus	Long-billed curlew	–	–	X
Oreoscoptes montanus	Sage thrasher	X	X	–
Pica hudsonia	Black-billed magpie	X	X	X
Pooecetes gramineus	Vesper sparrow	X	X	–
Spizella breweri	Brewer's sparrow	X	X	–
Spizella passerina	Chipping sparrow	–	–	–
Sturnella neglecta	Western meadowlark	X	X	X
Zenaida macroura	Mourning dove	X	X	X
Mammals				
Taxidea taxis	Badger	X	–	–
Canis latrans	Coyote	X	X	–
Antiliocapra americana	Pronghorn	X	X	–
Microtus montanus	Montane vole	X	–	–
Odocoileus virginianus	White-tailed deer	X	–	–
Lepus californicus	Black-tailed jack rabbit	X	–	–

Table 3-20 Wildlife Species Occurring on the Proposed EREF Property[a] (Cont.)

Scientific Name	Common Name	Sagebrush Steppe	Nonirrigated Pasture	Irrigated Cropland
Spermophilus townsendii	Townsend's ground squirrel	X	–	–
Tamias minimus	Least chipmunk	X	X	–
Peromyscus maniculatus	Deer mouse	X	–	–

[a] Species that were identified as present on the property based on visual observation, calls, or evidence of recent presence are indicated with an "X".
[b] Dash = not observed.
Source: AES, 2010; MWH, 2008a,b,c; MWH, 2009.

Pronghorn have been observed on the EREF property. Pronghorn use the property throughout the year, and the property is located within important winter-spring pronghorn habitat. Mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*) occur in the region during summer and winter and migrate through the INL area between summer and winter use areas (BLM/DOE, 2004). There are no indications that mule deer, elk, or pronghorn populations are declining in the region; elk and pronghorn populations may be slightly increasing (IDFG, 2009b).

3.8.3 Rare, Threatened, and Endangered Species

No Federally listed threatened or endangered species are known to occur, or are expected to occur, on the EREF property (FWS, 2009a), and none were identified on the property during field surveys. The following Federally listed species are known to occur in Bonneville County and adjacent Jefferson and Bingham Counties, and are found in stream, forest, wetland, and riparian habitats: the Utah valvata snail (*Valvata utahensis*), endangered; Canada lynx (*Lynx canadensis*), threatened; Ute ladies'-tresses (*Spiranthes diluvialis*), threatened; grizzly bear (*Ursus arctos*), threatened; and yellow-billed cuckoo (*Coccyzus americanus*), a candidate for listing (FWS, 2009b). None of their habitat types are found on the EREF property nor within an 8-kilometer (5-mile) radius of the property.

The Utah valvata snail is a freshwater aquatic snail that occurs in the mainstem of the Snake River (FWS, 2010a). The Snake River is about 32 kilometers (20 miles) from the property, and there are no freshwater habitats on or in the vicinity of the property. Therefore, this species would not occur on or near the property.

The Canada lynx (*Lynx canadensis*) is typically associated with forested habitats and may use riparian habitat along rivers as travel corridors. Ute ladies'-tresses (*Spiranthes diluvialis*), a plant primarily of wetland and riparian habitats, occurs in the Snake River floodplain (IDFG, 2009a). The yellow-billed cuckoo (*Coccyzus americanus*) is typically associated with riparian woodlands and shrubs and occurs along the Snake River. The grizzly bear occurs in a variety of habitats within portions of the Greater Yellowstone Area (FWS, 2010b).

The bald eagle (*Haliaeetus leucocephalus*) is listed as a threatened species by the State of Idaho, but is no longer a Federally listed species. It nests in trees along the Snake River northeast and southeast of the proposed EREF site and winters near open water (IDFG, 2005; FWS, 2007). Foraging is generally near rivers, lakes, or other water bodies. Bald eagles do not nest in the vicinity of the proposed EREF, and winter habitat does not occur in the vicinity.

Species of concern that were observed on the EREF property include the long-billed curlew (*Numenius americanus*), ranked as an imperiled breeding population in the State and BLM watch list; Brewer's sparrow (*Spizella breweri*), ranked as a vulnerable breeding population in the State and BLM regional/State imperiled; grasshopper sparrow (*Ammodramus savannarum*), ranked as an imperiled breeding population in the State and BLM watch list, which are all species of conservation concern (FWS, 2008) and BLM species of special concern.

Greater sage-grouse (*Centrocercus urophasianus*) was added to the Federal list of candidate species by the U.S. Fish and Wildlife Service (FWS) on March 5, 2010. The FWS determined that listing the sage-grouse as a protected species under the *Endangered Species Act* was warranted but precluded by the need to list higher priority species. Sage-grouse is also a species of conservation concern in Idaho and ranked as imperiled in the State and BLM rangewide/globally imperiled. The proposed EREF property appears to be located within the annual range of a local sage-grouse population, and sage-grouse evidently use the site. Sage-grouse were observed, and male sage-grouse were heard just north of the EREF property during surveys in 2008 (MWH, 2008a), and evidence of the presence of sage-grouse was observed on the property in 2008 and 2009 (MWH, 2008b, 2009). In June 2008, sage-grouse pellets (droppings), feathers, and a roost used by sage-grouse were found in sagebrush habitat on the property (MWH, 2008b). In January 2009, sage-grouse tracks were found in the sagebrush habitat on the property and the irrigated crops area of the property; in April 2009, sage-grouse feathers were found at three locations in sagebrush habitat on the property (MWH, 2009). In April 2010, old sage-grouse pellets were found in sagebrush habitat on the property (North Wind, 2010). No greater sage-grouse leks (breeding areas) were found during surveys of the proposed property on May 6–7, 2008 (MWH, 2008a) and April 28–29, 2010 (North Wind, 2010). Recommended survey dates are early March to early May (Connelly et al., 2003); specifically, lek surveys should be conducted March 25 through April 30 for low elevation areas and April 5 through May 10 for higher elevations (ISAC, 2006). At approximately 5200 feet (1600 meters) MSL, the EREF property could be considered a high elevation site. The nearest known breeding ground (lek) is 5.6 kilometers (3.5 miles) from the EREF site, and numerous leks are located within 16 kilometers (10 miles) (IDFG, 2009b). Key sage-grouse habitat occurs in the vicinity of the EREF property (IDFG, 2009b; ISAC, 2006).

Sage-grouse have experienced long-term declines throughout their range, which includes much of the western United States. These declines are associated in large part with the loss and degradation of sagebrush habitat. Sagebrush is an important component of sage-grouse breeding, nesting, and winter habitat. The Idaho populations of sage-grouse declined at an average rate of 3.0 percent per year from 1965 to 1984, but declines from 1985 to 2003 averaged only 0.1 percent per year (Connelly et al., 2004).

The proposed EREF property is located within the Upper Snake Local Working Group Planning Area, which is within sage-grouse Management Zone IV. Since 1996, sage-grouse populations in the Upper Snake Local Working Group Planning Area appear to be stable (USSLWG, 2009).

Male lek attendance was up slightly in 2009 from 2008. In the Upper Snake Planning Area, the average males per lek in 2009 was 15, a drop from 19 in 2008 and 24 in 2007. Total males counted on leks in the Upper Snake Planning Area (on leks counted each year) was 1465 in 2009, 1366 in 2008, and 2052 in 2007.

Productivity measured as chicks per hen (chicks alive in September and October) is strongly influenced by weather. Idaho sage-grouse productivity in 2008 was 1.48 chicks per hen, which was slightly lower than the previous 5-year average of 1.93 (ISACTAT, 2010). However, in 2009, productivity was 2.0, slightly higher than previous 5-year average of 1.88 (ISACTAT, 2010). In the Upper Snake Planning Area, productivity is increasing with a chick/hen ratio of 2.17 in 2009, 1.84 in 2008, and 1.16 in 2007 (ISACTAT, 2010). A chicks/hen ratio of 2.25 or more generally results in a stable to increasing population.

The major threats to sage-grouse in Idaho are the loss, degradation, and fragmentation of sagebrush habitat (Connelly et al., 2004). Alteration of historical fire regimes, conversion of land to farming or intensive forage production for livestock, water developments, herbicide and pesticide use, establishment of invasive species, urbanization, energy development, mineral extraction, and recreation are all factors that contribute to sagebrush habitat degradation (Connelly et al., 2004). Restoration of disturbed areas should include sagebrush, native forbs (especially legumes), and native bunchgrasses to provide suitable breeding habitat for sage-grouse (USSLWG, 2009). Fences may be a source of sage-grouse mortality unless visibility is increased by flagging or other means (USSLWG, 2009). Noxious weeds invade sagebrush steppe plant communities and displace desirable species, change fire frequencies, and reduce the value of the habitat for sage-grouse (USSLWG, 2009).

Many sage-grouse populations in Idaho are migratory. Sage-grouse occur year-round on the INL site and migrate between leks, nesting areas, late brood-rearing habitat (June to early November), and winter habitat (BLM/DOE, 2004). Nesting sites have been known to be up to 18 kilometers (11 miles) from leks. Important characteristics for winter habitat include topographic diversity and a diversity of sagebrush heights. DOE, the BLM, and the Idaho Department of Fish and Game all participate in and follow the Idaho Sage-Grouse Advisory Committee's *Conservation Plan for the Greater Sage-Grouse in Idaho* (ISAC, 2006) and will continue to follow this document.

Species of conservation concern that occur in the region and are likely to occur on the EREF property include Townsend's big-eared bat (*Corynorhinus townsendii*), ranked as vulnerable in the State and BLM regional/State imperiled. Lava tube caves approximately 8 kilometers (5 miles) from the property are used by Townsend's big-eared bat as roosts and hibernacula (IDFG, 2009c). The bats likely forage for insects above the sagebrush steppe habitat. The ferruginous hawk (*Buteo regalis*), a migratory species, is ranked as a vulnerable breeding population in the State and BLM regional/State imperiled. Ferruginous hawks, including a nest, have been observed within 8 kilometers (5 miles) of the proposed site (IDFG, 2009c). The prey species in western shrubsteppe habitats primarily include black-tailed jackrabbit, ground squirrels, and pocket gophers. Ferruginous hawk nests tend to be located on the ground or in relatively isolated trees (Dechant et al., 1999). The pygmy rabbit (*Brachylagus idahoensis*) is ranked as imperiled in the State and BLM rangewide/globally imperiled. This burrowing species has been frequently observed on the INL site (S.M. Stoller Corporation, 2001). The sharp-tailed grouse (*Tympanuchus phasianellus*) is known to occur in the vicinity of the proposed EREF site

(IDFG, 2010) and occupies shrub and grass habitats (IDFG, 2005). The sharp-tailed grouse does not occur throughout the Upper Snake River Plain, and its distribution in the proposed EREF site area is somewhat limited (IDFG, 2005).

3.8.4 Wetlands

Wetlands are "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (USACE, 1987). No wetlands occur on or adjacent to the EREF property (FWS, undated; Joyner, 2008). No aquatic habitats, such as streams, rivers, lakes, or ponds, are present on or adjacent to the property. Surface water on and near the property consists of intermittent and ephemeral drainages that carry flows following storms and typically dissipate due to infiltration and evapotranspiration (USGS, 1964; NRCS, 2009). A drainage in the southwestern corner of the property may occasionally convey surface water off the property. A small impoundment on this drainage occasionally contains surface water following storms. Small wet areas in the irrigated cropland and near the potato shed occasionally receive water from agricultural operations and support such species as cattail (*Typha* sp.) and spikerush (*Eleocharis* sp.), as well as providing potential breeding areas for the tiger salamander (*Ambystoma trigrinum*). Permanent surface waters nearest to the property are the Snake River, about 32 kilometers (20 miles) to the east, Mud Lake and Market Lake, about 32 kilometers (20 miles) to the northeast, and the Big Lost River, about 32 kilometers (20 miles) to the west.

3.8.5 Environmentally Sensitive Areas

Three State wildlife management areas are located about 32 kilometers (20 miles) north-northeast of the EREF property. Market Lake State Wildlife Management Area is managed primarily to provide habitat for waterfowl; the North Lake State Wildlife Management Area and Mud Lake Wildlife Management Area are managed for fish and wildlife resources. Hell's Half Acre WSA (BLM), immediately south of US 20, is a 26,790-hectare (66,200-acre) area of lava flows with sparse vegetation (BLM, 2008). Camas National Wildlife Refuge, about 32 kilometers (20 miles) north, includes lakes, ponds, and marshes.

3.9 Noise

This section describes the existing conditions at the proposed EREF site with respect to anthropogenic sources of noise, characterizes the geography and land cover with respect to noise propagation and attenuation, and identifies receptors that may be impacted by noise generated during preconstruction, construction, operation, or decommissioning of the proposed EREF. Existing noise regulatory controls and their respective enforcement authorities are also discussed.

Sound is a physical phenomenon and form of energy that can be described and measured and represented with precise mathematical expressions. Noise, on the other hand, is defined generally as any unwanted sound. Recognition of sound is based on the receptor's objective and reproducible response to sound's primary physical attributes: intensity (perceived by a receptor as loudness), frequency (perceived as pitch), frequency distribution and variation over time, and duration (continuous, sporadic [rhythmic], or impulsive). Perception of sound, however, is subjective and circumstantial. Sounds that are soothing to some are annoying to others, and sounds barely noticed and generally ignored in one circumstance may be considered highly objectionable in another. Sound levels that are acceptable during daytime hours are often unacceptable during nighttime hours.

3.9.1 Expected Sound Propagation Characteristics at the Proposed EREF Site

Sound propagation follows the inverse square law: the intensity of a sound wave decreases inversely with the square of the distance between the source and the receptor. Thus, doubling the distance between a receptor and a sound source reduces the intensity of the sound to one-fourth of its initial value, and tripling the distance results in one-ninth the original intensity, etc.

Throughout much of the continental United States, land cover results in attenuation of sound originating at or near ground level at a rate of 6 decibels for every doubling of distance between source and receptor. At a typical semiarid steppe with sparse vegetation and exposed, hard surface soils or rock, the ground surface would be expected to act primarily as a reflective surface rather than an absorptive surface, resulting in minimal attenuation of sound as it propagates from its source. However, the land surface composition around the proposed EREF does not represent a typical semiarid desert steppe. Native vegetation, primarily sage and cacti, exists in natural areas. However, crested wheatgrass, which had been introduced into the area some years ago, has spread throughout the area to a great extent, and, with the exception of small areas of basalt outcropping, the entire land surface of natural areas is now covered with a natural or introduced vegetative cover throughout the growing season. Other land areas surrounding the proposed EREF site that are currently in agricultural cultivation for potatoes or barley and that would continue to be used for those purposes after the proposed EREF becomes operational are also nearly fully covered with vegetation during much of the crop-growing cycle. Thus, given these circumstances and current and future surrounding land uses, it is reasonable to expect that the ground surface would be relatively sound-absorptive and that SPL attenuations would be at the average of 6 decibels with every doubling of distance from the source.

3.9.2 Existing Sound Sources and Potential Receptors at the Proposed EREF Property

Current activities at the proposed EREF property and on the surrounding land parcels are primarily agricultural. Noise sources related to current land use include an irrigation pump located in the approximate center of the site, the only identified significant anthropogenic point source, and machinery and equipment used seasonally to prepare the fields and to plant and harvest the crops. Truck transport of harvested crops to area processing plants represents another seasonal source.

The southern border of the proposed EREF property is defined by US 20, the only major transportation corridor in the immediate vicinity of the site. In addition to being used for commerce, US 20 is currently used by many employees of INL, located immediately west of the proposed EREF property, to commute between the laboratory and their homes in Idaho Falls. It is expected that US 20 will also be the primary route for the majority of employees of the proposed EREF once it becomes operational. Section 3.10 provides additional information about existing traffic patterns for US 20. No other significant anthropogenic sound sources exist in the immediate vicinity of the proposed EREF site.

The nearest human receptors are farm workers who may periodically be in agricultural fields bordering the proposed property (presumably only during daylight hours), hikers who may frequent a trail located on the BLM WSA about 0.5 kilometer (0.3 mile) southwest of the proposed property, and residents; the nearest residence was estimated to be located 7.7 kilometers (4.8 miles) east of the site on a parcel bordering US 20. No sensitive human receptors were identified. Individuals traveling on US 20 are not considered to be human receptors because of the short time during which they would be within a critical distance of any EREF sound source. The nearest community was identified as Idaho Falls, approximately 32 kilometers (20 miles) east of the site. Archeological sites at the Wasden Complex were identified at a distance of 1 kilometer (0.6 mile) from the proposed property. It is also presumed that indigenous wildlife would use the site and the vicinity throughout construction and operation and that cattle grazing would continue to occur on adjacent land parcels that are not involved in crop production. Cattle grazing may also be allowed on fallow portions of the proposed EREF property (excluding the industrial portion of the site) once construction is completed. AES identified one irrigation pump as the only anthropogenic point source of any significance and identified traffic on US 20 (which borders the site on its south boundary) as the only anthropogenic line source of note within the vicinity of the proposed site. Once construction of the proposed facility starts, the irrigation pump's operation will be discontinued. However, that same groundwater source is likely to be fitted with a different pump to provide water for construction-related activities.

3.9.3 Noise Regulatory Controls

Regulations addressing sound, or more precisely what society considers noise, exist for noise sources that originate or propagate on or above the ground surface. Federal noise standards have been established under the *Noise Control Act of 1972* for transportation and construction activities as well as for a variety of products. The *Noise Control Act* and subsequent Federal legislation (*Quiet Communities Act of 1978*, 42 U.S.C. 2901-4918) delegate the authority to regulate noise to State and local governments. Although there has been no formal noise control program functional at the Federal level since 1981, Federal noise standards have served as the basis for State and local regulations and ordinances addressing noise. Such State and local controls initially focused on construction or industrial noise but have evolved to also include noise control strategies in building codes to protect occupants from both exterior noise and noise generated within the structure. State and local regulations are typically enforced at the municipal or county level under broadly written nuisance statutes.

In addition to technical standards, the EPA has also published numerous guidance manuals for conducting community noise surveys, establishing acceptable levels of noise control at the community level, and enforcing those noise limits (e.g., EPA, 1980). Because of the increased sensitivity of most individuals to sound at night, a 10-decibel weighting factor is often added to the measured nighttime sound level to establish an equivalent sound level, or L_{eq}, that is then compared with the established standards. A day-night maximum average sound level (represented as L_{dn} or DNL) of 55 A-weighted decibels has been established as sufficient to protect the public from the effects of broadband environmental noise in quiet settings and residential neighborhoods (EPA, 1974). EPA guidelines also recommend that the L_{eq} (a sound level maintained continuously over a 24-hour period) be limited to 70 dBA or less over a 40-year period to protect the general population against hearing loss from nonimpulsive noise.

In addition to the EPA, other Federal agencies have issued circumstantially specific noise standards. The Federal Aviation Administration, in conjunction with the Federal Interagency Committee on Urban Noise, has issued land-use compatibility guidelines indicating that a yearly L_{dn} of less than 65 A-weighted decibels is compatible with residential land uses and that, if a community determines it is necessary, levels up to 75 dBA may be compatible with residential uses and transient lodgings if such structures also incorporate noise-reduction construction technologies (see 14 CFR Part 150, Appendix A). The U.S. Department of Housing and Urban Development (HUD) has also published noise guidance: levels of 65 L_{dn} or less (measured at the outside of an occupied residence) are acceptable under all circumstances, levels between 65 and 75 dBA are normally unacceptable but could become acceptable with the introduction of appropriate sound attenuation measures, and levels above 75 dBA are always unacceptable (Table 3-21). HUD has also promulgated standards (see 24 CFR Part 51, Subpart B) for residential noise that apply only to activities for which HUD provides assistance.[15] Finally, regulations governing the amount of noise to which workers can be exposed in the workplace are promulgated and enforced by the Occupational Safety and Health Administration (OSHA) (see 29 CFR Part 1910, Subpart G).

Noise limits in the ordinances are generally applied at the exterior of the nearest resident or sensitive receptor, such as a school or hospital, within a minimum distance, typically less than 2 kilometers (less than 1 mile). Limits on broadband noise in the various ordinances range from 45 to 65 dBA, with levels of about 50 dBA being the most frequently cited. Separate limits on low-frequency noises, which range up to 75 decibels, are included in many of the ordinances. A number of penalties, usually 5 dBA, are applied to these basic values to reduce impacts from annoyances such as evening operations, steady pure tones, or repetitive impulse sounds. There are no quantitative noise-limit regulations at the city, county, or State levels in Idaho; however, complaints about obtrusive noise that are made to local law enforcement authorities can be addressed under general nuisance ordinances.

3.9.4 Noise Analyses Performed for the Proposed EREF

Measurements of extant sound levels at various locations along the proposed property boundary of the proposed EREF site were performed by AES (AES, 2010). Background noise levels were established by using an A-weighted sound meter and data collected over six 24-hour periods at six locations from June 1 through 7, 2008 (see Figure 3-31). Data were collected and managed in accordance with applicable American Society of Testing and Materials (ASTM) standards (see ASTM Standard E-1686-03; ASTM, 2003). Average background noise levels ranged from 30.4 to 78.2 dBA; they are displayed in Table 3-22. The majority of measured levels met both the HUD and EPA standards. Levels exceeding 50 dBA were measured near US 20 during periods of heavy truck traffic, within the vicinity of the irrigation pump, and in the northeast corner of the proposed property during a windy (more than 40 kilometers or 25 miles per hour) period. As a contextual reference, Figure 3-32 presents levels representative of common everyday sounds.

Measurements of background noise levels conducted by AES are consistent with previously published measurements and estimates for the nearby INL (DOE, 2005) and are therefore considered to be an accurate representation of extant conditions at the site. For the general

[15] For additional details, consult the HUD Web site: http://www.hudnoise.com/.

Table 3-21 HUD Land Use Compatibility Guidelines

Land Use Category	Day-Night Sound Pressure Level or L_{dn} (dBA)			
	Clearly Acceptable	Normally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential	<60	60–65	65–75	>75
Livestock farming	<60	60–75	75–80	>80
Office buildings	<65	65–75	75–80	>80
Wholesale, industrial, manufacturing, and utilities	<70	70–80	80–85	>85

Source: HUD, 2009.

area surrounding the INL site (which would include the proposed EREF property), the county-wide L_{dn}, based on population density, was estimated to be the highest – at 39 dBA – in Bonneville County. It was estimated to be 35 dBA in Bingham and Jefferson Counties, a level representative of typical rural areas, and 30 dBA in Butte County, a level representative of the natural background noise level of a wilderness area. Noise measurement data obtained from locations within 15 meters (50 feet) of US 20 showed traffic noise ranged from 64 to 86 dBA, with buses identified as the primary source, contributing from 71 to 80 dBA.

3.10 Transportation

This section describes the existing transportation infrastructure at and in the region of the proposed EREF site. The proposed EREF site is served directly and exclusively by road. There are no plans for rail access to the site. AES has stated that local roads and highways would be the sole means for conveying workers and materials to and from the site and region (AES, 2010). Nearby rail and air transportation routes also serve the region, but there are no viable water transportation routes. Figure 1-1 shows transportation routes near the proposed EREF site.

3.10.1 Roads

The site lies immediately north of US 20, approximately 32 kilometers (20 miles) west of Idaho Falls (and the junction of US 20 and I-15). US 20 is predominantly a two-lane highway traversing east-west between Idaho Falls to the east and the junction with US 26 to the northwest of Atomic City. Access to the proposed EREF site would be from one or two planned access roads to US 20. Control and public access to the access road(s) have yet to be specified. All traffic traveling to and from the proposed EREF (construction workers, employees, and shipments) would use one of these access roads (AES, 2010).

US 20 intersects I-15 at Idaho Falls, and I-15 and US 20 (north of Idaho Falls) would serve as the main routes between the proposed EREF (via US 20 West) and population centers to the north and south of Idaho Falls. I-15 is the major north-south artery in the region and would serve as the primary route for all incoming and outgoing truck shipments. The nearest interstate access to the west is I-84, approximately 296 kilometers (184 miles) away at its closest point by way of US 20. Idaho Falls is also served by US 26 and US 91.

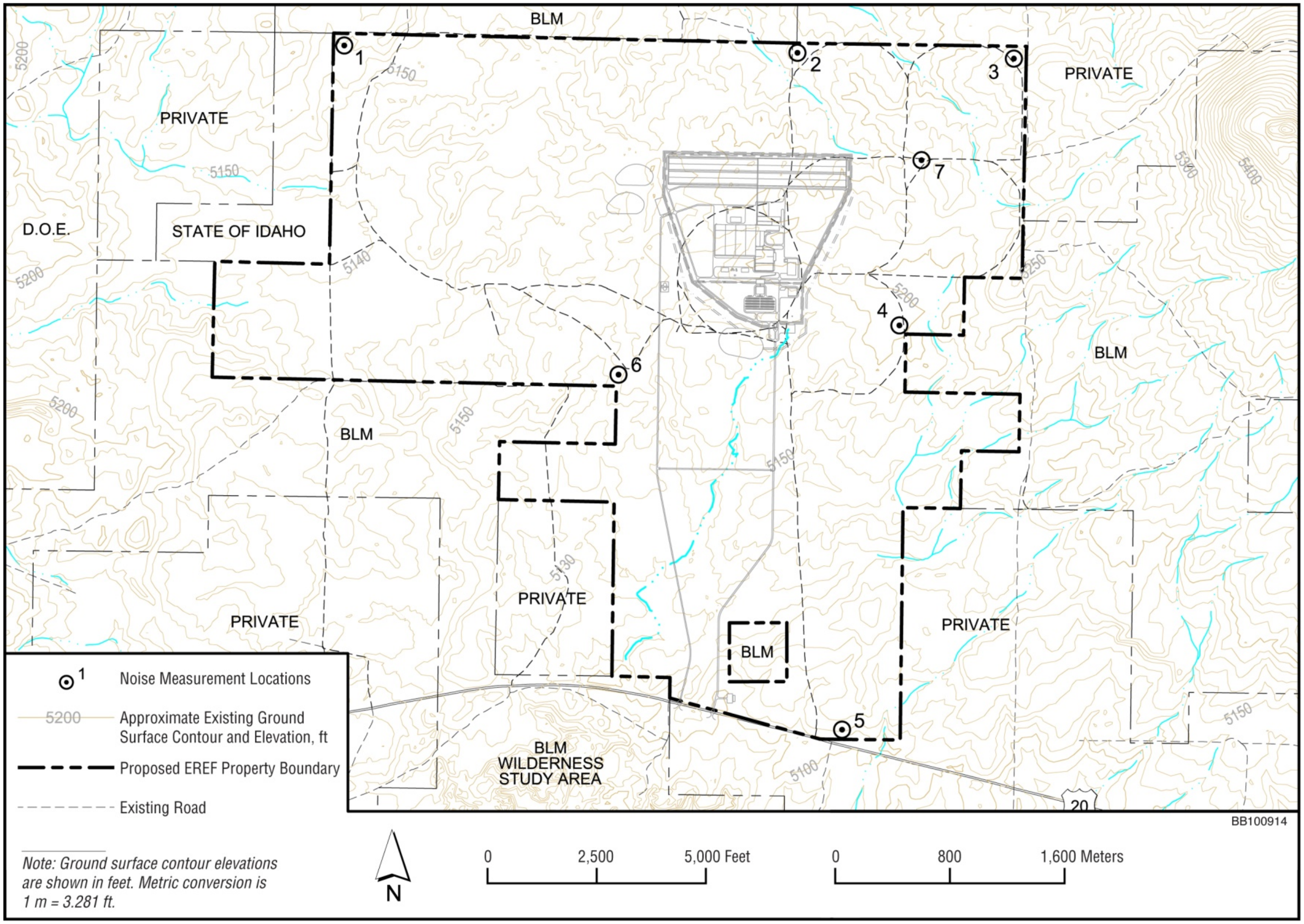

Figure 3-31 Noise Measurement Locations at the Proposed EREF Property (modified from AES, 2010)

Table 3-22 Extant Sound Levels at the Proposed EREF Property as Measured by AES

Measurement Location	Location Description	Average Sound Level (L_{eq})
Location 1	Northwest corner of proposed property	30.4 dBA
Location 2	North-central boundary of proposed property	39.8 dBA
Location 3	Northeast corner of proposed property (high wind conditions)	54.7 dBA
Location 4	Southeast corner nearest to proposed facility	37.1 dBA
Location 5	South boundary of proposed property next to US 20	57.5 dBA
Location 6	Southwest corner nearest to proposed facility	31.1 dBA
Location 7	Irrigation well pump in northeast portion of proposed property	78.2 dBA

Source: AES, 2010.

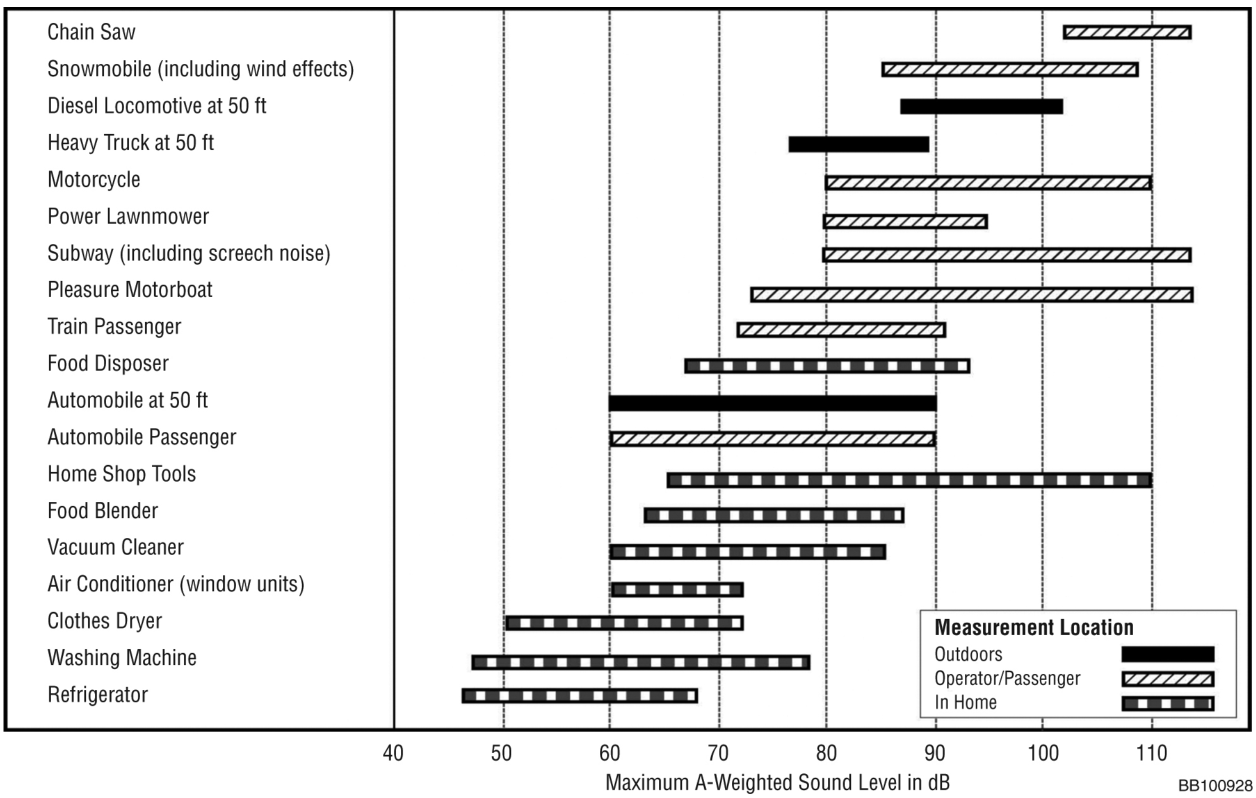

Figure 3-32 Sound Pressure Levels (dB) of Common Sources (All data reflect sound propagation in air and imply a human receptor.) (EPA, 1978)

As shown in Table 3-23, US 20 has an average daily traffic volume of 2210 vehicles in the vicinity of the proposed EREF site (mean monthly average from July 2008 to June 2009). A significant portion of this traffic is morning and afternoon commuting to and from INL (NRC, 2009; ITD, 2010e). This volume could increase if the INL park-and-ride bus system is discontinued.[16] The speed limit on US 20 in the vicinity of the proposed EREF site is 104.6 kilometers per hour (65 miles per hour); the average vehicle speed for all of 2009 was 103.8 kilometers per hour (64.5 miles per hour) (ITD, 2010b).

The relationship between the current/anticipated traffic volume on US 20 (in the vicinity of the proposed EREF site) and the road's design capacity is unknown, because the road was established before it became a major commuter route to INL. The Idaho Transportation Department (ITD) notes that the road was not designed for a specific level of service (LOS)[17] and is not engineered to accommodate the current traffic flow. However, the LOS is considered high for a two-lane road (NRC, 2009). Based on average traffic volumes, average traffic speeds, and the highly directional nature of peak flow (largely consisting of INL commuters), the LOS on US 20 is estimated to be high density but stable flow during peak periods and free flow at all other times (AASHTO, 1994; ITD, 2010b,c,e).

There is a local perception that US 20 between Idaho Falls and INL is unsafe (likely due to a history of high-profile accidents) and would get worse if the proposed EREF is licensed (NRC, 2009). However, ITD notes that the accident rate on the affected stretch of US 20 is actually lower than the statewide average and base area rates (ITD, 2005; NRC, 2009). In 2005, ITD performed an internal study of potential safety improvements for US 20 (i.e., widening and/or passing lanes) in the vicinity of the proposed EREF site (ITD, 2005, 2010c). At that time, funding was not available to implement the studied improvements (primarily selective passing lanes), and ITD does not anticipate a funding allocation in the foreseeable future (NRC, 2009).

According to ITD, US 20 is overbuilt (i.e., engineered to accommodate a higher LOS than presented by current traffic levels) to a distance of 8 kilometers (5 miles) west of Idaho Falls to accommodate growth at INL that was anticipated but did not materialize (NRC, 2009). This likely improves capacity and LOS for approximately 25 percent of the segment between Idaho Falls and the proposed EREF site. There are currently no plans to expand US 20 between Idaho Falls and the proposed EREF site, and no large projects are anticipated near the proposed site (NRC, 2009). However, the 18-mile stretch of US 20 from Idaho Falls to the Bonneville-Butte county line (west of the proposed EREF site) was resurfaced during the summer of 2010. ITD also noted that the need to upgrade or rebuild the interchange of US 20 and I-15 (through which all shipping to and from the proposed EREF would flow) may be accelerated by increased traffic from the proposed EREF, since the geometry of the interchange is not favorable and the right-of-way is limited (NRC, 2009). Currently, there are no funded plans for this work.

US 20 between Idaho Falls and the proposed EREF site is subject to chronic weather-related closure, primarily in winter months because of unfavorable road conditions, snow drifts, and low visibility (NRC, 2009; ITD, 2010d). The section of US 20 subject to closure extends from approximately 5 miles west of Idaho Falls to the junction of US 20 and US 26 near INL

[16] During a consultation meeting in June 2009, the Idaho Transportation Department noted that INL has discussed discontinuing the bus system as a cost-saving measure, but that no decisions had been made (NRC, 2009).

[17] LOS is a measure used by traffic engineers to assess the service quality of road infrastructure, taking into account factors such as traffic volume, road capacity, traffic speed, freedom to pass, and driver comfort and convenience.

Table 3-23 Annual Average Daily Traffic (AADT) on Major Roads near the Proposed EREF Site

Road	Direction	Location	AADT
US 20	E-W	At US 26 near Atomic City	1900
US 20	E-W	Near proposed EREF site	2210[a]
US 20	E-W	Idaho Falls west city limit	9900
US 20	E-W	Immediately east of I-15	29,733[a]
US 20	N-S	Idaho Falls north city limit	16,000
I-15	N-S	North of Idaho Falls	5400
I-15	N-S	At US 20	18,000
I-15	N-S	South of Idaho Falls (65th Street)	20,000
US 26	E-W	Atomic City	1100

[a] Average July 2008–June 2009. Source: ITD, 2009b.
Source: ITD, 2009a.

(mileposts 264 to 301), encompassing the proposed EREF site. These closure points are the most convenient for ITD, include the stretches of US 20 that are the most problematic, and include few access points via intersecting county roads. Road closures typically last from 6 hours to 1 day, with the maximum closure occurring only once or twice in the last 5 years. About five closures of US 20 are anticipated in a typical snow year. ITD is currently working with INL to install snow fencing to the west of the proposed EREF site (and is considering locations east of the proposed site), but this work will be gradual, subject to private landowner approval, and dependent on the annual ITD District 6 operating budget. Where snow fencing is not an option (and landowners approve), trenching can be an effective method of snow drift reduction. ITD has worked with the local school system to provide a plow escort and maintain access (i.e., for school buses) during road closures; ITD would likely work with the proposed EREF to facilitate shift changes that occur during road closures (ITD, 2010c,d).

Fire-related closures of US 20 are possible, but are less frequent and shorter in duration than weather-related closures. Most fire-related closures occur near INL; ITD has observed few fires to the east of the proposed EREF site. Dust storms occurring after fires (in the spring) can create localized drifting problems (ITD, 2010d).

Load limits on US 20 (between Idaho Falls and the proposed EREF site) and I-15 are controlled by ITD. The three-axle gross vehicle weight limits are 29,257 kilograms (64,500 pounds) on US 20 and 31,979 kilograms (70,500 pounds) on I-15 (AES, 2010; ITD, 2010a). Overweight permits can be issued for vehicles and/or loads exceeding this limit (ITD, 2007).

The current traffic volume on I-15 in the vicinity of Idaho Falls (and the junction with US 20) is approximately 18,000 vehicles per day (see Table 3-23). Design capacities for highways are not typically calculated, as capacities are considered high by default. However, the LOS on I-15 in the vicinity of Idaho Falls has been described as free flow (typically), with the LOS south of the city dropping to reasonably free flow or stable during peak periods (ITD, 2010c). Currently there are no plans to make any upgrades to I-15 in the vicinity of Idaho Falls.

There is currently no road or parking infrastructure at the proposed EREF site.

3.10.2 Rail

There is no direct rail access to the proposed EREF site, and there are no plans to perform any shipping operations by rail (AES, 2010). Nevertheless, Union Pacific provides three branches of freight rail service through Idaho Falls (Montana Main, Yellowstone, and Aberdeen), with the nearest access being approximately 32 kilometers (20 miles) to the east (AES, 2010; ITD, 1996).

In addition, a DOE-owned spur that connects at the Scoville Siding provides active freight service to the nearby INL, approximately 40 kilometers (25 miles) to the west of the proposed EREF site. A regional short line carrier, Eastern Idaho Railroad, connects areas north and east of Idaho Falls to Union Pacific lines (AES, 2010).

3.10.3 Air

Two airports serve the region of the proposed EREF site. The Idaho Falls Regional Airport, approximately 32 kilometers (20 miles) east of the proposed site, is operated by the City of Idaho Falls. It provides regularly scheduled regional passenger service to Denver, Salt Lake City, Boise, Seattle, and Las Vegas. The airport has two runways that are different sizes to accommodate commercial and private aviation. Approximately 32 kilometers (20 miles) to the west of the proposed EREF site is Midway Airport in Atomic City. This airport is used exclusively by private planes (AES, 2010).

In addition to these small regional airports that serve eastern Idaho is the Salt Lake City International Airport, which is approximately 336 kilometers (210 miles) south of Idaho Falls.

3.10.4 Water

Although the Snake River flows through Idaho Falls east of the proposed EREF site, there are no ports or viable water transportation routes that serve the region.

3.11 Public and Occupational Health

This section describes background radiation exposure in general and potential local influences near the proposed EREF. Potential health effects from exposure to radiation and to chemicals relevant to the proposed EREF are discussed as well. Several different media in and around the proposed EREF site contain radionuclides and chemicals that are both naturally occurring and anthropogenic (i.e., human-made) from historical and current operations at the nearby INL and from atomic bomb testing fallout. These media include soil, surface water, sediment, groundwater, and air. This section describes these radiological and chemical background and anthropogenic levels in terms of public and occupational exposure and health. It also summarizes the cancer incidence and death rates in the region, which were sufficient to establish baseline information for the analysis in Chapter 4 of the impacts on public and worker health that may be a result of preconstruction and the proposed action.

3.11.1 Background Radiological Exposure

Section 3.11.1.1 discusses the exposure from general background radiation that includes naturally occurring sources and man-made sources, except the exposure from INL operations. Offsite radiological exposures from the operation of INL are discussed in Section 3.11.1.2.

3.11.1.1 General Background Radiation

Humans are exposed to ionizing radiation from many sources in the environment, as shown below. Radioactivity from naturally occurring elements in the environment is present in soil, rocks, and living organisms. A major proportion (68 percent) of natural background radiation comes from naturally occurring radon. Together, these natural radiation sources contribute approximately 3.1 millisieverts (310 millirem) per year to the average total radiation dose that members of the general public annually receive (NCRP, 2009).

Ubiquitous background radiation contributes 50 percent of the average total radiation doses members of the general public receive. The remaining 50 percent of the average total radiation dose is associated with medical (48 percent) and industrial (2 percent) sources. As shown in Figure 3-33, approximately 48 percent of the annual background radiation dose (corresponding

Radiation Dose and Dose Equivalent

The exposure to radioactive material results in a radiation dose to the body. Radiation dose can result from external (outside the body) exposures such as gamma radiation emanating from the soil as well as internal exposures resulting from ingestion, such as potassium-40 (^{40}K) that resides naturally in bananas. The amount of energy deposited in matter is called the radiation dose and has SI units of gray (Gy)

In order to account for the damage done by different types of radiation, the term “dose equivalent” was developed. This allows different radiation doses from different radiation types to be compared. The radiation dose equivalent has SI units of sieverts (Sv).

Depending on its chemical form, radioactive material may transport to different parts of the body and reside in different organs when it is either ingested or inhaled. Each of these organs has different sensitivity to radiation. In addition, the radioactive material may reside in the body for many years. Therefore, to derive a whole body radiation dose equivalent, one must combine the effects of different radiation types with different organ sensitivities and consider the amount of time the radioactive material remains in the body. The term committed dose equivalent is used to describe the radiation dose equivalent a person will receive due to the radioactive material residing in the body after inhaling or ingesting radioactive material. This whole body dose equivalent has SI units of sieverts (Sv).

For brevity, it is common to refer to the whole body radiation dose equivalent as just the radiation dose. When the term radiation dose is used in this EIS, it refers to the total whole body committed radiation dose equivalent and will be expressed in SI units of Sv and parenthetically in conventional units of rem where 100 rem = 1 Sv.

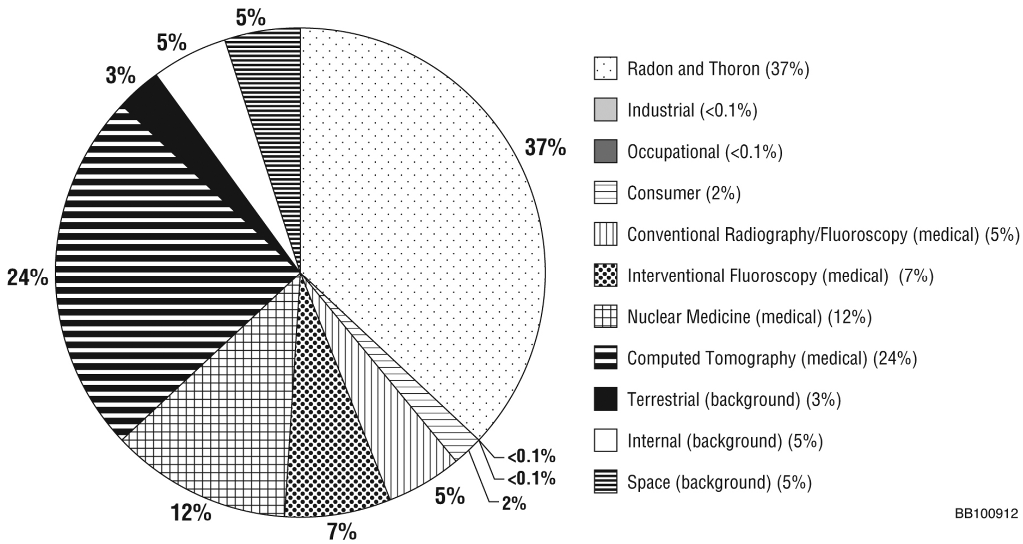

Figure 3-33 Percentage Contribution to the Effective Dose from All Sources of Radiation in the U.S. Population for 2006 (NCRP, 2009) (Reprinted with permission of the NCRP, http://NCRPonline.org.)

to 3.0 millisieverts [300 millirem]) is associated with medical sources, including computer tomography (24 percent), nuclear medicine (12 percent), interventional fluoroscopy (7 percent), and conventional radiograph/ fluoroscopy (5 percent). Consumer products and industrial and occupational sources of radiation comprise the remaining 2 percent (0.1 millisievert [10 millirem]) (NCRP, 2009).

3.11.1.2 Idaho National Laboratory

The location of the proposed EREF is within 8 kilometers (5 miles) of INL, a DOE laboratory in eastern Idaho. INL prepares an annual site environmental report for DOE summarizing environmental monitoring programs and other environmental activities at INL (DOE, 2007). Since the INL site is in such close proximity, the routine release of radioactive material from the INL would be considered part of the affected environment.

The radiological dose to the public surrounding the INL site is too small to be measured by available monitoring techniques. To show compliance with Federal regulations established to ensure public safety, the dose from INL site operations was calculated by using the amounts of radionuclides released during the year from INL site facilities that were reported and appropriate air dispersion computer codes. The noble gas krypton-85 (^{85}Kr) accounted for approximately 58 percent of the total release, followed by tritium (^{3}H) with 25 percent and argon-41 (^{41}Ar) with 16 percent of the total. The noble gas xenon-135 (^{135}Xe) contributed 1 percent. However, because these are noble gases, they contribute very little to the cumulative dose (affecting immersion only). Other than ^{41}Ar and ^{3}H, the radionuclides contributing to the overall dose were 0.01 percent of the total radionuclides released (DOE, 2007).

According to the 2007 INL site environmental report (DOE, 2007), the calculated maximum individual dose was 0.93 microsievert (0.093 millirem). The radionuclides contributing the most to this calculated dose were strontium-90 (^{90}Sr), which contributed 47 percent; isotopes of plutonium (plutonium-238 [^{238}Pu], plutonium-239 [^{239}Pu], and plutonium-240 [^{240}Pu]), which contributed 27 percent; isotopes of americium (americium-241 [^{241}Am] and americium-243 [^{243}Am]), which contributed 15 percent; cesium-137 (^{137}Cs), which contributed 9 percent; and iodine-129 (^{129}I), which contributed 1 percent. For comparison, the calculated maximum individual doses for 2003, 2004, 2005, and 2006 were 0.04, 0.04, 0.08, 0.04 millirem, respectively (DOE, 2007).

As part of an oversight program for the INL, the State of Idaho maintains 12 high-pressure ion chambers (HPICs) that provide real-time radiation exposure rates. Data are collected by the Idaho Department of Environmental Quality via radiotelemetry and are available to the public on the World Wide Web. The HPIC closest to the proposed EREF site (Rover Met Tower) has recorded an average exposure rate of $3.55 \times 10^{-9} \pm 0.24 \times 10^{-9}$ coulombs per kilogram per hour (13.75 ± 0.92 microroentgen per hour) over the last 3.5 years (AES, 2010). These recorded values are comparable with exposure measurements obtained from background locations (IDEQ, 2008).

3.11.2 Background Chemical Exposure

The location for the proposed EREF is on a site currently operated as a farm in an area characterized by farming and public lands. There are no known major sources of chemical exposure at this site that might impact the public. From the fall of 2007 to spring 2008, as part of soil characterization, AES collected 10 surface soil samples across the proposed site. The results of this sampling are presented in Section 3.6.4.2 and are summarized here. The samples were analyzed for metals, fluoride, pesticides, VOCs, and SVOCs (AES, 2010). All eight metals analyzed were within the range of local background areas. Only sporadic hits of trace levels of a few VOCs and SVOCs were found; they were mainly polycyclic aromatic hydrocarbons (PAHs) attributable to vehicle exhaust and other combustion sources. The only detection of a pesticide or herbicide compound in the samples was of trace levels (maximum 0.0110 milligram per kilogram) of the substance chlorpropham, which is used to inhibit sprouting of potatoes in storage.

Regarding other media, regional air quality in Bonneville County is classified as “good” 95.7 percent of the time and “moderate” 4.3 percent of the time, as discussed in Section 3.5.3. No surface water resources exist on the proposed site, as indicated in Section 3.7.1.1. Site groundwater has been tested for and found to be unimpacted by chemical contamination, including organic compounds, PCBs, pesticides, and metals, as discussed in Section 3.7.2.4.

3.11.3 Public Health Studies

3.11.3.1 Regulatory Requirements for Public and Occupational Exposure

NRC regulations in 10 CFR Part 20 identify maximum allowable concentrations of radionuclides in air and water above background at the boundary of unrestricted areas to control radiation exposures of the public and releases of radioactivity. The most restrictive maximum allowable concentration in air and water for uranium isotopes is 5×10^{-14} and 3×10^{-7} microcuries per cubic centimeter, respectively. Other 10 CFR Part 20 requirements are that the sum of the external and internal doses (Total Effective Dose Equivalent [TEDE]) for a member of the public may not exceed 1 millisievert per year (100 millirem per year), and the radiation levels at any unrestricted area should not exceed 0.02 millisievert (2 millirem) in any 1 hour and 0.5 millisievert (50 millirem) in a single year.

In addition to keeping within NRC requirements, releases to the environment must comply with EPA standards in 40 CFR Part 190, Subpart B. These standards specify limits on the annual dose equivalent from normal operations of uranium fuel-cycle facilities (except mining, waste disposal operations, transportation, and reuse of recovered special nuclear and byproduct materials). The public dose limit for annual whole body and any organ is 0.25 millisievert (25 millirem), and for the thyroid it is 0.75 millisievert (75 millirem).

10 CFR 20.1201 limits the TEDE of workers to ionizing radiation. Table 3-24 provides occupational dose limits for radiation workers who work at nuclear facilities.

3.11.3.2 Health Effects from Radiological Exposure

Radiation interacts with the atoms that form cells. There are two mechanisms by which radiation affects cells: direct action and indirect action. In a direct action, the radiation interacts directly with the atoms of the DNA molecule or some other component critical to the survival of the cell. Since the DNA molecules make up a small part of the cell, the probability of direct action is small. Because most of the cell is made up of water, there is a much higher probability that radiation would interact with water. In an indirect action, radiation interacts with water and breaks the bonds that hold water molecules together and produces reactive free radicals that are chemically toxic and destroy the cell. The body has mechanisms to repair damage caused by radiation. Consequently, the biological effects of radiation on living cells may result in one of three outcomes: (1) injured or damaged cells repair themselves, resulting in no residual damage; (2) cells die, much like millions of body cells do every day, being replaced through normal biological processes and causing no health effects; or (3) cells incorrectly repair themselves, which results in damaging or changing the genetic code (DNA) of the irradiated cell. Stochastic effects, that is, effects that may or may not occur based on chance, may occur when an irradiated cell is modified rather than killed. The most significant stochastic effect of radiation exposure is that a modified cell may, after a prolonged delay, develop into a cancer cell.

The biological effects on the whole body from exposure to radiation depend on many factors, such as the type of radiation, total dose, time interval over which the dose is received, and part of the body that is exposed. Not all organs are equally sensitive to radiation. The blood-forming organs are most sensitive to radiation; muscle and nerve cells are relatively insensitive to radiation. Health effects may be characterized according to two types of radiation exposure: (1) a single accidental exposure to high doses of radiation for a short period of time (acute exposure), which may produce biological effects within a short time after exposure, and (2) long-term, low-level overexposure, commonly called continuous or chronic exposure. High doses of radiation can cause death. Other possible effects of a high radiation dose include erythema, dry desquamation, moist desquamation, hair loss, sterility, cataracts, and acute radiation syndromes. Currently there are no data to unequivocally establish the occurrence of cancer following exposure to low doses and dose rates – below about 100 millisieverts (10,000 millirem) (NRC, 2004).

Table 3-24 Occupational Dose Limits for Adults Established by 10 CFR Part 20

Tissue	Dose Limit
Whole body or any individual organ or tissue other than the lens of the eye	More limiting of 0.05 Sv/yr (5 rem/yr) TEDE to whole body or 0.5 Sv/yr (50 rem/yr) sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye
Lens of the eye	0.15 Sv/yr (15 rem/yr) dose equivalent
Extremities, including skin	0.50 Sv/yr (50 rem/yr) shallow dose equivalent

In estimating the health impacts from low dose or low dose rate exposure to occupational workers and the general public, the probability of a fatal cancer per unit of radiation exposure recommended by the EPA was used. The estimated probability for both workers and the public is 6×10^{-2} $sievert^{-1}$ (EPA, 1999).

The National Program of Cancer Registries (NPCR) is the Centers of Disease Control and Prevention (CDC) State-based cancer control program. Under this program, States collect, manage, and analyze data about cancer incidence and mortality. The CDC and the National Cancer Institute release U.S. cancer statistics annually. Table 3-25 lists the cancer incidence and death rates for all cancers for 2002 to 2006 for Idaho and the United States.

3.11.3.3 Health Effects from Chemical Exposure

The primary hazardous chemicals of interest associated with the proposed EREF are uranium and hydrofluoric acid (HF). The latter is produced in the reaction of UF_6, the form of uranium used in the enrichment process, with moisture in air. HF is an irritant gas that causes eye, nose, and skin irritation. Breathing high levels can also harm the lungs and heart (ATSDR, 2003). Irritant effects in humans, including respiratory track inflammation, begin to be observed in the 1 to 10 ppm range, similar to occupational exposure limits. Low-level exposure effects are reversible once the exposure is terminated. Members of the public are generally not exposed to levels that have observable health effects from routine industrial emissions. There are no known background sources of HF exposure in the vicinity of the proposed EREF.

Uranium in various chemical forms exerts heavy metal toxicity, primarily to the kidneys (ATSDR, 1999). Exposure to UF_6 or any other uranium compounds that might be released from the proposed EREF or present within the proposed facility may be via inhalation or ingestion. The degree of absorption of inhaled uranium from the lung or ingested uranium into the bloodstream is greater for more soluble forms of uranium, such as UO_2F_2, which is formed from the reaction of UF_6 and water along with HF. Little direct toxicological data are available on chemical toxicity in humans at low inhalation exposures. Standards are based mainly on tests in mammals, which show low-level systemic health effects beginning at inhalation exposures in the 0.1 to 1 milligram per cubic meter range for chronic exposures. As for HF, there are no known background sources of uranium exposure in the vicinity of the proposed EREF, except from the very low levels occurring naturally in soils.

Table 3-25 Cancer Incidence and Death Rates for All Cancers for 2002 to 2006[a]

Area	All Cancer Incidence Rate	All Cancer Death Rate
United States	471.3	186.9
Idaho	461.7	171.6

[a] Per 100,000 persons and are age adjusted to the 2000 U.S. standard population.
Source: CDC, 2010.

3.12 Socioeconomics

This section describes current socioeconomic conditions and local community services within the region of influence (ROI) surrounding the site of the proposed EREF. Although the data used (BEA 2010) to estimate the impacts of the proposed EREF project comprised an 11-county ROI in Idaho – including Bannock, Bingham, Blaine, Bonneville, Butte, Caribou, Clark, Fremont, Jefferson, Madison, and Power Counties – the majority of the economic impacts of the proposed facility are expected to occur in two of these counties, Bingham and Bonneville Counties. These two counties (i.e., the two-county ROI) are expected to encompass the area in which the majority of EREF workers are expected to spend most of their wages and salaries, and which are expected to be the primary source of labor for each phase of the proposed EREF. It is also the area in which a significant portion of site purchases and non-payroll expenditures from the construction, manufacturing, operation, and decommissioning phases of the proposed facility are expected to occur. As it is anticipated that a number of workers will move into the area during each phase of the proposed project, with the majority of the demographic and social impacts associated with population in-migration likely to occur in Bingham and Bonneville Counties, the impacts of the proposed EREF on population, housing, and community services are assessed for a two-county ROI, consisting of Bingham and Bonneville Counties.

3.12.1 Population Characteristics

The population in the two-county ROI is characterized in terms of the major population centers around the proposed site, population growth trends, and significant transient and special populations. Minority and low-income populations are discussed in the environmental justice discussion in Section 3.13.

3.12.1.1 Major Population Centers

One city, Idaho Falls (estimated 2006 population 52,786), is located in Bonneville County, and several small towns are located in the remainder of the ROI, including Pocatello (53,932 residents in 2006), Blackfoot (11,007) and Shelley (4195) (U.S. Census Bureau, 2009a).

Estimated population density in the two-county ROI is highest in Bingham County, with 34.4 persons per square kilometer (89.1 per square mile) in 2008. Bonneville County has more land area than Bingham County and has a smaller population, with a population density of 9.1 persons per square kilometer (23.5 per square mile) (U.S. Census Bureau, 2009b).

3.12.1.2 Population Growth Trends

Table 3-26 presents recent and projected populations for the two-county ROI and Idaho. As shown, estimated population in the ROI stood at 143,038 in 2008, having grown at an average annual rate of 1.8 percent since 2000. This growth was lower than the 2.1 percent annual average growth rate for Idaho as a whole of over the same period.

The population has grown in both counties in the two-county ROI since 2000. Bonneville County recorded an annual average population growth of 2.3 percent between 2000 and 2008, while Bingham County grew by 0.6 percent during the same period. The estimated ROI population is expected to increase to 156,491 by 2013 and to 168,331 by 2017. Both counties in the ROI are projected to experience positive population growth between 2008 and 2017.

3.12.1.3 Transient and Special Populations

In addition to the residential population, institutional, transient, and seasonal populations occur in the two-county ROI. Institutional populations include school populations, which are described in Section 3.12.3.2. The transient population consists of visitors participating in various seasonal, social, and recreational activities within the local area. The region also has a large number of seasonal farm workers, as well as a number of seasonal workers in the construction and hospitality industries. Although U.S. Census and other Federal data may include transient and special population groups that were present when the Census was taken, data on the education level, ethnicity, and income characteristics of specific transient and special populations are not available.

3.12.2 Economic Trends and Characteristics

3.12.2.1 Employment

Employment in the two-county ROI stood at 62,608 in 2006 (Table 3-27). Over the past decade, employment within the two-county ROI has shifted slightly from government, construction, and farm sectors toward service, wholesale and retail trade, and manufacturing sectors. Currently, the service sector provides the highest percentage of employment in the region at 51.2 percent, followed by the wholesale and retail trade at 19.2 percent. Smaller employment shares are held by transportation and public utilities (10.4 percent) and agriculture (9.2 percent). The distribution of employment across sectors within the ROI is similar to that of the ROI as a whole, with a slightly higher percentage of employment in agriculture (12.6 percent), manufacturing (18.7 percent), and transportation and public utilities (21.1 percent) in Bonneville County. At 32.4 percent of total employment, Bonneville has less service employment than in the ROI as a whole.

3.12.2.2 Unemployment

Unemployment rates have varied across the two counties in the ROI (Table 3-28). Over the 10-year period 1999–2008, the average rate in Bingham County was 4.0 percent, with a lower

Table 3-26 Population in the Two-County ROI and Idaho

Location	2000	2008	Average Annual Growth (%) 2000–2008	2013	2017
Bingham County	41,735	43,903	0.6	45,315	46,477
Bonneville County	82,522	99,135	2.3	111,176	121,854
ROI	124,257	143,038	1.8	156,491	168,331
Idaho	1,293,953	1,523,816	2.1	1,687,782	1,831,569

Source: U.S. Census Bureau, 2009a; Argonne, 2010.

rate of 3.1 percent in Bonneville County. The average rate in the ROI as a whole over this period was 3.4 percent, which was lower than the average rate for the State of 4.4 percent. Unemployment rates for the first three months of 2009 contrast markedly with rates for 2008 as a whole; in Bonneville County, the unemployment rate increased to 6.1 percent, while in Bingham County the rate reached 5.6 percent. The average rate for the two-county ROI (5.7 percent) and the State (7.0 percent) during this period were also higher than the corresponding average rates for 2008.

3.12.2.3 Income

Total personal income in the two-county ROI stood at $4.5 billion in 2007 and had grown at an annual average rate of 3.1 percent over the period 1998 to 2007 (Table 3-29). ROI personal income per capita also rose over the same period, but at a slower rate of 1.7 percent, increasing from $27,023 to $31,973. Per capita incomes were higher in Bonneville County ($34,630) in 2007 than in Bingham County ($26,068). Although personal income and per capita income growth rates in the two-county ROI have been higher than for the State as a whole, personal income per capita was slightly higher in the State ($32,908) in 2007 than in the ROI. Although no corresponding data are available for Bingham and Bonneville Counties, in Idaho as a whole in 2007, there were 74,152 single-parent families, 18.7 percent of the total number of families in the State (U.S. Census Bureau, 2009b). The median annual family income of a single female parent with children under the age of 18 was $22,369.

Median household income in the two-county ROI over the period 2006–2008 ranged from $44,232 in Bingham County to $51,232 in Bonneville County (Table 3-29). The average in the ROI as a whole was $47,732, slightly higher than the State average of $47,331.

3.12.3 Housing Resources and Community and Social Services

This section describes housing and social services in the two-county ROI, including schools, law enforcement, and firefighting.

Table 3-27 Two-County ROI Employment in 2006[a]

Industry	Bingham County	% of Total	Bonneville County	% of Total	ROI	% of Total	Idaho	% of Total
Agriculture[a]	4324	8.5	1456	12.6	5780	9.2	50,540	8.5
Mining	0	0.0	0	0.0	0	0.0	2202	0.4
Construction	3409	6.7	1093	9.4	4502	7.2	52,804	8.9
Manufacturing	2728	5.3	2173	18.7	4901	7.8	64,212	10.8
Transportation and public utilities	4079	8.0	2448	21.1	6527	10.4	80,257	13.5
Wholesale and retail trade	9461	18.5	2540	21.9	12,001	19.2	104,604	17.6
Finance, insurance, and real estate	1686	3.3	310	2.7	1996	3.7	30,576	5.2
Services	28,286	55.0	3759	32.4	32,045	51.2	268,527	45.3
Other	24	0.0	1	0.0	25	0.0	184	0.0
Total	51,007		11,601		62,608		593,185	

[a] Agricultural employment includes 2007 data for hired farm workers.
Source: U.S. Census Bureau, 2009c; USDA, 2009.

Table 3-28 Two-County ROI Unemployment Rates (percent)

Location	1999–2008	2008	2009[a]
Bingham County	4.0	3.9	5.6
Bonneville County	3.1	3.4	6.1
ROI	3.4	3.5	5.7
Idaho	4.4	4.9	7.0

[a] Rates for 2009 are the average for January through March.
Source: DOL, 2009a–d.

Table 3-29 Two-County ROI and State Personal Income

Location	1998	2007	Annual Average Growth, 1998–2007 (%)
Bingham County			
Total income (billion 2008 $)	1.0	1.1	1.6
Per capita income ($)	23,303	26,068	1.1
Median household income[a]		44,232	
Bonneville County			
Total income (billion 2008 $)	2.3	3.3	3.6
Per capita income ($)	28,925	34,630	1.8
Median household income[a]		51,232	
Two-County ROI			
Total income (billion 2008 $)	3.3	4.5	3.1
Per capita income ($)	27,023	31,973	1.7
Median household income[a]		47,732	
Idaho			
Total income (billion 2008 $)	36.5	49.2	3.0
Per capita income ($)	29,120	32,908	1.2
Median household income[a]		47,331	

[a] 2006–2008, 3-year average.
Source: DOC, 2009; U.S. Census Bureau, 2009d.

3.12.3.1 Housing

Nearly 196,000 housing units were located in the two counties in 2007, with more than 70 percent of these located in Bonneville County (Table 3-30). The majority of housing units in the region are single-family structures (75 percent), but the number of multi-family structures is increasing as the region develops (U.S. Census Bureau, 2009b). Vacancy rates do not vary significantly between the two counties, with 9.2 percent of units vacant in Bingham County and 9.0 percent in Bonneville County. Owner-occupied units comprise 81 percent of the occupied units in Bingham County, but only 73 percent of the occupied units in Bonneville County. At the time of the 2000 Census, 480 seasonal-, recreational-, or occasional-use units were vacant.

Housing density in the two-county ROI was 6.8 units per square kilometer (17.7 per square mile), compared to 2.9 units per square kilometer (7.6 per square mile) for the State as a whole. There were 7.7 units per square kilometer (19.9 per square mile) in Bonneville County and 5.4 units per square kilometer (13.9 per square mile) in Bingham County (U.S. Census Bureau, 2009a).

Housing stock in the two-county ROI as a whole grew at an annual rate of 2.3 percent over the period 2000–2007, with 7872 new units added to the existing housing stock in the ROI (Table 3-30). With an overall vacancy rate of 9.1 percent, there were 4770 vacant housing units in the two-county ROI in 2007, of which 1073 (251 in Bingham County, 822 in Bonneville County) are expected to be rental units available to construction workers at the proposed EREF.

The median value of a home in Bonneville County of $93,500 was about 10.7 percent greater than the $84,400 in Bingham County. The median value of homes in both counties was somewhat lower than the $106,300 median value for the State of Idaho (U.S. Census Bureau, 2009a).

3.12.3.2 Schools

Seventy-four public and private elementary, middle, and high schools are located in the two-county ROI (NCES, 2009). Table 3-31 provides summary statistics for the school districts in the ROI, including enrollment, educational staffing, and two indices of educational quality – student-teacher ratios and levels of service (number of teachers per 1000 population). The student-teacher ratio in Bonneville County schools (19.8) is slightly higher than for schools in Bingham County (18.0), while the level of service is slightly higher in Bingham County. Five colleges and adult learning centers are located within 80.5 kilometers (50 miles) of the proposed EREF site, with a combined enrollment of 27,820 (NCES, 2009). The closest schools to the proposed EREF site are about 32 kilometers (20 miles) east in Idaho Falls.

3.12.3.3 Public Safety

Several State, county, and local police departments provide law enforcement in the two-county ROI. Bonneville County has 57 officers and would provide law enforcement services to the proposed EREF (Table 3-32); Bingham County has 30 officers (Table 3-32) (FBI, 2009). Currently there are 95 professional firefighters in Bonneville County and 39 in Bingham County (Table 3-32). The Idaho Falls Fire Department, the Ucon Volunteer Fire Department, and the Shelley Firth Rural Fire District all are located about 32 kilometers (20 miles) from the site of the

Table 3-30 Two-County ROI Housing Characteristics

Parameter	2000	2007[a]
Bingham County		
Owner occupied	10,564	11,290
Rental	2753	2735
Vacant units	986	1415
Seasonal and recreational use	103	NA[b]
Total units	14,303	15,540
Median value of owner-occupied units	$84,400	$121,400
Bonneville County		
Owner occupied	21,467	24,742
Rental	7286	9122
Vacant units	1731	3355
Seasonal and recreational use	377	NA
Total units	30,484	37,219
Median value of owner-occupied units	$93,500	$148,300
Two-County ROI Total		
Owner occupied	32,031	36,034
Rental	10,039	11,857
Vacant units	2717	4770
Seasonal and recreational use	480	NA
Total units	44,787	52,659
Median value of owner-occupied units	$88,950	$134,850

[a] 2006–2008, 3-year average.
[b] NA = not available.
Source: U.S. Census Bureau, 2009a,b,d.

Table 3-31 School District Data for the Two-County ROI in 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
Bingham County	9902	550	18.0	12.7
Bonneville County	19,557	988	19.8	10.2
ROI	29,459	1538	19.2	11.0

[a] Number of teachers per 1000 population.
Source: NCES, 2009.

Table 3-32 Public Safety Employment in the Two-County ROI in 2009

Location	Number of Police Officers	Level of Service[a]	Number of Firefighters[b]	Level of Service[a]
Bingham County	30	0.7	39	0.9
Bonneville County	57	0.6	95	1.0
ROI	87	0.6	134	0.9

[a] Number per 1000 population.
[b] Number does not include volunteers.
Source: FBI, 2009; FireDepartments.Net, 2009.

proposed facility. Levels of service in police and fire protection in each county are similar to those for the two-county ROI as a whole (Table 3-32).

3.12.4 Tax Structure and Distribution

Tax revenue in Idaho comes from primarily personal and corporate income taxes, sales and use taxes, and property taxes. Personal income taxes range from 1.6 percent on the first $1198 of taxable income to 7.8 percent of taxable income above $23,963 for single filers and $47,926 for married couples filing jointly (ISTC, 2009). A 6 percent sales tax is applied to the sale, rental, or lease of tangible personal property, while rates on some services, including food, hotel, motel, and campground accommodations, vary from 8 percent to 12 percent. A use tax is applied to stored goods if sales taxes have not already been paid (ISTC, 2009). Property taxes are collected by the county in which the proposed EREF property is located. The property tax rates for Bonneville County were 1.6 percent on average for urban property and 1.01 percent on average in rural areas. In Bingham County, the average 2007 rates were 2.1 percent for urban property and 1.2 percent for rural property (ISTC, 2009).

3.13 Environmental Justice

On February 11, 1994, the President signed *Executive Order* 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” which directs all Federal agencies to develop strategies for considering environmental justice in their programs, policies, and activities. Environmental justice is described in the *Executive Order* as "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

On December 10, 1997, the Council on Environmental Quality (CEQ) issued *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ, 1997). In addition to following general guidelines on the evaluation of environmental analyses set forth in the document *Environmental Review Guidance for Licensing Actions Associated with NMSS [Nuclear Material Safety and Safeguards] Programs* (NUREG-1748) (NRC, 2003a), the NRC has issued a final policy statement on the *Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions* (69 FR 52040) and environmental justice procedures to be followed in NEPA documents prepared by the NRC's Office of Nuclear Material Safety and Safeguards (NRC, 2003b).

Consistent with NRC guidelines and procedures set forth in Appendix C to NUREG-1748 (NRC, 2003a) and the NRC's *Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions* (NRC, 2004), this section describes data from the 2000 U.S. Census on minority and low-income populations within a 6.4-kilometer (4-mile) radius of the proposed EREF site (see Appendix G). This area includes a total of four Census block groups, including two in Bonneville County, the location of the proposed EREF, and one each in Bingham and Jefferson Counties (U.S. Census Bureau, 2009a).

3.13.1 Minority Populations

The CEQ guidelines define "minority" to include members of American Indian or Alaska Native, Asian or Pacific Islander, Black non-Hispanic, and Hispanic populations (CEQ, 1997).

Minority individuals are persons who identify themselves as members of the following population groups: Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, some other race, two or more races (meaning individuals who identified themselves on the 2000 Census form as being a member of two or more races, for example, White and Hispanic), and Hispanic or Latino. The 2000 Census allowed individuals the option of identifying themselves in one or more race categories, thereby creating the multiracial Census category of "two or more races." They are generally counted as part of the minority group they identified.

Minority populations can be determined by subtracting White, Not Hispanic or Latino populations from the total population.

There are no Census block groups in which the minority population either exceeds 50 percent of the total population and/or is more than 20 percentage points higher than the State or county percentage. Table 3-33 presents data for minority populations for the 6.4-kilometer (4-mile) area, for each county, and for the State.

Table 3-33 Minority and Low-Income Populations within a 6.4-kilometer (4-mile) Radius of the Proposed EREF Site

County	4-mile Radius			County Percent Minority	State Percent Minority
	Total Population[a]	Minority Population	Percent Minority		
Bingham County	1438	234	16.3	17.6	
Bonneville County	1777	244	13.7	7.2	9.0
Jefferson County	957	202	21.1	9.1	
County	**4-mile Radius**			**County Percent Low-Income**	**State Percent Low-Income**
	Total Population[b]	**Low-Income Population**	**Percent Low-Income**		
Bingham County	1384	162	11.7	12.4	
Bonneville County	1745	178	10.2	10.1	11.8
Jefferson County	957	223	23.3	10.4	

[a] 2000 data.

[b] 1999 data.

Source: U.S. Census Bureau, 2009a.

3.13.2 Low-Income Populations

Low-income populations are those that fall below the poverty level identified by the U.S. Census Bureau, including variations by family size and composition. If the total income for a family or unrelated individual falls below the relevant poverty threshold, then the family or unrelated individual is classified as being "below the poverty level." For example, in 1999, the most recent year for which Census block group data on poverty are available, the poverty threshold for a family of five with three children below the age of 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis.

There are no Census block groups in which the low-income population either exceeds 50 percent of the total population and/or is more than 20 percentage points higher than the State or county percentage. Table 3-33 presents data for low-income populations for the 6.4-kilometer (4-mile) area, for each county, and for the State.

3.13.3 Resource Dependencies and Vulnerabilities of Minority and Low-Income Populations

In some cases, minority and low-income groups may rely on natural resources for their subsistence and to support unique cultural practices. Differential patterns of consumption of natural resources should be considered (i.e., differences in rates and/or patterns of fish, vegetable, water, and/or wildlife consumption among groups defined by demographic factors such as socioeconomic status, race, ethnicity, and/or cultural attributes). In some circumstances, these groups could be unusually vulnerable to impacts from the proposed action. In particular, higher participation in outdoor recreation, home gardening, and subsistence fishing may increase exposure risk to low-income and minority groups through inhalation or ingestion through various environmental pathways.

Potential resource dependencies were sought in the course of public meetings and other information supplied by the Hispanic/Latino and African American/Black communities in meetings with the NRC staff. Letters were also sent to the Federally recognized Shoshone-Bannock Tribes to determine any potential resource dependencies. These letters solicited their concerns on the proposed project and inquired about whether they desired to participate in the Section 106 consultation process (see Appendix B). Currently, very few Native Americans live in the vicinity of the proposed EREF site (U.S. Census Bureau, 2009a).

In addition, the NRC staff examined data provided by the State of Idaho concerning the health status of the general population in Bingham and Bonneville Counties (Table 3-34). No exceptional health problems were found among residents in the two counties. It was not possible to identify any unusual incidences of birth defects, chronic diseases, or cancer clusters at the district level, the smallest area for which published health information is available. Age-adjusted cancer deaths are slightly lower in District 6, which includes Bingham County, than in District 7, which includes Bonneville County; rates in Districts 6 and 7 are lower than in Idaho as a whole. The income and ethnicity of individuals with chronic diseases are not available.

Table 3-34 Selected Health Statistics for Counties near the Proposed EREF, 2005–2007 (per 100,000 population)

	District 6 (includes Bingham County)	District 7 (includes Bonneville County)	Idaho
Annual average age-adjusted major causes of death			
Cancer	148.0	145.7	166.5
Heart disease	198.2	196.6	169.8
Lung cancer	32.0	30.0	42.7
Cerebrovascular disease	57.1	49.7	48.8
Chronic lower respiratory diseases	46.1	48.6	48.9

Source: Idaho Department of Health and Welfare, 2009.

3.14 References

(AASHTO, 1994) American Association of State Highway and Transportation Officials. "A Policy on Geometric Design of Highways and Streets."

(Ackerman et al., 2006) Ackerman, D.J., G.W. Rattray, J.P. Rousseau, L.C. Davis, and B.R. Orr. "Conceptual Model of Ground-Water Flow in the Eastern Snake River Plain Aquifer at the Idaho National Laboratory and Vicinity with Implications for Contaminant Transport." U.S. Geological Survey Scientific Investigations Report 2006-5122. DOE/ID-22198. Prepared in cooperation with the U.S. Department of Energy.

(AES, 2010) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Environmental Report, Rev. 2." Bethesda, Maryland. April.

(Anderson et al., 1996) Anderson, S.R., Liszewski, M.J., and Ackerman, D.J. "Thickness of Surficial Sediment at and near the Idaho National Engineering Laboratory, Idaho." U.S. Geological Survey Open-File Report 96-330. Idaho Falls, Idaho. June.

(Argonne, 2010) Argonne National Laboratory. "State and County Population Projections." Memorandum from T. Allison (Argonne) to B. Biwer (Argonne). May.

(ASTM, 2003) American Society of Testing and Materials. Standard E-1686-03, "Standard Guide for Selection of Environmental Noise Measurements and Criteria." <http://webstore.ansi.org/FindStandards.aspx?SearchString=E1686-03&SearchOption=0&PageNum=0&SearchTermsArray=null%7cE1686-03%7cnull> (Accessed July 7, 2009).

(ATSDR, 1999) Agency for Toxic Substances and Disease Registry. "Toxicological Profile for Uranium." September. <http://www.atsdr.cdc.gov/toxprofiles/tp150.html> (Accessed January 29, 2010).

(ATSDR, 2003) Agency for Toxic Substances and Disease Registry. "Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluorine." September. <http://www.atsdr.cdc.gov/toxprofiles/tp11.html> (Accessed January 29, 2010).

(BEA 2010) Bureau of Economic Analysis. "Regional Economic Accounts: RIMS II Multipliers." <https://www.bea.gov/regional/rims/rimsii/> (Accessed April 19, 2010).

Bingham County, 2005) Bingham County. "Bingham County Comprehensive Plan." Blackfoot, Idaho. March. ADAMS Accession No. ML101790177.

(BLM, 2007) U.S. Bureau of Land Management. "Manual 8400 Visual Resource Management." <http://www.blm.gov/nstc/VRM/8400.html> (Accessed September 27, 2009). ADAMS Accession No. ML101790184.

(BLM, 2008) Bureau of Land Management. "Hell's Half Acre, Wilderness Study Area, Upper Snake Field Office." ADAMS Accession No. ML101790192.

(BLM, 2009a) U.S. Bureau of Land Management. E-mail from J. Gilbert (U.S. Bureau of Land Management) to M. George (U.S. Nuclear Regulatory Commission) dated July 9. “Subject: RE: Follow Up – GIS Shape Files from BLM.” ADAMS Accession No. ML101870057.

(BLM, 2009b) U.S. Bureau of Land Management. “Visual Resource Inventory.” Manual H-8410-1. <http://www.blm.gov/nstc/VRM/8410.html> (Accessed October 8, 2009). ADAMS Accession No. ML101790201.

(BLM/DOE, 2004) Bureau of Land Management and U.S. Department of Energy. “Final Management Plan, INEEL Sagebrush Step Ecosystem Reserve.” EA ID-074-02-067. May.

(Carlsen, 2009) Carlsen, E. “Transfer No. 75268, Water Right No. 35-2642 – Transfer Approval Notice.” From E. Carlsen (Water Resources Manager, Idaho Department of Water Resources) to AREVA NC, Inc., Bethesda, Maryland. July 2. ADAMS Accession No. ML101790209.

(CDC, 2010) Centers for Disease Control and Prevention and National Cancer Institute, U.S. Cancer Statistics Working Group. “United States Cancer Statistics: 1999–2006 Incidence and Mortality Web-based Report.” U.S. Department of Health and Human Services, Atlanta, Georgia. <http://www.cdc.gov/uscs> (Accessed March 17, 2010). ADAMS Accession No. ML101830111.

(CEQ, 1997) Council on Environmental Quality. “Environmental Justice Guidance under the National Environmental Policy Act.” Executive Office of the President, Washington, D.C.

(Clawson et al., 1989) Clawson, K., G. Start, and N. Ricks (eds.). “Climatography of the Idaho National Engineering Laboratory, 2nd Edition.” Report No. DOE/ID-12118. National Oceanic and Atmospheric Administration, Environmental Research Laboratories, Air Resources Laboratory Field Research Division, Idaho Falls, Idaho. December. <http://niwc.noaa.inel.gov/climate/inelclimatologyedition2.pdf> (Accessed May 15, 2009).

(Connelly et al., 2003) Connelly, J.W., K.P. Reese, and M.A. Schroeder. “Monitoring of Greater Sage-grouse Habitats and Populations.” University of Idaho College of Natural Resources Experiment Station, Moscow, Idaho. Station Bulletin 80.

(Connelly et al., 2004) Connelly, J.W., S.T. Knick, M.A. Schroeder, and S.J. Stiver. “Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats.” Unpublished report. Western Association of Fish and Wildlife Agencies, Cheyenne, Wyoming.

(Dechant et al., 1999) Dechant, J.A., M.L. Sondreal, D.H. Johnson, L.D. Igl, C.M. Goldade, A.L. Zimmerman, and B.R. Euliss. “Effects of Management Practices on Grassland Birds: Ferruginous Hawk.” Northern Prairie Wildlife Research Center, Jamestown, North Dakota.

(DOC, 2009) U.S. Department of Commerce. “Local Area Personal Income.” Bureau of Economic Analysis. <http://www.bea.gov/regional/reis/default.cfm?selTable=CA1-3&section=2> (Accessed March 16, 2010). ADAMS Accession No. ML101790214.

(DOE, 1996) U.S. Department of Energy. “Site-Specific Probabilistic Seismic Hazard Analyses for the Idaho National Engineering Laboratory, Volume 1 – Final Report.” INEL-95/0536. Prepared by Woodward-Clyde Federal Services and Pacific Engineering and Analysis for the U.S. Department of Energy. May.

(DOE, 2005) U.S. Department of Energy. “Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems.” DOE/EIS-0373D. Office of Nuclear Energy, Science, and Technology, Washington, D.C. June. <http://www.gc.energy.gov/NEPA/draft-eis0373d.htm> (Accessed May 27, 2009).

(DOE, 2007) U.S. Department of Energy. “Idaho National Laboratory Site Environmental Report Calendar Year 2006.” DOE/ID-12082(07).

(DOE, 2010a) U.S. Department of Energy. “DOE Offers Conditional Loan Guarantee for Front End Nuclear Facility in Idaho.” Press release, May 20. <http://www.energy.gov/news/8996.htm> (Accessed November 29, 2010). ADAMS Accession No. ML103410146.

(DOE, 2010b) U.S. Department of Energy. Letter from M. McMillen (Director, Environmental Compliance Division, DOE) to J. Fullmer (Soil Conservationist-Bonneville County, NRCS) dated December 3, 2010. “Subject: NRCS Conversion Impact Rating for the Areva Eagle Rock Project.” ADAMS Accession No. ML103480644.

(DOL, 2009a) U.S. Department of Labor. “Local Area Unemployment Statistics: States and Selected Areas: Employment Status of the Civilian Noninstitutional Population, 1976 to 2007 Annual Averages.” Bureau of Labor Statistics. <http://www.bls.gov/lau/staadata.txt> (Accessed October 4, 2009). ADAMS Accession No. ML101790215.

(DOL, 2009b) U.S. Department of Labor. “Local Area Unemployment Statistics: Unemployment Rates for States.” Bureau of Labor Statistics. <http://www.bls.gov/web/laumstrk.htm> (Accessed October 4, 2009). ADAMS Accession No. ML101790222.

(DOL, 2009c) U.S. Department of Labor. “Local Area Unemployment Statistics: County Data.” Bureau of Labor Statistics. <http://www.bls.gov/lau/> (Accessed October 4, 2009). ADAMS Accession No. ML101790229.

(DOL, 2009d) U.S. Department of Labor. “Consumer Price Index, All Urban Consumers – (CPI-U) U.S. City Average, All items.” Bureau of Labor Statistics. <http://data.bls.gov/PDQ/servlet/SurveyOutputServlet?data_tool=latest_numbers&issues_id=CUUR0000SA0&output_view=pct_1mth> (Accessed October 4, 2009). ADAMS Accession No. ML101790267.

(Doty et al., 1976) Doty, S.R., R. Wallace, and G.C. Holzworth. “A Climatological Analysis of Pasquill Stability Categories Based on ‘Star’ Summaries.” National Oceanic and Atmospheric Administration, Environmental Data Service, National Climate Center, Asheville, North Carolina. April.

(EPA, 1974) U.S. Environmental Protection Agency. “Information on levels of Environmental Noise Requisite to Protect Public health and Welfare with an Adequate Margin of Safety.” EPA/ONAC 550/9-74-004. Office of Noise Abatement and Control, Washington, D.C. March. <http://www.nonoise.org/library/levels74/levels74.htm> (Accessed May 13, 2009). ADAMS Accession No. ML101790269.

(EPA, 1978) U.S. Environmental Protection Agency. “Protective Noise Levels; Condensed Version of EPA Levels Document.” EPA 550/9-79-100. Office of Noise Abatement and Control, Washington, D.C. November. <http://www.nonoise.org/library/levels/levels.htm> (Accessed May 13, 2009). ADAMS Accession No. ML101790276.

(EPA, 1980) U.S. Environmental Protection Agency. “Guidelines for Considering Noise in Land Use and Planning Control. EPA 550-9-81-423. Federal Interagency Committee on Urban Noise. <http://www.nonoise.org/epa/> (Accessed March 19, 2010).

(EPA, 1999) U.S. Environmental Protection Agency. “Cancer Risk Coefficients for Environmental Exposure to Radionuclides.” Federal Guidance Report No. 13. EPA 402-R-99-001. Prepared by Oak Ridge National Laboratory for U.S. Environmental Protection Agency, Office of Radiation and Indoor Air. September. <http://www.epa.gov/rpdweb00/docs/federal/402-r-99-001.pdf> (Accessed March 1, 2010).

(EPA, 2002) U.S. Environmental Protection Agency. “EPA Facts about Tritium.” July.

(EPA, 2009a) U.S. Environmental Protection Agency. “Final Mandatory Greenhouse Gas Reporting Rule.” <http://www.epa.gov/climatechange/emissions/ghgrulemaking.html> (Accessed December 15, 2009). ADAMS Accession No. ML101790281.

(EPA, 2009b) U.S. Environmental Protection Agency. “Regional Screening Levels Table – Industrial Soils (April 2009).” <http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm> (Accessed June 18, 2009). ADAMS Accession No. ML101790284.

(EPA, 2009c) U.S. Environmental Protection Agency. “Region 10 Sole Source Aquifer Program.” <http://yosemite.epa.gov/r10/water.NSF/Sole+Source+Aquifers/SSA> (Accessed October 6, 2009). ADAMS Accession No. ML101790288.

(EPA, 2010a) U.S. Environmental Protection Agency. “Section 303(d) List Fact Sheet for Watershed – American Falls.” <http://iaspub.epa.gov/tmdl_waters10/huc_rept.control?p_huc=17040206&p_huc_desc=American Falls> (Accessed March 10, 2010). ADAMS Accession No. ML101790289.

(EPA, 2010b) U.S. Environmental Protection Agency. “Drinking Water Contaminants – List of Contaminants and Their MCLs.” <http://www.epa.gov/safewater/contaminants/index.html> (Accessed February 24, 2010). ADAMS Accession No. ML101790290.

(Estes and Raley, 2009) Estes, M.B., and J. Raley. “Amendment to: A Class III Cultural Resource Inventory of the Proposed Eagle Rock Enrichment Facility Bonneville County, Idaho.” Western Cultural Resource Management, Inc., Sparks, Nevada. August 28.

(FBI, 2009) Federal Bureau of Investigation. “Crime in the United States: 2006.” http://www.fbi.gov/ucr/cius2006/about/table_title.html> (Accessed October 4, 2009). ADAMS Accession No. ML101790291.

(FEMA, 2010) Federal Emergency Management Agency. “Map Service Center – Quick Order (Map Panel 1600270025C).” <http://msc.fema.gov/webapp/wcs/stores/servlet/QuickOrderResultView> (Accessed March 31, 2010). ADAMS Accession No. ML101790293.

(Field et al., 2001) Field, N., L. Jones, T. Jordan, M. Benthien, and L. Wald. “Earthquake Shaking – Finding the ‘Hotspots.” U.S. Geological Survey Fact Sheet 001-01. <http://pubs.usgs.gov/fs/2001/fs001-01/fs001-01.pdf (Accessed November 29, 2010). ADAMS Accession No. ML103410201.

(FireDepartments.Net, 2009) Fire Departments Network. “Fire Department Listings.” <http://www.firedepartments.net/fire-department-listings/> (Accessed October 4, 2009). ADAMS Accession No. ML101790295.

(FWS, 2007) U.S. Fish and Wildlife Service. “National Bald Eagle Management Guidelines.” <http://www.fws.gov/migratorybirds/baldeagle.htm> (Accessed May 17, 2010). ADAMS Accession No. ML101790298.

(FWS, 2008) U.S. Fish and Wildlife Service. “Birds of Conservation Concern 2008, United States.” Division of Migratory Bird Management, Arlington, Virginia. <http://www.fws.gov/migratorybirds/> (Accessed October 4, 2009).

(FWS, 2009a) U.S. Fish and Wildlife Service. Letter from Damien Miller (Supervisor, Eastern Idaho Field Office, U.S. Fish and Wildlife Service) to Gloria Kulesa (NRC) dated July 15, 2009. “Subject: Proposed AREVA Eagle Rock Enrichment Facility in Bonneville County, Idaho. SL #09-0471.”

(FWS, 2009b) U.S. Fish and Wildlife Service. “Species Information by County.” <http://www.fws.gov/idaho/agencies/Countybycounty.htm> (Accessed May 14, 2009). ADAMS Accession No. ML101790299.

(FWS, 2010a) U.S. Fish and Wildlife Service. “Species Profile, Utah Valvata Snail (Valvata utahensis).” <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=G05R> (Accessed October 5, 2009). ADAMS Accession No. ML101790304.

(FWS, 2010b) U.S. Fish and Wildlife Service. “Grizzly Bear Recovery, Yellowstone Ecosystem.” <http://www.fws.gov/mountain-prairie/species/mammals/grizzly/yellowstone.htm> (Accessed April 21, 2010). ADAMS Accession No. ML101790297.

(FWS, undated) U.S. Fish and Wildlife Service. “National Wetland Inventory, Kettle Butte, Idaho, quadrangle map.” August 1980 aerial photography. Available from Earth Science Information Office, Blaisdell House, University of Massachusetts, Amherst, MA 01003.

(Gilbert, 2010) Gilbert, H. Personal communication from H. Gilbert (Idaho National Laboratory) to D.J. O'Rourke (Argonne National Laboratory) dated April 26, 2010. "Subject: Uniqueness of Late 19th Century Homestead Sties in the General Vicinity of the EREF Property." ADAMS Accession No. ML101790310.

(Gillerman and Bennett, 2008) Gillerman, V.S., and E.H. Bennett. "Idaho Mining and Exploration, 2007." *Mining Engineering*, Vol. 60, No. 5, pp. 84–88.

(Hackett et al., 2002) Hackett, W.R., R.P. Smith, and S. Khericha. "Volcanic Hazards of the Idaho National Engineering Laboratory, Southeast Idaho." In: *Tectonic and Magmatic Evolution of the Snake River Plain Volcanic Province*. (B. Bonnichsen, C.M. White, and M. McCurry, eds). Idaho Geological Survey, Bulletin 30.

(Halstead, 2009) Halstead, M. E-mail from M. Halstead (Bingham County, Idaho) to D.J. O'Rourke (Argonne National Laboratory) dated July 9. "Subject: RE: Information Need." ADAMS Accession No. ML101790314.

(HUD, 2009) U.S. Housing and Urban Development. "Chapter 2: The Noise Regulation." In: *The Noise Guidebook*. 24 CFR 51.103. <http://www.hud.gov/offices/cpd/environment/training/guidebooks/noise/index.cfm> (Accessed September 14, 2009).

(Hughes et al., 1999) Hughes, S.S., R.P. Smith, W.R. Hackett, and S.R. Anderson. "Mafic Volcanism and Environmental Geology of the Eastern Snake River Plain, Idaho." In: *Guidebook to the Geology of Eastern Idaho, Idaho Museum of Natural History*, pp. 143–168. (S.S. Hughes and G.D. Thackray, eds).

(Hukari, 2009) Hukari, N. Personal communication from N. Hukari (NOAA/ARLFRD) to R. Kolpa (Argonne National Laboratory) dated July 15. ADAMS Accession No. ML101870068.

(Idaho Department of Health and Welfare, 2009) Idaho Department of Health and Welfare. "Idaho Vital Statistics: Health District Report." <http://healthandwelfare.idaho.gov/Portals/0/Health/Statistics/Idaho%20Vital%20Statistics%20Health%20District%20Report,%201999-2007.pdf> (Accessed March 10, 2010).

(IDC, 2009) Idaho Department of Commerce. "Community Profiles of Idaho." <http://commerce.idaho.gov/business/socioeconomic-profiles.aspx> (Accessed October 6, 2009). ADAMS Accession No. ML101830116.

(IDEQ, 2005) Idaho Department of Environmental Quality. "State of Idaho Oversight Monitor: Idaho's Treasure – the Eastern Snake River Plain Aquifer." Idaho INL Oversight Program. Boise, Idaho. May. ADAMS Accession No. ML101790328.

(IDEQ, 2006a) Idaho Department of Environmental Quality. "INL Oversight Annual Report 2006." Idaho National Laboratory Oversight. <http://www.deq.idaho.gov/inl_oversight/library/2006_annual.pdf> (Accessed May 16, 2009).

(IDEQ, 2006b) Idaho Department of Environmental Quality. "American Falls Subbasin Total Maximum Daily Loan Plan: Subbasin Assessment and Loading Analysis." Prepared by Pocatello Regional Office, Shoshone-Bannock Tribes, and EPA Region 10. July.

(IDEQ, 2007a) Idaho Department of Environmental Quality. "2007 Air Quality Monitoring Data Summary." <http://www.deq.idaho.gov/air/data_reports/monitoring/07_aq_monitoring_report.pdf> (Accessed May 6, 2009).

(IDEQ, 2007b) Idaho Department of Environmental Quality. "Idaho Air Quality Planning Areas." <http://www.deq.idaho.gov/air/data_reports/planning/air_planning_areas_2007.pdf> (Accessed May 11, 2009). ADAMS Accession No. ML101790334.

(IDEQ, 2007c) Idaho Department of Environmental Quality. "INL Oversight Program Annual Report 2007." Idaho National Laboratory Oversight. <http://www.deq.idaho.gov/inl_oversight/library/2007_annual.pdf> (Accessed May 16, 2009).

(IDEQ, 2008) Idaho Department of Environmental Quality. "INL Oversight Annual Report 2008." Idaho National Laboratory Oversight. <http://www.deq.idaho.gov/inl_oversight/library/2008_annual.pdf> (Accessed February 1, 2010).

(IDEQ, 2009) Idaho Department of Environmental Quality. "2005 Idaho EI." Access database file from Gary Reinbold, Air Quality Analyst, Idaho Department of Environmental Quality. May 11. ADAMS Accession No. ML101870076.

(IDEQ, undated) Idaho Department of Environmental Quality. "Idaho Area Designation Recommendations for the 2006 $PM_{2.5}$ NAAQS." <http://www.deq.idaho.gov/air/data_reports/planning/designation_area_recommendations_06pm25_naaqs.pdf> (Accessed May 11, 2009).

(IDFG, 2005) Idaho Department of Fish and Game. "Idaho Comprehensive Wildlife Conservation Strategy." Idaho Conservation Data Center, Boise, Idaho. <http://fishandgame.idaho.gov/cms/tech/CDC/cwcs.cfm> (Accessed November 16, 2009). ADAMS Accession No. ML101800019.

(IDFG, 2009a) Idaho Department of Fish and Game. "*Spiranthes diluvialis* Sheviak, Ute ladies' tresses." <http://fishandgame.idaho.gov/cms/tech/CDC/spp_accounts_plants/spidil.cfm> (Accessed May 20, 2009). ADAMS Accession No. ML101800026.

(IDFG, 2009b) Idaho Department of Fish and Game. Letter from Sharon W. Kiefer (Assistant Director-Policy, Idaho Department of Fish and Game) to Andrea Kock (NRC).

(IDFG, 2009c) Idaho Department of Fish and Game. "Upper Snake Region – Annual Fisheries Report, 2008 Activities and Accomplishments." Issue 4. April. ADAMS Accession No. ML101800034.

(IDFG, 2010) Idaho Department of Fish and Game. Email from Sharon W. Kiefer (Assistant Director-Policy, Idaho Department of Fish and Game) to Stephen Lemont (NRC).

(IDWR, 2010) Idaho Department of Water Resources. “Internet Map Server.” <http://maps.idwr.idaho.gov/mapall2/viewer.htm> (Accessed February 25, 2010). ADAMS Accession No. ML101800036.

(INL, 2007) Idaho National Laboratory. “Idaho National Laboratory Cultural Resource Management Plan.” DOE/ID-10997. Revision 2. February.

(IPCS, 2009) International Programme on Chemical Safety. “INCHEM – Chemical Safety Data from Intergovernmental Organizations.” <http://www.inchem.org/> (Accessed May 17, 2009). ADAMS Accession No. ML101800038.

(ISAC, 2006) Idaho Sage-Grouse Advisory Committee. “Conservation Plan for the Greater Sage-Grouse in Idaho.” ADAMS Accession No. ML101800045.

(ISACTAT, 2010) Idaho Sage-grouse Advisory Committee Technical Assistance Team. “Idaho Sage-grouse Local Working Groups Statewide Annual Report 2009.” March 12. ADAMS Accession No. ML101800048.

(ISTC, 2009) Idaho State Tax Commission. “Property Tax Publications.” <http://tax.idaho.gov/pubs/EPB00129_12-31-2008.pdf> (Accessed October 4, 2009). ADAMS Accession No. ML101800049.

(ITD, 1996) Idaho Transportation Department. “Idaho State Rail Plan.” June. <http://www.itd.idaho.gov/planning/railfreight/rail.pdf> (Accessed October 2, 2009).

(ITD, 2005) Idaho Transportation Department. “US 20 Mileposts 263-301.3 Potential Safety Improvement Analysis.” July. ADAMS Accession No. ML101800051.

(ITD, 2007) Idaho Transportation Department. “Purple Overweight Chart.” May 22. <http://www.itd.idaho.gov/dmv/poe/Purple_Route_Chart.htm> (Accessed May 10, 2010). ADAMS Accession No. ML101800056.

(ITD, 2009a) Idaho Transportation Department. “District Six 2008 Rural Traffic Flow Map.” May. <http://www.itd.idaho.gov/planning/roadwaydata/RTFMaps/2008/TF2008RuralD6.pdf> (Accessed October 2, 2009). ADAMS Accession No. ML101800058.

(ITD, 2009b) Idaho Transportation Department. “Idaho Transportation Department Monthly Bulletin.” <http://dot.idaho.gov/planning/roadwaydata/Monthly_Bulletin/index.html> (Accessed October 2, 2009). ADAMS Accession No. ML101830118.

(ITD, 2010a). Idaho Transportation Department. “Route Capacity Map.” January. <http://www.itd.idaho.gov/dmv/POE/documents/route_cap2.pdf> (Accessed February 26, 2010). ADAMS Accession No. ML101800061.

(ITD, 2010b). Idaho Transportation Department. “Annual Vehicle Speed Report 2009: Station #57.” January 12. <http://www.itd.idaho.gov/planning/roadwaydata//057KettleButte/2009/09-Annual/L057_KettleButte_2009_AnnualVehicleSpeedReport.pdf> (Accessed March 12, 2010). ADAMS Accession No. ML101800088.

(ITD, 2010c) Idaho Transportation Department. Personal communication from M. Davison (Idaho Transportation Department) to K. Fischer (Argonne National Laboratory) dated February 26, 2010. ADAMS Accession No. ML101800099.

(ITD, 2010d) Idaho Transportation Department. Personal communication from K. Hahn (Idaho Transportation Department) to K. Fischer (Argonne National Laboratory) dated February 26 and March 1, 2010. ADAMS Accession No. ML101800102.

(ITD, 2010e) Idaho Transportation Department. "Hourly Traffic Volume Report By Direction: Station #57." March 9. <http://dot.idaho.gov/planning/roadwaydata//057KettleButte/2010/10-02feb/L057_KettleButte_Feb10_HourlyTrafficVolumeReportByDirection.pdf> (Accessed April 22, 2010). ADAMS Accession No. ML101800161.

(IWRB, 2009) Idaho Water Resource Board. "Eastern Snake Plain Aquifer (ESPA) – Comprehensive Aquifer Management Plan." January.

(Jefferson County, 2005) Jefferson County, Idaho. "Jefferson County Comprehensive Plan." 2005 Update. Adopted April 25, 2005.

(Jefferson County, 2008) Jefferson County, Idaho. "Jefferson County Zone Map." ADAMS Accession No. ML101800179.

(Jones, 2009) Jones, D. E-mail communication from D. Jones (Idaho Department of Environmental Quality INL Oversight Program) to B. Biwer (Argonne National Laboratory) dated July 14. "Subject: Soil Data."

(Joyner, 2008) Letter from J.M. Joyner (Regulatory Division, Walla Walla District, U.S. Corps of Engineers) to G. Harper (AREVA NP Inc.) dated October 10. NWW-2008-00670-120. ADAMS Accession No. ML101800184.

(Kuntz et al., 1994) Kuntz, M.A., B. Skipp, M.A. Lanphere, G.B. Dalrymple, D.B. Champion, G.F. Embree, W.R. Page, L.A. Morgan, R.P. Smith, W.R. Hackett, and D.W. Rodgers. "Geologic Map of the Idaho National Engineering Laboratory and Adjoining Areas, Eastern Idaho." U.S. Geological Survey Miscellaneous Inv. Map I-2330.

(Landscape Dynamics Lab, 1999) Landscape Dynamics Lab. "Idaho Land Cover." Version 2.1. February. ADAMS Accession No. ML101800245.

(Lindholm, 1996) Lindholm, G.F. "Summary of the Snake River Plain Regional Aquifer-System Analysis in Idaho and Eastern Oregon." Part of the Snake River Plain Regional Aquifer System Analysis (RASA) Project, U.S. Geological Survey Professional Paper 1408-A.

(Maupin and Barber, 2005) Maupin, M.A., and N.L. Barber. "Estimated Withdrawals from Principal Aquifers in the United States, 2000." U.S. Geological Survey Circular 1279. Reston, Virginia.

(McGrath et al., 2002) McGrath, C.L., A.J. Woods, J.M. Omernik, S.A. Bryce, M. Edmondson, J.A. Nesser, J. Shelden, R.C. Crawford, J.A. Comstock, and M.D. Plocher. "Ecoregions of Idaho." Color poster with map, descriptive text, summary tables, and photographs. U.S. Geological Survey, Reston, Virginia. ADAMS Accession No. ML101800248.

(MWH, 2008a) MWH. "Sage-Grouse Survey Report, Proposed Site for the Eagle Rock Enrichment Facility, Bonneville, Idaho." Revision 1. Prepared by MWH, Fort Collins, Colorado, for AREVA, Bethesda, Maryland. Attachment to the Environmental Report. December 8.

(MWH, 2008b) MWH. "Ecology Field Study Report, Proposed Site for the Eagle Rock Enrichment Facility, Bonneville, Idaho." Revision 1. Prepared by MWH, Fort Collins, Colorado, for AREVA, Bethesda, Maryland. Attachment to the Environmental Report. December 8.

(MWH, 2008c) MWH. "Ecology Field Study Report, Proposed Site for the Eagle Rock Enrichment Facility, Bonneville, Idaho, Fall 2008 Survey." Revision 1. Prepared by MWH, Fort Collins, Colorado, for AREVA, Bethesda, Maryland. Attachment to the Environmental Report. December 8.

(MWH, 2009) MWH. "Ecology Field Study Report, Proposed Site for the Eagle Rock Enrichment Facility, Bonneville, Idaho, Winter and Spring 2009 Surveys." Revision 1. Prepared by MWH, Fort Collins, Colorado, for AREVA, Bethesda, Maryland. Attachment to the Environmental Report. July 28.

(NCDC, 2009a) National Climatic Data Center. "Climate of Idaho." <http://cdo.ncdc.noaa.gov/climatenormals/clim60/states/Clim_ID_01.pdf> (Accessed May 11, 2009). ADAMS Accession No. ML101800249.

(NCDC, 2009b) National Climatic Data Center. "Storm Events for Bonneville County over the Period January 1, 1950, to December 31, 2008." <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms> (Accessed May 19, 2009). ADAMS Accession No.ML101830125.

(NCDC, 2009c) National Climatic Data Center. "Historic Palmer Drought Indices." National Oceanographic and Atmospheric Administration Satellite and Information Service. <http://www.ncdc.noaa.gov/oa/climate/research/drought/palmer-maps/> (Accessed June 30, 2009). ADAMS Accession No. ML101800253.

(NCES, 2009) National Center for Education Statistics. "National Center for Education Statistics Search for Public School Districts." U.S. Department of Education. <http://www.nces.ed.gov/ccd/districtsearch> (Accessed October 4, 2009). ADAMS Accession No. ML101800255.

(NCRP, 1998) National Council on Radiation Protection. "Exposure of the Population in the United States and Canada from Natural Background Radiation." Report No. 94. August 15.

(NCRP, 2009) National Council of Radiation Protection and Measurements. "Ionizing Radiation Exposure of the Population of the United States." NCRP Report No. 160.

(Nimmo et al., 2004) Nimmo J.R., J.P. Rousseau, K.S. Perkins, K.G. Stollenwerk, P.D. Glynn, R.C. Bartholomay, and L.L. Knobel. "Hydraulic and Geochemical Framework of the Idaho National Engineering and Environmental Laboratory Vadose Zone." *Vadose Zone Journal*, Vol. 3, pp. 6–34.

(NOAA, 2004a) National Oceanic and Atmospheric Administration. "Climatography of the United States, No. 20, 1971-2000, Idaho Falls 2 ESE, ID." National Climatic Data Center, Asheville, North Carolina. <http://cdo.ncdc.noaa.gov/climatenormals/clim20/id/104455.pdf> (Accessed September 10, 2009). ADAMS Accession No. ML101800258.

(NOAA, 2004b) National Oceanic and Atmospheric Administration. "Climatography of the United States, No. 20, 1971-2000, Idaho Falls 46 W, ID." National Climatic Data Center, Asheville, North Carolina. February. <http://cdo.ncdc.noaa.gov/climatenormals/clim20/id/104460.pdf> (Accessed September 10, 2009). ADAMS Accession No. ML101800269.

(NOAA, 2008) National Oceanic and Atmospheric Administration. "The Enhanced Fujita Tornado Scale." National Climatic Data Center. <http://www.ncdc.noaa.gov/oa/satellite/satelliteseye/educational/fujita.html> (Accessed March 16, 2010). ADAMS Accession No. ML101800280.

(NOAA, 2009) National Oceanographic and Atmospheric Administration. "Lightning Safety Resources and Links, Flash Density Map: 1997-2007." <http://www.lightningsafety.noaa.gov/more.htm > (Accessed March 25, 2010). ADAMS Accession No. ML10180284.

(NOAA, 2010) National Oceanographic and Atmospheric Administration. "Drought Severity Index by Division – Weekly Value for Period Ending February 20, 2010." Climate Prediction Center. <http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/palmer.gif> (Accessed February 24, 2010). ADAMS Accession No. ML101800285.

(North Wind, 2010) North Wind, Inc. "Sage-Grouse Survey Report, Eagle Rock Enrichment Facility." May 13.

(NPS, 2007) National Park Service. "Explore Air, Class I Area Locations, All Class I Areas." December 18. <http://www.nature.nps.gov/air/maps/classILoc.cfm> (Accessed September 9, 2009). ADAMS Accession No. ML101800287.

(NRC, 2003a) U.S. Nuclear Regulatory Commission. "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." NUREG-1748. Office of Nuclear Material Safety and Safeguards, Washington, D.C. August.

(NRC, 2003b) U.S. Nuclear Regulatory Commission. "Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." Prepared by the Office of Nuclear Material Safety and Safeguards. *Federal Register*, Vol. 69, p. 52040.

(NRC, 2004) U.S. Nuclear Regulatory Commission. "Fact Sheet: Biological Effects of Radiation." <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/bio-effects-radiation.pdf> (Accessed September 18, 2009).

(NRC, 2009) U.S. Nuclear Regulatory Commission. “Trip Report for AREVA Eagle Rock Enrichment Facility Site Visit and Agency Meetings, June 2-4, 2009.” December 18. ADAMS Accession No. ML093440020.

(NRC, 2010) U.S. Nuclear Regulatory Commission. “Safety Evaluation Report for the Eagle Rock Enrichment Facility in Bonneville County, Idaho.” NUREG-1951. Office of Nuclear Material Safety and Safeguards, Washington, D.C.

(NRCS, 2009) Natural Resources Conservation Service. “Custom Soil Resource Report for Bonneville County Area, Idaho.” U.S. Department of Agriculture Web Soil Survey. <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm> (Accessed May 16, 2009). ADAMS Accession No. ML101800288.

(Payne, 2006) Payne, S.J. “Modeling of the Sedimentary Interbedded Basalt Stratigraphy for the Idaho National Laboratory Probabilistic Seismic Hazard Analysis.” Report INL/EST-05-01047. Idaho National Laboratory. August.

(Payne, 2008) Payne, S.J. “Idaho National Laboratory – Seismic and Volcanic Hazards.” <http://www.inl.gov/geosciences/earthquakes.shtml> (Accessed July 17, 2008). ADAMS Accession No. ML101800292.

(Payne et al., 2000) Payne, S.J., V.W. Gorman, S.A. Jensen, M.E. Nitzel, M.J. Russell, and R.P. Smith. “Development of Probabilistic Design Basis Earthquake (DBE) Parameters for Moderate and High Hazards Facilities at INEEL.” Prepared by INEEL Geosciences Department, Bechtel BWXT Idaho LLC, for the U.S. DOE. INEEL/EXT-99-00775, Rev. 1. March.

(Reynolds, 2010) Personal communication from W. Reynolds (U.S. Bureau of Land Management) to D. O’Rourke, B. Biwer, and R. Van Lonkhuyzen (Argonne National Laboratory) dated February 12. ADAMS Accession No. ML101800326.

(Richards, 2009a) Richards, S. Personal communication from Susan Richards (Air Quality Analyst, IDEQ) to Albert E. Smith (Argonne National Laboratory) dated May 14, 2009. ADAMS Accession No. ML101800358.

(Richards, 2009b) Richards, S. Personal communication from Susan Richards (Air Quality Analyst, IDEQ) to Albert E. Smith (Argonne National Laboratory) dated May 12. “Subject: Southern Idaho Nonattainment Areas.” Excel spreadsheet. ADAMS Accession No. ML101800398.

(Ringhoff et al., 2008) Ringhoff, M., E.J. Stoner, C.C. Chambellan, and S. Mehls. “A Class III Cultural Resource Inventory of the Proposed Eagle Rock Enrichment Facility, Bonneville County, Idaho.” Prepared by Western Cultural Resource Management, Inc. for AREVA Enrichment Services, LLC. November.

(Scott, 1982) Scott, W.E. “Surficial Geologic Map of the Eastern Snake River Plain and Adjacent Areas, 111 to 115 W., Idaho and Wyoming.” U.S. Geological Survey Miscellaneous Inv. Ser. Map I-1372.

(Seaber et al., 2007) Seaber, P.R., F.P. Kapinos, and G.L. Knapp. "Hydrologic Unit Maps." U.S. Geological Survey Water-Supply Paper 2294.

(Serr, 2009) E-mail from S. Serr (Bonneville County, Idaho) to B. Biwer (Argonne National Laboratory) dated July 8. "Subject: G-I Zone." ADAMS Accession No. ML101800390.

(Shumar, 2004) Shumar, M.L. "Idaho Falls Subbasin Assessment and Total Maximum Daily Load – Final." Prepared for the Idaho Department of Environmental Quality. August 25.

(Smith, 2004) Smith, R.P. "Geologic Setting of the Snake River Aquifer and Vadose Zone." *Vadose Zone Journal*, Vol. 3, pp. 47–58.

(S.M. Stoller Corporation, 2001) S.M. Stoller Corporation. "Idaho National Laboratory Environmental Surveillance, Education, and Research Program." <http://www.stoller-eser.com/index.htm> (Accessed October 5, 2009). ADAMS Accession No. ML101800424.

(USACE, 1987) U.S. Army Corps of Engineers. "Corps of Engineers Wetlands Delineation Manual." Final Report. Environmental Laboratory. Vicksburg, Mississippi. January.

(U.S. Census Bureau, 2009a) U.S. Census Bureau. "American Fact Finder." <http://factfinder.census.gov/> (Accessed October 4, 2009). ADAMS Accession No. ML101800428.

(U.S. Census Bureau, 2009b) U.S. Census Bureau. "Land Area, Population, and Density for States and Counties: 1990." http://www.census.gov/population/censusdata/ 90den_stco.txt> (Accessed October 4, 2009). ADAMS Accession No. ML101800432.

(U.S. Census Bureau, 2009c) U.S. Census Bureau. "County Business Patterns, 2006." <http://www.census.gov/ftp/pub/epcd/cbp/view/cbpview.html> (Accessed October 4, 2009). ADAMS Accession No. ML101800445.

(U.S. Census Bureau, 2009d) U.S. Census Bureau. "GCT1901. Median Household Income: Households Data Set: 2006-2008 American Community Survey 3-Year Estimates." <http://factfinder.census.gov/servlet/GCTTable?_bm=y&-geo_id=01000US&-_box_head_nbr=GCT1901&-ds_name=ACS_2008_3YR_G00_&-_lang=en&-mt_name=ACS_2008_3YR_G00_GCT1901_US9T&-format=US-9T> (Accessed March 18, 2010). ADAMS Accession No. ML101800450.

(USDA, 2002) U.S. Department of Agriculture, Marketing Services Branch. "Idaho: Bingham County: Statistics from the Census of Agriculture (5-year cycle)." ADAMS Accession No. ML101800465.

(USDA, 2009) U.S. Department of Agriculture. "2007 Census of Agriculture: Idaho State and County Data, Volume 1, Geographic Area Series." National Agricultural Statistics Service, Washington, D.C. <http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Idaho/index.asp> (Accessed October 4, 2009). ADAMS Accession No. ML101800495.

(USDA, 2010a) U.S. Department of Agriculture. “The Twelve Orders of Soil Taxonomy.” Natural Resources Conservation Service. <http://sols.usda.gov/technical/soil_orders> (Accessed: February 11, 2010). ADAMS Accession No. ML101800498.

(USDA, 2010b) United States Department of Agriculture. “United States Department of Agriculture, Natural Resource Conservation Service, Plants Database.” <http://plants.usda.gov.> (Accessed January 25, 2010). ADAMS Accession No. ML101800505.

(USGS, 1964) U.S. Geological Survey. “Kettle Butte, Idaho Topographic Quadrangle.” ADAMS Accession No. ML101800506.

(USGS, 2008a) U.S. Geological Survey. “National Seismic Hazard Maps – 2008: Peak Horizontal Acceleration (%g) with 10% Probability of Exceedance in 50 Years.” <http://gldims.cr.usgs.gov/nshmp2008/viewer.htm> (Accessed November 19, 2010). ADAMS Accession No. ML103410170.

(USGS, 2008b) U.S. Geological Survey. “2006 Minerals Yearbook.” Prepared under a Memorandum of Understanding between the USGS and the Idaho Geological Survey.

(USGS, 2009a) U.S. Geological Survey. “What is Geologic Time?” <http://geomaps.wr.usgs.gov/parks/gtime/index.html> (Accessed May 15, 2009). ADAMS Accession No. ML101800515.

(USGS, 2009b) U.S. Geological Survey. Science in Your Watershed.” <http://water.usgs.gov/wsc/cat/17040201.html> (Accessed May 26, 2009). ADAMS Accession No. ML101800518.

(USGS, 2009c) U.S. Geological Survey. “National Water Information System: USGS 13057155 Snake River above Eagle Rock near Idaho Falls, Idaho – Daily Statistics.” <http://nwis.waterdata.usgs.gov/> (Accessed June 29, 2009). ADAMS Accession No. ML101800527.

(USGS, 2009d) U.S. Geological Survey. “National Water Information System: USGS 13057155 Snake River above Eagle Rock near Idaho Falls, Idaho – Monthly Statistics.” <http://nwis.waterdata.usgs.gov/> (Accessed June 29, 2009). ADAMS Accession No. ML101800531.

(USGS, 2009e) U.S. Geological Survey. “National Water Information System: USGS 13057155 Snake River above Eagle Rock near Idaho Falls, Idaho – Peak Streamflow.” <http://nwis.waterdata.usgs.gov/> (Accessed June 29, 2009). ADAMS Accession No. ML101800533.

(USGS, 2009f) U.S. Geological Survey. “National Water Information System: USGS 13057155 Snake River above Eagle Rock near Idaho Falls, Idaho – Annual Statistics.” <http://nwis.waterdata.usgs.gov/> (Accessed June 29, 2009). ADAMS Accession No. ML101800539.

(USGS, 2009g) U.S. Geological Survey. "Gap Analysis Program Northwest." <http://gap.uidaho.edu/index.php/gap-home/Northwest-GAP> (Accessed March 16, 2010). ADAMS Accession No. ML101800542.

(USGS, 2010) U.S. Geological Survey. "Estimated Use of Water in the United States – County Level Data for 2005." <http://water.usgs.gov/watuse/data/2005> (Accessed February 24, 2010). ADAMS Accession No. ML101830107.

(USGS and IGS, 2006) U.S. Geological Survey and Idaho Geological Survey. "Quaternary Fault and Fold Database of the United States." <http://earthquake.usgs.gov/hazards/qfaults> (Accessed March 11, 2010). ADAMS Accession No. ML101800544.

(USSLWG, 2009) Upper Snake Sage-grouse Local Working Group. "Plan for Increasing Sage-grouse Populations." June. ADAMS Accession No. ML101800564.

(Westinghouse Idaho Nuclear Company, 1994) Westinghouse Idaho Nuclear Company, Inc. "Background Concentrations of Selected Metals and Radionuclides in Big Lost River Alluvium at the Idaho Chemical Processing Plant, Rev. 1." U.S. Department of Energy Idaho Field Office. February 28. <http://ar.inel.gov/owa/search_all_by_title_2?F_title=RIVER> (Accessed March 16, 2010).

(Weston Geophysical Engineers, 2008) Weston Geophysical Engineers Inc. "Probabilistic Seismic Hazard Assessment – Final Report for the Eagle Rock Enrichment Facility." Prepared for AREVA NP, Inc. October 28.

(Whitehead, 1994) Whitehead, R.L. "Ground Water Atlas of the United States – Idaho, Oregon, Washington. HA 730-H." U.S. Geological Society. <http://pubs.usgs.gov/ha/ha730/ch_h/index.html> (Accessed June 30, 2009). ADAMS Accession No. ML101800567.

(Wood and Low, 1988) Wood, T.R., and W.H. Low. "Solute Geochemistry of the Snake River Plain Regional Aquifer System, Idaho and Eastern Oregon." Part of the Snake River Plain Regional Aquifer System Analysis (RASA) Project. U.S. Geological Survey Professional Paper 1408-D.

4 ENVIRONMENTAL IMPACTS

This chapter presents the potential environmental impacts associated with preconstruction, construction, operation, and decommissioning of the proposed AREVA Enrichment Services, LLC (AES) Eagle Rock Enrichment Facility (EREF).

4.1 Introduction

For the proposed action, this Environmental Impact Statement (EIS) considers impacts from construction activities, normal operations, credible accidents, terrorism, and decommissioning, as well as cumulative impacts and resource commitments. The impacts associated with preconstruction activities are also discussed, although, as discussed in Sections 1.2 and 4.2 of this EIS, preconstruction is not part of the proposed action. The chapter is organized by environmentally affected areas (i.e., land use, historic and cultural resources, visual and scenic resources, air quality, geology and soils, water resources, ecological resources, noise, transportation, public and occupational health, waste management, socioeconomics, and environmental justice) based on the descriptions of the preconstruction activities and the proposed action that are included in Section 2.1. The discussion of impacts on each environmentally affected area is divided into three categories – (1) preconstruction and construction, (2) operation, and (3) decontamination and decommissioning. Impacts from the intermediate time period during which both construction and operations take place are included in the sections on operations.

Within each resource area, those mitigation measures proposed by AES, including additional mitigation measures identified by the U.S. Nuclear Regulatory Commission (NRC) staff, are disclosed in this EIS. While the NRC cannot impose mitigation outside its regulatory authority under the *Atomic Energy Act*, mitigation measures have been identified within this chapter and in Chapter 5 that could potentially reduce the impacts of preconstruction and the proposed action. For the purposes of the *National Environmental Policy Act* of 1969, as amended (NEPA), per Title 10, “Energy,” of the U.S. *Code of Federal Regulations* (10 CFR) Part 51, the NRC is disclosing measures that could potentially reduce or avoid environmental impacts of preconstruction, construction, and operation of the proposed EFEF. Any mitigation measures identified by the applicant (AES) and proposed for implementation within the Environmental Report (ER) (AES, 2010a) are listed in Tables 5-1 and 5-2 in Chapter 5

Determination of the Significance of Potential Environmental Impacts

A standard of significance has been established for assessing environmental impacts. Based on the Council on Environmental Quality’s regulations, each impact is to be assigned one of the following three significance levels:

- ***Small:*** *The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.*

- ***Moderate:*** *The environmental effects are sufficient to noticeably alter but not destabilize important attributes of the resource.*

- ***Large:*** *The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.*

Source: NRC, 2003a.

and have been factored into the NRC staff's environmental impact analysis in Chapter 4. The additional mitigation measures identified by the NRC staff, which are listed in Tables 5-3 and 5-4 of Chapter 5, are not requirements being imposed upon the applicant.

Section 4.2 discusses potential environmental impacts of preconstruction and the proposed action under consideration in this EIS, namely the preconstruction, construction, and operation of the proposed EREF in Bonneville County, Idaho. The decontamination and decommissioning impacts discussed in Section 4.2.16 are preliminary, or estimated, for the proposed EREF. Detailed impacts from decontamination and decommissioning will be assessed by the staff at the end of the proposed EREF's operations and prior to NRC approval to begin such activities. Under 10 CFR 70.38, the NRC requires that AES file an application for decommissioning of the proposed EREF to be filed 12 months prior to the expiration of the license. This application would include a detailed Decommissioning Plan that would take into account the extent of radiological contamination at the site and would require a separate environmental review and NEPA document. Because decontamination and decommissioning would take place well in the future, advanced technology improving the decontamination and decommissioning process may be available. In addition, this chapter discusses the potential cumulative impacts (Section 4.3) and impacts of the no-action alternative (Section 4.4).

The proposed EREF, if licensed, will possess and use special nuclear material, source material, and byproduct material. Environmental impacts from the proposed EREF may be radiological or nonradiological. Radiological impacts from the proposed EREF could include radiation doses to workers and members of the public from the routine operations, transportation, potential accidents, potential terrorist activities, and decommissioning and environmental impacts from potential releases to the air, soil, or water. Nonradiological impacts could include chemical hazards, emissions (e.g., vehicle fumes), occupational accidents and injuries (e.g., vehicle collisions), and workplace accidents that could occur during preconstruction, construction, operation, and decommissioning.

4.2 Potential Impacts of Preconstruction and the Proposed Action

As described in Section 2.1 of this EIS, the proposed action is the construction, operation, and decommissioning of the proposed EREF near Idaho Falls in Bonneville County, Idaho. Under the proposed action, the NRC would issue a license to AES in accordance with the requirements of 10 CFR Parts 70, 40, and 30 to possess and use source, byproduct, and special nuclear material.

As described in Sections 1.4.1 and 2.1.4.1, the NRC has granted an exemption (NRC, 2010a) for AES to conduct certain preconstruction (e.g., site preparation) activities prior to granting the license for the proposed EREF. The NRC staff concluded that the request by AES to perform these activities is authorized by law, will not endanger life or property or common defense and security, and is in the public interest. No core production facilities would be constructed as part of the preconstruction activities. Because preconstruction and construction activities are closely related and their respective impacts are difficult to separate, Section 4.2 discusses the impacts of preconstruction and construction together for each resource area, in addition to the impacts of operation and decommissioning, although preconstruction activities are not part of the proposed action. Section 4.2.14 provides a summary of estimates regarding the apportionment of impacts between preconstruction (authorized under the exemption) and construction as defined by NRC (NRC, 2009a).

The potential environmental impacts are evaluated below for each of the potentially affected environmental resources. Sections 4.2.1 through 4.2.13 discuss impacts of preconstruction, construction, and operation. Section 4.2.14 discusses the relative contributions of preconstruction and construction activities to the impacts assessed in each environmentally affected area. Potential accident impacts are covered in Section 4.2.15. Section 4.2.16 discusses the decontamination and decommissioning impacts. Section 4.2.17 discusses the impacts of carbon dioxide and greenhouse gases. Potential terrorist activities are considered in Section 4.2.18.

4.2.1 Land Use Impacts

This section describes the potential impacts on land use during preconstruction, construction, and operation of the proposed EREF. Construction of a uranium enrichment facility such as the proposed EREF would alter the current land use, which consists primarily of agricultural and undeveloped rangeland. Land use impacts would result when project activities restrict future land use activities from occurring on or near the proposed facility or when the land use for the proposed project is not compatible with local, State, or Federal land use plans. Land use impacts could also occur if the activity restricts current or planned mineral resources exploitation. The proposed 240-hectare (592-acre) EREF site would be located entirely on private land. Proposed land uses on the property must comply with the zoning requirements of Bonneville County; and the county has zoned the location as G-1 Grazing, which allows for industrial development. This zoning is intended to allow certain activities that should be removed from population centers in the county (Serr, 2009). The operation of a uranium enrichment facility is consistent with the county's zoning. It is not anticipated that the proposed EREF preconstruction, construction, and operation would have any effect on the current land uses found on the surrounding Federal lands administered by the U.S. Bureau of Land Management (BLM) (Ennes, 2010). Land use impacts resulting from preconstruction, construction, and operation would be SMALL.

4.2.1.1 Preconstruction and Construction

Preconstruction and facility construction would result in the alteration of 240 hectares (592 acres) of land. Access to the 1700-hectare (4200-acre) property to be purchased by AES would be restricted beginning with preconstruction activities. It is probable that once preconstruction begins, all agricultural use on the proposed EREF property, including grazing and cultivation, would cease. However, similar land uses on surrounding lands would continue. As mentioned in Chapter 3, about 202 hectares (500 acres) on the proposed property are under cultivation. This area would no longer be used for agriculture, but this impact is not considered major due to the approximately 81,747 hectares (202,000 acres) of cultivated cropland found in Bonneville County (USGS, 2009). No other land uses could occur on the proposed property once preconstruction begins, other than those associated with the proposed EREF.

There is a potential for ongoing agricultural activities in surrounding areas to be temporarily affected by fugitive dust generated during preconstruction and construction. These offsite land use impacts could be lessened through the application of measures for fugitive dust control, which are discussed in Section 4.2.4.3. There is also the potential for preconstruction and construction activities to drive away some game species due to the increased activity on the proposed EREF site. This could affect successful hunting on surrounding lands because the preconstruction and construction activities would temporarily disturb game species such as pronghorn antelope, mule deer, and elk. However, these impacts on surrounding agriculture and local game would be temporary and would be SMALL.

The impacts of alteration of current land uses and the potential for temporary offsite land use impacts to agriculture and hunting resulting from preconstruction and construction would be SMALL. The alteration of land use would begin with preconstruction of the proposed EREF, and would continue through completion of construction. The majority (about 90 percent) of impacts to land use would occur during preconstruction when most of the land disturbance would occur.

4.2.1.2 Facility Operation

Operation of the proposed EREF would restrict land use on the proposed EREF property to the production of enriched uranium (AES, 2010a). The 1700-hectare (4200-acre) property would no longer be open to grazing and cultivation and would remain vacant (AES, 2010a). Operation of the proposed EREF is not expected to affect land use on adjacent public lands (Reynolds, 2010). Land use impacts from operation would be SMALL.

4.2.1.3 Mitigation Measures

Mitigation measures would be employed to minimize any potential impacts on offsite land use from erosion or fugitive dust. The following best management practices (BMPs), which have been identified by AES, would mitigate short-term increases in soil erosion or fugitive dust (additional discussion is provided in Section 4.2.5.3, Geology and Soils) (AES, 2010a):

- minimize the construction footprint to the extent practicable

- limit site slopes to a horizontal-vertical ratio of four to one, or less

- use a sedimentation detention basin

- protect undisturbed areas with silt fencing and straw bales, as appropriate

- use site stabilization practices such as placing crushed stone on disturbed soil in areas of concentrated runoff

- water onsite construction roads at least twice daily, when needed, to control fugitive dust emissions and, after construction is complete, stabilize the site with natural low-water-consumption, low-maintenance landscaping and pavement

4.2.2 Historic and Cultural Resources Impacts

This section describes the potential environmental impacts on historic and cultural resources resulting from preconstruction, construction, and operation of the proposed EREF. Historic and cultural resources include archaeological sites, historic structures, and places of cultural importance to groups for maintaining their heritage. Cultural resources are nonrenewable; that is, once altered, the information contained in cultural resources cannot be recovered. Impacts to cultural resources at the proposed EREF site would occur primarily during initial ground-disturbing activities. Some cultural resources could also be impacted by visual intrusions, in which case they are expected to occur primarily during construction and operation, as these are the actions that would most significantly affect the visual landscape through increased traffic and construction activities and the presence of an industrial complex. Impacts on historical and cultural resources from preconstruction, construction, and operation of the proposed EREF would range from SMALL to LARGE, although with the appropriate mitigation discussed below, the impacts would range from SMALL to MODERATE.

The *National Historic Preservation Act of 1966*, as amended (NHPA), requires that all adverse effects to *National Register of Historic Places* (NRHP)-eligible historic and cultural resources be considered during Federal undertakings, such as the NRC licensing activity for the proposed EREF. A resource is considered eligible for listing on the NRHP by meeting at least one of the following four criteria (36 CFR 60.4): (1) association with an historic person, (2) association with an historic event, (3) representation of the work of a master, or (4) potential to provide information on the history or prehistory of the United States.

Section 106 of the NHPA identifies the process for considering whether a project would affect significant cultural resources. The Area of Potential Effect for the Section 106 review for the proposed EREF project is the 240 hectares (592 acres) that would be directly affected by preconstruction and construction of the proposed EREF. The Section 106 process requires consultation between the lead Federal agency and the State Historic Preservation Office (SHPO), which is the custodian of information on cultural resources for the State. The Section 106 process also requires that Federally recognized Native American groups who have ancestral interest in the property should be consulted to determine if resources important to the tribe are present (36 CFR 800.2(4)(c)(ii)). For the proposed EREF project, Section 106 consultations are currently in progress between NRC and the Idaho SHPO and between the NRC and the Shoshone-Bannock Tribes. The NRC has contacted the Idaho SHPO and the Shoshone-Bannock Tribes concerning the presence of historic and cultural resources in the areas of the proposed EREF site and of the route of the proposed electrical transmission line needed to power the proposed EREF (see Section 1.5.6.2 and Appendix B).

4.2.2.1 Preconstruction and Construction

The greatest potential for impacts on historic and cultural resources would occur during ground disturbance during preconstruction. No additional significant impacts on historic and cultural resources are anticipated during facility construction because nearly all of the ground-disturbing activities would have already occurred during preconstruction. The proposed 240-hectare (592-acre) EREF site area has been surveyed for the presence of historic and cultural resources. The surveys were documented in two reports that were provided to, and reviewed by, the Idaho SHPO (Ringhoff et al., 2008; Estes and Raley, 2009). They identified site MW004, the John Leopard Homestead, and indicated that this site may be eligible for nomination to the NRHP. The site, which is described in Section 3.3.4 of this EIS, is important for the information it could provide on the homesteading activities in the area.

The SHPO concurred with the evaluations and recommendations in the two survey reports and agreed that site MW004 is the only one of the 13 sites located in the proposed EREF site eligible for listing on the NRHP (Idaho SHPO, 2009). During scoping and in its comments on the Draft EIS, the Shoshone-Bannock Tribes indicated that it would like to be part of the cultural resource surveys of the proposed EREF site area (Shoshone-Bannock, 2009). The tribes issued no response to requests for information relevant to the cultural resources aspect of the proposed project during the consultation under Section 106 of the NHPA (see Appendix B, Section B.2).

Site MW004 would be directly impacted by preconstruction activities at the proposed EREF site. Preconstruction activities would completely destroy this site because it would be under the footprint of the security fence and a proposed electrical substation for a proposed transmission line that would bring power to the proposed EREF. Therefore, AES prepared a treatment plan that detailed how it would mitigate site MW004 by professional excavation and data recovery prior to disturbing site MW004 during preconstruction activities (AES, 2010e). This treatment plan was provided to the Idaho SHPO for review, and the SHPO indicated its support for the proposed treatment of site MW004 (Idaho SHPO, 2010a).

During preconstruction and construction activities, there is the possibility for unexpected discoveries of archaeological or human remains. Therefore, AES also commissioned the development of the *Archaeological Monitoring and Discovery Plan for the EREF, AES, in Bonneville County, Idaho* (Stoner et al., 2009), which specifies procedures for addressing and handling the unexpected discovery of human remains or archaeological material at the proposed EREF. This plan has also been provided to the Idaho SHPO.

In a letter to the Idaho SHPO dated November 17, 2010, AES's archaeological consultant, Western Cultural Resource Management, Inc. (WCRM), provided a summary of its activities during the professional excavation of, and data recovery at, site MW004, which was conducted from October 5 to November 8, 2010 (WCRM, 2010). This mitigation serves to reduce the impact of the proposed EREF project on site MW004; however, the destruction of the site through formal professional excavation still is considered an adverse effect because the site no longer exists. In a letter dated November 26, 2010, the SHPO indicated that it had received and accepted the data recovery report (Idaho SHPO, 2010b). However, AES must receive a notice-to-proceed from the SHPO before initiating preconstruction activities in the area of site MW004. WCRM is preparing a report detailing the results of the excavations and an analysis of the information collected from the mitigation efforts (WCRM, 2010).

Preconstruction and construction are not expected to impact the Wasden Complex (see Section 3.3.4 for a description of the Wasden Complex). The site is distant enough from the proposed EREF property that no effects from these activities are anticipated. Visual or noise impacts are possible, but the distance makes it unlikely that the Wasden Complex would be affected.

Consultation among the NRC, the SHPO, the Shoshone-Bannock Tribes, and AES is ongoing. The NRC is developing a Memorandum of Agreement (MOA) with these parties. It is planned that the NRC, the SHPO, and AES will be signatories of the MOA. In addition, the Shoshone-Bannock Tribes has accepted the NRC's invitation to be a concurring party on the MOA (see Appendix B, Section B.2). The draft MOA addresses the completed mitigation of site MW004, the completed X-ray fluorescence analysis of obsidian artifacts found at the proposed EREF site (Idaho SHPO, 2010a), and the survey by AES for historical and cultural resources of any previously un-surveyed areas that may be identified following final design. Also, the draft MOA references AES's unanticipated discoveries and monitoring plan (Stoner et al., 2009).

The NRC staff initially considered that impacts on historic and cultural resources would be LARGE due to the destruction of site MW004 to accommodate preconstruction of the proposed EREF. However, since site MW004 was professionally excavated prior to ground disturbance in the area of this site, and because other examples of this particular homestead site type are found in the region (Gilbert, 2010), the impacts have been reduced to MODERATE. Impacts to other historic and cultural resources would be SMALL. The majority of impacts to historic and cultural resources would occur during preconstruction when most of the ground disturbances would occur; therefore, an estimated 90 percent of the impacts would be associated with preconstruction and only 10 percent with construction.

4.2.2.2 Facility Operation

No ground-disturbing activities are expected during operation of the proposed EREF. As a result, there is no potential for impacts on historic and cultural resources during operation. Operation is not expected to have any impact on the Wasden Complex because of its distance from the proposed EREF site. The greatest threat to the proposed site is unlawful collection of artifacts at the site by site workers; however, educating workers should minimize any effects. Therefore, impacts from operation would be SMALL.

4.2.2.3 Mitigation Measures

As discussed earlier, site MW004 was professionally excavated (with data recovery) by AES in accordance with a treatment plan supported by the SHPO (Idaho SHPO, 2010a). The Idaho SHPO received a summary of the data recovery efforts (WCRM, 2010) undertaken as mitigation (Idaho SHPO, 2010b). A report documenting the information discovered during the excavation, and an analysis of that information is being developed (WCRM, 2010). Any additional mitigation measures for historic and cultural resources, if needed, would be implemented through the *Archaeological Monitoring and Discovery Plan for the EREF, AES, in Bonneville County, Idaho* (Stoner et al., 2009) and the MOA that is being developed. The cultural resource mitigation measures identified by AES are listed below:

- educate workers on the regulations governing cultural resources stressing that unauthorized collecting is prohibited.

- use of onsite cultural resource monitors during construction activities

- procedures to address unexpected discoveries of human remains or previously unidentified archaeological materials during ground-disturbing activities and procedures for the evaluation and treatment of these resources

- cessation of construction activities in the area around any discovery of human remains or other item of archaeological significance and notification of the State Historic Preservation

Officer to make the determination of appropriate measures to identify, evaluate, and treat the discoveries

- treatment/mitigation plan for site MW004 (recommended eligible for inclusion in the NRHP) to recover significant information on that site (professional excavation and data recovery have been conducted)

4.2.3 Visual and Scenic Impacts

This section discusses the potential visual and scenic impacts that could result from preconstruction, construction, and operation of the proposed EREF. Visual impacts result when contrasts are introduced into a visual landscape. The current visual setting of the proposed EREF site is cultivated and undeveloped rangeland. The greatest potential for visual impacts would be expected from operation of the proposed EREF, as this would represent a long-term alteration of the existing landscape. Impacts on visual and scenic resources from preconstruction, construction, and operation of the proposed EREF would range from SMALL to MODERATE.

Visual impacts are often difficult to characterize due to the subjective nature of what is a concern visually. Opinions can vary widely on what is visually acceptable and whether it can enhance or detract from a visual setting. The BLM has developed an effective Visual Resource Management (VRM) System (BLM, 2007). This system relies on two main components: visual resource inventories (VRIs) and visual resource management. VRIs consider the base line visual characteristics of a location. VRM is a management decision by the BLM to either preserve a visual setting or to focus on resources other than visual resource considerations for a location. A more detailed discussion of this process is provided in Section 3.2. The visual resource impact discussion that follows relies on the terminology and concepts from the BLM VRM System.

BLM manages the visual resources on BLM lands in the area surrounding the proposed EREF, as illustrated in Figure 4-1 and described below. BLM has designated the public lands that immediately surround the proposed EREF property as VRM Class II. This designation reflects BLM's determination that the lands have scenic quality and that BLM will manage the lands to maintain the current visual character. Most of the BLM land south of US 20 (e.g., Hell's Half Acre WSA) is designated by BLM as VRM Class I. VRM I areas are managed to preserve the visual character with no new visual intrusions permitted. Also, in this region, some of the land that immediately borders US 20 is managed by BLM. The land along the highway is designated as VRM III. In VRM III areas, BLM is not trying to preserve the current visual setting.

4.2.3.1 Preconstruction and Construction

Preconstruction activities would be concentrated in the proposed EREF site area. Visual impacts could result along US 20 from the increased activity at the proposed site. Fugitive dust from preconstruction activities could also create visual impacts along US 20. These impacts would be of relatively short duration, with all activities occurring during daylight hours. The clearing of vegetation and installation of a perimeter fence would change the visual setting; however, they would not significantly alter the overall appearance of the area. The vehicular traffic associated with preconstruction would not be a permanent feature of the proposed project. The Wasden Complex a significant archaeological site located 1.6 km (1 mile) from the

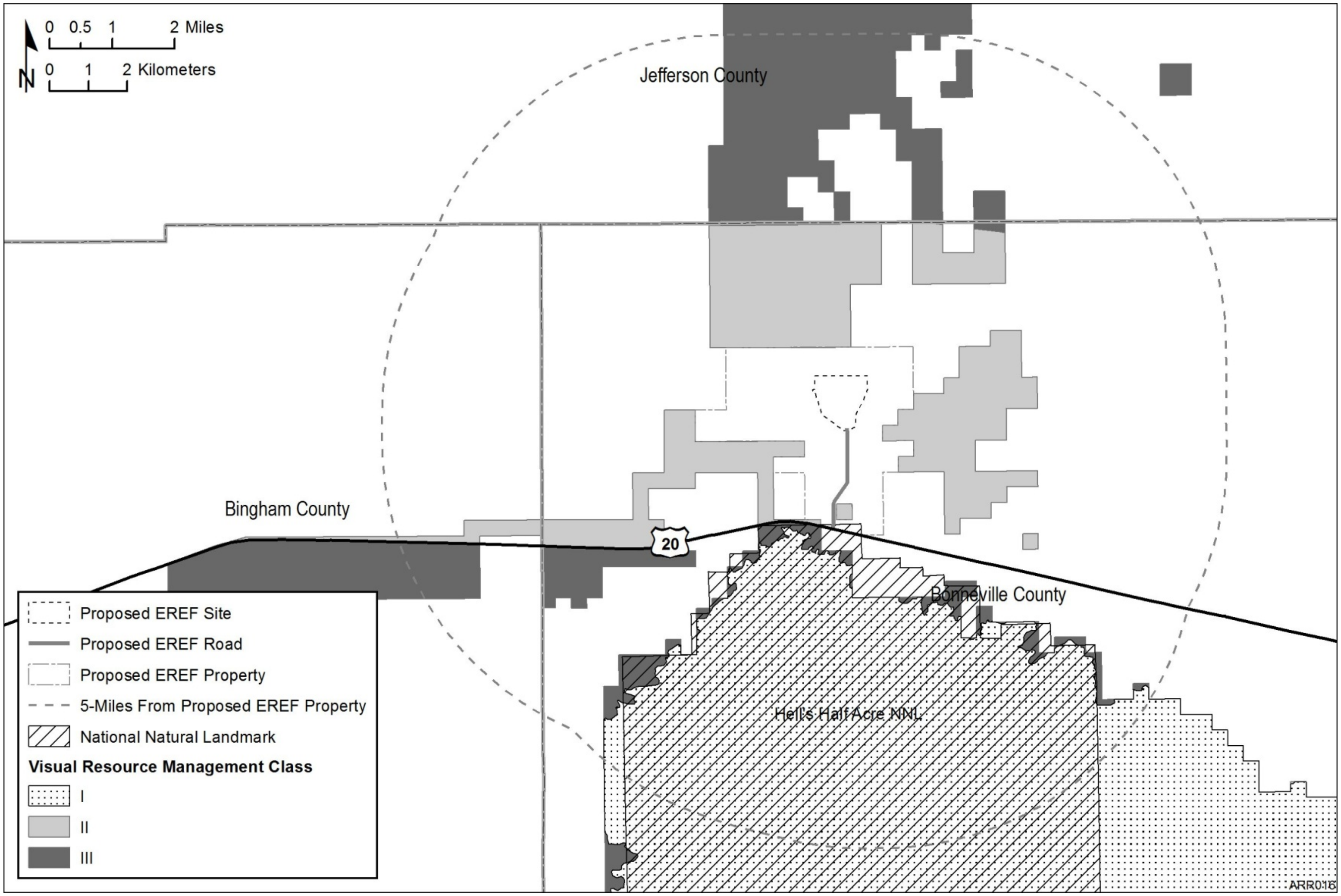

Figure 4-1 VRM Classes in the Area Surrounding the Proposed EREF Site

EREF site could also be impacted visually by preconstruction and construction (see Section 3.3.4 for a description of the Wasden Complex). An intervening ridgeline, would largely shield these activities from the site. Visual impacts associated with preconstruction would be SMALL.

Facility construction activities would involve erecting permanent buildings. The impact of such permanent structures is discussed in the following section on facility operation. The current visual landscape does not include any industrial structures of the types proposed for the proposed EREF. Industrial buildings are present at the Idaho National Laboratory (INL), but are not visible from the proposed EREF site. Facility construction activities would begin to introduce visual intrusions that are out of character with the surrounding region. The vehicular traffic associated with construction would not be a permanent feature of the plant. These activities would have an effect on the visual landscape; however, much of the activity associated with construction would end once construction was complete. Construction activities would not be expected to affect the Wasden site because the activities would be screened by an intervening ridgeline. Construction of the proposed facility may negatively affect the visual setting as perceived by visitors to Hell's Half Acre WSA. Construction activities would be partially visible from portions of Hell's Half Acre WSA. However, the security lighting required at the facility would result in the greatest impact due to it being visible to night users of Hell's Half Acre WSA (e.g., campers).

Visual impact levels associated with construction would range from SMALL to MODERATE. The majority of the impacts on visual and scenic resources would occur during construction (80 percent) when the taller built features are constructed; impacts associated with preconstruction are largely the result of increased activity (20 percent).

4.2.3.2 Facility Operation

The operation of the proposed EREF would have an effect on the overall visual setting of the area. The operation of a uranium enrichment facility would represent a significant visual departure from the existing visual setting. No developments of the type being proposed are currently visible near the proposed EREF site. The operation of the proposed facility would, using the BLM VRM System, be expected to lower the VRI value for the area of the proposed project. Based on the BLM VRI process, the visual landscape would be affected due to (1) sensitivity of the location for visual intrusions, (2) scenic qualities of the location, and (3) distances from which the location would be viewed (see Section 3.4 for a discussion of the VRI process). The area of the proposed project is presumed to have high sensitivity for recreational users, but lower sensitivity to the INL employees and farmers who use US 20. The scenic quality of the area is low, and the main viewing distance is roughly 2.4 kilometers (1.5 miles) away on US 20, which puts the proposed EREF site at a distance where intrusions are visible. Based on the BLM system, the impact level for operation of the plant is linked to its effect on the VRI class. BLM has indicated that the plant would reduce the relative visual value of the area (Boggs, 2010).

The Wasden Complex could be visually affected by the operation of the EREF. Due to an intervening ridgeline, only the top portions of the buildings would be visible from the Wasden Complex. Because only a portion of the complex would be visible, the operation of the EREF is not expected to visually affect the Wasden Complex.

Another factor to be considered in assessing the visual effect of operating a plant of this sort is the introduction of light pollution at night. Lights are perceivable over great distances in open environments like the vicinity of the proposed EREF site. The most sensitive locations where lights from the proposed EREF could be perceivable are at the trailhead for Hell's Half Acre Wilderness Study Area (WSA) located less than 3.5 kilometers (2 miles) south of the proposed EREF and from Craters of the Moon National Park located 72 kilometers (45 miles) to the west (NPS, 2009). The perimeter lighting for the plant would be plainly visible to campers at the Hell's Half Acre Twenty Mile Lava Trail trailhead where camping is permitted. Data is available from the National Park Service (NPS) for perception of the light dome from Craters of the Moon National Park (NPS, 2010). The NPS data show that the light from Idaho Falls is visible from the park. While the proposed EREF site is 20 miles closer to the park, it is a significantly smaller light source, and therefore is not expected to generate sufficient light that it would be perceivable from Craters of the Moon National Park.

The majority of those who would see the new plant are workers at INL who are not using the area for its visual qualities. The INL workers are the main group of commuters on US 20. Operation of the proposed facility may negatively affect the visual setting as perceived by visitors to Hell's Half Acre WSA. Operation would reduce the quality of the recreational experience for campers at the Hell's Half Acre trailhead for the duration of the proposed license. Additionally, operation would have an adverse impact on wilderness values at the Hell's Half Acre WSA because opportunities for solitude would be reduced due to the facility being within sight of user portions of the WSA. The impact would be greatest at night when artificial light is in use. Based on the NRC staff's review, the impact of operation of the proposed EREF on visual resources in the area of the proposed project would be MODERATE.

4.2.3.3 Mitigation Measures

Several mitigation measures have been identified by AES to reduce the effect of the proposed project on visual and scenic resources (AES, 2010a). They include the use of accepted natural low-water-consumption landscaping techniques using native landscape plantings on bare areas on the perimeter of the proposed EREF to limit any potential visual impacts, and the use of crushed stone in areas where planting is not viable. Revegetation would occur as quickly as possible during construction. Painting the proposed facility in colors that would blend with the surrounding vegetation could also reduce the contrast between the proposed EREF plant and the surrounding landscape. Creation of earthen berms or other types of visual screens made of other natural material would also help reduce the visibility of the proposed facility. To minimize light pollution, all perimeter lights would be downfacing (AES, 2010a).

4.2.4 Air Quality Impacts

Air quality impacts from the operation of construction equipment during preconstruction and facility construction were evaluated based on the construction schedules and parameters provided by AES (AES, 2010a). U.S. Environmental Protection Agency (EPA)-approved algorithms were applied to estimate emissions, and EPA-approved dispersion models were used to estimate ambient air concentrations of criteria pollutants at the proposed EREF property boundary under expected meteorological conditions. The impacts of travel to and from the EREF property by the construction workforce as well as truck deliveries of equipment and materials to the proposed EREF site were included in the evaluation. Air quality impacts during operation of the proposed EREF from the anticipated release of certain chemicals, the periodic operation of certain pieces of equipment such as emergency generators, and the potential release of uranium hexafluoride (UF_6) from the Cascade Halls were also evaluated. The NRC staff concludes that impacts on ambient air quality from preconstruction and construction would be SMALL for all hazardous air pollutants (HAPs) and all criteria pollutants except particulates, but may be MODERATE to LARGE for particulates during certain preconstruction periods and activities, despite application of mitigation measures. However, such impacts are expected to be the result of fugitive dust generation and to occur only when fugitive dust-generating activities are actually occurring. The NRC staff further concludes that impacts on ambient air quality from the routine operation of the proposed EREF would be SMALL with respect to all criteria pollutants and all HAPs.

4.2.4.1 Preconstruction and Construction

The NRC staff anticipates that air quality impacts may occur as a result of preconstruction and construction. Criteria pollutants would be generated as a result of the onsite operation of construction vehicles and equipment burning fossil fuels in internal combustion engines and from the operation of delivery vehicles and workforce transport vehicles traveling to and from the site. Lesser amounts of criteria pollutants may be released from the operation of heating systems using external combustion sources such as boilers or furnaces. Releases of volatile organic compounds (VOCs) (nonmethane hydrocarbons) may result from many onsite activities, including the onsite storage and/or dispensing of vehicle and equipment fuels, the use of cleaning solvents, and the applications of paints and corrosion-control coatings. Lesser amounts of VOCs may be released from the storage and use of fossil fuels for comfort heating and from the use of various industrial gases for welding, brazing, and other construction-related activities. Fugitive dust may result from the disturbance of the ground surface during cut-and-fill activities, excavations for foundations and footings, burial of utilities, construction of onsite roads, operation of an onsite concrete batch plant (including delivery, storage, and handling of sand, aggregate, and cement), and travel of construction vehicles on bare ground or on unpaved onsite roads. Lesser amounts of fugitive dust may result from wind erosion of bare ground.

Amounts of pollutants generated and released as a result of the above-noted activities would be functions of the scope and duration of each activity, circumstantial factors such as soil types, extant pollution-control devices, prevailing meteorological conditions, and mitigations resulting from the application of BMPs and appropriate controls. Although AES has not yet developed and submitted a detailed construction plan and schedule, sufficient details have been provided to derive a reasonable approximation of the air quality impacts that may result from preconstruction and construction. A similar array of assumptions and air impact-related parameters was developed by AES and provided in the EREF Environmental Report (ER) (AES, 2010a) and in supplementary information (AES, 2009b).

The NRC staff evaluated the assumptions and tentative schedules used by AES in estimating construction-related air impacts and, with exceptions noted below, found them to be reasonable, generally conservative, and appropriate representations of expected activities necessary and sufficient to support construction-related air impact analyses. Relevant parameters for construction activities proposed by AES are also consistent with industrial construction activities representative of EREF preconstruction and construction. Consequently, with the exception of expected reductions in fugitive dust from mitigation efforts (see below), AES's proposed construction-related parameters and schedules were used to form the basis for an assessment of air quality impacts.

The air emission model MOBILE 6.2, published by EPA (EPA, 2003), was used to estimate unit emissions of criteria pollutants from vehicles and equipment using fossil fuels in internal combustion engines (both compression-ignition [diesel] and spark-ignition engines). The NRC staff determined that the complement of construction support vehicles and construction vehicles and equipment proposed by AES was reasonable for the construction tasks at hand. Consequently, the number and type of vehicles proposed by AES were used to define the MOBILE 6.2 modeling inputs. Results for unit emission rates and daily emissions from construction support vehicles and construction vehicles and equipment as calculated by the NRC are displayed in Tables 4-1 and 4-2, respectively.

Supplemental information submitted by AES provide details of the onsite vehicle fuel storage and dispensing activities that would be occurring onsite during preconstruction and construction (AES, 2009b). Gasoline and diesel fuel would each be stored onsite in 2000-gallon aboveground steel tanks, each enclosed in reinforced concrete and each equipped with a 5-gallon overfill protection feature. Estimated throughputs during construction include 1325 liters (350 gallons) of gasoline per week and 37,854 liters (10,000 gallons) of diesel fuel per week. Assuming that design features that control releases of nonmethane VOCs are functional and BMPs are employed in the storage and dispensing of fuels (see Section 4.2.4.3), algorithms published in EPA AP-42, Fifth Edition, Volume 1, Chapter 7.1 (EPA, 2006a), and the EPA TANKS computer program (Version 4.09) (EPA, 2006b) predict VOC losses of 312 kilograms (688 pounds) per year during construction. Because each of the tanks has a

Table 4-1 NRC's Estimated Emissions of Criteria Pollutants from Construction Support Vehicles

Vehicle Type	Emission Factor g/km (g/mi)	Number in Operation[a]	Daily Estimated Mileage km (mi)[a]	Daily Emissions g (lb)	Workday Emission Rate g/s (lb/hr)
Carbon monoxide					
Light-duty vehicle	13.31 (21.41)	40	16.1 (10)	8572 (18.90)	0.238 (1.890)
Light-duty truck I	15.55 (25.03)	53	16.1 (10)	13,269 (29.25)	0.369 (2.925)
Light-duty truck II	15.60 (25.10)	4	16.1 (10)	1005 (2.22)	0.028 (0.222)
Heavy-duty truck	2.80 (4.50)	3	16.1 (10)	135 (0.30)	0.004 (0.030)
Totals				22,981 (50.67)	0.638 (5.066)
Nitrogen oxides					
Light-duty vehicle	0.66 (1.07)	50	16.1 (10)	425 (0.94)	0.018 (0.143)
Light-duty truck I	0.69 (1.12)	53	16.1 (10)	589 (1.30)	0.016 (0.130)
Light-duty truck II	0.88 (1.42)	4	16.1 (10)	57 (0.13)	0.002 (0.013)
Heavy-duty truck	5.82 (9.37)	3	16.1 (10)	2.81 (0.62)	0.094 (0.744)
Totals				1352 (2.99)	0.130 (1.029)

[a] Source: AES, 2010a.

Table 4-2 NRC's Estimated Emissions of Criteria Pollutants from Construction Vehicles and Equipment[a,b]

Equipment	Number	Workday Emission Rate in g/s (lb/hr)			
		Carbon Monoxide	Nitrogen Oxides	Sulfur Oxides	Particulates[c]
Wheeled tractor	1	0.006 (0.044)	0.015 (0.116)	0.001 (0.007)	0.001 (0.001)
Grader	4	0.021 (0.170)	0.057 (0.450)	0.004 (0.028)	0.001 (0.004)
Pans	5	0.023 (0.185)	0.058 (0.462)	0.004 (0.028)	0.001 (0.005)
Wheeled loader	8	0.440 (0.350)	0.117 (0.932)	0.007 (0.057)	0.001 (0.008)
Bulldozer	5	0.080 (0.633)	0.048 (0.380)	0.007 (0.056)	0.002 (0.015)
Dump truck	20	0.319 (2.531)	0.191 (1.519)	0.028 (0.225)	0,008 (0.060)
Roller	6	0.005 (0.041)	0.151 (1.197)	0.007 (0.056)	0.002 (0.013)
Water truck	4	0.022 (0.175)	0.059 (0.466)	0.004 (0.028)	0.001 (0.004)
Backhoe	9	0.036 (0.289)	0.094 (0.749)	0.006 (0.049)	0.001 (0.010)
25-ton crane	3	0.037 (0.295)	0.095 (0.757)	0.004 (0.032)	0.001 (0.008)
>25-ton crane	4	0.064 (0.506)	0.038 (0.304)	0.006 (0.045)	0.002 (0.012)
Manlift	16	1.119 (8.877)	0.061 (0.487)	0.002 (0.016)	0.002 (0.001)
Telehandler	5	0.350 (2.774)	0.019 (0.152)	0.001 (0.005)	0.001 (0.004)
Concrete truck	9	0.145 (1.139)	0.086 (0.684)	0.013 (0.101)	0.003 (0.027)
Concrete pumper truck	3	0.016 (0.128)	0.043 (0.388)	0.003 (0.021)	0.001 (0.003)
Miscellaneous	9	0.629 (4.994)	0.035 (0.274)	0.001 (0.001)	0.001 (0.001)
Total	111	2.914 (23.129)	1.167 (9.263)	0.097 (0.766)	0.022 (0.173)

[a] Data displayed are the result of the application of MOBILE 6.2 to EREF construction period parameters.
[b] Some rounding errors exist.
[c] Does not include particulates released as fugitive dust.

capacity of less than 37,854 liters (10,000 gallons), dispenses fuels with vapor pressures less than 80 mm of Hg @ 21°C, and is equipped with appropriate VOC controls, Idaho regulations categorize the tanks as insignificant sources (see IDAPA 58.01.01 Part 317.01(b)(i)(3)). The NRC staff concludes that VOC releases associated with the onsite storage and dispensation of vehicle fuels during preconstruction and construction would have a SMALL impact on air quality.

Fugitive dust from a variety of sources is a notable air impact from construction. Specific emission factors have been established for fugitive dust resulting primarily from vehicle travel on unpaved onsite roads (EPA, 2006c), cut-and-fill operations, aggregate handling and storage piles (EPA, 2006d), and other activities typically associated with heavy construction (EPA, 1995). EPA has also adopted guidance on adjusting emission factors to reflect local conditions in order to estimate PM_{10} (particulate matter ≤10 micrometers in aerodynamic diameter) and $PM_{2.5}$ (particulate matter ≤2.5 micrometers in aerodynamic diameter) fractions of fugitive dust generated (MRI, 2006). Particle size distribution of fugitive dust depends on a number of factors, particularly the silt and moisture contents of the impacted soils. Although the proposed EREF site is characterized broadly as a semiarid environment where soils typically have low silt content, available information indicates silt content of soils on the site to be as high as 70 percent (NRCS, 2009). Correction factors published by EPA that allow estimation of PM_{10} and $PM_{2.5}$ fractions of total suspended particulates (generally accepted to be represented as PM_{30}, which is particulate matter ≤30 micrometers in aerodynamic diameter) were derived from analyses of the behavior of soils with silt content no higher than 30 percent. For such soils, EPA guidance suggests that the modeled value of pounds of particulate per vehicle miles traveled (VMT) be multiplied by correction factors of 0.306 and 0.0306 to estimate PM_{10} and $PM_{2.5}$ fractions, respectively (MRI, 2006). However, EPA has not published correction factors for soils with exceptionally high silt content such as those present at the proposed EREF property; consequently, no additional corrections beyond those noted above are introduced in estimating PM_{10} and $PM_{2.5}$ fractions for indigenous soils at the proposed EREF site. To estimate fugitive dust generation, the NRC assumed an average rate of fugitive dust emissions of 1.2 tons per acre per month and an average daily disturbed acreage (i.e., active construction zone as indicated by AES) to be 89.4 hectares (221 acres). Without the introduction of any mitigative controls, this would result in estimated uncontrolled releases of PM_{10} at a rate of 97.3 grams per second (773.2 pounds per hour) and $PM_{2.5}$ of 9.7 grams per second (77.3 pounds per hour) over the construction hours of operation (10 hours per day for 21 days per month).

As noted above, the moisture content of the soils on unpaved roads plays a significant role in the rate of fugitive dust generation. AES has committed to a mitigative strategy that involves watering onsite roads at least twice a day. AES estimates that such a watering schedule would result in a 90 percent reduction in fugitive dust generated. However, EPA estimates that achieving a 90 percent reduction in fugitive dust would require maintaining the soil moisture content ratio, M,[1] well over 4.0 (see Figure 13.2.2-2 of EPA, 2006c). Given the high silt content of the soils, moisture levels that high could be expected to cause the roads to become safety hazards and even impassable in some cases. Instead, it is more reasonable to expect that a watering strategy that maintains a value for M of approximately 2.0 would be an appropriate compromise between mitigating fugitive dust to the greatest extent practical and avoiding hazardous road conditions. At an M value of approximately 2.0, a fugitive dust reduction of 75 percent would be anticipated. However, this analysis does not preclude additional mitigative measures such as use of alternative dust control techniques in addition to watering that would effect a greater reduction in fugitive dust without compromising safety. Additional mitigation options that could contribute to further reductions in fugitive dust generation are discussed in Section 4.2.4.3. A 75 percent reduction in uncontrolled fugitive dust results in controlled fugitive dust releases of PM_{10} at a rate of 24.3 grams per second (193.3 pounds per hour) and $PM_{2.5}$ of 4.9 grams per second (38.7 pounds per hour).

The EREF development plan states that four 2500-watt diesel-fueled emergency generators and two smaller diesel-fueled generators not related to construction but intended to support facility operation would become operational while the construction phase is still ongoing (AES, 2010a). Once installed, these generators would be enrolled in a preventative

[1] The moisture content ratio, M, is defined as the ratio of the moisture content of a watered roadway to that of an unwatered roadway (i.e., the roadway in a representative natural condition). It essentially represents the percentage of soil pore spaces that are filled with water.

maintenance protocol that requires their operation for an average of 1.6 hours per week, 52 weeks per year. Therefore, these generators would release criteria pollutants during both the construction and operation phases. However, none of the generators is expected to be used to provide power to support construction-related activities. To ensure the estimated impacts are conservative, emission calculations presume all six generators have nameplate ratings of 2500 watts. The generators would be exempt from permit requirements under a Category II Exemption as provided for in Section 222(01)(d) of Idaho air pollution rules (IAC, 2010). The generators would burn ultra-low-sulfur diesel fuel, the only diesel fuel expected to be available in the area through commercial vendors. Using the preventative maintenance schedule suggested by the equipment manufacturer and applying appropriate EPA-published algorithms reflective of the above assumptions, the estimated air quality impacts of the generators include: the generation of 61 kilograms per year (0.067 tons per year) of PM_{10}, 8437 kilograms per year (9.3 tons per year) of nitrogen oxides (NO_x), 726 kilograms per year (0.080 ton per year) of carbon monoxide (CO), and 168 kilograms per year (0.185 ton per year) of nonmethane VOCs (AES, 2010a). Annual impacts of the above magnitude would continue throughout the operating phase of the proposed EREF and may increase if any of the generators are called into service to provide emergency power.

On June 17, 2009, AES submitted a request to the NRC for an exemption from 10 CFR requirements governing commencement of certain preconstruction activities. As granted by the NRC (NRC, 2010a), the exemption allows AES to undertake certain preconstruction activities prior to NRC completing its environmental review and issuing a materials license for the EREF. Activities covered under the exemption include preconstruction actions such as clearing the site; site grading and erosion control; excavating the site (including rock blasting and removal, if required); installing parking areas, stormwater control features, and utilities; and constructing permanent highway access roads, onsite roads, buildings, offices, and other structures not subject to NRC licensing authority and not radiation safety-related.

Collectively, the identified preconstruction activities would constitute the majority of air quality impacts associated with preconstruction and construction. The construction activities that would remain to be addressed under the NRC license include construction of the Separation Building Modules (SBMs) and installation of centrifuges and their monitoring and emission-control systems. Because these remaining construction actions can be expected to occur on a relatively small disturbed land area and utilize a reduced construction workforce, and with the major pollutant-emitting activities being completed under the exemption, the NRC staff concludes that the identified preconstruction activities would constitute as much as 90 percent of the overall impacts expected from preconstruction and construction combined. Further, commencement of the identified preconstruction activities would coincide with cessation of agricultural activities on the site, thus eliminating the seasonal air quality impacts associated with the agricultural activities (e.g., fugitive dust from field cultivation and criteria pollutant releases from operating farm vehicles and equipment).

Average emissions of criteria pollutants and fugitive dust for a typical construction workday are shown in Table 4-3. The estimated emissions, adjusted for local conditions, and the relevant most recently available meteorological data from the National Weather Service (NWS) were used as inputs to the EPA-approved air dispersion model, AERMOD, to estimate air quality

Table 4-3 NRC's Estimated Daily Emissions during Preconstruction and Construction

Pollutant	Total Workday Average Emissions g/s (lb/hr)	Notes
Vehicle emissions		
Hydrocarbons	0.34 (2.67)	• Includes contributions from diesel emergency generators installed during construction and enrolled in a preventative maintenance program. • Particulates from vehicle exhaust are assumed to be $PM_{2.5}$.
Carbon monoxide	3.55 (28.19)	
Nitrogen oxides	1.30 (10.29)	
Sulfur oxides	0.10 (0.77)	
Particulates	0.02 (0.17)	
Fugitive dust		
PM_{10}	24.3 (193.1)	• Assumes a 75 percent reduction in fugitive dust from unpaved roads as a result of twice/day watering mitigations and maintenance of a moisture content ratio of 1.75. • Assumes an average daily disturbed acreage of 221 acres and a 10-hour workday for 21 days each month. • Assumes an uncontrolled fugitive dust emission rate of 1.2 tons/acre/month. • Assumes fine particle size ratios of 1.5/4.9 for PM_{10} and 0.15/4.9 for $PM_{2.5}$ with respect to PM_{30}.
$PM_{2.5}$	2.43 (19.3)	

impacts of the preconstruction and construction phases of the proposed EREF.[2] Local meteorological data from the NWS meteorological station located at the Idaho National Laboratory's Materials and Fuels Complex (identified in NWS databases as the MFC station) for the period calendar year (CY) 2005 through CY 2008 and upper-level data from the NWS Automated Surface Observing Systems station located at the Boise International Airport (the closest station to the proposed EREF at which upper-level data are recorded) collected over the same period were used as meteorological data inputs. Data from the Pocatello Municipal Airport NWS station over the same time frame were used to fill gaps in the MFC data, pursuant to the AERMOD model.

To determine whether the estimated emission levels would cause an exceedance of an ambient air quality standard, the modeled results were added to existing ambient air quality data representative of background conditions, and the sum was compared to the National Ambient Air Quality Standards (NAAQS) (see Table 3-12). The ambient air monitoring network in Idaho is maintained by the Idaho Department of Environmental Quality (IDEQ). Not all criteria pollutants are monitored at each authorized monitoring station, and there is no monitoring station close to the proposed EREF site. Therefore, the NRC staff selected the monitoring stations closest to the EREF site for each criteria pollutant. It is important to note that the

[2] Details of the model and the methodology for its application are presented in Appendix C. Additional descriptive information is available from the EPA Web site at http://www.epa.gov/scram001/dispersion_prefrec.htm#aermod.

closest monitoring station for particulates is in an urban setting in Pocatello. That monitoring location was determined to have a similar geographic setting to the proposed EREF site, and thus was expected to experience similar meteorological conditions over time, especially with respect to wind speeds and directions. However, because that monitoring station is in an urban setting, the potential sources of particulate emissions would be different from those expected from the proposed EREF's rural and agricultural setting, and the Pocatello particulate monitor may not capture seasonal peaks in airborne particulates associated with agricultural activities. Thus, the monitoring results from the Pocatello station may underrepresent background particulate values at the EREF site, which is surrounded by cultivated fields. However, since no monitoring data collected in an Idaho agricultural setting was available from which to assess the magnitude of the impact agricultural activities could have on particulate values, no attempt was made to introduce correction factors reflective of these acknowledged differences. Further, EPA guidance regarding the application of AERMOD does not require that quantitative corrections be made for unique circumstantial factors or events but does recommend consideration of such factors in interpreting modeling results (EPA, 2005a). The highest values for each criteria pollutant for calendar years 2006 and 2007 were identified, and the higher of the two values was selected as a conservative representation of the background concentration for each criteria pollutant at the proposed EREF site. Selected background ambient air quality data for the impact assessment are displayed in Table 4-4.

Results of AERMOD modeling are displayed in Table 4-5. The results suggest that over the preconstruction and construction phases, the NAAQS for both PM_{10} and $PM_{2.5}$ may be exceeded at the boundary of the proposed EREF property during certain meteorological conditions when actions to mitigate the release of fugitive dust from unpaved onsite roads are limited to twice-per-day watering to the extent necessary to effect a 75 percent reduction. Modeled results at the proposed EREF property boundary show 24-hour PM_{10} and $PM_{2.5}$ concentrations to be as high as 271.5 percent and 105.3 percent of their respective standards while all other NAAQS are satisfied. It must be noted, however, that meteorological data for the MCF station obtained from the NWS and used in the AERMOD model included wind speed data as low as 0.134 meter (5.3 inches) per second, reflecting the sensitivity of the wind speed monitoring instrument used at the NWS MCF weather station. Evaluation of the modeling data suggests that exceedance of the ambient air quality standard for particulates at the proposed EREF property boundary would occur primarily during periods of very low wind speed, as might typically occur during the early morning hours over the spring and summer seasons.

EPA recognizes that the manner in which AERMOD conceptualizes fugitive dust dispersion at low wind speeds and evaluates impacts from low-level (i.e., ground-level) sources introduces some bias that may result in overpredictions of near-field impacts during such conditions. Independent studies are ongoing designed to demonstrate the impacts of possible modeling bias (Paine and Connors, 2009). Nevertheless, the current EPA guidance does not provide the opportunity for corrections to reflect possible low wind speed bias, and actual observed wind speeds must be used as inputs to the model when they are available. While the modeled concentrations in Table 4-5 should be viewed as representative of preconstruction and construction impacts, some consideration of possible bias is appropriate. In order to evaluate

Table 4-4 Background Ambient Air Quality at Monitoring Stations Closest to the Proposed EREF Site

Pollutant	Averaging Period	Closest Monitoring Station	Station ID	Measured Ambient Background Concentrations 2006	Measured Ambient Background Concentrations 2007	Selected Background Concentration
Carbon monoxide	1-hour	Eastman Building 166 N. 9th Street Boise, ID	160010014	3.5 ppm	4.3 ppm	4.3 ppm
Carbon monoxide	8-hour	Eastman Building 166 N. 9th Street, Boise, ID	160010014	2.1 ppm	1.6 ppm	2.1 ppm
Nitrogen dioxide	Annual	N. of Lancaster Road Hayden, ID	16055003	11.3 $\mu g/m^3$	11.3 $\mu g/m^3$	11.3 $\mu g/m^3$
Sulfur dioxide	3-hour	Sewage treatment plant Batiste and Chubbuck Roads Pocatello, ID	160050004	159.7 $\mu g/m^3$	133.5 $\mu g/m^3$	159.7 $\mu g/m^3$
Sulfur dioxide	24-hour	Sewage treatment plant Batiste and Chubbuck Roads Pocatello, ID	160050004	62.8 $\mu g/m^3$	62.8 $\mu g/m^3$	62.8 $\mu g/m^3$
Sulfur dioxide	Annual	Sewage treatment plant Batiste and Chubbuck Roads Pocatello, ID	160050004	13.1 $\mu g/m^3$	15.7 $\mu g/m^3$	15.7 $\mu g/m^3$
Particulate PM_{10}	24-hour	G&G Corner of Garret and Gould Pocatello, ID	160050015	52 $\mu g/m^3$	45 $\mu g/m^3$	52 $\mu g/m^3$
Particulate PM_{10}	Annual	G&G Corner of Garret and Gould Pocatello, ID	160050015	21 $\mu g/m^3$	22 $\mu g/m^3$	22 $\mu g/m^3$
Particulate $PM_{2.5}$	24-hour	G&G Corner of Garret and Gould Pocatello, ID	160050015	21 $\mu g/m^3$	Not detected	21 $\mu g/m^3$

Table 4-4 Background Ambient Air Quality at Monitoring Stations Closest to the Proposed EREF Site (Cont.)

Pollutant	Averaging Period	Closest Monitoring Station	Station ID	Measured Ambient Background Concentrations 2006	Measured Ambient Background Concentrations 2007	Selected Background Concentration
Particulate $PM_{2.5}$	Annual	G&G Corner of Garret and Gould Pocatello, ID	160050015	6.4 $\mu g/m^3$	Not detected	6.4 $\mu g/m^3$

Sources: IDEQ annual air quality monitoring reports for the calendar years 2006 and 2007 (IDEQ, 2007 and 2008, respectively).

Table 4-5 Estimated Air Quality Impacts at the Proposed EREF Property Boundary Associated with Initial Preconstruction and Construction[a]

			Concentration ($\mu g/m^3$, except ppm for CO)				Percent of Standard	
Pollutant	Emission Rate (g/s)	Averaging Time	Background	Modeled Maximum*	Total	NAAQS/ SAAQS[b]	Modeled Maximum	Total
CO	3.55	1-hour	4.3	0.8	5.1	35	2.4	14.6
	3.55	8-hour	2.1	0.1	2.2	9	1.5	24.9
NO_2	1.3	Annual	11.3	1.0	12.3	100	1.0	12.3
SO_2	0.1	3-hour	159.7	11.3	171.0	1300	0.9	13.2
	0.1	24-hour	62.8	1.8	64.6	365	0.5	17.7
	0.1	Annual	15.7	0.1	15.8	80	0.1	19.7
PM_{10}	24.3	24-hour	52.0	355.2	407.2	150	236.8	271.5
	24.3	Annual	22.0	15.9	37.9	50	31.8	75.8
$PM_{2.5}$	2.4	24-hour	21.0	15.9	36.9	35	45.3	105.3
	2.4	Annual	6.4	1.6	8.0	15	10.5	53.2

[a] AERMOD model uses the following:

- The highest of the second-highest concentrations over 5 years for CO and for 30-hr and 8-hr sulfur dioxide (SO_2).
- The highest of the annual averages over 5 years for nitrogen dioxide (NO_2) and SO_2.
- The high-6th-high concentration over 5 years for 24-hr PM_{10}.
- The highest of multiyear average of high-8th-high at each receptor for 24-hr $PM_{2.5}$, the highest of the annual averages over 5 years for NO_2 and SO_2, and with a wind speed measurement sensitivity of 0.134 m/s and no default value applied for low wind speed.

[b] SAAQS = State Ambient Air Quality Standards.

how AERMOD low wind speed bias might impact near-field results for the proposed EREF, the NRC staff also modeled impacts using the same emission factors, but introduced a “calm wind” default wind speed of 1.0 meter (3.3 feet) per second, allowing all other modeling parameters to remain unchanged. As expected, selection of a higher wind speed as the default value for calm wind resulted in reductions in near-field (i.e., property boundary) modeled concentrations of particulates. Table 4-6 displays the changes to modeling results that would occur if the “calm wind speed” default value was set at 1.0 meter (3.3 feet) per second. Under those conditions, only the 24-hour PM_{10} standard would be exceeded (by 161 percent) while all other standards are met.

The NRC staff concludes that preconstruction and construction would have a SMALL impact on ambient air quality for all criteria pollutants except particulates, but would have a MODERATE impact on near-field air quality (as modeled at the EREF property boundary) with respect to particulates when fugitive dust-producing construction activities (site clearing, grading, travel on unpaved onsite roads, transfer and stockpiling of materials) coincide with low prevailing wind speeds in the direction of the closest property boundary from the proposed EREF industrial area. Such wind directions are expected to occur less than 4 percent of the time (see Figure 3-11).

4.2.4.2 Facility Operation

<u>Air Impacts during the Four-Year Overlap Period</u>

The plan of development for the proposed EREF calls for a 4-year period of overlap during which some limited production (i.e., enrichment of UF_6) would begin before heavy construction has been completed (AES, 2010a). AES has indicated that all preconstruction work (site clearing, grading, stockpiling of materials), construction of all permanent onsite roads and parking areas (i.e., hard-surface paving for both roads and parking areas), construction of some production facilities, and construction of all ancillary faculties necessary to support full production would have been completed before the start of this overlap period (i.e., before any partial production begins) (AES, 2010a). AES indicates that construction during the overlap period would be limited to construction of the remaining SBMs, necessitating the disturbance of a relatively small land area and allowing for dramatic reductions in both the complement of construction vehicles and equipment and the construction workforce (AES, 2010a). Air quality impacts associated with continuing construction and limited facility operation would be additive during the overlap period. Air quality impacts during preconstruction and construction result primarily from the use of numerous pieces of heavy construction equipment, the disturbance of a large land area, the presence of a large construction workforce, and frequent material and equipment deliveries. With all such activities being completed or reduced during the construction/operation overlap period, the NRC staff concludes that approximately 85 percent of the air quality impacts related to preconstruction and construction would have occurred before any facility operations begin, with the remaining construction activities, approximately 15 percent, occurring during the construction/operation overlap period.

Table 4-6 Sensitivity of AERMOD Dispersion Modeling Results to Low Wind Speed Default Values

Pollutant	Averaging Time	Concentration ($\mu g/m^3$, except ppm for CO) NAAQS/ SAAQS[a]	Background	Modeled Maximum at Calm Wind Default Value of 0.134 m/sec	Total	Percent of Standard	Modeled Maximum at Calm Wind Default Value of 1.0 m/s	Total	Percent of Standard
CO	1-hour	35	4.3	0.8	5.1	14.6	0.3	4.6	13.2
	8-hour	9	2.1	0.1	2.2	24.9	0.1	2.2	24.1
NO_2[b]	Annual	100	11.3	1.0	12.3	12.3	0.8	12.1	12.1
SO_2[b]	3-hour	1300	159.7	11.3	171.0	13.2	6.3	166.0	12.8
	24-hour	365	62.8	1.0	63.8	18.4	0.3	65.1	17.5
	Annual	80	15.7	0.1	15.8	19.7	0.1	15.8	19.7
PM_{10}	24-hour	150	52.0	355.2	407.2	271.5	189.9	241.9	161.3
	Annual	50	22.0	15.9	37.9	75.8	13.1	35.1	70.2
$PM_{2.5}$	24-hour	35	21.0	15.9	36.9	105.3	12.0	33.0	94.1
	Annual	15	6.4	1.6	8.0	53.2	1.3	7.7	51.3

[a] SAAQS = State Ambient Air Quality Standards.
[b] NO_2 = nitrogen dioxide; SO_2 = sulfur dioxide.

Plans submitted by AES indicate that the majority of preconstruction (cut and fill, onsite road construction, trenching, and burial of components) would all be completed for the entire site during the initial construction period, before any facility operation commences, and that construction of the second, third, and fourth SBMs and other miscellaneous structures and expansions of cask storage pads would occur during the 4-year overlap period (AES, 2010a). These remaining construction activities would result in a significant reduction in the number and types of heavy-duty construction vehicles onsite, as well as a substantial reduction in workforce; thus, air quality impacts would be substantially less than impacts during the initial preconstruction and construction phase. Impacts on air quality from partial operation during the period when operation and construction overlap would be minimal. Consequently, air quality impacts during the initial preconstruction and construction phase would represent a bounding condition that would not be exceeded during any subsequent phase of facility development and/or operation, including the 4-year construction/operation overlap period. Because of the bounding nature of the air impacts of the initial construction phase, a detailed air quality impact assessment representative of the overlap period and a more detailed plan of development for the overlap period are unnecessary.

Generation and Release of Criteria Pollutants Resulting from EREF Operations

Air impacts during operation include criteria pollutant releases from passenger vehicles and delivery vehicles traveling to and from the site, the periodic preventative maintenance-directed operation of emergency diesel generators (see below), and the operation of miscellaneous comfort heating systems burning fossil fuels. In its Environmental Report, AES (2010a) estimated the number of passenger vehicles involved in the workforce's daily commute to be 550 vehicles, which is equivalent to the number of individuals in the workforce (i.e., no credit taken for buses or carpools), and assumed each vehicle completes an average commute of 80.5 kilometers (50 miles) (daily, roundtrip).[3] AES also estimated the number and type of delivery vehicles traveling to or from the site daily to deliver materials, equipment, and feedstock and remove products and waste materials to be 36 heavy-duty trucks and estimated the average travel distance of each to be 805 kilometers (500 miles). AES has also estimated that there would be 250 workdays per year. Air impacts from the above activities were determined using the EPA-approved MOBILE 6.2 model. The NRC staff has reviewed the assumptions used by AES to define the input parameters for MOBILE 6.2 and has determined that all are reasonable and appropriate. The NRC staff confirmed the resulting air impacts through an independent analysis. The results are displayed in Table 4-7.

Not reflected in Table 4-7 are the incidental amounts of criteria pollutants that would result from the operation of comfort heating systems using fossil fuels such as natural gas and/or propane. However, because of the difficulty in predicting how much fuel would be consumed and because these contributions are expected to be negligible, they are not represented in Table 4-7. Also not reflected in Table 4-7 are impacts from the onsite storage and dispensing of vehicle fuels during EREF operation. Fuel consumption during operation is estimated at 568 liters (150 gallons) of gasoline per week and 568 liters (150 gallons) of diesel fuel per week.

[3] This assumption is consistent with the expectation that the majority of the EREF workforce would reside in Idaho Falls, approximately 25 miles east of the site.

Table 4-7 NRC's Estimated Emissions of Criteria Pollutants Resulting from Operations at the Proposed EREF

Vehicle Type	Emission Factor (g/mi)	Estimated Daily Number of Vehicles	Estimated Daily Mileage km (mi)	Daily Workday Emissions grams (tons)
Nonmethane hydrocarbons				
Light-duty vehicles (gasoline)	1.219	550	80 (50)	33,523 (3.7 × 10^{-2})
Heavy-duty vehicles (diesel)	0.506	36	805 (500)	9108 (1.0 × 10^{-2})
Emergency generators	NA[a]	6	NA	646[b] (7.1 × 10^{-4})
Total				43,277 (4.78 × 10^{-2})
Carbon monoxide				
Light-duty vehicles (gasoline)	20.350	550	80 (50)	559,625 (6.17 × 10^{-1})
Heavy-duty trucks (diesel)	2.560	36	805 (500)	46,080 (5.08 × 10^{-2})
Emergency generators				2792[c] (3.1 × 10^{-3})
Total				608,497 (6.81 × 10^{-1})
Nitrogen oxides				
Light-duty trucks (gasoline)	1.193	550	80 (50)	32,808 (3.6 × 10^{-2})
Heavy-duty trucks (diesel)	10.292	36	805 (500)	185,256 (0.204)
Emergency generators	NA	NA		32,450[d] (3.6 × 10^{-2})
Total				250,514 (0.277)

[a] NA = not applicable.
[b] Based on the AES estimate of 168 kg/yr (0.185 tons/yr) from preventative maintenance operations.
[c] Based on the AES estimate of 726 kg/yr (0.80 tons/yr) from preventative maintenance operations.
[d] Based on the AES estimate of 8437 kg/yr (9.3 tons/yr) from preventative maintenance operations.

EPA-approved algorithms predict releases of 298 kilograms (657 pounds) per year of VOCs during operation. Given the VOC control features of the tanks, their modest size, the limited volumetric throughputs, the estimated annual releases, and commitments by AES to identify and employ BMPs for the storage and dispensing of fuels (AES, 2010a), impacts on air quality from the storage and dispensing of fuels during operation would be SMALL.

Generation and Release of Non-Criteria Chemical Pollutants Related to EREF Operations

In addition to the criteria pollutants released as a result of preventative maintenance testing of emergency generators, AES has identified the potential for release of certain specific chemicals as a result of routine operations of the proposed EREF (AES, 2010a). Based on the operating experiences at a European enrichment facility using the same centrifuge technology as EREF, and scaled to the number of separative work units (SWUs) represented in the currently proposed EREF design, AES estimates the following releases: 2.0 kilograms (4.4 pounds) per year of hydrogen fluoride (HF),[4] 173 kilograms (382 pounds) per year of ethanol, and 1684 kilograms (3713 pounds) per year of methylene chloride. In addition to the above noted releases associated with operation of the centrifuges, the ER (AES, 2010a) also notes the potential for release of uranic materials to the atmosphere from the operation of the Liquid Effluent System Evaporator. The uranic materials in the liquid effluents discharged to the evaporator that are not removed and captured by precipitation or filtration would be evaporated to the atmosphere. AES estimates that the discharge of total uranium to the atmosphere from the evaporator would be <0.0356 grams per year (AES, 2010a). Idaho air regulations (Title 58 of the Idaho Administrative Code [IAC, 2010]) establish specific controls for fluoride, ethanol, methylene chloride, and total uranium (natural isotopic distribution, both soluble and insoluble salts).[5] The regulations establish occupational exposure levels (OEL), maximum allowable emission limits (EL), and acceptable ambient concentrations (AACs) for each, as shown in Table 4-8.

In addition to the applicable standards displayed in Table 4-8, the following allowable levels of fluoride in animal feed crops and forage crops are established in Title 58 Part 557.06: 40 ppm (dry basis, monthly), 60 ppm (dry basis, two consecutive months), and 80 ppm (dry basis, never to be exceeded) (IAC, 2010). Emissions of UF_6 from the GEVSs of the SBMs will result in the formation of HF in the atmosphere. These crop fluoride accumulation standards are relevant to the proposed EREF because of the potential for animal feed or forage crops to be grown on adjacent land parcels.

The NRC staff evaluated whether the estimated maximum annual amount of fluoride emissions would exceed Idaho limits for the maximum rate of fluoride release, AAC for fluoride, and/or the maximum amount of fluoride accumulation on forage crops (AES, 2010a). To ensure a conservative evaluation of the maximum concentration of fluoride in air, the NRC staff assumed that release of the entire projected annual amount of HF (2 kilograms [4.4 pounds]) occurred instead within a one-month period (i.e., over a period of 720 hours instead of over 8760 hours in a year). Those conditions would result in a release rate of approximately 2.7 grams per hour (6.0×10^{-3} pound per hour). Thus, the maximum release rate, even over a compressed time frame, is substantially less than the allowable rate of 75.8 grams (0.167 pound) per hour in Idaho rules. Based on the European experience, AES estimated an HF concentration at the point of release of 7.7 micrograms per cubic meter. The NRC staff has independently verified

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4 Trace amounts of UF_6 are potentially released from the gaseous emission ventilation systems (GEVSs). Each mole of UF_6 released will hydrolize when exposed to humidity in ambient air to form 4 moles of HF and one mole of uranyl fluoride (UO_2F_2).

5 Releases from GEVSs would be in the form of UF_6. Although the feedstock arriving at EREF would contain a natural distribution of uranium isotopes, as the UF_6 progresses through the centrifuge chain, enrichment of the ^{235}U isotope occurs and the UF_6 no longer exhibits the natural isotopic ratio. UF_6 could be released from any of the centrifuges in the series, and releases from a particular centrifuge could change over time. All such releases are collected in a common header before being sent to a GEVS; thus, it is difficult to ascertain the precise isotopic ratio of the collective UF_6 releases arriving at each GEVS. However, for the purpose of this impact assessment, the Idaho standard for uranium releases is still presumed to apply to all GEVS releases, even though most such releases are unlikely to exhibit the natural isotopic distribution.

Table 4-8 Idaho Chemically Specific Air Quality Standards[a]

CAS Number	Pollutant	OEL (mg/m^3)	EL (lb/hr)	AAC
NA	Fluoride[b]	2.5	0.167	0.125 mg/m^3
64-17-5	Ethanol[b]	1880	125	94 mg/m^3
75-9-2	Methylene chloride[c]	4.1×10^{-6}	1.6×10^{-3}	0.24 $\mu g/m^3$
7440-61-1	Uranium[b]	0.2	0.013	0.01 mg/m^3

[a] CAS = Chemical Abstract Service Number (unique identifier).
NA = not applicable.
OEL = occupational exposure level.
EL = exposure level.
AAC = acceptable ambient concentration (mg/m^3 for noncarcinogens, $\mu g/m^3$ for carcinogens).
[b] *Idaho Administrative Procedures Act* (IDAPA) 58.01.01 Part 585, "Toxic Air Pollutants Noncarcinogenic Increments." Uranium as natural isotopic distribution, all soluble and insoluble salts.
[c] IDAPA 58.01.01 Part 586, "Toxic Air Pollutants Carcinogenic Increments."

this concentration at the point of release (SBM rooftop),[6] and finds it to be substantially less than the allowable 0.125 milligrams per cubic meter in Idaho rules. Dispersion even in the most stable atmospheric stability class would reduce this concentration even further at the proposed EREF property boundary, the closest possible distance for public access; thus, the public's HF exposure potential would be well below allowable levels.

The amount of HF released annually, 2 kilograms (4.4 pounds), represents 100 moles of HF (1900 grams of fluoride). Coincident with the formation of 100 moles of HF will be the formation of 25 moles of uranyl fluoride (UO_2F_2) (7700 grams [16.9 pounds]) (equivalent to 50 moles of fluoride, or 950 grams [2 pounds]). This represents a rate of release of 2850 grams (6.3 pounds) of fluoride over the course of 1 year (0.33 gram per hour or 7.2×10^{-4} pound per hour (lb/hr) over the course of a year, assuming a steady rate of release over the entire year). This amount would be substantially less than the Idaho allowable amount of 5.9 grams (0.013 pound) per hour.

Operation of the evaporator would result in the atmospheric release of less than 0.0356 gram per year of additional uranic materials. Assuming a continuous operation of the evaporator over the course of the year (8760 hours/yr), the release would equate to 3.99×10^{-4} gram per hour (8.79×10^{-7} pound per hour). This projected release rate is also substantially below the allowable 1.3×10^{-2} pound per hour exposure level. Collectively, all releases of uranic materials resulting from routine operation are also substantially below the allowable exposure level.

The most conservative site-specific air dispersion factor calculated at the proposed EREF property boundary is 4.3×10^{-6} second per cubic meter. Applying that to the calculated maximum rate of release for HF results in a concentration of HF in air of 2.7×10^{-7} milligram per cubic meter ($1.7. \times 10^{-14}$ pounds per cubic foot). This value is substantially less than the AAC of

[6] Flow rates from the GEVS are withheld from public disclosure in accordance with 10 CFR 2.390.

fluoride in ambient air of 0.125 milligram per cubic meter ($8. \times 10^{-9}$ pound per cubic foot) (annual average) specified in *Idaho Administrative Procedures Act* (IDAPA) 58.01.01 Part 585.[7]

The highest estimated deposition factor, occurring in the northeast sector of the proposed EREF site, was calculated to be 2.43×10^{-7} per square meter. Applying this deposition factor to the annual fluoride emissions of 2.0 kilograms (4.4 pounds) results in an estimated maximum HF deposition rate of 4.9×10^{-7} kilogram per square meter (2.6×10^{-6} pound per square meter). Over the course of the year, this rate of deposition would be distributed over surrounding sectors in accordance with the expected wind rose (e.g., a circular diagram showing, for a specific location, the percentage of time the wind blows from each compass direction over a specified period), and the IDAPA regulatory limits would not be exceeded.

An annual emission of 173 kilograms (382 pounds) of ethanol represents an emission rate of 2.0×10^{-2} kilogram per hour (4.4×10^{-2} pound per hour). This emission rate is less than the allowable rate of 56.7 kilograms (125 pounds) per hour contained in Idaho regulations (IAC, 2010). Applying a conservative assumption that the entire annual emissions of ethanol would occur over a 1-month period (720 hours), an emission rate of 0.24 kilogram per hour (0.53 pound per hour) would result, which is less than the allowable amount.

AES indicated that methylene chloride is used exclusively in small bench-top quantities to clean certain pieces of equipment on an average of 20 hours each week (based on a 5-day work week) (AES, 2010a). Of the total 5295 liters (849 gallons) of methylene chloride used each year, 4415 liters (638 gallons) would be recovered from the cleaning operation and managed as liquid hazardous waste, while an estimated 1055 kilograms (2325 pounds) would be released from the cleaning operation as vapor (AES, 2010a). Idaho rules establish a maximum allowable emission rate for methylene chloride of 7.2×10^{-5} gram per hour (1.6×10^{-3} pound per hour) and a maximum AAC concentration standard of 2.4×10^{-1} microgram per cubic meter (1.4×10^{-13} pound per cubic feet). Applying the most conservative site-specific air dispersion factor at the proposed EREF boundary of 4.3×10^{-6} second per cubic meter to the methylene chloride usage parameters proposed by AES, the emissions of methylene chloride would be in compliance with all applicable Idaho standards even without the application of any emission controls. The use of charcoal filters in the ventilation system serving the cleaning operation would further reduce the amount of methylene chloride actually released to the atmosphere to well below applicable standards.

NRC's analysis supports the conclusion that all emission standards in Idaho regulations for noncriteria pollutants released from point sources would be satisfied during normal operation, and all Idaho standards for AAC are met at the proposed EREF property boundary. The NRC further concludes that National Ambient Air Quality Standards would also be met at the proposed EREF property boundary during normal operations. The NRC staff therefore concludes that air quality impacts during operation of the EREF would be SMALL.

[7] The Idaho standard is based on releases of the fluoride ion and not releases of HF. Correcting for the differences in weight of HF and the fluoride ion involves multiplying the amount of HF released by a correction faction of 18/19, or 0.95, to provide the amount of fluoride ion contained in that HF release. Given the five orders of magnitude difference between HF released and the fluoride standard, even with application of this correction factor, the HF releases are well below the fluoride standard.

4.2.4.3 Mitigation Measures

Impacts from the release of criteria pollutants, aside from PM associated with fugitive dust, from the operation of vehicles and equipment during preconstruction, construction, and operation are not expected to result in exceedance of ambient air quality standards or violation of applicable stationary source standards extant in Idaho.

Various mitigative measures are available to reduce, or in some cases eliminate, certain air quality impacts related to preconstruction, construction, and operation. AES has identified the following mitigative options for preconstruction and construction (AES, 2010a):

- BMPs would be applied during preconstruction and construction to reduce fugitive dust generation to the greatest practical level; such measures would include:
  - twice per day watering of unpaved onsite roads, excavation areas, and clearing and grading areas
  - use of alternative dust palliatives (inorganic salts, asphaltic products, synthetic organics)
  - established and enforced speed limits for onsite roads
  - suspension of certain dust-producing activities during windy conditions
  - application of gravel to the unpaved surfaces of onsite haul roads as an interim measure before permanent pavements are installed
  - apply erosion mitigation methods in areas of disturbed soils
  - use of water sprays at material-drop and conveyor-transfer points
  - limit the height and disturbance of material stockpiles
  - apply water to the surfaces of stockpiles
  - cover open-bodied trucks that transport materials that could be sources of airborne dust
  - promptly remove earthen materials deposited on paved roadways by wind, trucks, or earthmoving equipment
  - promptly stabilize or cover bare areas resulting from roadway or highway interchange construction

To mitigate potential impacts from onsite vehicle fuel storage and dispensing during preconstruction, construction, and operation, AES has identified the following mitigation measures (AES, 2010a):

- BMPs would be applied to the design and operation of onsite vehicle and equipment fueling activities to minimize the release to the atmosphere of nonmethane hydrocarbons and mitigate the potential impact of spills or accidental releases; these measures would include:
  - storage tanks would be equipped with appropriate VOC controls, liquid level gauges, and overfill protection
  - fuel delivery drivers would receive adequate training prior to being allowed onsite
  - appropriate warning signs would be posted at the fuel dispensing facility
  - fuel unloading and dispensing areas would be paved and equipped with curbs to control small spills
  - delivery contractors would carry spill kits and would be required to address minor spills during fuel deliveries

Mitigation measures identified by AES to control the release of volatile organic compounds and criteria pollutants during preconstruction and construction include:

- maintaining all internal combustion engines and their pollution control devices in good working order

Mitigation measures identified by AES for operation include the following:

- install the SBM Safe-by-Design Gaseous Effluent Vent System (GEVS) and SBM Local Extraction GEVS, which are designed to collect and clean all potentially hazardous gases from the plant prior to release to the atmosphere; provide instrumentation to detect and signal, via alarm, all nonroutine process conditions, including the presence of radionuclides or HF in the exhaust stream that will trip the system to a safe condition in the event of effluent detection beyond routine operational limits

- install the Technical Services Building (TSB) GEVS, which is designed to collect and clean all potentially hazardous gases in the serviced areas from the TSB prior to release to the atmosphere; provide instrumentation to detect and signal the Control Room, via alarm, regarding all nonroutine process conditions, including the presence of radionuclides or HF in the exhaust stream; operators would then take appropriate actions to mitigate the release

- install the Centrifuge Test and Postmortem Facilities GEVSs, which are designed to collect and clean all potentially hazardous gases in the serviced areas from the Centrifuge Assembly Building prior to release to the atmosphere; provide instrumentation to detect and signal the Control Room, via alarm, regarding all nonroutine process conditions, including the presence of radionuclides or HF in the exhaust stream; operators would then take appropriate actions to mitigate the release

- design the TSB Contaminated Area heating, ventilating, and air conditioning (HVAC) system, the Ventilated Room HVAC system in the Blending, Sampling, and Preparation Building (BSPB), and the Centrifuge Test and Postmortem Facilities exhaust filtration system to collect and clean all potentially hazardous gases in the serviced areas prior to release to the atmosphere

- apply gravel to the unpaved surface of the secondary access road

- impose speed limits on the unpaved secondary access road

- maintain air concentrations of criteria pollutants resulting from vehicle emissions and fugitive dust below NAAQS

The NRC staff concludes that the above mitigation measures and BMPs would be sufficient to ensure that air quality impacts would remain at acceptable levels over the majority of time throughout the preconstruction and initial construction phases. Additionally, the NRC staff concludes proper application of these mitigation measures, including temporary suspension of certain dust-producing activities, would ensure that periods of potentially unacceptable levels of air impacts would be avoided. The NRC further concludes that the BMPs committed to by AES for application during the operation of the proposed EREF would be sufficient to ensure air impacts remain at acceptable levels. The following mitigation measures identified by NRC would further reduce air quality impacts:

- ensure vehicles and equipment with internal combustion engines are properly tuned and pollution control devices are functional

- provide first responder training to selected workers; ensure storage tanks are equipped with fully functional overflow and vapor control features

- install hard-surface pavements, curbs, scupper drains, and drainage ways at fuel dispensing islands that will channel spilled fuels to fire-safe containment sumps; require delivery drivers to remain in attendance throughout all fuel deliveries; require drivers to verify the proper working condition of storage tank overfill features before commencing fuel deliveries; require drivers to promptly address all spills occurring during fuel deliveries (including removal of all fuels in overfill devices after completion of fuel transfers)

- install emergency shut-offs for fuel dispensing pumps; post spill response directives at the fuel dispensing islands; provide spill containment and cleanup materials at the fuel dispensing islands for cleanup of small spills; ensure the fuel dispensing islands have adequate lighting

- adopt a policy that requires prompt cleanup of all spilled materials

- identify and select construction-related products and chemicals that are free of volatile solvents

- suspend high fugitive dust-generating activities during early morning hours with calm winds and during windy periods

4.2.5 Geology and Soil Impacts

This section describes the potential environmental impacts on geologic resources and soils during preconstruction/construction and operation of the proposed EREF. Impacts could result primarily during the preconstruction and construction phases from planned surface grading and excavation activities that loosen soil and increase the potential for erosion by wind and water. Soil compaction as a result of heavy vehicle traffic could also increase the potential for soil erosion by increasing surface runoff. Spills and inadvertent releases during all project phases could contaminate site soils. Implementation of mitigation measures would ensure that these impacts would be SMALL. Because there are no known petroleum resources or nonpetroleum mineral deposits on the proposed EREF site (see Section 3.6.1.2), impacts on geologic resources are not expected.

4.2.5.1 Preconstruction and Construction

Preconstruction and construction activities for the proposed EREF site have the potential to impact site soils in the construction area. During preconstruction, conventional earth- and rock-moving and earth-grading equipment would be used. Blasting and mass rock excavation may also be required. Activities would include surface grading and excavation of the soils for roads, utility lines, stormwater basins, and installation of certain building foundations.

Preconstruction and construction activities would disturb a total of about 240 hectares (592 acres) within the proposed 1700-hectare (4200-acre) property, or about 14 percent of the total property area (AES, 2010a). This total includes the proposed EREF footprint of about 186 hectares (460 acres) and an additional 53.6 hectares (132.5 acres) for temporary construction facilities, parking areas, material storage areas, and excavated areas for underground utilities (AES, 2010a). The proposed EREF footprint would include buildings and other permanent structures such as parking areas, retention/detention ponds, cylinder storage pads, and roads. Facility structures would have foundations and footings with depths ranging from 0.76 meter (2.5 feet) to 6.0 meters (20 feet) (AES, 2009b); utility trenches would range in depth from 0.9 meter (3 feet) to 3.7 meters (12 feet) (AES, 2009b). The remaining land, about 1460 hectares (3608 acres), would be left in a natural state with no designated use for the life of the proposed facility (AES, 2010a). About 3 hectares (7.5 acres) would be landscaped, of which about 2 hectares (5 acres) would be irrigated (AES, 2009b). Areas within the proposed property boundaries currently used for irrigated crops and grazing would be taken out of service during the construction and operation of the proposed EREF (AES, 2010a).

The proposed EREF would be located on relatively flat terrain; however, some cut and fill would be required to bring the ground level to final grade (AES, 2010a). Onsite soils are suitable for fill and consist of a combination of soil and basaltic bedrock. Excavated soils would be used for fill at lower areas of the proposed site; no offsite disposal of soils would be required (AES, 2009b). Current plans are for a total of 778,700 cubic meters (1,018,500 cubic yards) of soil to be cut and used as fill (AES, 2010a). The deepest cut would be about 6 meters (20 feet), and the deepest fill also would be about 6 meters (20 feet) (AES, 2010a). Onsite soils would be used in site grading to the extent possible. Additional soil from offsite sources would be used to augment fill requirements of roads and structures, as needed (AES, 2009b). Approximately 66,000 cubic meters (86,325 cubic yards) of clay would be brought onto the proposed EREF site from a nearby source for use as liner material for the two Cylinder Storage Pads Stormwater Retention Basins (AES, 2009b).

Geologic Hazards

Preliminary site geotechnical investigations indicate that the entire area of the proposed EREF footprint is underlain by competent bedrock of basaltic lava (AES, 2010a). Subsidence due to construction is not expected; however, there is some potential for collapse due to increased loads during construction where lava tubes occur in the subsurface. Lava tubes have been observed at other locations on the Eastern Snake River Plain (ESRP) (such as that reported by Kesner, 1992). The presence of lava tubes will be considered during subsurface investigations associated with facility construction. The potential for landslides on the proposed EREF site is considered low because slopes across the proposed site are low, soils are thin or absent, and precipitation rates are low.

The proposed EREF site is in an area of very low seismic activity (see Section 3.6.1.1). Seismic history and geologic conditions indicate that earthquakes with a magnitude of more than 5.5 are not likely to occur within the ESRP; however, moderate to strong ground shaking from earthquakes with loci in other areas within the Basin and Range province could be felt at the proposed EREF site. The liquefaction potential of soils at the proposed EREF site is considered to be low since soils are dry or only partially saturated and groundwater at the proposed site is very deep.

The likelihood of a volcanic event (basaltic or silicic eruption) is very low at the proposed EREF site (see Section 3.6.1.1).

Impacts Summary

Preconstruction and construction activities could cause an increase in soil erosion at the proposed EREF site by loosening soils and making them more susceptible to erosion by wind action and rain, although rainfall in the vicinity of the proposed site is low. Compaction of soils due to heavy vehicle traffic could also contribute to soil erosion in some areas if infiltration rates are reduced to the point of causing increased surface runoff. Because these impacts are short-term and can be mitigated (see Section 4.2.5.3), they would be SMALL.

Chemical spills or releases around vehicle maintenance and fueling locations, storage tanks, and painting operations could introduce contaminants to soils during the preconstruction and construction phase. Contaminated soils could leave the proposed site via wind or water erosion (as fugitive dust or surface runoff). Leaching of contaminated soils could affect shallow groundwater. These processes are naturally mitigated by site characteristics such as thin or absent soil coverage, a low rate of precipitation, and the absence of onsite perennial drainages (see Sections 3.6.3 and 3.7.1). They also could be controlled by following best management practices and procedures (e.g., diverting stormwater to a detention basin). For all these reasons, impacts due to chemical spills or releases at the proposed EREF site would be SMALL.

The majority of soil-disturbing activities (i.e., blasting, excavating, and grading) and heavy equipment traffic would occur during the preconstruction period; it is estimated, therefore, that about 95 percent of the impacts described in this section would be attributed to the preconstruction phase of development (AES, 2010a).

4.2.5.2 Facility Operation

Soil conditions would stabilize during the operations period as ground-disturbing activities associated with construction wind down and mitigation measures such as revegetation are implemented. Impacts on soils during operation of the proposed EREF would be SMALL because operations would not involve activities that increase the potential for soil erosion and the rate of soil erosion due to wind and rain would be similar for the proposed site as that for the surrounding area.

Releases to the atmosphere during normal operation of the proposed EREF, as discussed in Section 4.2.4.2, could contribute to a small increase in the amount of HF, ethanol, methylene chloride, and UF_6 in surrounding soils as they are transported downwind. All estimated atmospheric releases of pollutants would be below the amounts allowed by permits, and the impacts on soil quality due to aerial deposition during operations would be SMALL. Therefore, operations at the proposed EREF would result in SMALL impacts on site and surrounding area soil resources.

4.2.5.3 Mitigation Measures

Mitigation measures identified by AES (2010a) to avoid or minimize impacts due to soil erosion include:

- using BMPs to reduce soil erosion (e.g., earth berms, dikes, and sediment fences)
- revegetating or covering bare areas with natural materials promptly
- watering soils to control fugitive dust
- using standard drilling and blasting methods to reduce the potential for over-excavation, minimize damage to surrounding rock, and protect adjacent surfaces intended to remain intact
- placing stockpiles in an appropriate manner
- reusing excavated materials whenever possible

The NRC identified the following additional mitigation measures:

- minimizing the areas affected by construction to the extent possible
- covering stockpiles to reduce exposure to wind and rain
- limiting routine vehicle traffic to paved or gravel roads

AES would be required to comply with the provisions in the National Pollutant Discharge Elimination System (NPDES) Construction General Permit and Industrial Stormwater Permit, issued by EPA Region 10 with an oversight review by the IDEQ (AES, 2010a). The NPDES Construction General Permit requires AES also to develop a Stormwater Pollution Prevention (SWPP) Plan to identify control measures to minimize disturbed areas and protect natural site features and erodible soil (EPA 2010a). A stormwater detention basin would be used during preconstruction, construction, and operation (AES, 2009b). Following the requirements of a Spill Prevention Control and Countermeasures (SPCC) Plan would reduce the potential impacts from chemical spills or releases around vehicle maintenance and fueling locations, storage tanks, and painting operations during construction and operation, and ensure prompt and appropriate cleanup. Appropriate waste management procedures would be followed to minimize the impacts on soils from solid waste and hazardous materials that would be generated during all phases. Where practicable, a recycling program for materials suitable for recycling would be implemented.

4.2.6 Water Resources Impacts

This section discusses the potential environmental impacts on surface water and groundwater during preconstruction/construction and operation of the proposed EREF. The discussion includes the potential impact to natural drainage on and around the proposed EREF property and the effect of the proposed EREF on the regional water supply.

During preconstruction, construction, and operation, the water supply for the proposed EREF would be obtained from onsite wells completed in the ESRP aquifer. The primary point of diversion would be the existing onsite agricultural well (Lava Well; as discussed in Section 3.7.2.3) and an additional well installed to supply potable water. No surface water sources would be used. Because the annual maximum usage rates during preconstruction, construction, and normal operations would be well below the annual water right appropriation (Carlsen, 2009), impacts on the groundwater supply would be SMALL.

All preconstruction and construction activities would comply with the requirements of the NPDES Construction General Permit[8] (AES, 2010a). Stormwater runoff would be diverted to a stormwater detention basin (AES, 2009b). During operations, stormwater would be released to onsite detention and retention basins from the central footprint area of the proposed EREF (AES, 2010a); stormwater runoff to adjacent properties therefore would not be increased. There would be no direct discharges of wastewater to surface water or groundwater (AES, 2010a). AES would develop an SWPP Plan to identify control measures to minimize disturbed areas and protect natural site features and erodible soil. Process effluents in the Liquid Effluent Treatment System Evaporator would only be discharged by evaporation to the atmosphere (AES, 2010a). Compliance with the requirements of an SPCC Plan would minimize impacts to water quality due to potential chemical spills or releases. For these reasons, impacts on water resources would be SMALL.

4.2.6.1 Preconstruction and Construction

Water Use

The water supply during the 12-year preconstruction and construction period would be obtained from one or more onsite wells completed in the ESRP aquifer. No surface water sources would be used. During this period, the proposed EREF would consume water to meet potable and sanitary needs, as well as for concrete mixing, dust control, compaction of fill, and watering of vegetation. None of this water would be returned to its original source.

Average daily water usage during the preconstruction and construction period would be about 207 cubic meters (54,700 gallons), with a peak daily usage of 382 cubic meters (101,000 gallons) in the second year (Table 4-9). Water requirements for construction are expected to taper off significantly after the seventh year. Average daily water usage during the last five years of construction would be about 28 cubic meters (7326 gallons). These usage rates are within the water right appropriation that has been transferred with the proposed property for use as industrial water. The annual appropriation for industrial use is 506.8 acre-feet, which is 625,000 cubic meters (165 million gallons), or about 1700 cubic meters (453,000 gallons) per day (Carlsen, 2009).

[8] Updates on the NPDES permitting process can be viewed on the EPA's website at http://cfpub.epa.gov/npdes/stormwater/noi/noidetail_new.cfm?ApplId=IDR10CI01.

Table 4-9 Water Use for the Preconstruction and Construction Period

	Construction[a]				
Year	Potable Water cubic meters (gallons)	Concrete[b] cubic meters (gallons)	Dust[c] cubic meters (gallons)	Soil Compaction[d] cubic meters (gallons)	Total Construction cubic meters (gallons)
1	19,555 (5,166,000)	1216 (321,331)	52,466 (13,860,000)	16,982 (4,486,100)	90,219 (23,833,431)
2	28,141 (7,434,000)	3649 (963,993)	52,466 (13,860,000)	12,130 (3,204,350)	96,385 (25,462,343)
3	19,078 (5,040,000)	10,948 (2,891,978)	52,466 (13,860,000)	9704 (2,563,500)	92,196 (24,355,478)
4	13,832 (3,654,000)	72,989 (1,927,985)	52,466 (13,860,000)	4852 (1,281,750)	78,448 (20,723,735)
5	13,832 (3,654,000)	6082 (1,606,655)	52,466 (13,860,000)	4582 (1,281,750)	77,232 (20,402,405)
6	8347 (2,205,000)	4561 (1,204,991)	52,466 (13,860,000)	0 (0)	65,374 (17,269,991)
7	6677 (1,764,000	2433 (642,662)	52,466 (13,860,000)	0 (0)	61,576 (16,266,662)
8	6677 (1,764,000)	1216 (321,331)	26,233 (6,930,000)	0 (0)	34,127 (9,015,331)
9	6677 (1,764,000)	304 (80,333)	6558 (1,732,500)	0 (0)	13,540 (3,576,833)
10	5962 (1,575,000)	76 (20,083)	1640 (433,125)	0 (0)	7678 (2,028,208)
11	5008 (1,323,000)	19 (5021)	410 (108,281)	0 (0)	5437 (1,436,302)
12	3816 (1,008,000)	5 (1255)	102 (27,070)	0 (0)	3923 (1,036,326)

[a] Assumes 252 workdays per year for construction-related activities (5 days per week).
[b] Assumes a usage rate of 151.4 liters (40 gal) used per cubic yard of concrete mixing and curing.
[c] Assumes a usage rate of 208,198 liters (55,000 gal) per day.
[d] Earthwork and soil compaction are assumed to be completed by the end of the 5th year.
Source: AES, 2010a.

The average daily (industrial) water usage during the preconstruction and construction period would be less than 1 percent of the total daily groundwater withdrawals of 640,000 cubic meters (169 million gallons) from the ESRP aquifer in Bonneville County, as measured by the USGS in 2005 (USGS, 2010). The preconstruction phase is estimated to occur during an 8-month period.

Water usage for landscaping and restoration of disturbed areas would begin in the second year of construction (2013) and continue to increase until construction is completed in 2022. AES would use xerophilic plants in landscaped areas and drought-tolerant native plants to reclaim disturbed areas. The method of irrigation would be chosen so water usage does not exceed 24,670 cubic meters (6.5 million gallons) during the growing season, April 1 through October 31, as defined by the IDWR in Carlsen (2009) (AES, 2009b). This is within the appropriation for irrigation, which is 20.0 acre-feet per year, or 25,000 cubic meters (6.5 million gallons) (Carlsen, 2009).

Water Quality

No wastewater would be generated or discharged during the preconstruction and construction period. Sanitary waste would be handled by portable systems until such time that the sanitary waste facility is operational. Short-term increases in sediment, oil and grease, fuel, and chemical constituents in surface (stormwater) runoff would be expected. Stormwater runoff would be collected in a stormwater detention basin in accordance with the NPDES Construction General Permit to contain stormwater within the boundaries of the proposed EREF property.[9] The stormwater detention basin would allow water to evaporate or infiltrate the ground surface and would overflow only during extreme rainfall events exceeding its design capacity (5.70 cm [2.22 inches] of rainfall in a 24-hour period) (AES, 2010a). Flood control measures would not be required because the site grade is above the 100- and 500-year floodplain elevations (see Section 3.7.1.3).

Ground-disturbing activities such as blasting, surface grading, and excavation could increase groundwater contamination by creating conduits that could accelerate downward migration of contaminants, if present. However, these activities are not expected to affect groundwater in the ESRP aquifer because they would take place at relatively shallow depths (i.e., no deeper than 6.0 meters [20 feet]) as compared to groundwater below the proposed site, which occurs at depths of 201.5 meters (661 feet) below the ground surface (see Section 3.7.2.2).

Chemical spills or releases around vehicle maintenance and fueling locations, storage tanks, and painting operations could infiltrate the ground surface and contaminate shallow groundwater during the preconstruction and construction phase. However, such spills and releases are not expected to affect groundwater in the ESRP aquifer because it occurs at great depths (201.5 meters [661 feet]) below the ground surface (see Section 3.7.2.2) and contaminants would likely be adsorbed by overlying soils before reaching the aquifer.

Impacts Summary

During the preconstruction and construction period, the proposed EREF would consume water to meet potable and sanitary needs, as well as for concrete mixing, dust control, compaction of fill, and watering of vegetation. Water for these uses would be obtained from one or more onsite wells completed in the ESRP aquifer; no surface water would be used. Average and

9 Because site preparation and construction activities would disturb an area greater than 0.4 hectare (1 acre), a NPDES Construction General Permit from EPA Region 10 and an oversight review by the IDEQ would be required (EPA, 2010b). The permit also requires the development of a SWPP Plan (EPA, 2010a).

peak daily water usages during this period would be well within the water right appropriation that has been transferred with the proposed property for use as industrial and irrigation water. The daily water usage would be less than 1 percent of the total daily groundwater withdrawals from the ESRP aquifer in Bonneville County. For these reasons, the impact to the regional water supply from water consumption during preconstruction and construction would be SMALL.

No wastewater would be generated or discharged during the preconstruction and construction period. Sanitary waste would be handled by portable systems until such time that the sanitary waste facility is operational. Surface water quality could be affected by short-term increases in sediment, oil and grease, fuel, and chemical constituents in surface (stormwater) runoff. Because stormwater would be diverted to an onsite detention basin, the potential for contaminated stormwater discharging to water bodies on adjacent properties is low. For these reasons, the NRC staff concludes that the impact to surface water quality would be SMALL.

Ground-disturbing activities have the potential to increase groundwater contamination by creating conduits that could accelerate the downward migration of contaminants, if present; chemical spills or releases could contaminate groundwater resources by infiltrating the ground surface. Because groundwater in the ESRP aquifer in the vicinity of the proposed site occurs at great depths (201.5 meters [661 feet]) and contaminants would likely be adsorbed by overlying soils before reaching the aquifer, the impact to groundwater quality would be SMALL.

4.2.6.2 Facility Operation

Water Use

The water supply for operation of the proposed EREF would be obtained from one or more onsite wells completed in the ESRP aquifer. No surface water sources would be used. The proposed EREF would consume water to meet potable, sanitary, and process consumption needs. None of this water would be returned to its original source.

Average and peak daily water usage during the operation period would be about 68 cubic meters (18,100 gallons) and 1567 cubic meters (416,160 gallons), respectively (AES, 2010a). Usage rates under normal operations are within the water right appropriation that has been transferred with the proposed property for use as industrial water. The annual appropriation for industrial use is 506.8 acre-feet, which is 625,000 cubic meters (165 million gallons), or about 1700 cubic meters (453,000 gallons) per day (Carlsen, 2009). Usage rate estimates under peak conditions could exceed the water right appropriation during the 8-hour period following a fire when the proposed facility would be required to refill its fire water storage tanks (with an estimated usage rate of up to 1.4 cubic meters per minute [375 gallons per minute]; AES, 2010a). Both the average and peak annual water use requirements would be less than 1 percent of the total groundwater withdrawals of 640,000 cubic meters (169 million gallons) per day from the ESRP aquifer in Bonneville County, (as measured by the USGS in 2005 (USGS 2010).

Water would continue to be used for landscaping during the operations phase. AES would use xerophilic plants in landscaped areas and choose a method of irrigation that would limit water usage to no more than 24,670 cubic meters (6.5 million gallons) during the growing season, April 1 through October 31, as defined by the IDWR in Carlsen (2009) (AES, 2009b). This is within the appropriation for irrigation, which is 20.0 acre-feet per year, or 25,000 cubic meters (6.5 million gallons) (Carlsen, 2009).

During the first 7 years of construction (which includes the period when construction and operations activities overlap), the average annual water usage would be about 92,740 cubic meters (24.5 million gallons), with an estimated annual maximum of 98,460 cubic meters (26.0 million gallons) during the second year, decreasing to 85,550 cubic meters (22.6 million gallons) during the seventh year (AES, 2010a; Table 4-10). The maximum annual usage rate comprises about 16 percent of the annual water right appropriation that has been transferred with the proposed property for use as industrial water. Figure 4-2 shows the change in water usage for construction and operation during the overlap period, starting with construction in 2011 and ending with full facility production in 2022.

The closest and largest municipalities that rely on the ESRP aquifer for drinking water are Idaho Falls (Bonneville County) and Pocatello (Bannock County). Groundwater consumption at the proposed EREF would not affect groundwater availability in these municipalities because of their location relative to the predominant groundwater flow pattern in the ESRP aquifer (see Figure 3-24; Section 3.7.2.1). Idaho Falls is hydrologically upgradient of the proposed EREF; Pocatello is on the other (southeastern) side of the Snake River, a major discharge area.

Water Quality

Liquid effluent generation rates would be relatively small, and no direct discharges to surface water or groundwater would occur. Wastewater volume from all sources would be about 18,800 cubic meters (5 million gallons) annually. This includes approximately 59.1 cubic meters (15,600 gallons) annually of wastewater from the Liquid Effluent Collection and Treatment System and 18,700 cubic meters (4.9 million gallons) from the Domestic Sanitary Sewage Treatment Plant.

The Liquid Effluent Collection and Treatment System would treat (by precipitation and filtration) liquid wastes such as laboratory wastes, floor washings, miscellaneous condensates, degreaser water, and spent citric acid and discharge them to the atmosphere by evaporation through the Liquid Effluent Treatment System Evaporator. None of these waste effluents would be discharged to the stormwater basins. Domestic sanitary sewage effluent would be discharged to the two Cylinder Storage Pads Stormwater Retention Basins.

Approximately 420,090 cubic meters (111 million gallons) of stormwater would be released annually to the onsite detention and retention basins from the developed central footprint area of the proposed EREF, which comprises about 164.9 hectares (407.5 acres), or 9.7 percent of the proposed site property area. In addition, about 3.9 million cubic meters (1.0 billion gallons) of annual runoff from the undeveloped areas within the proposed site property could be expected. Site drainage is intermittent and generally flows to the south; however, runoff does not discharge into any natural surface water bodies because there are no natural surface water bodies within or near the proposed EREF property and most of the water would be consumed by evapotranspiration or infiltration before it reaches the proposed property line. Water that infiltrates the ground surface may be held in soil and taken up by plant roots or eventually make its way to the water table. It is not expected, therefore, that the proposed EREF would increase stormwater runoff to adjacent properties.

Table 4-10 Water Use for Overlapping Years of Construction and Operations

Year	Construction	Operations			Total
	Total Construction cubic meters (gallons)	Potable Water cubic meters (gallons)	Process Water[a] cubic meters (gallons)	Total Operations[b] cubic meters (gallons)	Total Construction and Operation cubic meters (gallons)
1	90,219 (23,833,431)	0 (0)	0 (0)	0 (0)	90,219 (23,833,431)
2	96,385 (25,462,343)	2073 (547,500)	0 (0)	2073 (547,500)	98,458 (26,009,843)
3	92,196 (24,355,478)	4145 (1,095,000)	1593[c] (420,833)[c]	5738 (1,515,833)	97,934 (25,871,311)
4	78,448 (20,723,735)	17,409 (4,599,000)	461 (121,667)	17,870 (4,720,667)	96,318 (25,444,402)
5	77,232 (20,402,405)	17,409 (4,599,000)	691 (182,500)	18,100 (4,781,500)	95,332 (25,183,905)
6	65,374 (17,269,991)	19,896 (5,256,000)	921 (243,333)	20,817 (5,499,333)	86,191 (22,769,324)
7	61,576 (16,266,662)	22,798 (6,022,500)	1151 (304,167)	23,949 (6,326,667)	85,525 (22,593,329)
8	34,127 (9,015,331)	22,798 (6,022,500)	1382 (365,000)	24,179 (6,387,500)	58,306 (15,402,831)
9	13,540 (3,576,833)	22,798 (6,022,500)	1554 (410,625)	24,352 (6,433,125)	37,892 (10,009,958)
10	7678 (2,028,208)	22,798 (6,022,500)	1727 (456,250)	24,525 (6,478,750)	32,203 (8,506,958)
11	5437 (1,436,302)	22,798 (6,022,500)	1900 (501,875)	24,697 (6,525,375)	30,134 (7,960,677)
12	3923 (1,036,326)	22,798 (6,022,500)	2073 (547,500)	24,870 (6,570,000)	28,793 (7,606,325)

[a] Process water includes demineralized water, fire water, and liquid effluent water.
[b] Value represents industrial water use only. Irrigation water use would not exceed 24,700 cubic meters (6.5 million gallons) during the growing season, April 1 through October 31.
[c] Process (makeup and deionized) water and fire protection water values begin in the third year, just before the first cascade is placed into service. About 1363 cubic meters (360,000 gallons) of the process water demand value for this year is for a one-time fill of two Fire Water Tanks, each storing 681.5 cubic meters (180,000 gallons).
Source: AES, 2010a.

Liquid Effluent Collection and Treatment System

Routine liquid effluents discharging to the Liquid Effluent Collection and Treatment System are listed in Table 4-10. Liquid process effluents would be contained on the proposed EREF site in collection tanks. Effluents in the tanks would be sampled and analyzed periodically to determine if treatment is needed before being discharged to the Liquid Effluent Treatment System Evaporator. About 59.1 cubic meters (15,600 gallons) of liquid process effluents would

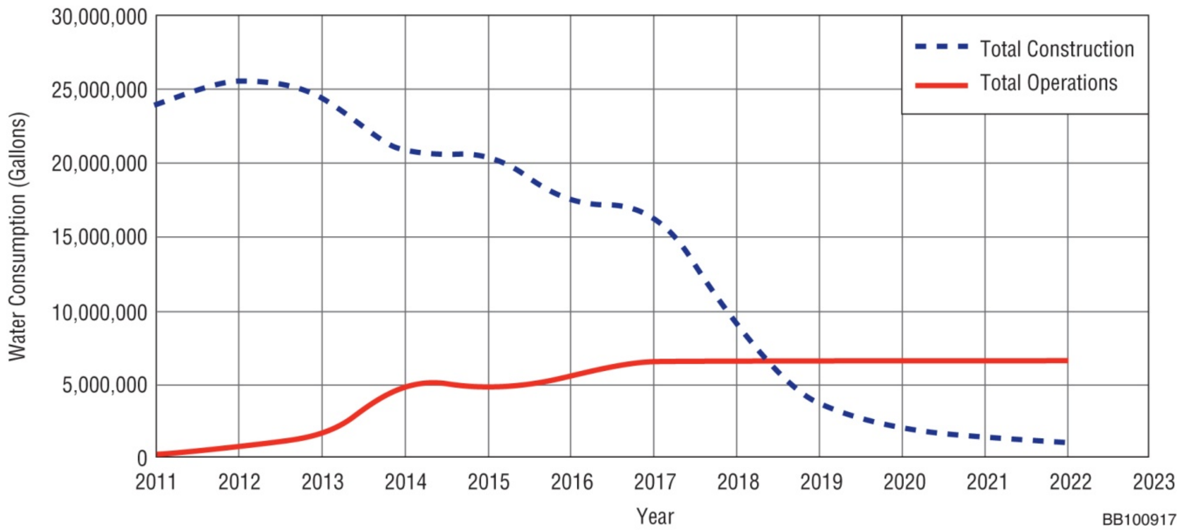

Figure 4-2 Water Use during Period When Construction and Operations Activities Overlap (AES, 2010a)

be treated and discharged annually by evaporation to the atmosphere in the Liquid Effluent Treatment System Evaporator. Because no process effluents from plant operations would be discharged to the retention or detention basins or into surface water, the Liquid Effluent Collection and Treatment System would have a SMALL impact on water resources.

Cylinder Storage Pads Stormwater Retention Basins

Treated sanitary effluents from the Domestic Sanitary Sewage Treatment Plant and stormwater runoff from the concrete-paved areas in the cylinder storage areas would be discharged to two Cylinder Storage Pads Stormwater Retention Basins, located northwest of the proposed EREF footprint (Figure 4-3). The retention basins would serve an area of about 26 hectares (63 acres); each would have a storage capacity of about 83,000 cubic meters (67 acre-feet), maintaining a freeboard of 0.3 meter (1.0 feet). Water discharged from the Domestic Sanitary Sewage Treatment Plant would consist only of treated sanitary effluents; no process-related effluents would be treated there (AES, 2010a). The retention basins would be open to the air and lined to prevent infiltration, and would have no outlets. The only discharge from the retention basins would be by evaporation to the atmosphere; no direct discharge to surface water or groundwater would occur. If necessary, residual solids would be removed for treatment and disposal (AES, 2010a).

A water balance of each of the retention basins (which have identical construction), including consideration of effluent and precipitation inflows and evaporation outflows, indicates that they could be dry for up to 5 months of the year (June through October), depending on annual precipitation rates. The basins would have the capacity to hold all inflows for the life of the proposed EREF. Because all of the water discharged to the Cylinder Storage Pads Stormwater Retention Basins would evaporate, the basins would have a SMALL impact on water resources.

Site Stormwater Detention Basin

Site stormwater runoff from paved surfaces (except the Cylinder Storage Pad area), building roofs, and landscaped areas would be diverted to the Site Stormwater Detention Basin located to the south of the proposed EREF footprint (Figure 4-3). The Site Stormwater Detention Basin would be unlined and would serve an area of about 139.3 hectares (344 acres). It would have a storage capacity of about 32,800 cubic meters (27 acre-feet), maintaining a freeboard of 0.6 meter (2 feet). Discharges from the detention basin would occur mainly by evaporation and infiltration into the ground. The detention basin would also have an outlet that would allow overflow runoff to the surrounding ground surface (and downgradient terrain) in the event of extreme rainfall events (exceeding 24-hour, 100-year design criteria) (AES, 2010a).

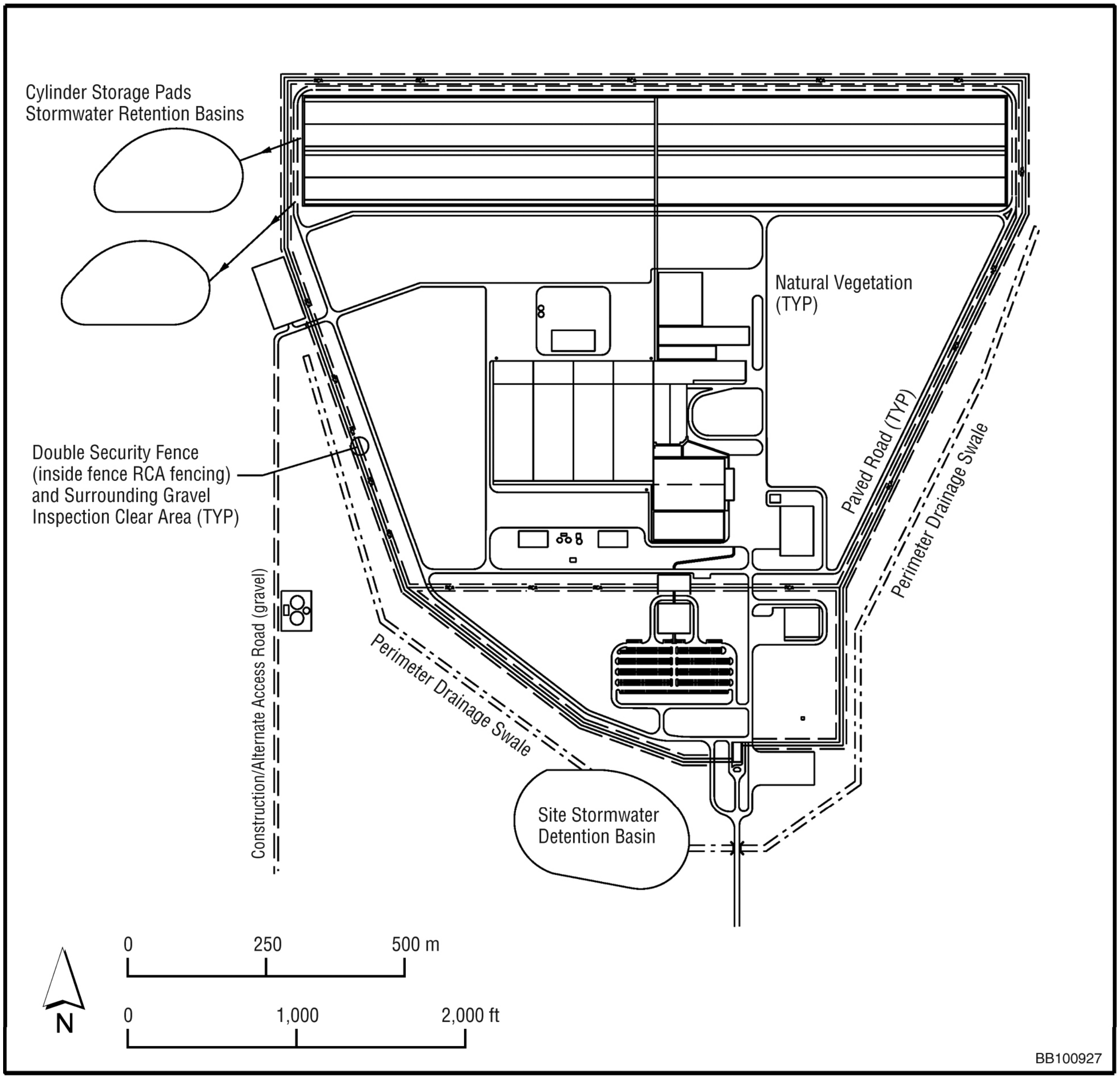

Figure 4-3 Locations of the Proposed EREF Stormwater Basins (AES, 2010a)

A water balance of the Site Stormwater Detention Basin, including consideration of effluent and precipitation inflows and evaporation outflows, indicates that it would be dry every month of the year except during rainfall events (because the evaporation rate typically exceeds the rate of effluent and precipitation inflows except during rainfall events). Most of the water discharged into the basin would seep into the ground or evaporate and would not find its way to a natural surface water body. Water seeping into the ground from the detention basin would flow vertically downward until reaching a low-permeability layer such as a sedimentary interbed. There the water could become temporarily perched or flow laterally until the low-permeability layer pinches out or contacts a higher permeability zone (e.g., fractures in the basalt). Water would migrate from the ground surface downward in a step-like manner until it reaches the saturated zone. Further transport would depend on the transmissivity and flow direction of groundwater in the aquifer.

The water quality of the basin discharge would be typical of runoff from paved surfaces and building roofs from any industrial facility. Except for small amounts of soil products and grease expected from onsite traffic that would readily adsorb onto the soil, the plume would not be expected to contain contaminants. As a result, the Site Stormwater Detention Basin seepage would have a SMALL impact on water resources of the area.

Compliance with the requirements of an SPCC Plan would minimize the impacts due to potential spills during operations. Following standard BMPs to minimize and contain stormwater within the proposed site boundaries would also minimize impacts on offsite surface water bodies. Sanitary wastewater generated during operation of the proposed EREF would be discharged to a lined stormwater retention basin. Because natural surface water bodies are absent within and near the proposed EREF site and no wastewater would be discharged to the ground surface, water quality impacts during the operations period would be SMALL.

Impacts Summary

During the operations period, the proposed EREF would consume water to meet potable, sanitary, and process consumption needs. Water for these uses would be obtained from one or more onsite wells completed in the ESRP aquifer. No surface water sources would be used. Average and peak daily water usages during normal operations are within the water right appropriation that has been transferred with the proposed property for use as industrial and irrigation water. The daily water usage would be less than 1 percent of the total daily groundwater withdrawals from the ESRP aquifer in Bonneville County. For these reasons, the impact on the regional water supply would be SMALL.

The maximum annual (industrial) water usage would occur during the second year of the construction and operations overlap period. Because this value represents only about 16 percent of the annual water right appropriation that has been transferred with the proposed property for use as industrial water, the impact to the regional water supply would be SMALL.

Liquid effluent generation rates would be relatively small, and no direct discharges to surface water or groundwater would occur. Stormwater runoff does not discharge into any natural surface water bodies because there are no natural surface water bodies within or near the proposed EREF property and most of the water is consumed by evapotranspiration or infiltration before it reaches the proposed property line. Routine liquid process effluents would be treated and discharged only by evaporation to the atmosphere. Runoff from the cylinder storage areas would be discharged to two lined retention basins, each designed with the capacity to hold all inflows for the life of the proposed EREF. Therefore, the impacts to surface water and groundwater quality would be SMALL.

4.2.6.3 Mitigation Measures

Water Use

Mitigation measures to minimize water use (relative to conventional practices) at the proposed EREF identified by AES (2010a) include:

- using low-water consumption landscaping practices
- implementing conservation practices when spraying water for dust control
- installing low-flow toilets, sinks, and showers
- localizing floor washing by using mops and self-contained cleaning machines
- incorporating closed-loop cooling systems
- eliminating evaporative losses and cooling tower blowdown by not using cooling towers

Water Quality

Mitigation measures to minimize potential impacts on water quality identified by AES (2010a,b) include:

- employing BMPs to control the use of hazardous materials and fuels
- maintaining construction equipment in good repair, without visible leaks of oils, grease, or hydraulic fluids
- controlling and mitigating spills in conformance with the SPCC Plan
- ensuring all discharges to surface impoundments meet the standards for stormwater and treated domestic sanitary wastewater, and that no radiological discharges are made
- using BMPs to control stormwater runoff to prevent releases to nearby areas
- using BMPs for dust control associated with excavation and fill operations (water conservation would be considered when deciding how often dust suppression sprays would be applied)
- using silt fencing and/or sediment traps
- using only water (no detergents) for external vehicle washing

- placing stone construction pads at entrances/exits in areas where unpaved construction accesses adjoin a State road

- arranging all temporary construction basins and permanent basins to provide for prompt, systematic sampling of runoff in the event of special needs

- controlling water quality impacts by compliance with the NPDES Construction General Permit requirements and by applying BMPs as detailed in the site SWPP Plan

- implementing a SPCC Plan for the proposed facility to identify potential spill substances, sources, and responsibilities

- berming or self-containing all aboveground gasoline and diesel storage tanks

- constructing curbing, pits, or other barriers around tanks and components containing radioactive wastes

- handling any hazardous materials by approved methods and shipping offsite to approved disposal sites.

- handling sanitary wastes by portable systems until the Domestic Sanitary Sewage Treatment Plant is available for site use and providing an adequate number of these portable systems

- requiring control of surface water runoff for activities covered by the NPDES Construction General Permit

- eliminating the need to discharge treated process water to an onsite basin by using evaporators in the Liquid Effluent Collection and Treatment System

The NRC identified additional mitigation measures to reduce the impacts of stormwater runoff from impervious surfaces. The following mitigation measures are based on EPA (2005, 2007):

- reducing the size of impervious surfaces (parking lots, roads, and roofs) to the extent possible

- implementing a “fix it first” infrastructure policy to set spending priorities on the repair of existing infrastructure (e.g., roads) over the installation of new infrastructure

- employing low-impact development strategies and practices during construction and operation activities, as defined and promoted by the EPA (EPA, 2007).

4.2.7 Ecological Impacts

The potential impacts on ecological resources from preconstruction, construction, and operation of the proposed EREF are evaluated in this section. Preconstruction could result in direct impacts due to habitat loss and wildlife mortality as well as indirect impacts to ecological resources in surrounding areas primarily from fugitive dust and wildlife disturbance. Impacts associated with construction of facility components would primarily include wildlife disturbance and fugitive dust. Facility operations would result in impacts primarily due to wildlife disturbance. Impacts on plant communities and wildlife from preconstruction would be MODERATE. Impacts from facility construction would be SMALL, and impacts from facility operation would be SMALL.

According to the U.S. Fish and Wildlife Service (FWS) (FWS, 2009), no Federally listed threatened or endangered species, or critical habitat for any species, occur in the vicinity of the proposed EREF site; therefore, no impacts on these species or habitats would occur as a result of the preconstruction, construction, and operation of the proposed EREF. Similarly, no impacts on the yellow-billed cuckoo (*Coccyzus americanus*), a candidate species, would occur because that species does not occur in the vicinity of the proposed EREF site. The greater sage-grouse (*Centrocercus urophasianus*), a candidate species (FWS, 2010), occurs on the proposed property and would be affected by preconstruction, construction, and operation of the proposed EREF. Potential impacts on species identified by FWS and the Idaho Department of Fish and Game (IDFG) are summarized in Table 4-11.

4.2.7.1 Preconstruction and Construction

Preconstruction and construction activities would extend over an 84-month period, with preconstruction comprising the first 8 months. A total of approximately 240 hectares (592 acres) of the proposed, approximately 1700-hectare (4200-acre), property to be

Table 4-11 Special Status Species Identified for the Proposed EREF

Common Name	Scientific Name	Status[a]	Impact Level
Plants			
Ute ladies'-tresses	*Spiranthes diluvialis*	FT	None
Animals			
Canada lynx	*Lynx canadensis*	FT, ST	None
Utah valvata snail	*Valvata utahensis*	FE	None
Grizzly bear	*Ursus arctos*	FT, ST	None
Yellow-billed cuckoo	*Coccyzus americanus*	FC, PNS	None
Greater sage-grouse	*Centrocercus urophasianus*	FC	Moderate
Ferruginous hawk	*Buteo regalis*	SGCN, PNS	Moderate
Townsend's big-eared bat	*Corynorhinus townsendii*	SGCN, PNS	Small
Sharp-tailed grouse	*Tympanuchus phasianellus*	SGCN	Moderate
Bald eagle	*Haliaeetus leucocephalus*	ST	Small

[a] FE = Federally listed as endangered, FT = Federally listed as threatened, FC = Federal candidates for listing as threatened or endangered, SGCN = Species of Greatest Conservation Need in Idaho, ST = State listed as threatened, PNS = Idaho protected nongame species.
Source: FWS, 2010; IDFG, 2009, 2010.

purchased by AES would be disturbed during preconstruction and facility construction. This area would include the proposed facility footprint as well as temporary construction areas such as temporary construction facilities, parking areas, material storage areas, and areas excavated for underground utilities. The proposed EREF footprint would occupy 186 hectares (460 acres) and would include buildings and other permanent structures such as parking areas, retention/detention ponds, cylinder storage pads, and roads, and all habitats and non-mobile biota would be eliminated within this footprint. About 53.6 hectares (132.5 acres) of the disturbed area would be replanted with native plant species following the completion of construction activities (AES, 2010a).

Vegetation

Plant communities would be affected by direct and indirect impacts associated with preconstruction and construction. Direct impacts would result from land clearing and grading as well as construction activities such as underground utility installation and road construction during preconstruction. All vegetation would be cleared from the proposed facility footprint, as well as from construction laydown areas and equipment assembly and staging areas. Approximately 75 hectares (185 acres) of sagebrush steppe habitat, 55 hectares (136 acres) of nonirrigated pasture, and 109 hectares (268 acres) of irrigated cropland would be eliminated by preconstruction and construction activities (AES, 2010a). Figure 4-4 shows the proposed EREF in relation to habitats on the proposed site. No rare or unique habitats, wetlands, riparian areas, or aquatic habitat would be impacted by preconstruction and construction.

Sagebrush steppe is the predominant plant community type in the region, and provides valuable habitat for numerous native species. The sagebrush steppe that would be lost under the proposed action is a small proportion of sagebrush (*Artemisia* spp.) habitat in the area (0.7 percent within an 8-kilometer [5-mile] radius of the center of the proposed EREF site) (Landscape Dynamics Lab, 1999). Because the sagebrush steppe habitat that would be lost is located adjacent to irrigated cropland and nonirrigated pasture, habitat fragmentation of this community type would be limited.

The exclusion of livestock from the remaining 1514 hectares (3740 acres) of the proposed property outside the proposed EREF footprint would increase species diversity and overall habitat quality in the remaining sagebrush steppe habitat. Spring forb production would likely increase with the removal of grazing, and non-native species, such as cheatgrass (*Bromus tectorum*), would likely decrease due to increased shading. Livestock exclusion would also likely result in an increase in native plant species in the remaining nonirrigated pasture habitat.

Nonirrigated pasture is a highly modified and degraded habitat, resulting from the removal of shrubs from sagebrush steppe and the planting of crested wheatgrass (*Agropyron cristatum*), which has become the dominant species, and other grasses. Small areas of native species are associated with rock outcrops. Because of the high degree of disturbance, this community type includes a high representation of non-native species, particularly crested wheatgrass. The loss of 55 hectares (136 acres) of this habitat type would have a negligible effect on native vegetation.

Fugitive dust levels would, in certain conditions, exceed NAAQS at the proposed EREF property boundary during portions of the preconstruction period (see Section 4.2.4.1). Deposition of

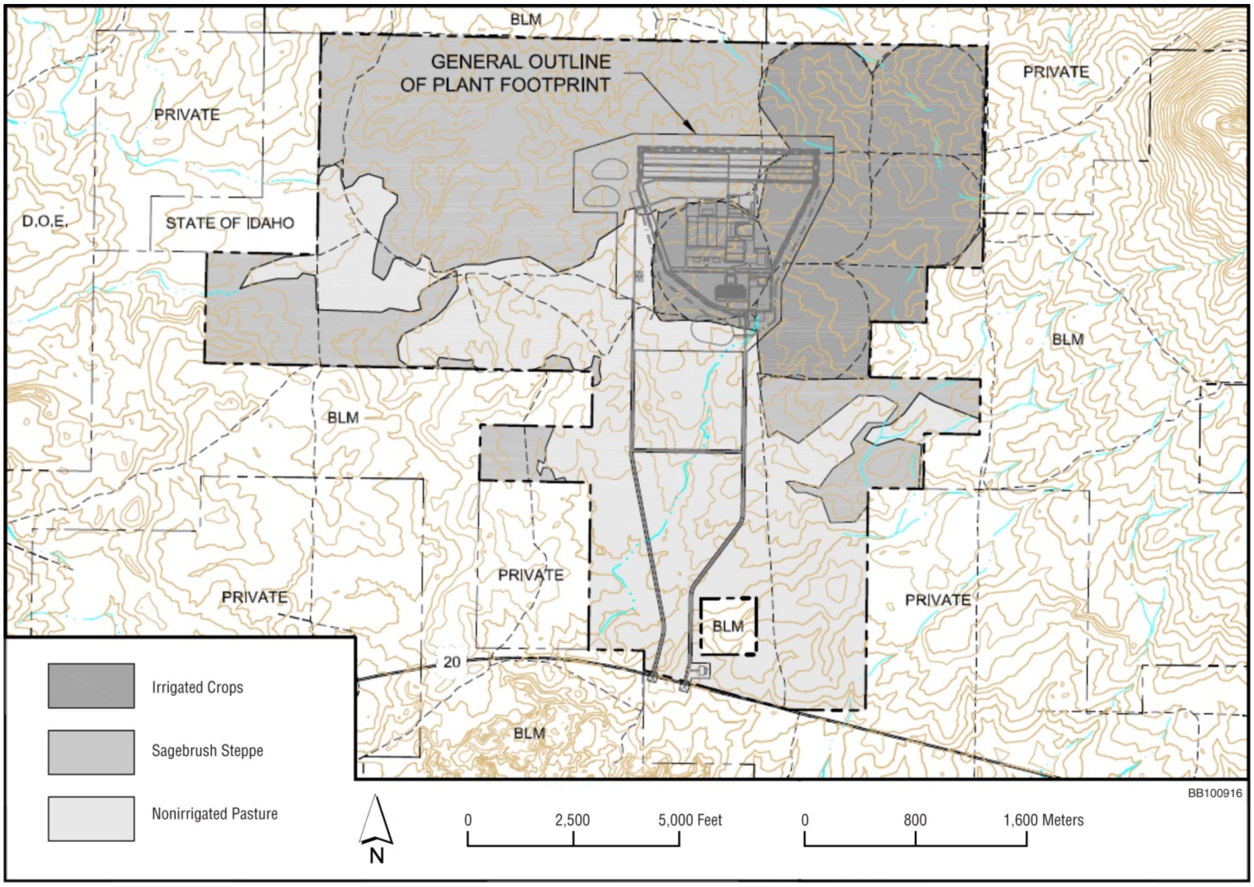

Figure 4-4 Proposed EREF Footprint Relative to Vegetation (AES, 2010a)

fugitive dust could occur in nearby offsite areas, potentially including the Hell's Half Acre Wilderness Study Area (WSA) immediately south of the proposed EREF site near the proposed new access road entrance. Deposition of fugitive dust can adversely affect plants, potentially reducing productivity and species diversity. However, soils in the region are wind-formed soils, and plant species in native habitats are regularly exposed to wind-generated fugitive dust. Because of the smaller, finer leaf structure of the native evergreen shrubs, grasses, and forbs, they may be less susceptible to the effects of fugitive dust deposition (Hlohowskyj et al., 2004). Impacts of fugitive dust would be minor.

Disturbed soils could provide an opportunity for the establishment and spread of non-native invasive species. Seven non-native species have been identified on the proposed EREF property (see Section 3.8). Additional non-native species could be introduced by construction equipment. Herbicides would not be used during the preconstruction and construction period (AES, 2010a). Invasive species present in low population densities on the proposed site, such as Canada thistle (*Cirsium arvense*), could develop large populations during the preconstruction and construction overlap period and contribute to increased occurrences in the sagebrush steppe habitat beyond the proposed site. Although these species are known to already occur in various habitats in the region, the development of increased seed sources in disturbed areas during the preconstruction and construction period could increase the spread of these species in nearby habitats.

Stormwater runoff from construction areas could result in erosion of disturbed soils and could be a source of sedimentation. Although the release of surface runoff or sediment to areas outside of the proposed EREF site is unlikely, if sediment was released from the proposed EREF site, plant communities in adjacent areas could be adversely affected by sediment accumulation, resulting in decreased plant cover and diversity. Also, sedimentation could promote the establishment and spread of invasive species.

Although spills are unlikely, accidental releases of hazardous materials such as fuels, lubricants, or other materials used or stored on the proposed EREF site could adversely affect biotic communities near and downgradient from a spills. The potential impacts of a spill would depend on the material spilled, its volume, its location, the season, and the efficacy of cleanup measures. The movement of spilled materials to areas off the proposed EREF project site would be unlikely due to the infiltration capacity of soils on the proposed site.

Impacts on plant communities due to the loss of 75 hectares (185 acres) of sagebrush steppe habitat as a result of preconstruction and construction would be MODERATE.

Wildlife

Vegetation removal and site grading would result in direct impacts on wildlife present on the proposed EREF site. Preconstruction would result in mortality of less mobile species, such as reptiles and small mammals, and nesting or burrowing species; species with greater mobility would likely be displaced to nearby suitable habitat. Increased competition in these areas could result in reduced survival of displaced individuals. The loss of 75 hectares (185 acres) of sagebrush steppe would particularly affect individuals of sagebrush obligate species that would be present at the start of preconstruction, due to their restriction to sagebrush habitats for breeding, nesting, brood-rearing, and foraging. However, species currently present on the proposed site occur throughout the region, and preconstruction and construction would not result in the local elimination of any wildlife species.

The sagebrush steppe community type provides habitat for numerous wildlife species. As noted above, the sagebrush steppe that would be lost under the proposed action is a small proportion of sagebrush steppe in the area (0.7 percent within an 8-kilometer [5-mile] radius of the center of the proposed EREF site). Some wildlife species are totally dependent on the sagebrush steppe ecoregion for their livelihood and are classified as sagebrush obligates. Depending on the species and specific habitat requirements, this loss of sagebrush habitat could potentially reduce available habitat for various life stages, such as breeding, nesting, brood rearing, or wintering. Pygmy rabbits (*Brachylagus idahoensis*), a sagebrush obligate species and Idaho species of conservation concern, live in burrows. Because they are abundant in similar habitats at the nearby INL (S.M. Stoller Corporation, 2001), pygmy rabbits may occur on the proposed site. Clearing and grading of sagebrush steppe habitat could potentially result in mortality of pygmy rabbits as well as habitat loss.

Migratory birds could be affected by preconstruction and construction activities. Several migratory species, such as sage thrasher (*Oreoscoptes montanus*), sage sparrow (*Amphispiza belli*), and Brewer's sparrow (*Spizella breweri*), which were observed on the proposed EREF property, are also sagebrush obligate species (see Section 3.8.2). Disturbance of active nests would be unlikely due to the seasonal timing of land clearing, as clearing would occur outside the nesting period. However, depending on specific habitat requirements, the loss of sagebrush steppe from the proposed EREF property could reduce the amount of habitat available for nesting of some species, and could potentially reduce the local overall level of nesting success. Because these species' populations occur over the large area of sagebrush habitat that is available in the region, population-level effects for the region would be unlikely.

Wildlife species with large home ranges, such as pronghorn antelope (*Antilocapra americana*), would likely avoid the proposed EREF site area; however, no impacts on local populations would occur due to habitat loss because of the contiguous extensive habitat available in the vicinity. Although the proposed EREF site is located within the crucial winter range for pronghorn, the total area affected, including an avoidance zone, would represent a small portion of that habitat. Migration patterns of other wildlife, such as elk (*Cervus canadensis*) or mule deer (*Odocoileus hemionus*), would not be altered due to the extensive undisturbed landscape in the region available for migratory movements. Onsite roads would present a hazard to wildlife from construction-related traffic, and traffic would increase on roads off the proposed site. Wildlife mortality from vehicles could increase; however, limiting vehicle speeds on the proposed site would help reduce impacts on wildlife (AES, 2010a).

Wildlife in nearby habitats would be disturbed by preconstruction and construction activity, human presence, and noise. Preconstruction and construction would result in increased noise levels from various sources, such as equipment operation during site grading (see Section 4.2.8). In addition, activities such as blasting would result in periodic high noise levels. While current background noise levels are approximately 30 A-weighted decibels (dBA), noise levels of approximately 61 dBA are estimated to occur at the north boundary of the proposed EREF property, the closest boundary to the industrial footprint of the proposed facility (for comparison, an automobile at 15 meters (50 feet) ranges from about 60 to 90 dBA; see Section 3.9.1). As a result, many wildlife species in adjacent habitats would be expected to avoid the vicinity of the proposed project site. Many species, such as migratory birds, would continue to be affected by noise throughout the 84-month preconstruction and construction period.

The loss of sagebrush steppe habitat would likely affect greater sage-grouse. No sage-grouse leks (breeding areas) were found during surveys of the proposed property on May 6–7, 2008 (MWH, 2008a) and April 28–29, 2010 (North Wind, 2010). Recommended survey dates are early March to early May (Connelly et al., 2003); specifically, lek surveys should be conducted March 25 through April 30 for low elevation areas and April 5 through May 10 for higher elevations (ISAC 2006). At approximately 5200 feet (1600 meters) MSL, the proposed EREF property could be considered a high elevation site. Surveys of the proposed EREF property indicated that the sagebrush steppe on or near the proposed property is used by the local sage-grouse population (AES, 2010a; MWH, 2008 a,b,c; MWH, 2009). However, extensive sagebrush habitat is available in the region, and loss of habitat on the proposed site would not threaten the local sage-grouse population.

Sage-grouse annually migrate between seasonal use areas in southeast Idaho, and populations occupy relatively large areas (Leonard et al., 2000; BLM/DOE, 2004). In one Idaho study, conducted northeast of the proposed EREF site, the average distance sage-grouse moved from their lek was 3.5 kilometers (2.2 miles) in spring, 12.1 kilometers (7.52 miles) in summer, 21.9 kilometers (13.6 miles) in fall, and 27.7 kilometers (17.2 miles) in winter

(Leonard et al., 2000). These sage-grouse utilized large areas over the course of a year, moving an average of 107 kilometers (66.5 miles). A population may occupy a summer home range of 3 to 7 square kilometers (1-3 square miles), while a winter home range may be more than 140 square kilometers (54 square miles) (Connelly et al., 2000).

Sage-grouse habitat requirements include breeding habitat (consisting of nesting habitat and early brood-rearing habitat), summer late brood-rearing habitat, and fall and winter habitat.

Within breeding habitat, female sage-grouse may travel more than 20 kilometers (12.4 miles) from lek to nest in the spring (Connelly et al., 2000). At INL, nesting sites have been known to be up to 18 kilometers (11 miles) from leks (BLM/DOE, 2004). Studies in Idaho indicate that nesting habitat includes a grass height of 15–34 centimeters (5.9–13 inches), coverage of 3–30 percent, and sagebrush height of 58–79 centimeters (23–31 inches) at the nest site and an overall canopy cover of 15–38 percent (Connelly et al., 2000). Guidelines for productive sage-grouse breeding habitat include a sagebrush height of 30–80 centimeters (10–30 inches), varying by moisture regime, with a cover of 15–25 percent, and a grass/forb height more than 18 centimeters (7.1 inches) with a cover of at least 15 percent and in mesic sites greater than 10 percent forb cover (Connelly et al., 2000). Greater nesting success occurs in areas of greater sagebrush canopy cover and greater height and cover of grasses (Connelly et al., 2000). Early brood-rearing habitat is usually near nesting areas and is characterized by a high species diversity and abundant forb cover with tall grasses and forbs, although sagebrush cover may be relatively open with about 14 percent cover (Connelly et al., 2000).

Summer habitats for sage-grouse broods include a variety of habitat types but are usually mesic areas with a relatively abundant forb component (Connelly et al., 2000). Guidelines for productive sage-grouse summer late brood-rearing habitat include a sagebrush canopy cover of 10–25 percent with a height of 40–80 centimeters (16–31 inches), along with a grass/forb cover greater than 15 percent (Connelly et al., 2000), although the grass/forb cover can be greater than 60 percent (Braun et al., 2005).

Fall habitat is frequently located on higher north-facing slopes that provide succulent native forbs (Braun et al., 2005). Sage-grouse begin to shift toward traditional winter use areas and the increased use of areas with a sagebrush canopy cover greater than 20 percent and more than 25 centimeters (9.8 inches) tall (Braun et al., 2005).

Winter habitat requires an adequate sagebrush component, as this constitutes nearly the entire winter diet of sage-grouse (Connelly et al., 2000; Braun et al., 2005). Studies in Idaho indicate the sagebrush canopy above snow may range 15–26 percent with a height of 26–46 centimeters (10–18 inches) above snow; studies that measured the entire canopy found a 38 percent coverage of sagebrush and a sagebrush height of 56 centimeters (22 inches) (Connelly et al., 2000). Guidelines for productive sage-grouse winter habitat include a sagebrush canopy cover of 10–30 percent and height of 25–35 centimeters (9.8–14 inches) above snow (Connelly et al., 2000). Sage-grouse tend to use south- and southwest-facing slopes in hilly areas (Braun et al., 2005).

The canopy coverage of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) on the proposed EREF property is approximately 16 percent and that of threetip sagebrush

(*Artemisia tripartita*) is approximately 0.3 percent (AES, 2010a). The total areal cover of all plants, excluding mosses, is about 60 percent. The total areal cover of shrubs is about 34 percent, of grasses about 20 percent, and forbs about 6 percent. The density of Wyoming big sagebrush ranges from 6000 plants per hectare (2428 per acre) for those less than 40 centimeters (15.7 inches) in height to 6900 plants per hectare (2792 per acre) for those at least 40 centimeters (15.7 inches) in height. The average maximum vegetation height is about 43 centimeters (17 inches).

Although the spatial relationships of habitat used by sage-grouse are not well understood (Braun et al., 2005), habitat characteristics can help evaluate potential use of a particular habitat by sage-grouse populations. The canopy cover and height of sagebrush on the proposed EREF property would provide suitable habitat for sage-grouse. Although the grass cover within this community would potentially provide habitat, forb production is relatively low. The proposed EREF property appears to be located within the annual range of a local sage-grouse population, and sage-grouse evidently use the proposed site. Sage-grouse were observed, and male sage-grouse were heard, just north of the proposed property during surveys in 2008, and evidence of the presence of sage-grouse was observed on the proposed property in 2008 and 2009. The nearest known lek is located approximately 5.6 kilometers (3.5 miles) from the boundary of the proposed site, and numerous leks are located within 16 kilometers (10 miles). The loss of 75 hectares (185 acres) of sagebrush steppe, plus an additional area of avoidance around the proposed EREF, could reduce available habitat for the local sage-grouse population; however, based on the size of seasonal use areas in Idaho and elsewhere, the area likely represents a small portion of seasonal habitat use.

The exclusion of livestock from grazing the proposed 1700-hectare (4200-acre) EREF property would result in an increase in species diversity and overall habitat quality in the remaining sagebrush steppe habitat, including an increase in available forage in the spring, especially forbs production and a decrease in non-native species, such as cheatgrass. Livestock exclusion would also likely result in an increase in native plant species in the remaining nonirrigated pasture habitat. These changes in habitat quality would likely increase the habitat value for sage-grouse.

Greater sage-grouse breeding behavior at lek sites can be affected by high noise levels that are more than 10 dBA above ambient levels. The nearest known lek is located approximately 5.6 kilometers (3.5 miles) from the boundary of the proposed EREF site. At that distance, noise levels due to preconstruction and construction of the proposed EREF, other than from blasting, are estimated to be approximately 35 dBA (see Section 4.2.8.1). This is less than 10 dBA above the ambient levels of approximately 30 dBA, measured at the northwest corner of the proposed EREF property (see Section 3.9). In addition, recommendations for avoiding disturbance to breeding sage-grouse from construction of energy-related facilities in the Upper Snake Sage-Grouse Planning Area include maintaining a distance of at least 3.2 kilometers (2 miles) from active leks (USSLWG, 2009), while the proposed EREF site boundary is approximately 5.6 kilometers (3.5 miles) from the nearest lek. Impacts on sage-grouse from preconstruction/construction-related noise would be minimal.

Ferruginous hawks (*Buteo regalis*), an Idaho species of conservation concern, are known to nest within 8 kilometers (5 miles) of the proposed EREF site (IDFG, 2009). Impacts on this species could result from habitat loss or human disturbance in the vicinity of nesting sites.

Ferruginous hawks hunt for small mammals, such as ground squirrels, on grassland and shrub-steppe habitats. The average home range for breeding males in Idaho is approximately 7 to 8 square kilometers (2.7 to 3.0 square miles) (IDFG, 2005). The loss of habitat as a result of proposed EREF preconstruction/construction could affect a locally nesting pair; however, grassland and shrub-steppe habitats are relatively abundant in the area. Ferruginous hawks are easily disturbed during the breeding season, and disturbance may result in nest abandonment (White and Thurow, 1985; Dechant et al., 1999). Noise and human presence associated with preconstruction and construction activities for the proposed EREF could potentially impact ferruginous hawks in the vicinity of the proposed project.

Townsend's big-eared bats (*Corynorhinus townsendii*), an Idaho species of conservation concern, use lava tube caves, approximately 8 kilometers (5 miles) from the proposed EREF site, for roosts and winter hibernacula (IDFG, 2009). This species forages for insects, primarily moths, above shrub-steppe habitats (Pierson et al., 1999). The loss of 75 hectares (185 acres) of sagebrush steppe would constitute a small impact on the foraging habitat of local bat populations. Noise from preconstruction and facility construction would be unlikely to disturb roosting or hibernating bats.

The sharp-tailed grouse (*Tympanuchus phasianellus*), an Idaho species of conservation concern, is known to occur in the vicinity of the proposed EREF site (IDFG, 2010). The sharp-tailed grouse does not occur throughout the Upper Snake River Plain, and its distribution in the proposed EREF site area is somewhat limited (IDFG, 2005). The loss of shrub and grass habitat as a result of vegetation clearing during preconstruction could reduce habitat used by sharp-tailed grouse in the area. No sharp-tailed grouse leks are known to occur in the vicinity of the proposed EREF site; however, disturbance from noise and human presence would affect sharp-tailed grouse use of habitat near the proposed EREF site.

The bald eagle (*Haliaeetus leucocephalus*), listed as a threatened species by the State of Idaho, nests along the Snake River and winters near open water (IDFG, 2005; FWS, 2007). Foraging is generally near rivers, lakes, or other water bodies. Disturbance during nesting is considered the greatest threat to bald eagles in Idaho (IDFG, 2005). Because bald eagles do not nest in the vicinity of the proposed EREF and winter habitat does not occur in the vicinity, the bald eagle would be unlikely to be affected by disturbance or habitat loss resulting from preconstruction or construction.

The implementation of BMPs and mitigation measures during construction would reduce potential impacts on wildlife on and in the vicinity of the proposed EREF. Therefore, impacts on wildlife due to preconstruction and construction would be SMALL to MODERATE.

Preconstruction activities would result in most (95 percent) of the habitat losses associated with development of the proposed EREF, while approximately 5 percent of habitat loss would be attributable to the construction of facility components. Preconstruction and construction are expected to extend over an 84-month time period, with the preconstruction phase estimated to comprise 10 percent of that period and facility component construction comprising 90 percent. Some impacts, such as wildlife disturbance due to noise and human presence, would occur throughout the long facility construction period. Because the greatest ecological impacts would be attributable to habitat loss and mortality associated with preconstruction activities, the estimated contribution to ecological impacts from preconstruction would be 80 percent, with

20 percent from construction. On this basis, preconstruction would result in MODERATE impacts, and facility construction would result in SMALL impacts.

4.2.7.2 Facility Operation

Limited facility operations would begin 8 years before the end of the construction phase. Operation of the proposed EREF is assumed to continue for approximately 30 years. Permanent structures of the proposed EREF would include buildings, depleted UF_6 storage pads, retention and detention basins, parking areas, and local roadways. Stormwater runoff from buildings, roads, and parking areas would be collected in a detention basin. Runoff from the Cylinder Storage Pads would be collected in two lined retention basins, which would also receive treated domestic sanitary effluent. The detention basins would have an overflow discharge, while the retention basins would be designed to prevent overflow (AES, 2010a). Potential impacts from stormwater runoff, such as erosion and sedimentation, would be minimized by the stormwater collection basins.

Vegetation

Maintenance activities associated with facility operation would include the periodic application of herbicides along roadways, the security fence, and the industrial area to control noxious weed species (AES, 2010a). Invasive species populations in areas of the proposed property outside of the industrial footprint would remain unaffected. Although nontarget species in the area could be impacted by drift during herbicide application, the amount of drift and associated effects would be very small.

The area of native plant communities would increase as the remaining irrigated crop areas and temporary construction areas would be replanted using native plant species at the conclusion of the preconstruction and construction phase. Successful restoration of habitats in arid climates is difficult, however, and extended periods of time may be required (Monsen et al., 2004). Thus, the restored plant community may be different from regional sagebrush steppe communities in species composition and shrub cover (Newman and Redente, 2001; Paschke et al., 2005).

Although operation of the proposed EREF could result in some impacts on plant communities, habitat quality in the undisturbed areas would continue to improve from the exclusion of cattle, and the area of native communities would increase from the replanting of disturbed areas. Therefore, impacts on plant communities from facility operation would be SMALL.

Wildlife

Wildlife use of the undeveloped portions of the proposed AES property may increase as a result of improved habitat quality from the exclusion of livestock, and because the existing boundary fence around the proposed 1700-hectare (4200-acre) property would be modified to be conducive to access by wildlife, such as pronghorn antelope (smooth wire would be used for the bottom wire, which would be at least 40 centimeters [16 inches] above the ground [AES, 2010a]). However, many wildlife species would likely avoid areas near the proposed facility due to noise, structures, and human presence, although noise and human presence would decrease following the construction period.

The proposed EREF would not discharge process water to the onsite basins. However, the retention basins would receive Cylinder Storage Pad runoff and treated domestic sanitary effluents, and the detention basins would receive general site stormwater runoff. The retention and detention basins would be fenced to minimize access by wildlife. However, birds, reptiles, tiger salamanders (*Ambystoma tigrinum*), or small mammals could potentially enter the basins and be exposed to contaminants when the basins contain water. Contaminants in the retention basins could include water treatment chemicals and, potentially, small amounts of radionuclides. Small amounts of oil, grease, or other automotive fluids could be present in the detention basins. Because of the scarcity of surface water in the region, birds and small wildlife species would likely be attracted to the basins.

Collisions with vehicles along the entrance road would continue to be a hazard for wildlife, and may increase if wildlife use of the habitat on the proposed site increases. In addition, facility buildings could present a collision hazard for birds. Lights would be located along roadways and near building areas. Nocturnal insects attracted to lights could be preyed upon by bats, such as the Townsends big-eared bat.

Although the Cylinder Storage Pads would be fenced to exclude wildlife, entry to the storage pads by small species could occur. A small number of individuals could subsequently be exposed to elevated radiation levels from the cylinders. However, it is unlikely that wildlife would be present for extended periods. Atmospheric releases of materials such as UF_6 could also result in exposures of wildlife or plants. The U.S. Department of Energy (DOE) has established radiation dose limits of 1 rad (10 milligray) per day for the protection of terrestrial plants and 0.1 rad (1 milligray) per day for terrestrial animals (DOE, 2002). Based on atmospheric releases of radionuclides from the proposed EREF, estimated doses to biota in the surrounding area would be below the DOE limits. Therefore, impacts on biota from exposure to elevated radiation levels would also be small.

Greater sage-grouse would also be affected by factors related to operation of the proposed EREF. Sage-grouse would likely avoid areas near the proposed facility due to noise, visibility of structures, lighting, and human presence. Avoidance of otherwise suitable habitat would result in a larger area of effective loss of habitat for the local population and would displace individuals to other areas of their seasonal range. In addition, the EREF property fence could be a source of mortality for sage-grouse. Although, as noted above, the fence would be modified for access by wildlife, fences are known to create a collision hazard for sage-grouse (ISAC, 2006). The addition of markers to increase wire visibility (AES, 2010g) could help reduce collision-related mortality.

Operation of the proposed EREF could result in impacts on wildlife and plant communities on the proposed EREF site and occupying nearby habitats. However, the implementation of mitigation measures and BMPs would reduce potential impacts. Therefore, impacts on ecological resources from facility operation would be SMALL.

4.2.7.3 Mitigation Measures

This section presents mitigation measures to minimize impacts on ecological resources. Included are mitigation measures that AES has committed to (AES, 2010a) and mitigation measures identified during the NRC staff's review.

Mitigation Measures Identified by AES

- unused open areas, including areas of native grasses and shrubs, would be left undisturbed and managed for the benefit of wildlife

- native plant species (i.e., low-water-consuming plants) would be used to revegetate disturbed areas, to enhance wildlife habitat

- the detention and retention basins would be fenced to limit access by wildlife

- vehicle speeds on the proposed site would be reduced

- dust suppression BMPs would be used to minimize dust, thereby reducing the impact of fugitive dust on nearby plant communities; when required, and at least twice daily, water would be applied to control dust in construction areas in addition to other fugitive dust prevention and control methods

- during construction and operations, all lights would be focused downward

- the boundary fence around the proposed property would be improved to allow pronghorn access to the remaining sagebrush steppe habitat on the proposed property; the fence would include a smooth top wire no more than 42 inches above the ground, adequate wire spacing to prevent wildlife entanglement, a smooth bottom wire approximately 16 to 18 inches above the ground, and durable markers to increase wire visibility (AES, 2010g)

- livestock grazing on the proposed property would be eliminated when the proposed EREF becomes operational

- measures would be taken to protect migratory birds during construction and decommissioning, e.g., clearing or removal of habitat, such as sagebrush, including buffer zones, would be performed outside of the migratory bird breeding and nesting season; additional areas to be cleared would be surveyed for active nests during the migratory bird breeding and nesting season; activities would be avoided in areas containing active nests of migratory birds; the FWS would be consulted to determine appropriate actions regarding the taking of migratory birds, if needed

- herbicides would not be used during construction, but would be used in limited amounts along the access roads, plant area, and security fence surrounding the plant to control noxious weeds during operation of the plant; herbicides would be used according to government regulations and manufacturer's instructions to control noxious weeds

- eroded areas would be repaired and stabilized, and sediment would be collected in a stormwater detention basin

- erosion- and runoff-control methods, both temporary and permanent, would follow BMPs such as minimizing the construction footprint to the extent possible, limiting site slopes to a horizontal-to-vertical ratio of four to one or less, using sedimentation detention basins, protecting adjacent undisturbed areas with silt fencing and straw bales, as appropriate, and using crushed stone on top of disturbed soil in areas of concentrated runoff

- cropland areas on the proposed property would be planted with native species when the proposed EREF becomes operational

- consider all recommendations of appropriate State and Federal agencies, including the Idaho Department of Fish and Game and the FWS

Additional Mitigation Measures Identified by NRC

- plant disturbed areas and irrigated crop areas with native sagebrush steppe species to establish native communities and prevent the establishment of noxious weeds; plant immediately following the completion of disturbance activities and the abandonment of crop areas

- develop and implement a noxious weed control program to prevent the establishment and spread of invasive plant species; hose down tires and undercarriage of off-road vehicles prior to site access to dislodge seeds or other propagules of noxious weeds; monitor for noxious weeds throughout the construction and operations phases and immediately eradicate new infestations; minimize indirect impacts of weed control activities, such as herbicide effects on nontarget species, and soil disturbance and fire hazards from vehicle operation in undisturbed areas during weed control activities

- develop areas that will retain water of suitable quality for wildlife and provide wildlife access to such areas with suitable water quality

- for basins with water quality unsuitable for wildlife, use animal-friendly fencing and netting or other suitable material over basins to prevent use by migratory birds

- place metal reflectors on the top wire of the fence along the AES property boundary, to reduce sage-grouse mortality resulting from collisions with the fence

- coordinate with Idaho National Laboratory in monitoring risks to sage-grouse and other sensitive species and identifying measures to reduce risks and protect these species and their habitat, particularly sagebrush steppe

- coordinate with Idaho Department of Fish and Game to determine corrective action or mitigation for the offsite public lands lost to wildlife due to project effects

4.2.8 Noise Impacts

Noise impacts from preconstruction and construction were evaluated based on the number and type of construction equipment proposed to be on the proposed EREF site during those periods, together with other relevant parameters associated with those actions. The noise assessment also included an assessment of incremental noise along US 20 resulting from travel to and from the proposed site by the construction and operating workforces, as well as resulting from trucks delivering equipment and materials during construction and trucks delivering feedstock and removing wastes and enriched uranium products from the proposed site during operation. Background noise levels at the proposed property boundary were provided by AES and documented in the ER (AES, 2010a). No independent measurements of background noise were conducted. Instead, NRC verified the appropriateness of the data collection instruments and methodology used by AES.

NRC assigned typical noise signatures of construction vehicles and equipment in order to anticipate noise sources during preconstruction and construction. A standard noise attenuation rate of 6 dB per doubling of distance from the source was applied to each significant noise source that was presumed to be operating anywhere along the perimeter of the proposed EREF site (i.e., the industrial footprint of the proposed EREF) in order to estimate approximate noise levels at the nearest human receptor (beside the construction workforce).

Noise estimates from operation were based on expected noise signatures of the various pieces of noise-producing equipment that would be operating in outside locations.

The NRC staff has concluded from its noise assessments that, notwithstanding short-term noise impulse events such as blasting, adequate mitigation controls would ensure noise impacts during preconstruction, construction, and operation would all be below recommended standards at the closest human receptor; thus, noise impacts would be SMALL.

4.2.8.1 Preconstruction and Construction

Noise impacts would result from preconstruction and from construction activities. Specifically, noise would result from: the operation of various construction vehicles and equipment; the operation on area roads of vehicles used by the workforce to commute to and from the proposed site and delivery trucks bringing materials and equipment to the proposed site; the use of explosives (together with associated warning alarms), pile drivers, and/or backhoes to remove rock outcrops, install foundations, and bury utilities or facilitate cut and fill and grade alterations; travel of vehicles on onsite roads, loading, unloading, transferring, and stockpiling soils and materials; onsite support activities such as a concrete batch plant operation; and the operation of stationary sources such as the six emergency generators that would become operational while construction is still ongoing and, once installed, would be operated periodically throughout the construction period for the purpose of preventative maintenance. A similar preventative maintenance schedule would extend throughout the operation phase for each of the generators.

Although a detailed preconstruction and construction plan has not yet been produced, AES has developed a comprehensive list of the number and types of vehicles that would be involved and identified the general parameters of their expected use (AES, 2010a). In addition to light-duty commuting and light-duty and heavy-duty delivery vehicles, AES has indicated that the following types of vehicles and equipment would be used: cranes, cherry pickers, water trucks, concrete delivery trucks, concrete pump trucks, stake body trucks, compressors, generators, and pumps (AES, 2010a).

Noise would be generated at US 20 during construction of the site access roads and at their interconnection with US 20. Noise related to traffic on US 20 would increase due to traffic increases in delivery vehicles and commuting vehicles of the construction workforce.

Notwithstanding construction of the US 20 interchange, the majority of the construction activities would occur within the proposed EREF site (i.e., the industrial footprint of the proposed facility), which is located in the approximate center of the proposed EREF property, approximately 3060 meters (10,039 feet) north of the US 20 interchange. AES estimates that noise from the operation of construction vehicles and equipment would range from 80 to 95 dBA at a distance of 15 meters (50 feet) from each source (AES, 2010a). Given that the majority of vehicles and equipment would be operating primarily within the industrial footprint (construction of the highway interchange and site access roads notwithstanding) and with the expectation that access to the active area would be limited to the authorized, fully informed, and adequately protected construction workforce, it is reasonable to expect that all potential public receptors would be at least no closer than 15 meters (50 feet) from high noise sources and, in most instances, at substantially greater distances from those sources. Members of the public traveling on US 20 would be close to high noise sources associated with construction of the interchange, but those individuals would be in vehicles and their exposures would be limited to a relatively short duration as their vehicle passed by the active construction zone. The noise level is expected to vary throughout the 10-hour workday with certain activities such as blasting creating short-term, high-intensity impulse noise that is likely to be higher than 95 dB at the source.

According to the facility construction plan proposed by AES (AES, 2010a), most of the major noise-producing activities (site clearing and grading, excavations [including the use of explosives], utility burials, construction of onsite roads [including the US 20 interchanges], and construction of the ancillary buildings and structures) would occur during preconstruction.

As discussed in Section 3.9, various noise standards have been promulgated at the Federal level that could serve as a basis for local ordinances. Although no specific noise ordinances have been adopted for the local area, the Federal standards of relevance in evaluating the acceptability of noise impacts from preconstruction and construction of the proposed EREF include:

- Day-night average noise levels, L_{dn}, less than 65 dBA are considered clearly acceptable for residential, livestock, and farming land uses; L_{dn} between 65 dBA and 75 dBA are normally unacceptable but could be made acceptable (to human receptors) with the application of noise attenuation features to occupied structures; L_{dn} above 75 dBA are always unacceptable for residential land uses, but L_{dn} between 70 and 80 dBA are acceptable for industrial and manufacturing areas (HUD, 2009).

- Day-night average noise levels, L_{dn}, less than 65 dBA are considered compatible with residential land uses; levels up to 75 dBA may be compatible with residential uses and transient lodging if structures have noise isolation features (EPA, 1980).

- Day-night average noise levels, L_{dn}, below 55 dBA are always acceptable (EPA's goal for outdoor spaces).

Noise attenuation with distance is dependent on a number of factors, including land type and cover, topography, the presence of natural or man-made obstructions, and meteorological conditions such as wind speed and direction, temperature inversions, and cloud cover. The widely accepted rate of noise attenuation is a reduction of 6 dBA for every doubling of distance.

However, this rate represents a fully vegetated land surface. In arid or semiarid locations where vegetative cover is less than complete and surface soils tend to be highly sound-reflective, lesser amounts of attenuation can be expected. However, despite its characterization as a semiarid steppe, the proposed EREF site has a relatively complete vegetative cover, notwithstanding the volcanic rock outcroppings that constitute approximately 28 percent of the land area (see Section 3.6 for additional details). It is therefore reasonable to expect that noise attenuation would occur at or near the average of 6 dBA with every doubling of distance from the source.[10]

Figure 4-5 shows the site plan for the proposed EREF site, the access roads, US 20 interchange, and the visitor center. The proposed EREF property boundary closest to the industrial footprint is to the north at a distance of approximately 762 meters (2500 feet). The industrial footprint is approximately 3060 meters (10,039 feet) north of US 20. Except as noted below, adjacent land parcels are expected to continue to be used for livestock grazing and agricultural activities. The nearest residence to the proposed site was identified by AES as being 7.7 kilometers (4.8 miles) east of the proposed site. No other sensitive human receptors (schools, churches, hospitals) are closer. The Wasden Complex, an archeological site, is approximately 1.0 kilometer (0.6 mile) outside the proposed EREF property boundary. The Wasden Complex contains no brick-and-mortar or masonry structures and, at its distance from the proposed site, would not experience any potentially destructive sound pressure levels. (See Section 4.2.7 for a more detailed discussion of ecological impacts from noise related to preconstruction, construction, and operation.)

Assuming a noise level of 95 dBA at the perimeter of the proposed EREF site (potentially occurring during preconstruction activities), applying an attenuation rate of 6 dBA per distance doubling, and considering the distances from the active construction zone to facility boundaries, noise levels of 61 dBA are estimated to occur at the north boundary of the proposed EREF property. Assuming the maximum noise levels from site access road construction to also be 95 dBA, an attenuation rate of 6 dBA per doubling of distance, and considering that access roads approach the west facility boundary of the proposed EREF property as close as 37 meters (120 feet), noise levels at that boundary are estimated to be as high as 89 dBA. Although this anticipated level exceeds suggested acceptable limits, construction activities for the road in proximity to the west boundary of the proposed EREF property would be short-term, and the immediately adjacent offsite land parcel is expected to be used for either livestock grazing or agriculture and to not have a human presence during the majority of time the preconstruction activities are occurring.

At their closest point, one access road, the highway interchange, and the visitor center are immediately adjacent to BLM's Hell's Half Acre WSA located to the south. However, individuals visiting Hell's Half Acre are expected to be no closer than the start of the hiking trail, another 0.5 kilometer (0.3 mile) farther to the south. At the start of the hiking trail, attenuated construction noise is estimated to be between 51 and 66 dBA. Although construction noise would be audible at the hiking trail, the initial preconstruction and construction activities that represent the highest potential noise emissions would be short-term (for intermittent periods

[10] Some slight seasonal variation in noise attenuation is anticipated due to the presence or absence of vegetative cover or snow cover. No quantitative estimates were made, however, since it is difficult to anticipate the manner in which adjacent land parcels would be used from year to year.

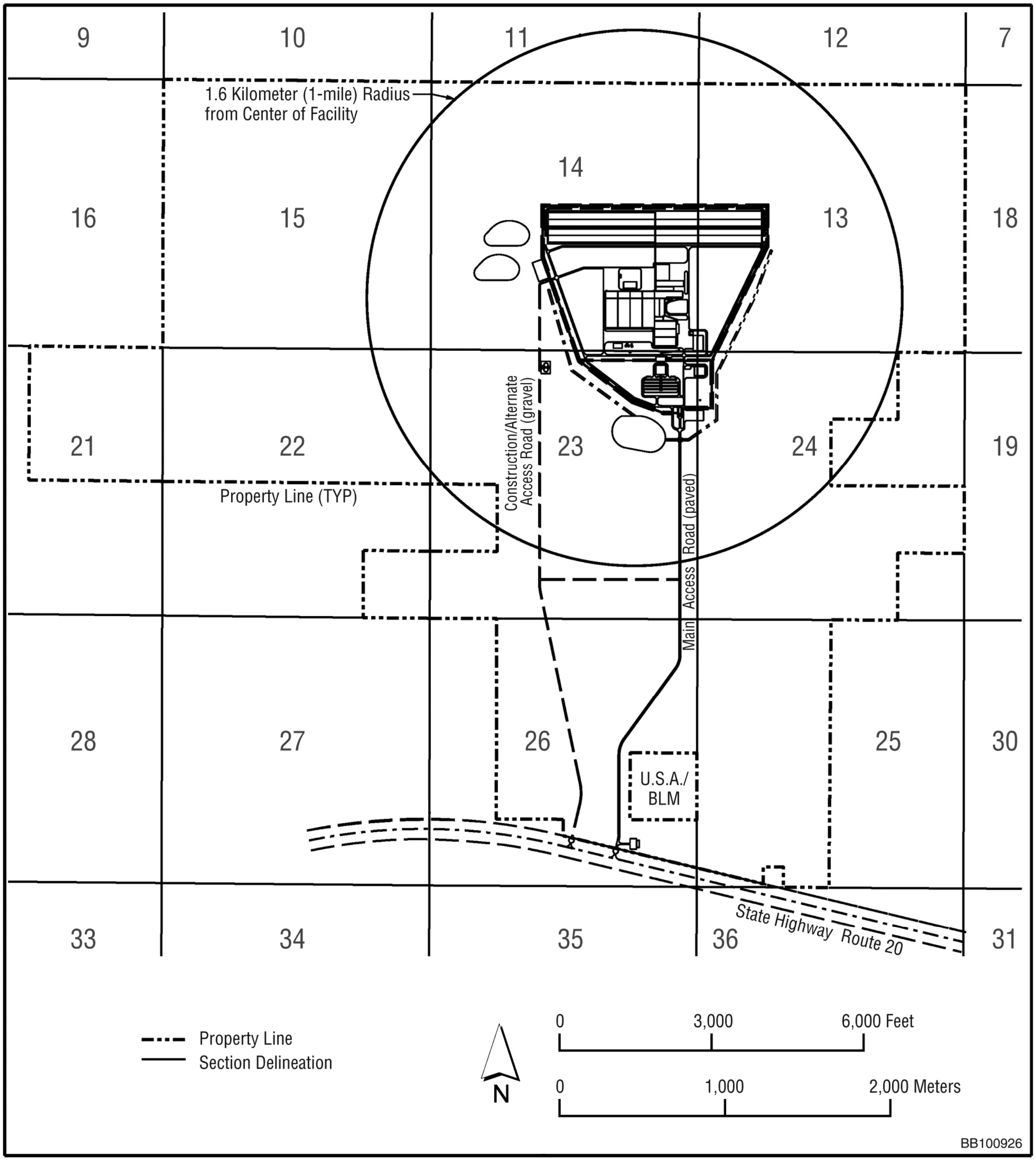

Figure 4-5 Proposed EREF Site Plan (AES, 2010a)

over the 12 month construction period for the highway interchanges) and associated noise would combine with highway noise already occurring in that area, measured and documented by AES in the AES ER at 57 dBA (AES, 2010a).

Available data suggest that construction noise during preconstruction would be audible at some boundaries of the proposed EREF property. Construction noise emanating from activities within the industrial footprint is expected to be attenuated to acceptable levels at the boundaries of the proposed EREF property. Noise resulting from highway interchange, site access road, and visitor center construction may occur at offsite locations at levels above values suggested in Federal standards as acceptable, albeit for relatively short periods of time throughout construction of the US 20 interchanges (estimated by AES as 12 months or less). However, with the exception of individuals using the Hell's Half Acre hiking trail or traveling on US 20 (at highway speeds), the potentially impacted offsite areas are all used for livestock grazing and/or agricultural purposes and would typically not have a human presence. No residence is expected to experience unacceptable levels of noise during any phase of preconstruction and construction.

The NRC staff concludes that noise impacts from initial preconstruction activities may exceed established standards at some locations along the proposed EREF property boundary for relatively short periods of time. However, because of the distances involved, expected levels of attenuation, the application of mitigation measures, and the expected limited presence of human receptors at these locations, the impacts would be SMALL for human receptors. During the 4-year overlap period when partial operations begin as heavy construction is completed, noise impacts from remaining construction activities and from operation are expected to be additive, but nevertheless substantially reduced from noise levels during preconstruction and construction would be SMALL.

4.2.8.2 Facility Operation

Current development plans provide for a period of approximately 4 years when the proposed facility becomes partially operational while some structure construction is still ongoing within the industrial footprint. However, the majority of the largest noise emissions are expected to occur during preconstruction. Those activities would all have been completed throughout the proposed site before any operations begin, with ongoing construction confined to a small area and not involving major noise-producing equipment or activities. The combined noise impacts from simultaneous remaining construction and partial operation would be dominated by the higher noise source but nevertheless is expected to be diminished from impacts during initial preconstruction and construction.

Major noise sources associated with operation of the proposed EREF include the six diesel-fueled emergency generators located at outdoor areas within the industrial footprint, commuter traffic noise for the operational workforce (and a small construction workforce for the 4-year period of heavy construction and operation overlap), traffic noise from the movement of delivery vehicles to bring feedstock materials and other support materials to the proposed site and remove product and waste materials from the proposed site, noise from operation of various pumps and compressors, and cooling fan noise. Numerous pieces of equipment associated with operation can be expected to have noise signatures. However, with the exception of emergency generators, cooling fans, and large compressors, the majority of noise-producing equipment would be located inside buildings and their noise sources would be significantly attenuated by those structures.[11] Some of the outdoor equipment with significant noise signatures are expected to be located within noise-suppressing enclosures.

AES referenced noise measurements from the Almelo Enrichment Plant in Almelo, The Netherlands, a facility also using the same gas centrifuge design as the proposed EREF, as ranging from 30 to 47 dBA at the facility boundary (AES 2010a). Because the Almelo Facility's design does not include a substantial fallow buffer area between industrial activities and the facility's boundary, AES has characterized the Almelo-measured operational noise levels as conservative representations of the proposed EREF operational noise levels (as measured at the proposed EREF property boundary) and concluded they satisfy all relevant or potentially relevant U.S. noise standards and guidance. NRC concurs that same noise levels that would occur at the proposed EREF would comply with relevant U.S. noise standards and guidance.

Traffic associated with operations at the proposed EREF would result in increased noise levels along US 20 in the vicinity of the proposed EREF, contributing to traffic-related noise that already exists in proximity to the highway, especially during expected periods of commuting of INL personnel from Idaho Falls. Residents in the vicinity of US 20, but otherwise unaffected by operational noise emanating from the proposed EREF site, would be impacted by increased traffic noise. Traffic noise can be expected to increase slightly and, depending on the operational schedules established for the proposed EREF, the duration of traffic noise may increase over the course of a workday.

The NRC staff concludes that distances from noise sources to sensitive receptors would result in adequate control of noise sources related to operation of the proposed EREF, and noise impacts from operation of the proposed EREF would be SMALL.

4.2.8.3 Mitigation Measures

The most effective strategy for mitigating noise impacts to the general public involves maximizing the distance between noise sources and potential public receptors. The size of the proposed EREF property, the positioning of the proposed EREF site within that property, the design of the proposed EREF site, and site access controls would guarantee such separations during preconstruction, construction, and operating periods. In addition to the intrinsic controls of the proposed EREF property and the placement of the proposed EREF site within that property, AES identified the following noise mitigation strategies for preconstruction and construction (AES, 2010a):

- restricting most of US 20 use after twilight through early morning hours to minimize noise impacts to the nearest residence; restrict usage of heavy truck and earthmoving equipment after twilight through early morning hours during construction of the access roads and

[11] The gas centrifuges operate at extremely high speeds. However, because they are supported magnetically and operate under high vacuum, their operation is expected to be extremely quiet. Catastrophic failure of a centrifuge may create a high impulsive noise. Their design, together with their locations inside buildings, suggest that the centrifuges would not contribute significantly to the operational noise signature of the proposed EREF that would be experienced at the proposed EREF property boundary.

highway entrances, to minimize noise impacts on the Hell's Half Acre Wilderness Study Area

- performing construction or decommissioning activities with the potential for noise or vibration at residential areas that could have a negative impact on the quality of life, during the daytime hours (7:00 am–7:00 pm); if it is necessary to perform an activity that could result in excessive noise or vibration in a residential area after hours, AES would notify the community in accordance with site procedures

- using engineered and administrative controls for equipment noise abatement, including the use of equipment and vehicle mufflers, acoustic baffles, shrouding, barriers, and noise blankets

- sequencing construction or decommissioning activities to minimize the overall noise and vibration impact (e.g., establish the activities that can occur simultaneously or in succession)

- using blast mats, if necessary, when using explosives

- creating procedures for notifying State and local government agencies, residents, and businesses of construction or decommissioning activities that may produce high noise or vibration that could affect them

- posting appropriate State highway signs warning of blasting

- creating a Complaint Response Protocol for dealing with and responding to noise or vibration complaints, including entering the complaint into the site's Corrective Action Program

- establishing and enforcing onsite speed limits

The NRC identified the following additional noise mitigation measure for preconstruction and construction:

- suspend the use of explosives during periods when meteorological conditions (e.g., low cloud cover) can be expected to reduce sound attenuation

AES has identified the following mitigative actions to control noise impacts during operation of the proposed EREF (AES, 2010a):

- mitigating operational noise sources primarily by plant design, whereby cooling systems, valves, transformers, pumps, generators, and other facility equipment are located mostly within plant structures and the buildings absorb the majority of the noise located within

- restricting most of US 20 use after twilight through early morning hours to minimize noise impacts to the nearest residence

- establishing preventative maintenance programs that ensure all equipment is working at peak performance (AES, 2009b)

4.2.9 Transportation Impacts

This section discusses the potential impacts from transportation to and from the proposed EREF site. Transportation impacts resulting from the movement of personnel and material during preconstruction, construction, and operation of the proposed EREF include:

- transportation of construction materials and construction debris
- transportation of the construction workforce
- transportation of the operational workforce
- transportation of feed material (including natural UF_6 [i.e., not enriched], empty tails cylinders, and supplies for the enrichment process)
- transportation of the enriched UF_6 product (and empty product cylinders)
- transportation of process wastes, including depleted UF_6 and other radioactive wastes

The primary impact of preconstruction and the proposed action on transportation resources is expected to be increased traffic on nearby roads and highways. Transportation impacts during preconstruction and construction, and during facility operation would be SMALL to MODERATE on adjacent local roads (due to the potentially significant increase in average daily traffic), but regional impacts would be SMALL.

No fatalities are expected as a result of construction worker traffic to and from the proposed EREF site during each of the peak years of construction. Measures proposed by AES to mitigate potential traffic impacts at the entrance to the proposed EREF include encouraging carpooling, varying shift change times, and incorporating traffic safety measures to improve traffic flow on US 20 (AES, 2010a).

No construction or operational worker fatalities are expected from traffic accidents. Less than two latent fatalities are expected from truck emissions on an annual basis. Less than two latent cancer fatalities (LCFs) to either the general public or occupational workers are expected from incident-free transport of radioactive materials. No fatalities to the general public resulting from truck accidents are anticipated. The potential health impacts from the transportation of radioactive materials and from chemical exposures resulting from a transportation accident would be SMALL.

4.2.9.1 Preconstruction and Construction

Preconstruction and construction activities for the proposed EREF would cause an impact on the local transportation network due to the construction of the highway entrance(s), the daily commute of up to 590 construction workers during the peak years of construction, and daily construction deliveries and waste shipments (AES, 2010a). The commute of the peak number of construction workers, combined with the anticipated number of construction deliveries and waste shipments, could increase the daily traffic on US 20 from 2210 vehicle trips per day (see Table 3-23 in Chapter 3) to 3420 vehicle trips per day (2210 plus 590 commuting round trips and 15 delivery/waste round trips). This represents a 55 percent increase in traffic volume over current levels. Based on employment and delivery/shipment projections for the proposed facility, this estimate also represents the maximum number of vehicle-trips during the period when construction and operations overlap (AES, 2009b) (see Section 4.2.9.2).

Because traffic volume is expected to remain below capacity on Interstate 15 (I-15) and traffic slowdowns or delays would only be expected to occur at the entrance to the proposed EREF during shift changes, the impacts on overall traffic patterns and volumes would be MODERATE on US 20 and SMALL on I-15.

In addition to the increased traffic that might result from the construction of the site entrance(s) along US 20, there would be an increased potential for traffic accidents. Assuming an 80-kilometer (50-mile) round-trip commute (i.e., the round-trip distance between the Idaho Falls area and the proposed EREF) for 250 workdays per year, 590 vehicles would travel an estimated total of 11,800,000 vehicle kilometers (7,375,000 vehicle miles) per year. This average round-trip distance was assumed because Idaho Falls is the closest principal business center to the proposed EREF. Based on the statewide vehicle accident and fatality rates of 85.8 injuries and 1.59 fatalities per 100 million annual vehicle miles (ITD, 2009), seven injuries and no fatalities (risk of <0.12 fatalities estimated) would be expected to occur during a peak preconstruction/construction employment year. Therefore, the impacts from construction vehicle accidents would be SMALL.

An average of 3940 delivery and waste trucks would arrive and depart the proposed site in each of the three peak years of construction (about 16 trucks per day) (AES, 2010a). Assuming an average round-trip distance of 80 kilometers (50 miles), construction-related trucks would travel an estimated 315,200 vehicle kilometers (197,000 vehicle miles) per year. Based on State-level surface freight accident rates of 63.4 injuries and 40.1 fatalities per 100 million annual truck miles (Saricks and Tompkins, 1999), no injuries (risk of <0.13 injuries) and no fatalities (risk of <0.08 fatalities) from construction delivery and waste shipments would be expected to occur during peak preconstruction/construction. The impacts from the truck traffic to and from the proposed site during preconstruction and construction would have a SMALL impact on overall traffic.

In addition to the potential for injuries and fatalities from construction shipments, there are potential impacts from truck emissions. Based on a conservative (Class VIIIB) emission rate (Biwer and Butler, 1999), no latent fatalities would be expected from truck emissions during a peak year of construction (risk of <0.17 latent fatalities). Therefore, pollution impacts from construction vehicle traffic would be SMALL.

Two access roadways into the proposed EREF site are planned to support access during preconstruction, construction, and facility operation (AES, 2010a).[12] The main (eastern) access road would run north from US 20 to the southern entrance of the proposed EREF site. The construction/alternate (western) access road would run north from US 20 to the western entrance of the proposed EREF site. One or both roadways would eventually be converted to

[12] Plans for permanent access to US 20, including the number of full-time operational connections, have not been finalized. As of August 2010, AES continues to consult with ITD. The impacts described in this EIS are not expected to be sensitive to the number or placement of access roads.

permanent access roads upon completion of construction. The Idaho Transportation Department (ITD) would require AES to secure and maintain a permit for access to the proposed EREF site (NRC, 2009b).

AES has initiated discussions with ITD regarding the construction of the site access roads from US 20 and related safety requirements. For the main (eastern) access road, AES has expressed little interest in at-grade turn lanes (which would not solve difficulties associated with left turns to and from the main site access road) or a loop road similar to that used by INL (which would not solve difficulties associated with the high-speed merge into peak traffic that includes few gaps) (ITD, 2010). Instead, AES has indicated a preference for a grade-separated interchange (ITD, 2010). The proposed EREF site is favorable for construction of an overpass due to existing physical features, peak directional flow to/from INL, and low traffic volumes at all other times (ITD, 2010). Ramp construction would likely require 3 to 4 months and would present a minor impact on current traffic flow (due to the mandatory construction zone speed reduction to 72 kilometers per hour [45 miles per hour]); overpass construction would result in some traffic flow disruption, but it is not expected to be significant (ITD, 2010). US 20 appears to have the available capacity to absorb additional traffic created by construction and operations related to the proposed EREF without adverse effects, with the possible exception of peak, directional travel periods (i.e., rush hour) in the morning and afternoon. Impacts on US 20 peak flow could be minimized by ceasing construction activities during peak directional flow (see Section 3.12.1) (ITD, 2010). Impacts on US 20 traffic flow due to construction of site access roads would be SMALL and temporary, occurring only during the period of access road construction.

As noted above, there is currently no road or parking infrastructure at the proposed EREF site. Therefore, site-specific traffic levels (e.g., during construction and shift changes) are based on maximum projections of construction traffic, regular operational workforce, incoming deliveries, and outgoing shipments. Peak traffic flows are anticipated at shift changes, with the principal problem area occurring where the site access roads meet US 20. The proposed EREF site is assumed to have enough parking capacity to accommodate each working shift and any necessary visitors (AES, 2010a).

Overall, the anticipated transportation impacts from preconstruction and construction, as well as the period when construction activities and operation overlap, would be SMALL to MODERATE. Assuming AES estimates for the first year of construction are representative of preconstruction (AES, 2010a), and assuming eight months of preconstruction, the estimated relative contributions to these impacts are 10 percent during preconstruction and 90 percent during construction.

4.2.9.2 Facility Operation

Operations impacts could occur from the transport of personnel, nonradiological materials, and radioactive material to and from the proposed EREF site, with the highest impacts occurring during the period when facility construction and operation overlap. The impacts from each are discussed below.

Transportation of Personnel

Operations at the proposed EREF would be continuous, requiring an operational workforce of 550 workers, approximately 4.2 employees to staff each position, three shifts per day (seven days per week), and an average of 130 positions per shift (AES, 2010a). Based on a conservative commuting density of one employee per vehicle, the average increase in daily local traffic (on US 20) due to employee commuting is estimated to be 35 percent (2210 plus 780 employee vehicle trips). Assuming a round-trip distance of 80 kilometers (50 miles) and statewide vehicle accident rates, employees would travel approximately 11,388,000 vehicle kilometers (7,117,500 vehicle miles) per year of facility operation. Based on statewide vehicle accident and fatality rates (ITD, 2009), seven injuries and no fatalities (risk of <0.12 fatalities) would be anticipated from traffic accidents during a peak year of operation.

As noted in Section 4.2.9.1, the maximum number of daily vehicle-trips during the period when construction and operations overlap is projected to be 590 commuting round trips (1180 vehicle-trips) and 15 delivery/waste round trips (30 vehicle-trips). This projection bounds the 780 daily vehicle-trips that are anticipated during peak operation, and the associated level of increased traffic would have a SMALL to MODERATE impact on the current traffic on US 20 (SMALL for an off-peak shift change).

Transportation of Nonradiological Materials

The transportation of nonradiological materials would include the delivery of routine supplies and equipment necessary to sustain operation and the removal of nonradiological wastes (including hazardous wastes). The transportation of hazardous waste is subject to EPA and U.S. Department of Transportation (DOT) regulations. Nonradiological deliveries and waste removal would require an estimated 3889 truck round-trips per year (including eight shipments of hazardous waste per year) (AES, 2010a), or approximately 16 round-trips per day. This traffic would have a SMALL impact on the current traffic on US 20. Assuming a round-trip distance of 80 kilometers (50 miles), these trucks would travel approximately 311,120 kilometers (194,450 miles) per year of operation, no injuries (risk <0.13), and no fatalities (risk <0.8) would be expected per year of peak operation. Therefore, the impacts from accidents involving the shipment of nonradiological materials would be SMALL. The 80-kilometer (50-mile) distance is reflective of the round-trip distance between the proposed EREF site and the Idaho Falls area. Peterson Hill Landfill, the proposed destination for most of the nonhazardous and nonradioactive waste generated by the proposed EREF, is located near Idaho Falls. Hazardous wastes would be shipped to a local or regional Resource Conservation and Recovery Act (RCRA)-permitted treatment, storage, and disposal facility (TSDF), such as the U.S. Ecology facility near Grandview, Idaho (approximately 121 kilometers [75 miles] from the proposed EREF site).

Transportation of Radiological Materials

Transportation of radiological materials would include shipments of feed material (natural UF_6), product material (enriched UF_6), depleted tails (depleted UF_6) and other radioactive wastes, and empty feed, tails, and product cylinders. Due to the lack of rail access in the region, AES did not propose rail transportation as a future means of shipping radioactive material and wastes

(AES, 2010a). AES has proposed trucking as the sole mode of freight transportation to and from the proposed EREF.

Transportation of radiological materials is subject to NRC and DOT regulations. All materials shipped to or from the proposed EREF could be shipped in Type A containers. The product (enriched UF_6) is considered by the NRC to be fissile material and would require additional fissile packaging considerations such as using an overpack surrounding shipping containers. However, when impacts are evaluated, the effects of the overpack are not incorporated into the assessment and result in a set of conservative assumptions.

The potential impacts from radiological shipments, other than the traffic increase on local roads, were analyzed using the WebTRAGIS and RADTRAN computer codes. WebTRAGIS (Johnson and Michelhaugh, 2003) is a Web-based version of the Transportation Routing Analysis Geographic Information System (TRAGIS), which is used to model highway, rail, and waterway routes within the United States. RADTRAN 5 (Weiner et al., 2008) is used to calculate the potential impacts of radiological shipments using the routing information generated by WebTRAGIS. Appendix D presents details of the methodology, calculations, and results of these analyses.

RADTRAN 5.6 estimates several different types of transportation impacts. "Incident-free" impacts are those not involving any release of radioactive material, including health impacts from traffic accidents (fatalities) and due to radiation exposure from a passing radiological shipment (latent cancer fatalities [LCFs]). These impacts are estimated based on one year of shipments and are presented for both the general public near the transportation routes and the maximally exposed individual (MEI).[13] Risks are calculated based on a population density located within 800 meters (0.5 mile) of the transportation route. In addition to incident-free impacts, RADTRAN presents impacts and resultant risks (impact multiplied by probability of occurrence) from a range of accidents severe enough to release radioactive material to the environment. It was conservatively assumed that once a container is breached, the material that is released is completely aerosolized and respirable (see Section D.3.4.2).

Health effects from vehicle exhaust emissions (latent fatalities) are also considered to be an incident-free impact. These impacts are estimated using the methodology discussed in Appendix D.

<u>Radiological Shipments by Truck</u>

Impacts discussed in this section include the traffic impacts from EREF-related truck traffic as well as the radiation exposure from the radiological shipments involving UF_6, enriched product, depleted UF_6, and other low-level radioactive wastes, and empty shipping containers.

The NRC staff evaluated the number of shipments of each type of material based on the amount and type of material being transported to and from the proposed EREF:

[13] A maximally exposed individual (MEI) is a member of the general public that would be expected to receive the highest potential radiological dose for a given scenario.

- Feed material (natural UF_6) would be shipped to the proposed EREF site in Type 48Y cylinders (up to 1424 per year) primarily from UF_6 conversion facilities near Metropolis, Illinois, or Port Hope, Ontario, Canada (AES, 2010a). Feed material could also be received from international sources, via major international shipping ports on the East Coast (Portsmouth, Virginia, or Baltimore, Maryland). There would be one 48Y cylinder per truck, resulting in approximately six shipments per day (assuming 250 shipping days per year).

- Enriched UF_6 product would be shipped in Type 30B cylinders (up to 1032 per year) to any of three domestic fuel manufacturing plants (located in Richland, Washington; Wilmington, North Carolina; or Columbia, South Carolina) or to international destinations via the two international shipping ports (Portsmouth, Virginia, or Baltimore, Maryland). Up to five Type 30B cylinders could be shipped on one truck; however, AES proposes to ship only two cylinders per truck (AES, 2010a). Therefore, 516 truck shipments per year (approximately two per day) would leave the proposed site.

- The impacts of transporting depleted UF_6 to a conversion facility in preparation for eventual disposal were also analyzed. Conversion could be performed at a DOE facility or a private facility (see Section 2.1.5), although AES has not indicated any plans to use a private facility. DOE conversion facilities are currently being constructed at Paducah, Kentucky, and Portsmouth, Ohio, and the NRC is currently reviewing a license application for a private conversion facility (International Isotopes, Inc.) (NRC, 2010d). Depleted UF_6 would be placed in Type 48Y cylinders for temporary storage at the proposed EREF site and eventual shipment offsite. Approximately 1222 truck shipments per peak year (one cylinder per truck) would be required to transport the depleted UF_6 to a conversion facility where the waste would be converted into U_3O_8. If DOE performs the conversion at the Paducah or Portsmouth facilities, the resulting U_3O_8 could be shipped offsite for disposal.

- In addition to full feed, product, and depleted UF_6 shipments, 1424 empty feed, 1032 empty product, and 1222 empty depleted UF_6 cylinders on an average annual basis would be shipped to or from the proposed EREF. Assuming two cylinders per truck for all shipments (AES, 2010a), 1839 truck shipments would be required per year (about 7 to 8 per day, assuming 250 shipping days per year).

- Other radiological waste of approximately 146,500 kilograms (323,000 pounds) per year would be shipped offsite to EnergySolutions (in Oak Ridge, Tennessee) for processing or to EnergySolutions (near Clive, Utah) or U.S. Ecology (in Hanford, Washington) for disposal (AES, 2010a). These shipments would total approximately 16 truck shipments per year. The distance to the Oak Ridge disposal site, which is the furthest of the two disposal sites from the proposed EREF, adequately encompasses the range of radiological waste disposal sites that could be available in the future.

Based on the discussion above, the total number of trucks containing radiological shipments (i.e., both incoming and outgoing material) would be about 20 per day (5017 total shipments over 250 shipping days per year), which would have a minimal impact on US 20 traffic in the vicinity of the proposed EREF site.

Latent Cancer Fatality from Exposure to Ionizing Radiation

A latent cancer fatality (LCF) is a death from cancer resulting from, and occurring an appreciable time after, exposure to ionizing radiation. Death from cancer induced by exposure to radiation may occur at any time after the exposure takes place. However, latent cancers would be expected to occur in a population from 1 year to many years after the exposure takes place. To place the significance of these additional LCF risks from exposure to radiation into context, the average individual has approximately 1 chance in 4 of dying from cancer (LCF risk of 0.25).

The EPA has suggested a conversion factor such that for every 100 person-sieverts (10,000 person-rem) of collective dose, approximately 6 individuals would ultimately develop a radiologically induced cancer (Eckerman et al., 1999). If this conversion factor is multiplied by the individual dose, the result is the individual increased lifetime probability of developing an LCF. For example, if an individual receives a dose of 0.00033 sieverts (0.033 rem), that individual's LCF risk over a lifetime is estimated to be 2×10^{-5}. This risk corresponds to a 1 in 50,000 chance of developing a LCF during that individual's lifetime. If the conversion factor is multiplied by the collective (population) dose, the result is the number of excess latent cancer fatalities.

Because these results are statistical estimates, values for expected latent cancer fatalities can be, and often are, less than 1.0 for cases involving low doses or small population groups. If a population group collectively receives a dose of 50 sieverts (5000 rem), which would be expressed as a collective dose of 50 person-sieverts (5000 person-rem), the number of potential latent cancer fatalities experienced from within the exposure group is 3. If the number of latent cancer fatalities estimated is less than 0.5, on average, no latent cancer fatalities would be expected.

Source: NRC, 2004, 2005.

Table 4-12 presents a summary of the potential health impacts to the public and transportation crews for one year of shipments via truck, calculated using RADTRAN 5. The results are presented in terms of a range of values for each type of shipment. The range represents the lowest to highest impacts for the various proposed shipping routes. For example, for feed material, the range of impact values represents one year of shipments from any of the four locations where feed material shipments could originate. If feed materials were provided from one or more of the locations, the impacts would be somewhere between the low and high values (impacts could be evaluated by summing the products of the fraction of material from each location and the calculated impacts from those locations). Also included in the table are the range of impacts summed over shipments of the feed, product, depleted uranium, and waste.

Table 4-12 Summary of Annual Impacts on Humans from Truck Transportation of Radioactive Material[a]

		Incident-Free LCF			Accident	
Material	Range	Latent Emissions Fatalities	Public Radiation LCF	Crew Radiation LCF	Physical Fatalities	LCF[b]
Feed	High	6.1×10^{-1}	1.9×10^{-1}	1.1×10^{-2}	8.2×10^{-2}	6.6×10^{-3}
	Low	3.5×10^{-1}	9.6×10^{-2}	7.2×10^{-3}	5.7×10^{-2}	4.8×10^{-3}
Product	High	2.4×10^{-1}	8.4×10^{-2}	3.1×10^{-3}	3.0×10^{-2}	5.9×10^{-3}
	Low	3.9×10^{-2}	1.3×10^{-2}	6.6×10^{-4}	7.3×10^{-3}	8.4×10^{-4}
Depleted UF_6/tails	High	3.5×10^{-1}	1.1×10^{-1}	7.8×10^{-3}	5.9×10^{-2}	4.4×10^{-3}
	Low	3.1×10^{-1}	9.6×10^{-2}	6.0×10^{-3}	5.0×10^{-2}	3.2×10^{-3}
Empty feed	High	3.0×10^{-1}	2.7×10^{-1}	1.6×10^{-2}	4.1×10^{-2}	2.5×10^{-8}
	Low	1.8×10^{-1}	1.6×10^{-1}	1.1×10^{-2}	2.9×10^{-2}	1.6×10^{-8}
Empty product	High	2.4×10^{-1}	3.2×10^{-1}	1.5×10^{-2}	3.0×10^{-2}	1.2×10^{-8}
	Low	3.9×10^{-2}	6.6×10^{-2}	3.3×10^{-3}	7.3×10^{-3}	1.7×10^{-9}
Empty depleted UF_6/tails	High	2.6×10^{-1}	2.3×10^{-1}	1.4×10^{-2}	3.5×10^{-2}	2.5×10^{-8}
	Low	1.5×10^{-1}	1.3×10^{-1}	9.0×10^{-3}	2.5×10^{-2}	1.0×10^{-8}
Waste	High	5.0×10^{-3}	1.4×10^{-3}	1.9×10^{-4}	7.6×10^{-4}	1.3×10^{-6}
	Low	1.2×10^{-3}	2.6×10^{-4}	3.0×10^{-5}	1.1×10^{-4}	2.5×10^{-7}
Total	High	2.0	1.2	6.7×10^{-2}	2.8×10^{-1}	1.7×10^{-2}
	Low	1.1	5.6×10^{-1}	3.7×10^{-2}	1.8×10^{-1}	8.8×10^{-3}

[a] Risks calculated based on a population density within 800 meters (0.5 mile) of the transportation route.
[b] LCF from accidental release is a population risk (probability × consequence).

Table 4-13 presents the radiological risk from each type of shipment to a member of the general public who is an MEI (calculated using RADTRAN 5). The MEI is defined as being located 30 meters (98 feet) from a shipment passing at a speed of 24 kilometers per hour (15 miles per hour) (NRC, 1977). MEI dose and risk are dependent only on the cargo dose rate, not on the route or distance traveled.

For members of the general public, the largest impacts from the shipment of radioactive materials are from incident-free transportation (one to two latent fatalities from the vehicle emissions per year and less than one fatality from traffic accidents per year). The high-range risk of LCFs would be approximately one per year from incident-free radiation exposure and no LCFs would be expected from postulated accidents. These impacts on the public would be SMALL, because the collective radiation exposure would be distributed among all people along the transportation routes and each exposed individual would receive a minimal dose. The greatest radiological risk to an MEI would be from empty product cylinders (risk of 2.1×10^{-7}, or 1 chance in 4.8 million) and the associated dose would be less than 0.00001 percent of the

Table 4-13 Risk to the MEI from a Single Radioactive Material Shipment[a]

Material	Dose (rem)	LCF[b]
Feed	1.9×10^{-4}	1.1×10^{-7}
Product	6.9×10^{-5}	4.1×10^{-8}
Depleted UF_6/tails	1.6×10^{-4}	9.6×10^{-8}
Empty feed	2.9×10^{-4}	1.7×10^{-7}
Empty product	3.5×10^{-4}	2.1×10^{-7}
Empty depleted UF_6/tails	2.5×10^{-4}	1.5×10^{-7}
Waste	2.1×10^{-6}	1.3×10^{-9}

[a] MEI is located 30 m from a passing shipment that is traveling 24 km/h (15 mph).
[b] LCFs based on risk of 6×10^{-4} fatal cancer per person-rem (EPA, 1999).

100-millirem annual regulatory limit for members of the general public. No LCFs would be expected from incident-free radiation exposure to transportation crews, so these impacts would also be SMALL.

Import and Export Impacts

As noted in the previous section, AES has indicated that the proposed EREF could import feed materials from overseas suppliers or export enriched product to overseas purchasers (AES, 2010a). In this case, the proposed EREF would need to comply with licensing and other requirements for import and export activities in 10 CFR Part 110. Any import or export activity would also need to be conducted in accordance with transportation security requirements in 10 CFR Part 73. Transportation security for the proposed EREF should be addressed in a physical security plan. The discussion below summarizes expected transportation impacts associated with potential import/export activities along routes to the two seaports identified by AES (Portsmouth, Virginia, and Baltimore, Maryland).

For this EIS, the NRC staff performed analyses for the transportation of enriched uranium from the proposed EREF to fuel fabrication facilities in Wilmington, North Carolina (Global Nuclear Fuels-America); Columbia, South Carolina (Westinghouse Electric); and Richland, Washington (AREVA NP). These analyses are representative of enriched uranium shipments from the proposed EREF to the seaports identified above, because the truck and rail routes that would be used in transporting enriched uranium to these seaports have similar distances and population densities to the routes analyzed for shipments to the domestic fuel fabrication facility destinations.

The NRC staff also performed analyses for the transportation of feed material to the proposed EREF from Port Hope, Ontario, Canada. This analysis is considered representative of potential feed material shipments from the seaports to the proposed EREF, because the distances, population densities, and expected external radiation doses for such shipments would not be significantly different from those already analyzed.

Therefore, for shipments of both enriched uranium and feed material to or from seaports, transportation impacts (incident-free and accidents) would be SMALL and would not be significantly different from transportation impacts referenced above.

<u>Chemical Impacts during Transportation of Radioactive Materials</u>

In addition to the potential radiological impacts from the shipment of UF_6, chemical impacts from an accident involving UF_6 could affect the surrounding environment and public. No chemical impacts are expected during normal transportation conditions as no releases from packaging would occur. However, when released from a shipping container, UF_6 would react with moisture in the atmosphere to form hydrofluoric acid and uranyl fluoride (UO_2F_2), which are chemically toxic to humans. Hydrofluoric acid is extremely corrosive and can damage the lungs and result in death if inhaled at high enough concentrations. Uranium compounds, in addition to being radioactive, can have toxic chemical effects (primarily on the kidneys) if they enter by way of ingestion and/or inhalation (DOE, 2004a,b).

The potential chemical impacts resulting from transportation accidents involving depleted UF_6 have been analyzed in EISs previously published by DOE (DOE, 2004a,b). The results of these analyses were used to estimate the chemical impacts associated with the proposed EREF and are discussed in Appendix D. The results are applicable because the chemical impact analysis performed by DOE is independent of shipping route and level of enrichment. Chemical impacts would be only dependent on the quantity of UF_6 being transported. In addition, the proposed EREF would use the same containers (Type 48Y cylinders) that DOE evaluated. The DOE analyses showed the estimates of irreversible adverse effects from chemical exposure to be approximately 1 to 3 orders of magnitude lower than the estimates of public latent cancer fatalities from radiological accident exposure. Since the estimated public health effects from radiological accident exposure would be SMALL, the chemical impacts would also be SMALL.

4.2.9.3 Mitigation Measures

Measures identified by AES to mitigate transportation impacts during preconstruction activities, construction, and facility operation include (AES, 2010a):

- encourage carpooling and minimize traffic due to employee travel
- stagger shift changes to reduce the peak traffic volume on US 20
- promptly remove earthen materials on paved roads or the proposed EREF site carried onto the roadway by wind, trucks, or earthmoving equipment
- promptly stabilize or cover bare earthen areas once roadway and highway entrance earthmoving activities are completed
- cover open-bodied trucks that transport materials likely to give rise to airborne dust

- construct acceleration and deceleration lanes at the entrances to the proposed EREF site to improve traffic flow and safety on US 20

- construct acceleration and deceleration lanes (or a grade-separated interchange) on US 20 at the entrances to the proposed EREF site to improve traffic flow and safety

- build gravel pads at the proposed EREF entry/exit points along US 20 in accordance with the Idaho Department of Environmental Quality (IDEQ) *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties, Volume 2, Erosion and Sediment Controls* (IDEQ, 2009)

- apply periodic top dressing of clean stone to the gravel pads, as needed, to maintain the effectiveness of the stone voids

- perform tire washing, as needed, on a stabilized stone (gravel) area that drains to a sediment trap

- prior to entering US 20, inspect vehicles for cleanliness from dirt and other matter that could be released onto the highway

- maintain low speed limits onsite to reduce noise and minimize impacts on wildlife

The NRC identified the following additional mitigation measures to reduce transportation impacts during facility operation:

- consider working with INL to operate a joint bus system

- establish shift changes outside of INL peak commuting periods

The ITD would review any access permit application, as noted in Table 1-3. If a permit is issued, ITD may assign mitigation measures specific to the proposed EREF (e.g., turning lanes).

4.2.10 Public and Occupational Health Impacts

This section analyzes the potential impacts on public and occupational health from proposed EREF preconstruction/construction and operation. The analysis is divided into two main sections: nonradiological impacts and radiological impacts.

The analysis of nonradiological impacts during the preconstruction and facility construction phase includes estimated numbers of injuries and illnesses incurred by workers and an evaluation of impacts due to exposure to chemicals and other nonradiological substances, such as particulate matter (dust) and vehicle exhaust. All such potential nonradiological impacts would be SMALL. Analysis of nonradiological impacts during facility operation likewise evaluates the numbers of expected illnesses and injuries and impacts from exposure to toxic chemicals used or present during operations, mainly uranium and HF. These impacts would be SMALL.

No radiological impacts are expected during preconstruction and initial facility construction, prior to radiological materials being brought onsite. The radiological impacts analysis for facility operations addresses both public and occupational exposures to radiation. Exposures to construction workers completing facility construction during initial phases of operation are also evaluated. Evaluated exposure pathways include inhalation of airborne contaminants, ingestion of contaminated food crops, and direct exposure from material deposited on the ground and external exposure associated with stored UF_6 cylinders. Impacts from exposure of members of the public would be SMALL. Worker exposures would vary by job type, but would be carefully monitored and maintained as low as reasonably achievable (ALARA) and impacts would be SMALL.

4.2.10.1 Preconstruction and Construction

This section evaluates the potential for occupational injuries and illnesses associated with the proposed preconstruction and construction activities. It also evaluates the potential public and occupational health impacts from nonradiological and radiological releases during preconstruction and construction.

Occupational Injuries and Illnesses

The proposed EREF project involves a major construction activity with the potential for industrial accidents related to construction-vehicle accidents, material-handling accidents, and trips and falls. Resultant injuries could range from minor temporary injuries to long-term injuries and/or disabilities, and even to fatalities. The proposed activities are not anticipated to be any more hazardous than those for other major industrial construction or demolition projects.

Numbers of injuries and illnesses potentially incurred by workers during preconstruction and construction were estimated using annual injury and illness data for heavy construction compiled by the U.S. Department of Labor (DOL) Bureau of Labor Statistics (BLS). For preconstruction and construction of the proposed EREF, North American Industry Classification System Code 237, “Other Heavy and Civil Engineering Construction,” is applicable. Incident rates for total recordable cases and lost workday cases for calendar year 2007 for this activity code were obtained from the BLS data for 2007 (BLS, 2008a). Fatality incident rates for 2007 were taken from BLS data for construction occupations (BLS, 2008b) to estimate potential fatalities during preconstruction and construction of the proposed EREF. The number of construction workers per year (full-time equivalents [FTEs]) and the duration of construction were obtained from AES’s ER (AES, 2010a). The incident rates for total recordable cases, lost workday cases, and fatalities were applied to the number of construction workers per year and the construction schedule to estimate the total number of respective incidents. The estimated total incidents are summarized in Table 4-14.

A total of 202 nonfatal illnesses and injuries and less than one fatality are estimated during the projected 7 years of heavy preconstruction and construction activities based on peak construction levels. The numbers of such incidents would be substantially smaller during the four following years of assemblage and testing of the proposed project, as a much smaller number of worker-years would be involved, while the nature of work would shift from primarily structural crafts to primarily electrical and mechanical crafts with typically lower injury rates.

Table 4-14 Estimated Occupational Health Related Incidences during Preconstruction and Construction

FTE		Injury and Illness Cases		Lost Workday Cases		Fatalities	
FTEs per Year	Total FTE[a]	Incidents per 100 FTEs[b]	Total Recordable Cases	Incidents per 100 FTEs[b]	Lost Workday Cases	Incidents per 100,000 FTEs[c]	Total Fatalities
590	4130	4.9	202	2.6	107	12.3	0.51

[a] FTEs = full time equivalents; total FTEs based on 7 years at a peak level of 590 per year.
[b] BLS, 2008a.
[c] BLS, 2008b.

Based on these estimates, impacts on occupational safety from preconstruction and construction would be SMALL.

Nonradiological Exposures

Occupational exposures during preconstruction and construction would include exposure of construction workers to airborne fugitive dust generated from vehicle traffic and heavy equipment use, exposure to pollutants emitted from diesel- and gasoline-powered equipment (e.g., CO, NO_x, SO_x, and PM), and exposure to vapors from any fuels, paints, or solvents that are used. Any such exposures would be minor and would be minimized using the work practices and personal protective equipment as required by OSHA (29 CFR 1910). Such exposures would be typical of other construction projects of industrial facilities. Therefore, impacts to workers from chemical and dust exposure during preconstruction and construction would be SMALL.

Approximately 10 percent of the total occupational injury and nonradiological impacts discussed above would occur from the preconstruction activities. This value is based on AES's estimate that the preconstruction activities would be completed within the first 8 months of a total 84-month construction schedule (AES, 2009b). This 10 percent estimate is likely an upper bound, as fewer workers would be expected to be involved during preconstruction than during the main facility construction phase.

Radiological Exposures

The radionuclide concentrations at the proposed EREF site are either at or below background natural levels (see Section 3.6.4). Therefore, there would not be any radiological impacts above normal background levels.

4.2.10.2 Facility Operation

This section evaluates the potential for occupational injuries and illnesses associated with the operation of the proposed EREF. It also evaluates the potential public and occupational health impacts from nonradiological and radiological releases during facility operation.

Occupational Injury and Illness Rates and Fatalities

Workplace safety regulations are administered by the Occupational Safety and Health Administration (OSHA). Occupational hazards would be minimized when workers adhere to safety standards and use appropriate protective equipment; however, fatalities and injuries from accidents could still occur.

The ER summarizes a comparison of yearly reportable lost-time accidents for fiscal years 2003–2007 for the similar URENCO Capenhurst Limited uranium enrichment facility in Great Britain. The OSHA lost workday case rates varied from 0 to 1.62 per 100 FTE workers (FTEs) per year (AES, 2010a). For comparison, the BLS compiles annual injury and illness incidence rates by industry (BLS, 2008a). The national average incidence rate of nonfatal occupational injuries and illnesses resulting in lost workdays for classification 325, "Chemical Manufacturing," for calendar year 2007 was 0.8 per 100 FTEs per year, which is within range of 0 to 1.62 reported for the Capenhurst enrichment facility. Thus, the rates of occupational injuries and illnesses at the proposed EREF would be expected to be similar to those at the existing Capenhurst facility and to those in the chemical manufacturing industry in general.

Assuming an estimated 550 FTEs during operation of the proposed EREF (AES, 2010a) and using a rate of 3.1 total incidents and 0.8 lost-time injuries and illnesses per 100 workers, 17 total incidents and 4.4 lost-time injuries and illnesses per year would be projected. For an operating period of 30 years, 512 total incidents and 132 lost-time incidents would be projected, as shown in Table 4-15.

The number of fatal accidents projected during operations was computed assuming an incident rate of 2.0 per 100,000 FTEs for chemical manufacturing (BLS, 2008b). For 30 years of operation, less than one fatality is projected. Accordingly, impacts for occupational illnesses and injuries and fatalities during facility operation would be SMALL.

Nonradiological Exposures

Chemical exposures of primary concern to workers and members of the public during plant operations would be to UF_6 vapors and HF, which are produced along with UO_2F_2 when UF_6 vapors contact moisture in air. Exposures to uranium compounds and HF would be of similar concern, given similar exposure standards for these chemicals in occupational settings. However, the potential for exposures to any of these chemicals during normal operations would be slight, since the UF_6 process line is maintained at subatmospheric pressure. Exposure risks at process line points where feed and product vessels are connected and disconnected would be minimized through the use of flexible fume collection lines operated at subatmospheric pressure and through the use of personal protective equipment by workers. Handling of all chemicals would be done in accordance with the Environment, Health, and Safety Program for the proposed EREF, which would conform to 29 CFR 1910 and specify the use of engineering controls, including personal protective equipment, to minimize chemical exposures during operations (AES, 2010a).

Process ventilation lines would be run to chemical traps before venting to the outdoors to prevent exposures to the public. AES estimates that the annual average HF concentration emission from a nominal 6 million SWU per year centrifuge enrichment plant would be

Table 4-15 Estimated Occupational Health-Related Incidences during Plant Operation

FTE		Injury and Illness Cases		Lost Workday Cases		Fatalities	
FTEs per Year	Total FTE[a]	Incidents per 100 FTEs[b]	Total Recordable Cases	Incidents per 100 FTEs[b]	Lost Workday Cases	Incidents per 100,000 FTEs[c]	Total Fatalities
550	16,500	3.1	512	0.8	132	2.0	0.33

[a] Assumes 30 years of operation.

[b] BLS, 2008a.

[c] BLS, 2008b.

7.7 micrograms per cubic meter (0.0094 ppm) at the point of discharge (rooftop) based on annual emission of less than 2.0 kilograms (4.4 pounds) (AES, 2010a). This concentration is well below the occupational exposure limit of 2.5 milligrams per cubic meter (3.1 ppm) for 8-hour exposure set by both OSHA and the National Institute for Occupational Safety and Health (NIOSH) (ATSDR, 2003). Workers would not be expected to be exposed to HF concentrations greater than that at the discharge point.

Taking atmospheric dispersion into consideration, the discharge point concentration would fall to 3.4×10^{-4} micrograms per cubic meter (4.2×10^{-7} ppm) at the proposed property boundary 1100 meters (3600 feet) to the north, based on dispersion modeling (see Appendix E), and to even lower levels at further distances where members of the public might be exposed. These levels are several orders of magnitude below Idaho's AAC of 125 micrograms per cubic meter (0.15 ppm) for fluoride (IDAPA 58.01.01).

Occupational and public exposure to uranium compounds, UF_6 and UO_2F_2, would be to concentrations similar to or less than that of HF. Using releases from a 1.5 million SWU plant described in NUREG-1484 (NRC, 1994) linearly scaled up to a 6.6 million SWU facility, the size of the proposed EREF, results in an estimated annual gaseous release of 743 grams (1.63 pounds) of uranium which is about half the estimate of the annual HF release. Conservatively applying the same dispersion factors as used for HF, uranium concentrations at the proposed property boundary would be on the order of 1×10^{-4} microgram per cubic meter. While no Federal or Idaho ambient air standard is available for uranium with which to compare this level, it is more than five orders of magnitude below the NIOSH and OSHA occupational exposure limit of 50 micrograms per cubic meter (soluble uranium forms, 8-hour time weighted average) (NIOSH, 1996, 2005).

Occupational exposures would be expected to be low, but might be briefly elevated to some workers during cylinder connection and disconnection activities. Estimates of such "puff" emissions of UF_6 performed for the proposed American Centrifuge Plant in Piketon, Ohio, of up to 0.7 milligram per cubic meter (NRC, 2006) are similar to the short-term exposure limit of 0.6 milligram per cubic meter for uranium set by the American Conference of Governmental Industrial Hygienists (NIOSH, 1996), and well below the NIOSH "Immediately Dangerous to Life and Health" standard of 10 milligrams per cubic meter for exposures over a 1-hour period (NIOSH, 1996). At the proposed EREF, any such brief exposures would be mitigated with a gaseous effluent ventilation system (AES, 2010a), which would be expected to maintain levels below occupational health standards based on the similarity of the design of the proposed EREF to that of the American Centrifuge Plant (NRC, 2006).

Thus, due to low estimated concentrations of uranium and HF at public (proposed property boundary) and workplace receptor locations, the public and occupational health impacts due to exposures to hazardous chemicals during normal operations would be SMALL.

Radiological Exposures

Exposure to uranium may occur from routine operations as a result of small controlled releases to the atmosphere from the uranium enrichment process lines and decontamination and maintenance of equipment, releases of radioactive liquids to surface water, and as a result of direct radiation from the process lines, storage, and transportation of UF_6. Direct radiation and skyshine (radiation reflected from the atmosphere) in offsite areas due to operations within the SBMs is expected to be undetectable because most of the direct radiation associated with the uranium would be almost completely absorbed by the heavy process lines, walls, equipment, and tanks that would be employed at the proposed EREF, and would have to travel 8 kilometers to reach the nearest member of the public.

At the proposed EREF, the major source of occupational exposure would be from direct radiation from UF_6 with the largest exposure source being the empty Type 48Y cylinders with residual material, full Type 48Y cylinders containing either the feed material or depleted UF_6, Type 30B product cylinders, and various traps that help minimize UF_6 losses from the cascade (AES, 2010a). Atmospheric releases would be expected to be a source of public exposure. Such releases would be primarily controlled through the Technical Support Building and SBM gaseous effluent vent systems (AES, 2010a).

Radiological Sources

The estimated release of gaseous uranium from the proposed EREF would be less than 20 grams (0.7 ounces) per year (AES, 2010a). However, for conservatism, the radiological impacts to both workers and members of the public were modeled, using the CAP88-PC computer code (EPA, 2009d), on the basis of releases from a 1.5 million SWU plant described in NUREG-1484 (NRC, 1994), *Final Environmental Impact Statement for the Construction and Operation of Claiborne Enrichment Center, Homer, Louisiana*, linearly scaled up to a 6.6 million SWU facility resulting in an annual gaseous release of 743 grams (1.63 pounds) of uranium (AES, 2010a). This corresponds to an activity concentration of 19.5 megabecquerels (527 microcuries) (AES, 2010a).

During the time period when the proposed EREF is operational and construction activities continue, construction workers would be exposed to gaseous uranium effluents and external radiation from UF_6 cylinders. For conservatism, the same 19.5-megabecquerel (527-microcurie) annual release was used when estimating the dose from airborne releases during construction and operation. Two different release points were used to model doses to the construction workers during the period of expansion. One release point was associated with the Technical Service Building and the other release point was associated with the Separation Building Modules (AES, 2009b). For the external dose calculations, the construction workers were conservatively modeled, using the MCNP computer code (X5 Monte Carlo Team, 2003), as being positioned in the cylinder yard as if they were completing the last 20 percent of the cylinder pad, when the largest amount of material is in storage during construction, and thus were exposed to external radiation from stored UF_6 tails, full UF_6 feed, and empty cylinders (AES, 2009b).

Doses to members of the public were modeled, using CAP88-PC (EPA, 2009d), based on the same 19.5-megabecquerel (527-microcurie) annual release from the proposed EREF. Due to the distance (8000 m) of the nearest resident to the TSB and SBM, all releases were modeled as originating from a single source. For the external pathway it was conservatively assumed members of the public were exposed to a full cylinder storage pad (AES, 2010a). Table 4-16 provides the radiological sources used for the normal operation impact assessment for occupational workers and members of the public.

Occupational Exposure

Occupational exposure to radioactive material could result from releases to the atmosphere from the proposed EREF through stack releases from the Technical Support Buildings and SBMs gaseous effluent vent system and direct external radiation from the Cylinder Storage Pad.

The expected exposure pathways for the public include inhalation of airborne contaminants, direct exposure from material deposited on the ground, and external exposure associated with the stored UF_6 cylinders.

Two groups of workers were evaluated, the construction worker dose during the overlap period when construction is continuing at the proposed EREF and routine operations have begun, and the worker population supporting the proposed EREF during operations.

The construction worker population dose was modeled by considering 10 different receptor locations around the proposed EREF (AES, 2009b). Receptors 1 to 4 considered the construction workers at the SBMs and the UF_6 handling areas, and receptors 5 to 10 considered the storage pad workers completing the last 20 percent of the UF_6 Cylinder Storage Pad (AES, 2009b). Table 4-17 provides the atmospheric dispersion factors (χ/Q) used in the dose calculations for the collective construction worker population dose during the overlap period of construction and operations. Table 4-18 provides the worker population distribution and duration of exposure during this period of construction and operation overlap.

Table 4-19 provides a summary of the dose impacts to the construction workers during the overlap period of construction and operations. The collective construction worker annual population dose was estimated to be 0.376 person-sievert (37.6 person-rem) with over 99.99 percent of the radiation dose being attributable to the external dose associated with the stored UF_6 cylinders.

The most significant impact would be from direct radiation exposure to the construction workers completing the cylinder storage pads. The dose to an average construction worker completing the last 20 percent of the UF_6 cylinder pad is estimated to receive a dose of 1.96 millisieverts per year (196 millirem per year). Since this dose exceeds the limit specified in 10 CFR 20.1301, these workers should be part of a radiation dosimetry program and reclassified as radiation workers.

Table 4-16 Source Term Used for the Radiological Impact Assessment for Normal Operations[a]

Radionuclide	Wt %	Activity MBq (µCi)
^{234}U	5.5×10^{-3}	9.5 (260)
^{235}U	0.71	0.5 (10)
^{238}U	99.3	9.5 (260)
Total		19.5 (530)

[a] Members of the general public, 6.6-million-SWU facility. Annual uranium released: 760 grams, 19.5 MBq (530 µCi).
Source: Derived from AES, 2010a.

Table 4-20 provides estimated annual doses for representative workers within the proposed EREF, and Table 4-21 provides estimated dose rates for workers at several areas at the proposed EREF. Annual whole-body dose equivalents accrued by workers at an operating uranium enrichment plant are typically low and range from 0.22 to 0.44 millisievert (22 to 44 millirem) (URENCO, 2003, 2004, 2005, 2006, 2007). In general, annual doses to workers are expected to range from 0.050 millisievert per year (5 millirem per year) for general office staff to 3 millisieverts per year (300 millirem per year) for cylinder handlers. For the proposed EREF, AES has proposed an administrative limit of 0.01 sievert per year (1 rem per year) to any radiation worker. This limit is 20 percent of the limit provided in 10 CFR 20.1201. Impacts to workers at the proposed EREF are expected to be typical of similar facilities, and would be SMALL.

Public Exposure

Public exposure to radioactive material could result from releases to the atmosphere from the proposed EREF through stack releases from the Technical Support Building and SBM gaseous effluent vent systems. Also, although members of the public would not be expected to spend a significant amount of time at the property boundary closest to the Cylinder Storage Pad, this exposure possibility is considered in the impact assessment. The analysis estimated the potential radiation dose to the collective population residing within 80 kilometers (50 miles) of the proposed EREF, a hypothetical MEI located at the proposed EREF property boundary and the nearest resident who lives 8 kilometers (5 miles) from the proposed EREF.

The expected exposure pathways for the public include: inhalation of airborne contaminants, external exposure from material deposited on the ground, external exposure associated with the stored UF_6 cylinders, and ingestion of resuspended soil. In addition, members of the public may be exposed to uranium compounds that are incorporated into the edible portions of plants and animals. These additional exposure pathways include the ingestion of vegetables, the ingestion of locally produced meat, and the ingestion of locally produced milk. Table 4-22 provides the population distribution used to estimate the collective population dose for airborne releases associated with the proposed EREF. Table 4-23 provides the locations and exposure times for

Table 4-17 Locations and Annual Average Atmospheric Dispersion Factors χ/Q (s/m^3) for the Construction Workers during the Period of Construction and Operations Overlap

Receptor Location	1	2	3	4	5	6	7	8	9	10
Direction/distance from release point 1 to receptor location (m)[a]	WSW/ 202	WSW/101	SW/241	SW/173	N/310	NNW/317	NNW/349	N/504	N/515	NNE/533
Atmospheric dispersion factors (s/m^3)	1.18×10^{-4}	2.88×10^{-4}	7.84×10^{-5}	1.34×10^{-4}	5.65×10^{-5}	4.73×10^{-5}	3.93×10^{-5}	2.33×10^{-5}	2.24×10^{-5}	1.80×10^{-5}
Direction/distance from release point 2 to receptor location (m)[a]	W/252	WNW/151	WSW/252	WSW/158	N/389	NNW/414	NNE/410	N/587	NNW/605	NNE/601
Atmospheric dispersion factors (s/m^3)	5.70×10^{-5}	6.32×10^{-5}	8.29×10^{-5}	1.70×10^{-4}	3.76×10^{-5}	2.94×10^{-5}	2.93×10^{-5}	1.76×10^{-5}	1.47×10^{-5}	1.44×10^{-5}

[a] Source: AES, 2009b.

Table 4-18 Worker Population Distribution during the Period of Construction and Operations Overlap

Labor Craft	Plant Area	Craft Hours per Year	Persons
Civil/structural	UF_6 handling	109,174	54
	SBM	269,296	134
	Cylinder pad	24,729	12
Mechanical	UF_6 handling	65,504	32
	SBM	161,577	80
	Cylinder pad	14,837	7
Electrical	UF_6 handling	43,669	22
	SBM	107,718	53
	Cylinder pad	9891	5
Totals	UF_6 handling	218,348	108
	SBM	538,592	267
	Cylinder pad	49,459	24.5

Source: AES, 2009b.

the public receptors evaluated in the radiological impact assessment. The impacts of normal operations at the proposed EFEF to public health would be SMALL.

The most significant impact would be from direct radiation exposure to public receptors close to the storage of full feed, full tails, and empty Cylinder Storage Pads.

For conservatism the dose to the maximally exposed individual was calculated at the proposed northern site boundary since this was the location of both the maximum external and inhalation dose to a receptor. The dose was calculated assuming 2000 hours per year occupancy. The 2000 hours per year was selected as the exposure time assuming a 40-hour work week and that any developments adjacent to the proposed EREF would be commercial resulting in a person occupying the adjacent site part time (approximately 2,000 hours per year rather than a full time (8,760 hours per year). The dose equivalent for this exposure scenario was estimated to be 0.014 millisievert per year (1.4 millirem per year)

The collective population dose for persons living within 80 kilometers (50 miles) of the proposed EREF was estimated to be 1.7×10^{-5} person-sievert (1.7×10^{-3} person-rem). The dominant pathway is inhalation, which comprises approximately 88 percent of the total dose. Due to the large distance between the population and the stored UF_6 cylinders, the entire dose is due to atmospheric releases of uranium compounds during normal operations. Table 4-24 provides the calculated atmospheric dispersion factors (χ/Q) used in the dose calculations for members of the general public.

Table 4-19 Summary of Annual Radiological Impacts Associated with the Construction Workers during the Overlap Period of Construction and Operations at the Proposed EREF

Receptor	Atmospheric Dispersion Factors[a] (s/m^3)	Dose Associated with Air Releases person-Sv (person-rem) or mSv (mrem)	Dose Associated with Direct Radiation from Stored UF_6 Cylinders person-Sv (person-rem) or mSv (mrem)	Total Committed Effective Dose person-Sv (person-rem) or mSv (mrem)
Construction worker Population:				
SBM + UF_6 handling area		1.57×10^{-4} (1.57×10^{-2})	0.136[b] (13.6)	0.136 (13.6)
Storage pad		2.39×10^{-6} (2.39×10^{-4})	0.24[b] 24	0.24 24
Total		1.59×10^{-4} (1.59×10^{-2})	**0.376 (37.6)**	**0.376 (37.6)**
Construction pad worker	5.65×10^{-5} [c]	1.59×10^{-7} [d] (1.59×10^{-5})	1.96[b] (196)	1.96 (196)
Regulatory limit for Individual				0.1[e]: 1[f]: 5[g] (10:100:500)

[a] The atmospheric dispersion factors are provided in Table 4-16.
[b] Source: AES, 2009b.
[c] This represents the maximum atmospheric dispersion factor for the six areas (locations 5-10) that were modeled for the construction pad worker. See Table 4-16.
[d] For airborne releases, the construction worker is assumed to be present in the area yielding the largest inhalation dose.
[e] Source: 10 CFR 20.1101 (applies to airborne releases only).
[f] Source: 10 CFR Part 20, Subpart D.
[g] Source: 10 CFR Part 20, Subpart C.

Table 4-20 Estimated Occupational Annual Exposures for Various Occupations for the Proposed EREF

Position	Annual Dose Equivalent mSv (mrem)
General office staff	<0.05 (<5.0)
Typical operations and maintenance technician	1 (100)
Typical cylinder handler	3 (300)

Source: AES, 2010a.

Table 4-21 Estimated Dose Rates at Various Locations within the Proposed EREF

Position	Dose Rate mSv per hour (mrem per hour)
Plant general area	0.0001 (0.01)
Separation building cascade halls	0.0005 (0.05)
Separation building	0.001 (0.1)
Empty used UF_6 shipping cylinder	
on contact	0.1 (10)
At 1 meter (3.3 feet)	0.01 (1)
Full UF_6 shipping cylinder	
on contact	0.05 (5)
At 1 meter (3.3 feet)	0.002 (0.2)

Source: AES, 2010a.

The dose to the nearest resident was estimated to be 2.12×10^{-6} millisievert per year (2.12×10^{-4} millirem per year). Due to the large distance between the stored UF_6 cylinders and the receptor, only the dose contribution is associated with the airborne release. The dominant pathway is inhalation comprising 94 percent of the total dose. For comparative purposes, this dose is over 470,000 times lower than the 0.1 millisievert per year (10 mrem per year) dose limit for members of the public as codified in 10 CFR 20.1101 for airborne releases.

The dose to a member of the public at the proposed property boundary was estimated to be approximately 0.014 millisievert per year (1.4 millirem per year). Approximately 98.6 percent of the total dose to this individual is due to the external dose of the stored UF_6 cylinders. Since the vast majority of the dose is from external gamma radiation from the UF_6 cylinders, for comparative purposes, this dose is over 70 times lower than the 1 millisievert per year (100 mrem per year) dose limit for members of the public as codified in 10 CFR 20.1301.

Table 4-25 provides a summary of all radiological impacts to members of the general public associated with the proposed EREF. Because of the low doses involved, these impacts would be SMALL.

4.2.10.3 Mitigation Measures

Plant design features such as controls and processes for the proposed EREF have been identified by AES to minimize the gaseous and liquid effluent releases, and to maintain the impacts to workers and the surrounding population below regulatory limits (AES, 2010b). These would include:

- maintain system process pressures that are subatmospheric

- pass process gases through desublimers to solidify as much UF_6 as possible

Table 4-22 Extrapolated Population Distribution within 80 km (50 miles) of the Proposed EREF

Direction	0-1.6 km (0-1 mi)	1.6-3.2 km (1-2 mi)	3.2-4.8 km (2-3 mi)	4.8-6.4 km (3-4 mi)	6.4-8.0 km (4-5 mi)	8.0-16 km (5-10 mi)	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)
S	0	0	0	0	0	0	169	20,589	3835	61,264
SSW	0	0	0	0	0	0	49	757	1172	3477
SW	0	0	0	0	0	0	49	55	5	38
WSW	0	0	0	0	0	0	0	33	9	6
W	0	0	0	0	0	0	0	0	10	2142
WNW	0	0	0	0	0	0	0	56	220	562
NW	0	0	0	0	0	0	0	0	0	84
NNW	0	0	0	0	0	0	53	299	58	18
N	0	0	0	0	0	0	921	223	146	70
NNE	0	0	0	0	0	0	290	559	157	831
NE	0	0	0	0	0	3	193	8	1365	4882
ENE	0	0	0	0	0	3	1561	9655	29,946	4229
E	0	0	0	0	0	17	1004	13,654	3436	37
ESE	0	0	0	0	0	14	12,744	68,188	421	0
SE	0	0	0	0	0	0	741	10,303	21	2
SSE	0	0	0	0	0	75	142	6214	78	114

Source: AES, 2010a.

Table 4-23 General Public Receptor Locations for Radiological Impact Assessment

Receptor	Direction from the Source to the Receptor	Distance from Source to Receptor (m)	Time Spent at the Location (hr)
Nearest resident[a]	Northeast	8000	8761
Hypothetical member of the public at the proposed site boundary:[b]			2000
Cylinder pad	North	760	
Atmospheric release	North	1100	

[a] Source: AES, 2010a.

[b] Derived from AES, 2010a.

- pass gaseous effluents through pre-filters, high-efficiency particulate air (HEPA) filters, and activated carbon filters to reduce the radioactivity in the final discharged effluent to very low concentrations

- investigate alternative solvents or apply control technologies for methylene chloride solvent use

- use administrative controls, practices, and procedures to assure compliance with the proposed EREF Health, Safety, and Environmental Program; design the program to ensure safe storage, use, and handling of chemicals to minimize the potential for worker exposure

- monitor all UF_6 process systems by instrumentation that will activate alarms in the Control Room and will either automatically shut down the facility to a safe condition or alert operators to take the appropriate action to prevent release in the event of operational problems

- put in place radiological practices and procedures to ensure compliance with the proposed EREF Radiation Protection Program; design the program to achieve and maintain radiological exposure to levels that are as low as reasonably achievable (ALARA)

- conduct routine facility radiation and radiological surveys to characterize and minimize potential radiological dose/exposure

- monitor all radiation workers by use of dosimeters and area air sampling to ensure that radiological doses remain within regulatory limits and are ALARA

- provide radiation monitors in the gaseous effluent vents to detect and alarm and effect the automatic safe shutdown of process equipment in the event contaminants are detected in the system exhaust; design systems to automatically shut down, switch trains, or rely on operator actions to mitigate the potential release

Table 4-24 Annual Average Atmospheric Dispersion Factors χ/Q (s/m^3) for the General Population

Direction	0-1.6 km (0-1 mi)	1.6-3.2 km (1-2 mi)	3.2-4.8 km (2-3 mi)	4.8-6.4 km (3-4 mi)	6.4-8.0 km (4-5 mi)	8.0-16 km (5-10 mi)	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)
S	3.86×10^{-7}	1.92×10^{-7}	1.11×10^{-7}	7.54×10^{-8}	5.58×10^{-8}	3.02×10^{-8}	1.26×10^{-8}	6.60×10^{-9}	3.98×10^{-9}	2.53×10^{-9}
SSW	6.11×10^{-7}	2.90×10^{-7}	1.65×10^{-7}	1.12×10^{-7}	8.24×10^{-8}	4.48×10^{-8}	1.88×10^{-8}	1.00×10^{-8}	6.15×10^{-9}	4.00×10^{-9}
SW	4.85×10^{-7}	2.64×10^{-7}	1.60×10^{-7}	1.12×10^{-7}	8.50×10^{-8}	4.88×10^{-8}	2.15×10^{-8}	1.18×10^{-8}	7.42×10^{-9}	4.90×10^{-9}
WSW	2.05×10^{-7}	1.61×10^{-7}	1.08×10^{-7}	7.90×10^{-8}	6.26×10^{-8}	3.89×10^{-8}	1.81×10^{-8}	1.03×10^{-8}	6.59×10^{-9}	4.39×10^{-9}
W	1.16×10^{-7}	9.11×10^{-8}	6.14×10^{-8}	4.53×10^{-8}	3.63×10^{-8}	2.31×10^{-8}	1.07×10^{-8}	6.04×10^{-9}	3.79×10^{-9}	2.47×10^{-9}
WNW	8.35×10^{-8}	6.31×10^{-8}	4.16×10^{-8}	3.01×10^{-8}	2.35×10^{-8}	1.42×10^{-8}	6.22×10^{-9}	3.39×10^{-9}	2.04×10^{-9}	1.26×10^{-9}
NW	8.15×10^{-8}	6.59×10^{-8}	4.40×10^{-8}	3.19×10^{-8}	2.49×10^{-8}	1.50×10^{-8}	6.56×10^{-9}	3.60×10^{-9}	2.19×10^{-9}	1.37×10^{-9}
NNW	1.66×10^{-7}	1.38×10^{-7}	9.41×10^{-8}	6.93×10^{-8}	5.51×10^{-8}	3.42×10^{-8}	1.60×10^{-8}	9.21×10^{-9}	6.00×10^{-9}	4.09×10^{-9}
N	2.88×10^{-7}	2.06×10^{-7}	1.36×10^{-7}	9.82×10^{-8}	7.67×10^{-8}	4.61×10^{-8}	2.10×10^{-8}	1.19×10^{-8}	7.60×10^{-9}	5.08×10^{-9}
NNE	5.19×10^{-7}	2.75×10^{-7}	1.66×10^{-7}	1.16×10^{-7}	8.77×10^{-8}	5.03×10^{-8}	2.25×10^{-8}	1.26×10^{-8}	8.15×10^{-9}	5.59×10^{-9}
NE	6.45×10^{-7}	2.79×10^{-7}	1.58×10^{-7}	1.07×10^{-7}	7.89×10^{-8}	4.32×10^{-8}	1.87×10^{-8}	1.02×10^{-8}	6.52×10^{-9}	4.47×10^{-9}
ENE	4.24×10^{-7}	1.79×10^{-7}	9.87×10^{-8}	6.55×10^{-8}	4.79×10^{-8}	2.55×10^{-8}	1.06×10^{-8}	5.61×10^{-9}	3.47×10^{-9}	2.30×10^{-9}
E	2.29×10^{-7}	9.78×10^{-8}	5.49×10^{-8}	3.67×10^{-8}	2.68×10^{-8}	1.42×10^{-8}	5.67×10^{-9}	2.91×10^{-9}	1.72×10^{-9}	1.07×10^{-9}
ESE	2.31×10^{-7}	9.89×10^{-8}	5.58×10^{-8}	3.72×10^{-8}	2.72×10^{-8}	1.43×10^{-8}	5.61×10^{-9}	2.84×10^{-9}	1.65×10^{-9}	1.00×10^{-9}
SE	2.69×10^{-7}	1.14×10^{-7}	6.31×10^{-8}	4.18×10^{-8}	3.04×10^{-8}	1.59×10^{-8}	6.29×10^{-9}	3.20×10^{-9}	1.87×10^{-9}	1.15×10^{-9}
SSE	3.18×10^{-7}	1.49×10^{-7}	8.45×10^{-8}	5.67×10^{-8}	4.16×10^{-8}	2.22×10^{-8}	8.98×10^{-9}	4.64×10^{-9}	2.75×10^{-9}	1.72×10^{-9}

Table 4-25 Summary of Radiological Impacts for Members of the Public Associated with the Proposed EREF

Receptor	Atmospheric Dispersion Factors (s/m^3)	Dose Associated with Air Releases person-Sv (person-rem) or mSv (mrem)	Dose Associated with Direct Radiation from Stored UF_6 Cylinders person-Sv (person-rem) or mSv (mrem)	Total Committed Effective Dose person-Sv (person-rem) or mSv (mrem)
General population	See Table 4-24	1.74×10^{-5} (1.74×10^{-3})	~ 0	1.74×10^{-5} (1.74×10^{-3})
Nearest resident	1.26×10^{-7}	2.12×10^{-6} (2.12×10^{-4})	~0	2.12×10^{-6} (2.12×10^{-4})
Hypothetical member of the public at the proposed site boundary	5.39×10^{-6}	1.94×10^{-5} (1.94×10^{-3})	0.014[a] (1.4)	0.014 (1.4)
Regulatory limit for individual[b]				0.1[c]:1 (10:100)

[a] Source: AES, 2010a.
[b] Source: 10 CFR Part 20, Subpart D.
[c] Source: 10 CFR 20.1101 (applies to airborne releases only).

- design the proposed facility to delay and reduce UF_6 releases inside the buildings in a potential fire incident from reaching the outside environment, including automatic shutoff of room HVAC systems during a fire event

- move UF_6 cylinders only when cool and when UF_6 is in solid form, to minimize the risk of inadvertent release due to mishandling

- separate uranic compounds and various other heavy metals in waste material generated by decontamination of equipment and systems

- use liquid and solid waste handling systems and techniques to control wastes and effluent concentrations

- route process liquid waste to collection tanks and treat through a combination of precipitation, evaporation, and ion exchange to remove most of the radioactive material prior to a final evaporation step to preclude any liquid effluent release from the proposed facility

- to further mitigate radiation dose, implement an ALARA program in addition to routine radiological surveys and personnel monitoring

The NRC identified the following additional mitigation measure:

- store “empty” cylinders with heels in the middle of a storage pad between full tail cylinders to reduce external exposure to workers

4.2.11 Waste Management Impacts

This section describes the analysis and evaluation of the potential impacts of the solid, hazardous, and radioactive waste management program at the proposed EREF, and includes impacts resulting from temporary storage, conversion, and disposal of depleted UF_6. The impacts of gaseous effluent and wastewater releases are addressed in Sections 4.2.4, 4.2.6, and 4.2.10 of this EIS. Waste management impacts (not including depleted UF_6) would be SMALL due to the low volumes of waste generated by the proposed facility in comparison to the availability of disposal options and capacity for the various waste streams. Impacts from the conversion of depleted UF_6 from the proposed EREF at an offsite location would be SMALL.

Due to the nature, design, and operation of a gas centrifuge enrichment facility, the generation of waste materials can be categorized by three distinct facility operations: (1) preconstruction and construction, which generates typical construction wastes associated with an industrial facility; (2) enrichment process operations, which generate gaseous, liquid, and solid waste streams; and (3) generation and temporary storage of depleted UF_6. Section 4.2.16 of this chapter discusses decommissioning wastes. Waste materials include low-level radioactive waste (i.e., depleted UF_6 and material contaminated with UF_6), designated hazardous materials (as defined in 40 CFR Part 261), mixed (radioactive and hazardous), and nonhazardous materials (any other wastes not identified as radioactive or hazardous). Hazardous materials include any fluids, equipment, and piping contaminated as defined in 40 CFR Part 261 that would be generated due to preconstruction, construction, operation, and maintenance activities.

The handling and disposal of waste materials are governed by various Federal and State regulations. The proposed EREF waste management program is intended to minimize the generation of waste through reduction, reuse, or recycling, and includes systems for the collection, removal, and proper disposal of waste materials (AES, 2010a). This program would assist in identifying process changes that can be made to reduce or eliminate mixed wastes, methods to minimize the volume of regulated wastes through segregation of materials, and the substitution of nonhazardous materials as required under *Resource Conservation and Recovery Act* (RCRA) regulations.

4.2.11.1 Preconstruction and Construction

Nonhazardous/Nonradioactive Solid Wastes

Solid nonhazardous wastes generated during preconstruction and construction would be very similar to wastes generated from the construction sites of other industrial facilities. These wastes would be transported offsite to an approved local landfill (AES, 2010a).

Approximately 6116 cubic meters (8000 cubic yards) per year of noncompacted packing material, paper, and scrap lumber would be generated (AES, 2010a), based largely on projections for the National Enrichment Facility (NEF) in Lea County, New Mexico (LES, 2005). In addition, there would also be scrap structural steel, piping, and sheet metal that would not be expected to pose significant impacts on the surrounding environment because most could be recycled or directly placed in an offsite landfill.

Nonhazardous construction wastes would likely be transported to the Bonneville County Hatch Pit for disposal (AES, 2010a). The Hatch Pit is a former gravel mining site that is being reclaimed as a landfill. Upon opening in 1999, it was expected to reach capacity within 15 years (Bonneville County, 2006). Preconstruction and major construction activities at the proposed EREF site would begin in 2010 and last for approximately 8 years. Therefore, the Hatch Pit may reach capacity and stop accepting waste during construction of the proposed EREF, requiring the identification of an alternate disposal location for construction wastes in Bonneville County or a nearby county. Although detailed information on current waste acceptance rates are not available, the Bonneville Country Public Works Department has confirmed that a new construction and demolition waste disposal site will be permitted when the Hatch Pit nears capacity (Bonneville County, 2009).

Impacts from nonhazardous solid waste generation during preconstruction and construction would be SMALL due to the available current or future capacity at nearby disposal facilities.

<u>Hazardous Wastes</u>

Hazardous wastes (e.g., waste oil, greases, excess paints, and other chemicals) generated during preconstruction and facility construction (e.g., due to the maintenance of construction equipment and vehicles, painting, and cleaning) would be packaged and shipped offsite to a licensed TSDF in accordance with Federal and State environmental and occupational regulations (AES, 2010a). The local TSDF is the U.S. Ecology facility near Grandview, Idaho, which is permitted to receive at least 4.5 million cubic meters (5.9 million cubic yards) of hazardous waste (AES, 2010a). Table 4-26 shows the hazardous wastes that would be expected from preconstruction and construction of the proposed EREF, which are based largely on projections for the NEF in Lea County, New Mexico (LES, 2005). This quantity of hazardous waste totals approximately 26 tons and represents less than 0.005 percent of the hazardous waste received by the U.S. Ecology facility in 2009 (IDEQ, 2010). The quantity of hazardous waste generated during preconstruction and construction would result in SMALL impacts due to the available capacity.

Table 4-26 Hazardous Waste Types and Quantities Expected during Preconstruction and Facility Construction

Waste Type	Annual Quantity
Paints, solvents, thinners, organics	11,360 liters (3000 gallons)
Petroleum products, oils, lubricants	11,360 liters (3000 gallons)
Sulfuric acid (battery)	379 liters (100 gallons)
Adhesives, resins, sealers, caulking	910 kilograms (2000 pounds)
Lead (batteries)	91 kilograms (200 pounds)
Pesticides	379 liters (100 gallons)

Source: AES, 2010a.

Stormwater

As discussed in Section 4.2.6 (Water Resources Impacts), stormwater runoff during preconstruction and construction would be collected in a stormwater detention basin that would allow the water to evaporate or infiltrate the ground surface (with allowance for overflow runoff to downgradient terrain).

Due to the types of activities performed and the types of wastes generated during preconstruction and construction, the relative contributions to waste impacts are estimated to be 10 percent for preconstruction and 90 percent for construction.

4.2.11.2 Facility Operation

Gaseous effluents, liquid effluents, and solid wastes containing nonhazardous/nonradioactive, hazardous, and/or radioactive, and/or mixed waste materials would be generated onsite during normal operation of the proposed EREF. Appropriate treatment systems would be established to control releases or collect hazardous materials for onsite treatment or shipment offsite (AES, 2010a). Waste generation would be minimized, liquid wastes would be treated onsite, and solid wastes would be appropriately packaged and shipped offsite for further processing or final disposition (AES, 2010a). The impacts from gaseous and liquid effluents are described in Sections 4.2.4, 4.2.6, and 4.2.10. This section presents the onsite and offsite impacts from the management of solid and liquid wastes.

Solid Wastes

The operation of the proposed EREF would generate approximately 75,369 kilograms (165,812 pounds) of solid nonradioactive waste annually, including approximately 5062 kilograms (11,136 pounds) of hazardous wastes (AES, 2010a). Approximately 146,500 kilograms (322,300 pounds) of radiological and mixed waste would be generated annually, of which approximately 100 kilograms (220 pounds) would be mixed waste (AES, 2010a). The types and quantities of radioactive and mixed waste are shown in Table 4-27.

Solid wastes generated during operations would be segregated and processed based on whether the material could be classified as wet solid or dry solid wastes and segregated into industrial (nonhazardous/nonradioactive), radioactive, hazardous, or mixed-waste categories.

Radioactive solid wastes would be Class A low-level radioactive wastes as defined in 10 CFR Part 61, packaged per DOT standards, and shipped to a licensed commercial low-level radioactive waste disposal facility or for further processing for volume reduction (AES, 2010a). Wet solid radioactive waste would include uranic waste precipitate from the liquid waste treatment process (AES, 2010a) (see Section 4.2.6). In its most recent analysis of low-level radioactive waste disposal capacity, the U.S. Government Accountability Office (GAO) concluded that the availability of disposal capacity in the United States for Class A low-level radioactive waste is not considered to be a problem for the short or long term (GAO, 2004, 2007). Therefore, the impact of low-level radioactive waste generation would be SMALL on disposal facilities. Management of depleted UF_6 is discussed later in this section.

Table 4-27 Radiological and Mixed Waste Types and Quantities Expected during Facility Operation

Waste Type	Annual Quantity kg (lb)	Uranium Content kg (lb)
Activated carbon	600 (1323)	50 (110)
Activated alumina	4320 (9524)	4.4 (9.7)
Perfluoropolyether oil	2054 (4528)	10 (22)
Liquid waste treatment sludge[a]	2086 (4599)	114 (251)[b]
Activated sodium fluoride[c]	–	–
Assorted materials (paper, clothing, etc.)	4200 (9262)	60 (132)
Ventilation filters	92,196 (203,259)	11 (24)
Non-metallic components	10,000 (22,050)	Trace[d]
Miscellaneous mixed wastes (organic compounds)[e]	100 (220)	4 (8.8)
Combustible waste	7000 (15,436)	Trace[d]
Scrap metal	24,000 (52,920)	Trace[d]

[a] Sludge and evaporator concentrates.
[b] Value is composed of uranium in the citric acid and degreaser tanks, precipitated aqueous solutions, uranium in precipitated laboratory/miscellaneous effluents, and uranium in sludge from the citric acid and degreaser tanks.
[c] No wastes are produced on an annual basis. Sodium fluoride traps are not expected to saturate over the life of the plant.
[d] Not detectable above naturally occurring background concentrations.
[e] Representative organic compounds consist of acetone, toluene, ethanol, and petroleum ether.
Source: AES, 2010a.

As described in Sections 2.1.4.2 and 4.2.4.3, gaseous effluent from the GEVSs would pass through a pre-filter (to capture dust and other particulates), two sets of HEPA filters (to capture uranium particulates and aerosols), and an activated carbon filter (to capture HF). Similar filters would be used in the Centrifuge Test and Postmortem Facilities Exhaust Filtration System. After loaded filters are removed from service, they would be bagged to prevent the spread of contamination, sampled for ^{235}U content, and packaged for storage and eventual shipment to a volume reduction facility or low-level waste disposal facility (AES, 2010a).

Hazardous wastes (e.g., solvents, hydrocarbon sludge, chemicals, and empty hazardous material containers) generated at the proposed EREF would be collected at the point of generation, classified, packaged, and shipped offsite to a licensed TSDF in accordance with Federal and State environmental and occupational regulations. Hazardous wastes would not be treated, stored, or disposed of at the proposed EREF in a manner that requires a RCRA permit (AES, 2010a). The annual quantity of hazardous waste that would be generated by the proposed EREF represents approximately 0.001 percent of the hazardous waste received by the U.S. Ecology facility in 2009 (IDEQ, 2010). EPA and Idaho regulations, including the Idaho

Standards for Hazardous Waste (IAC, 2008), would guide the management of hazardous wastes (AES, 2010a).

Mixed wastes that can be processed to meet land disposal requirements would be treated, packaged per DOT requirements, and shipped to a licensed commercial low-level radioactive waste disposal facility (AES, 2010a). Other mixed wastes would be collected, packaged per DOT standards, and shipped to a licensed commercial TSDF (such as the EnergySolutions facilities in Clive, Utah or Oak Ridge, Tennessee). Mixed wastes would not be treated, stored, or disposed of at the proposed EREF in a manner that requires a RCRA permit (AES, 2010a). Due to the small quantity of mixed waste that would be generated, the impact of mixed waste generation would be SMALL on disposal facilities.

The annual volume of industrial wastes generated at the proposed EREF would require approximately 181 shipments per year to a local landfill for disposal (AES, 2010a). The Peterson Hill Landfill is Bonneville County's sole municipal landfill, accepting between 58,960 and 68,040 metric tons (65,000 and 75,000 tons) of waste annually. Based on current waste generation rates and service population, Bonneville County expects the landfill to have a lifetime of 130 years, which would adequately encompass the operating lifetime of the proposed EREF (AES, 2010a; Bonneville County, 2009). Based on the estimate of waste accepted by the landfill in 2007, industrial solid waste generation from operation of the proposed EREF would increase the volume of wastes impounded at the landfill by less than 0.1 percent. Based on the quantities of solid wastes generated, the application of industry-accepted procedures, and the availability of capacity at regional disposal facilities, the impacts from solid wastes generated during operation would be SMALL.

Liquid Wastes

As noted in Section 4.2.6.2, there would be no discharge of liquid effluents to surface water or groundwater during facility operation, and water quality impacts from facility operations are expected to be SMALL.

Liquid waste streams from facility operations would be processed by the Liquid Effluent Collection and Treatment System and would include laboratory effluent, degreaser water, citric acid, floor washings, miscellaneous condensates, and emergency hand washing and shower water from radiation areas. Most of these waste streams would be collected in the Miscellaneous Effluent Collection Tank, and some wastes (such as floor washings) would be sampled for uranic content prior to collection in the tank. Waste in this tank would be sampled for uranic content, treated by filtration and precipitation (if necessary), and vaporized in the Liquid Effluent Treatment System Evaporator to produce a chemically decontaminated gaseous effluent (see Section 4.2.10.2) (AES, 2010a).

Effluents containing uranium would be treated with potassium hydroxide to precipitate uranium and other precipitating agents (such as lime) to precipitate fluoride. Treated effluents would be sampled for uranium and fluoride content, and microfiltration and precipitation cycles would be repeated, as necessary. Uranium precipitate and calcium fluoride sludge would be removed by filtration and disposed of as low-level radioactive waste. Effluents meeting regulatory release levels for uranium and fluorine would be sent to the Liquid Effluent Treatment System

Evaporator. A small volume of liquid evaporator concentrate would be periodically removed, analyzed for uranium content, and disposed of as low-level radioactive waste (AES, 2010a).

The proposed EREF would not be connected to a publicly operated treatment works (POTW). All domestic sanitary sewage would be treated onsite to comply with 10 CFR 20.2003 and collected in the cylinder storage pad stormwater retention basins for evaporation to the atmosphere (AES, 2010a).

Stormwater runoff during facility operations would be collected in a Site Stormwater Detention Basin that would allow the water to evaporate or infiltrate the ground surface (with allowance for overflow runoff to downgradient terrain). Because this basin would only receive runoff from paved surfaces (not including the Cylinder Storage Pads), building roofs, and landscaped areas, no uranic content would be expected. Stormwater runoff from the Cylinder Storage Pads would be collected in two lined Cylinder Storage Pads Stormwater Retention Basins and allowed to evaporate. Because these basins would not receive process-related effluents, the only potential sources of radiological contamination would be residual contamination on the exterior of a cylinder or the accidental release of UF_6 from a leaking cylinder or handling accident. Therefore, no significant releases of uranic material to these basins would be expected (AES, 2010a). Although all three basins would not receive process-related effluents and would not be expected to contain uranium or hazardous constituents from other sources, stormwater and sediment from all three basins would be sampled quarterly as a part of the site environmental measurement and monitoring program (as described in Chapter 6).

<u>Depleted UF_6 Waste Management</u>

The proposed EREF is expected to generate 1222 cylinders of depleted UF_6 annually (AES, 2010a). As discussed in Section 2.1.3 of this EIS, until a conversion facility is available, depleted UF_6-filled Type 48Y cylinders would be temporarily stored on an outdoor Cylinder Storage Pad. Storage of depleted UF_6 cylinders at the proposed EREF would occur for the duration of the facility's 30-year operating lifetime and before final removal of depleted UF_6 from the proposed EREF site (AES, 2010a). However, AES has stated that depleted UF_6 cylinders would not be stored at the proposed EREF site beyond the facility's licensed lifetime (AES, 2010a).

The proposed EREF's Full Tails Cylinder Storage Pads are currently designed to accommodate up to 33,638 depleted UF_6 cylinders (AES, 2010a), which provide storage capacity for the expected lifetime generation of the facility in the event that a DOE conversion facility should be unavailable or delayed.

<u>Temporary Depleted UF_6 Storage Impacts</u>

Proper and active depleted UF_6 cylinder management, which includes routine inspections and maintaining the anticorrosion layer on the cylinder surface, has been shown to limit exterior corrosion or mechanical damage necessary for safe storage (DNFSB, 1995a,b, 1999). DOE has stored depleted UF_6 in Type 48Y or similar cylinders at the Paducah and Portsmouth Gaseous Diffusion Plants and the East Tennessee Technical Park in Oak Ridge, Tennessee, since the mid-1950s, and cylinder leaks due to corrosion led DOE to implement a cylinder management program (Biwer et al., 2001). Past evaluations and monitoring by the Defense

Nuclear Facility Safety Board (DNFSB) of DOE's cylinder maintenance program confirmed that DOE met all of the commitments in its cylinder maintenance implementation plan, particularly through the use of a systems engineering process to develop a workable and technically justifiable cylinder management program (DNFSB, 1999). AES intends to implement a similar cylinder management program at the proposed EREF (AES, 2010a), as a properly implemented cylinder maintenance program would assure the integrity of the depleted UF_6 cylinders for temporary onsite storage of depleted UF_6 on the Cylinder Storage Pads.

The principal impacts from temporary storage of depleted UF_6 would be the radiological exposure from an increasing quantity of depleted UF_6 temporarily stored in cylinders on the Full Tails Cylinder Storage Pad (up to the design capacity of 33,638 cylinders at the end of the facility's operating lifetime) under normal conditions and the potential release (slow or rapid) of depleted UF_6 from the depleted UF_6 cylinders due to an off-normal event or accidents (operational, external, or natural hazard phenomena events). These radiation exposure pathways are analyzed in Section 4.2.10, and based on these results, the impacts from temporary storage of depleted UF_6 would be SMALL. The annual impacts from temporary storage would continue until the depleted UF_6 cylinders are removed from the proposed EREF site.

Offsite Disposal Impacts

For the offsite disposal of the depleted UF_6, AES has proposed that the Type 48Y cylinders would be transported to either of the DOE's conversion facilities at Paducah, Kentucky, or Portsmouth, Ohio, for conversion to triuranium octaoxide (U_3O_8) (AES, 2010a). Following conversion, the U_3O_8 would be stored for potential future use or transported to a licensed disposal facility (DOE, 2004a,b). The transportation of the Type 48Y cylinders from the proposed EREF to either of the conversion facilities would have environmental impacts that are included in the transportation analysis presented in Section 4.2.9.2.

If the DOE conversion facility could not immediately process the depleted UF_6 cylinders upon arrival, potential impacts would include radiological impacts proportional to the time of temporary storage at the conversion facility. DOE has previously assessed the impacts of depleted UF_6 cylinder storage during the operation of a depleted UF_6 conversion facility (DOE, 2004a,b), which bounds the impacts of temporary storage of EREF-originated depleted UF_6 cylinders at the conversion facility site. At the Paducah and Portsmouth conversion facilities, the maximum collective dose to workers (i.e., workers at the cylinder yards) would be 0.055 person-sieverts (5.5 person-rem) per year and 0.03 person-sievert (3 person-rem) per year, respectively considering the existing stored inventories of depleted UF_6 (DOE, 2004a,b). There would be negligible exposure to noninvolved workers or the public due to their distance from the cylinder yards and because air emissions from the cylinder preparation and maintenance activities would be negligible (DOE, 2004a,b).

The Paducah conversion facility would operate for approximately 25 years to process the 436,400 metric tons (481,000 tons) that were in storage prior to anticipated startup of the conversion facility in 2006 (DOE, 2004a). Similarly, the Portsmouth conversion facility would operate for 18 years to process 243,000 metric tons (268,000 tons) (DOE, 2004b). The projected lifetime production of depleted UF_6 by the proposed EREF (321,235 metric tons [354,101 tons]) would represent approximately 74 percent and 132 percent of the initial

Paducah and Portsmouth inventories, respectively. The proposed EREF would produce (and provide for conversion) approximately 7635 metric tons (8418 tons) of depleted UF_6 per year at full production capacity (AES, 2010a), which represents approximately 47 percent of the annual conversion capacity of the Paducah facility (18,000 metric tons [20,000 tons]) and approximately 62 percent of the annual conversion capacity of the Portsmouth facility (13,500 metric tons [15,000 tons]). The proposed EREF's projected lifetime production of depleted UF_6 inventory, if processed by either the Paducah or Portsmouth conversion facility, could extend the potential duration of conversion facility operation by approximately 18 years or 24 years, respectively.

With routine facility and equipment maintenance, and periodic equipment replacements or upgrades, DOE indicated that the Paducah and Portsmouth conversion facilities could be operated safely beyond their proposed operational lifetimes to process the depleted UF_6 such as that originating at the proposed EREF (DOE, 2004a,b). In addition, DOE indicated the estimated impacts that would occur from prior conversion facility operations would remain the same when processing depleted UF_6 such as the proposed EREF wastes (DOE, 2004a,b). The overall cumulative impacts from the operation of a DOE conversion facility would increase proportionately with the increased life of the facility (DOE, 2004a,b).

Additional conversion processing capacity could also be achieved through increased efficiency of the Paducah and Portsmouth conversion plants and the possibility of a commercial conversion plant being constructed. International Isotopes, Inc. submitted a license application to the NRC on December 31, 2009, to construct and operate a depleted UF_6 conversion facility near Hobbs, New Mexico (the NRC staff is currently conducting environmental and safety reviews of the application) (NRC, 2010d).

To meet the increased demand for enriched uranium, as discussed in Section 1.3.1, three other uranium enrichment facilities are planned or under construction. These facilities would also generate depleted UF_6, in addition to the currently operating gaseous diffusion enrichment plant at Paducah, that would also require conversion and disposal. Should all of the facilities become operational, extended storage times for the depleted UF_6 cylinders at conversion facilities may be necessary and could result in the need for an additional conversion facility.

The above assumptions and data indicate that environmental impacts from the conversion of depleted UF_6 from the proposed EREF at an offsite location such as Portsmouth or Paducah would be SMALL.

The impacts from transportation of U_3O_8 (from the conversion of depleted UF_6) to potential disposal sites have been previously evaluated for the depleted UF_6 stored at the Paducah and Portsmouth sites (DOE, 2004a,b). Transportation impacts relating to the shipment of EREF-originated U_3O_8 from the DOE conversion facilities to a potential disposal site would be SMALL.

4.2.11.3 Mitigation Measures

Measures identified by AES to mitigate waste management impacts during preconstruction activities, construction, and facility operation include (AES, 2010a):

- develop a construction phase recycling program

- design system features to minimize the generation of solid waste, liquid waste, and gaseous effluent (gaseous effluent design features are described above under Public and Occupational Health)

- store waste in designated areas of the facility until an administrative limit is reached, then ship offsite to a licensed disposal facility; no disposal of waste onsite

- dispose of all radioactive and mixed wastes at offsite licensed facilities

- maintain a cylinder management program to monitor storage conditions on the Full Tails Cylinder Storage Pads, to monitor cylinder integrity by conducting routine inspections for breaches and to perform cylinder maintenance and repairs as needed

- store all tails cylinders filled with depleted UF_6 on saddles of concrete, or other suitable material, that do not cause corrosion of the cylinders; place saddles on a concrete pad

- segregate the storage pad areas from the rest of the enrichment facility by barriers, such as vehicle guard rails

- double-stack depleted uranium tails cylinders on the storage pad, arrayed to permit easy visual inspection of all cylinders

- survey depleted uranium tails cylinders for external contamination (wipe test) prior to being placed on a Full Tails Cylinder Storage Pad or transported offsite

- fit depleted uranium tails cylinder valves with valve guards to protect the cylinder valves during transfer and storage

- make provisions to ensure that depleted uranium tails cylinders will not have defective valves (identified in NRC Bulletin 2003-03, "Potentially Defective 1-inch Valves for Uranium Hexafluoride Cylinders") (NRC, 2003c) installed

- perform touch-up application of paint coating on depleted uranium tails cylinders if coating damage is discovered during inspection (UF_6 cylinder manufacturing will include abrasive blasting and coating with anticorrosion primer/paint, as required by specification)

- allow only designated vehicles, operated by trained and qualified personnel, on the Full Tails Cylinder Storage Pads, Full Feed Cylinder Storage Pads, Full Product Cylinder Storage Pad, and the Empty Cylinder Storage Pad (refer to the Integrated Safety Analysis [ISA] Summary, Section 3.8, for controls associated with vehicle fires on or near the Cylinder Storage Pads)

- inspect depleted uranium tails cylinders for damage prior to placing a filled cylinder on a storage pad. Annually reinspect depleted uranium tails cylinders for damage or surface coating defects. These inspections will verify that:
  - lifting points are free from distortion and cracking
  - cylinder skirts and stiffener rings are free from distortion and cracking
  - cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion

- cylinder valves are fitted with the correct protector and cap
- cylinders are inspected to confirm that the valve is straight and not distorted, two to six threads are visible, and the square head of the valve stem is undamaged
- cylinder plugs are undamaged and not leaking

- if inspection of a depleted uranium tails cylinder reveals significant deterioration or other conditions that may affect the safe use of the cylinder, transfer the contents of the affected cylinder to another cylinder in good condition and discard the defective cylinder; determine the root cause of any significant deterioration and, if necessary, make additional inspections of cylinders

- make available onsite proper documentation on the status of each depleted uranium tails cylinder, including content and inspection dates

- use the lined Cylinder Storage Pads Stormwater Retention Basins to capture stormwater runoff from the Full Tails Cylinder Storage Pads

- minimize power usage by efficient design of lighting systems, selection of high-efficiency motors, and use of proper insulation materials

- control process effluents by means of the following liquid and solid waste handling systems and techniques:
  - follow careful application of basic principles for waste handling in all of the systems and processes
  - collect different waste types in separate containers to minimize contamination of one waste type with another; carefully package materials that can cause airborne contamination; provide ventilation and filtration of the air in the area as necessary; confine liquid wastes to piping, tanks, and other containers; use curbing, pits, and sumps to collect and contain leaks and spills
  - store hazardous wastes in designated areas in carefully labeled containers; also contain and store mixed wastes separately
  - neutralize strong acids and caustics before they enter an effluent stream
  - decontaminate and/or reuse radioactively contaminated wastes to reduce waste volume as far as possible
  - reduce the volume of collected waste such as trash, compressible dry waste, scrap metals, and other candidate wastes at a centralized waste processing facility
  - include administrative procedures and practices in waste management systems that provide for the collection, temporary storage, processing, and disposal of categorized solid waste in accordance with regulatory requirements
  - design handling and treatment processes to limit wastes and effluent; perform sampling and monitoring to assure that plant administrative and regulatory limits will not be exceeded
  - monitor gaseous effluent for HF and radioactive contamination before release
  - sample and/or monitor liquid wastes in liquid waste treatment systems
  - sample and/or monitor solid wastes prior to offsite treatment and disposal
  - return process system samples to their source, where feasible, to minimize input to waste streams

- implement a spill control program for accidental oil spills; prepare a Spill Prevention Control and Countermeasure (SPCC) Plan prior to the start of operation of the facility or prior to the storage of oil on the proposed site in excess of *de minimis* quantities, which will contain the following information:
  - identification of potential significant sources of spills and a prediction of the direction and quantity of flow that will likely result from a spill from each source
  - identification of the use of containment or diversionary structures such as dikes, berms, culverts, booms, sumps, and diversion ponds, at the facility to control discharged oil
  - procedures for inspection of potential sources of spills and spill containment/diversion structures
  - assigned responsibilities for implementing the plan, inspections, and reporting
  - as part of the SPCC Plan, other measures will include control of drainage of rain water from diked areas, containment of oil and diesel fuel in bulk storage tanks, aboveground tank integrity testing, and oil and diesel fuel transfer operational safeguards

- implement a nonhazardous materials waste recycling plan during operation; perform a waste assessment to identify waste reduction opportunities and to determine which materials will be recycled; contact brokers and haulers to find an end-market for the materials; perform employee training on the recycling program so that employees will know which materials are to be recycled; purchase and clearly label recycling bins and containers; periodically evaluate the recycling program (i.e., waste management expenses and savings, recycling and disposal quantities) and report the results to the employees

4.2.12 Socioeconomic Impacts

This section provides an analysis of the socioeconomic impacts associated with preconstruction, construction, and operation of the proposed EREF. Wage and salary spending and expenditures associated with materials, equipment, and supplies would produce income and employment and local and State tax revenue, while the migration of workers and their families into the area would affect housing availability, area community services such as schools, education, and law enforcement, and the availability and cost of public utilities such as electricity, water, sanitary services, and roads. The economic impacts of the proposed EREF project are evaluated for an 11-county region of influence (ROI) in Idaho – including Bannock, Bingham, Blaine, Bonneville, Butte, Caribou, Clark, Fremont, Jefferson, Madison, and Power Counties – which encompasses the area that is expected to be the primary source of labor for each phase of the proposed project and where workers employed during preconstruction, construction, and operation of the proposed EREF are expected to live and spend most of their salary. The 11-county ROI is also the area in which a significant portion of site purchase and non-payroll expenditures are expected to occur. The majority of the economic impacts of the proposed facility are expected to occur in two of these counties, Bingham and Bonneville. It is anticipated that a number of workers will move into the area during each phase of the proposed project, with the majority of the demographic and social impacts likely to occur in Bingham and Bonneville Counties. The impacts of the proposed EREF on population, housing, and community services are assessed for a two-county ROI, consisting of Bingham and Bonneville Counties. The impacts of preconstruction, construction, and facility operation would be SMALL.

4.2.12.1 Methodology

This analysis of socioeconomic impacts includes impacts on employment, income, State tax revenues, population, housing, and community and social services.

Employment impacts are evaluated by estimating the level of direct and indirect employment associated with the proposed facility. Direct employment is created by preconstruction and construction activities and facility operations, while indirect employment is created in the 11-county ROI to support the needs of the workers directly employed by the proposed EREF and jobs created to support site purchase and non-payroll expenditures. The number of direct jobs created in each stage is estimated based on anticipated labor inputs for various engineering and construction activities. Indirect employment is estimated using economic multipliers from the RIMS-II input-output model, developed by the U.S. Bureau for Economic Analysis (BEA, 2010), which accounts for inter-industry relationships within regions.

State income tax revenue impacts are estimated by applying State income tax rates to project-related construction and operations earnings. State and local sales tax revenues are estimated by applying appropriate State and local sales tax rates to after-tax income generated by construction and operations employees, spent within the 11-county ROI. Impacts on population characteristics are evaluated by estimating the fraction of direct and indirect jobs that would be filled by in-migrating workers from outside the two-county ROI. The average family size and age profiles of in-migrating families are estimated using appropriate demographic assumptions based on U.S. Census Bureau statistics. Impacts on area housing resources are estimated by comparing rental and owner-occupied vacancy statistics with estimated population in-migration into the two-county ROI during the preconstruction, construction, and operations phases of the proposed project.

Impacts on community and social services are assessed by estimating the number of additional local community service employees that would be required to maintain existing levels of service of education, law enforcement, and fire services, given the number of in-migrating workers expected into the two-county ROI during the various phases of the proposed project. Although Bingham and Bonneville Counties are expected to be the primary sources of labor for the proposed EREF, some labor in-migration is expected during each phase of the proposed project. The number of in-migrating workers used in the analysis was assumed to be small, with the majority of craft skills available in the two-county ROI. Sixty-five percent of in-migrating workers were assumed to be accompanied by their families, which would consist of an additional adult and one school-age child (AES, 2010a).

There are large differences between the indirect (offsite) impact of the proposed EREF during the operations phase and during other phases of the proposed project. These differences are due to the relatively minor role in the economy of the 11-county ROI of suppliers of capital equipment, materials, and services provided to the proposed project during construction, compared to other phases of the proposed project, particularly operations (AES, 2010a).

As no detailed data on the preconstruction share of total construction employment or total construction expenditures were available for the proposed EREF, payroll expenditure data provided for the proposed Global Laser Enrichment, (GLE) Facility in North Carolina (GLE, 2009) were used as a basis for estimating the impacts of preconstruction and construction activities for the proposed EREF. The proposed GLE Facility is another proposed nuclear fuel fabrication facility, with proposed preconstruction activities similar in nature, and on a similar scale, to those for the proposed EREF. Income data for Idaho Falls, Idaho, are estimated using data presented in the AES Environmental Report (AES, 2010a). Based on this information, preconstruction activities at the proposed EREF would contribute 5 percent of the impacts during the preconstruction period (2010–2011), and construction activities would contribute 95 percent (2012–2022).

Impacts for each phase of the proposed project are summarized in Table 4-28, and are based on data provided in the AES Environmental Report (AES, 2010a). These impacts are discussed in the following sections. The NRC has reviewed and verified the data and methodology.

4.2.12.2 Preconstruction and Construction

Preconstruction

Preconstruction activities in 2010–2011 would create 108 direct jobs at the proposed EREF site (AES, 2010a). An additional 200 indirect jobs would be created in the 11-county ROI with the procurement of material and equipment and the spending of direct worker wages and salaries (Table 4-28). Preconstruction would produce $4.4 million in income in the 11-county ROI. Preconstruction would produce $0.1 million in direct State income taxes and $0.9 million in direct State sales taxes (AES, 2010a). Preconstruction activities would constitute less than 1 percent of total two-county ROI employment (see Section 3.12.2); the economic impact of preconstruction of the proposed EREF would be SMALL.

Given the likelihood of a lack of local worker availability in the required occupational categories, EREF preconstruction would require some in-migration of workers and their families from outside the two-county ROI, with an estimated 49 persons in-migrating into the two-county ROI during the peak of preconstruction (AES, 2010a). Although in-migration may potentially impact local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (hotels, motels, and mobile home parks) would mean that the impact of preconstruction on the number of vacant rental housing units is not expected to be large, with 21 additional rental units being expected to be occupied in the two-county ROI during preconstruction (AES, 2010a). These occupancy rates would represent less than 0.1 percent of the vacant rental units expected to be available in the two-county ROI during preconstruction; the impact of EREF preconstruction on housing would, therefore, be SMALL.

In addition to the potential impact on housing markets, in-migration would also affect local community and educational services employment to maintain existing levels of service in the two-county ROI. Accordingly, less than one additional police officer and less than one additional firefighter would be required during the preconstruction period (AES, 2010a). Assuming that a certain number of workers are accompanied by their families during preconstruction, 14 additional school-age children would be expected in the two-county ROI during the preconstruction period, meaning that one additional teacher would be required to maintain existing student–teacher ratios in the local school system (AES, 2010a). These staffing increases would represent less than 0.1 percent of community service employment in each employment category expected in the two-county ROI; the impact of EREF preconstruction on community and educational services employment would be SMALL.

Table 4-28 Socioeconomic Effects of the Proposed EREF[a]

Parameter	Preconstruction	Peak Facility Construction	Construction-Operations Overlap Period	Operations
Employment (number of jobs)				
Direct	108	590	275	550
Indirect	200	1097	1370	2739
Total	308	1687	1645	3289
Income ($m 2008 $)				
Direct	4.4	23.9	14.1	28.2
Indirect	7.5	41.2	32.1	64.2
Total	11.9	65.0	46.2	92.4
Tax Revenues				
Income Taxes ($m 2008 $)	0.1	0.7	0.7	1.3
Sales and use Taxes ($m 2008 $)	0.9	5.1	NA[b]	NA
Property Taxes ($m 2008 $)	NA	NA	1.8	3.5
Population (number of new residents)	49	266	124	199
Housing (number of units required)	21	112	52	87
Public Service Employment (number of new employees)				
Police officers	<1	<1	<1	<1
Firefighters	<1	<1	<1	<1
Teachers	1	4	2	3

[a] Impacts are shown for preconstruction (2011), the peak year of construction (2012), the first year of start-up (2014) and the first year of operations (2022). Employment, income and tax impacts are estimated for the 11-county ROI; population, housing and public service employment impacts are estimated for the two-county ROI.
[b] NA = not applicable.
Sources: AES, 2010a; direct preconstruction figures based on information in GLE, 2009.

Facility Construction

Construction activities in the peak year (2012) would create 590 direct jobs at the proposed EREF site (AES, 2010a). An additional 1097 indirect jobs would be created in the 11-county ROI with the procurement of material and equipment and the spending of direct worker wages and salaries (Table 4-28). Facility construction would produce $65.0 million in income in the 11-county ROI in 2012. Construction would produce $0.7 million in direct State income taxes and $5.1 million in direct State sales taxes (AES, 2010a). Peak year construction activities would constitute less than 1 percent of total two-county ROI employment in 2012 (see Section 3.12.2); the economic impact of constructing the proposed EREF would be SMALL.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, EREF construction would mean that some in-migration of workers and their families from outside the two-county ROI would be required, with 266 persons in-migrating into the two-county ROI during the peak year of construction (AES, 2010a). Although in-migration may potentially impact local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (hotels, motels, and mobile home parks) would mean that the impact of facility construction on the number of vacant rental housing units is not expected to be large, with 112 additional rental units expected to be occupied in the two-county ROI during construction (AES, 2010a). These occupancy rates would represent less than 0.1 percent of the vacant rental units expected to be available in the two-county ROI in 2012; the impact of EREF construction on housing would be SMALL.

In addition to the potential impact on housing markets, in-migration would also affect local community and educational services employment to maintain existing levels of service in the two-county ROI. Accordingly, less than one police officer and less than one firefighter would be required in the peak construction year, 2012 (AES, 2010a). During construction, 76 additional school-age children would be expected in the two-county ROI in 2012, meaning four additional teachers would be required to maintain existing student–teacher ratios in the local school system (AES, 2010a). These staffing increases would represent less than 0.1 percent of community service employment in each employment category expected in the two-county ROI in 2012; the impact of EREF construction on community and educational service employment would be SMALL.

4.2.12.3 Facility Operation

Facility Construction/Operations Startup Overlap Period

Full production at the proposed EREF would not occur until 2022 when final construction would be completed. However, limited production of enriched uranium would begin with the opening of the first cascade in 2014 because of the modular nature of the proposed EREF. Enriched uranium production would increase and heavy construction would continue until 2018 when all major building structures would be completed and SBMs 1 and 2 would be fully operational. During this period, construction employment is expected to decline from levels reached in the peak construction year (2012) and startup employment would likely remain at the level established in 2014 until full facility operation commences in 2022 with the completion of the cascades in SBM 4 (AES, 2010a).

Startup activities in the first year (2014) would create 275 direct jobs at the proposed EREF (AES, 2010a). An additional 1370 indirect jobs would be created in the 11-county ROI with the procurement of material and equipment and the spending of direct worker wages and salaries (Table 4-28). Facility startup would produce $46.2 million in income in the 11-county ROI in 2014 and $0.7 million in direct State income taxes (AES, 2010a). Property taxes payable to Bonneville County would amount to $1.8 million annually between 2015 and 2017. Startup activities would constitute less than 1 percent of total two-county ROI employment in 2014 (see Section 3.12.2); the economic impact during the period of construction/operations overlap of the proposed EREF would be SMALL.

Given the scale of startup activities and the likelihood of local worker availability in the required occupational categories, startup of the proposed EREF would result in some in-migration of workers and their families from outside the two-county ROI, with 124 persons in-migrating into the two-county ROI during the first year of startup (AES, 2010a). Although in-migration may potentially impact local housing markets, there would be a relatively small number of in-migrants, and temporary accommodation (hotels, motels, and mobile home parks) would be available. Approximately 52 additional rental units would be expected to be occupied in the two-county ROI during this period (AES, 2010a). These occupancy rates would represent less than 0.1 percent of the vacant rental units expected to be available in the two-county ROI in 2014; therefore, the impact of the proposed EREF project on housing during the construction/operations overlap period would be SMALL.

In addition, in-migration would also affect local community and educational services employment to maintain existing levels of service in the two-county ROI. Accordingly, less than one police officer and less than one firefighter would be required in the first year, 2014, when operations begin. During startup, 35 additional school-age children would be expected in the two-county ROI in 2014, meaning two additional teachers would be required to maintain existing student–teacher ratios in the local school system (AES, 2010a). These staffing increases would represent less than 0.1 percent of community service employment in each employment category expected in the two-county ROI in 2012; therefore, the impact of the proposed EREF project on community and educational service employment during the construction/operations overlap period would be SMALL.

Full Operation

Operations activities in the first full year (2022) would create 550 direct jobs at the proposed EREF site itself (AES, 2010a). An additional 2739 indirect jobs would be created in the 11-county ROI with the procurement of material and equipment and the spending of direct worker wages and salaries (Table 4-28). Facility operations would produce $92.4 million in income in the 11-county ROI in 2022. Operations would produce $1.3 million in direct State income taxes and $3.5 million in direct property taxes (AES, 2010a). Property taxes would be payable to Bonneville County. Operations activities would constitute less than 1 percent of total two-county ROI employment in 2022 (see Section 3.12.2); the economic impact of operating the proposed EREF would be SMALL.

Given the scale of operations activities and the likelihood of local worker availability in the required occupational categories, EREF operation would result in some in-migration of workers and their families from outside the two-county ROI, with 199 persons in-migrating into the two-county ROI during the first year of operation (AES, 2010a). Although in-migration may potentially impact local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (hotels, motels, and mobile home parks) would mean that the impact of facility operation on the number of vacant owner-occupied housing units is not expected to be large, with 87 rental units expected to be occupied in the two-county ROI during operations (AES, 2010a). These occupancy rates would represent less than 0.1 percent of the vacant owner-occupied units expected to be available in the two-county ROI in 2022; the impact of EREF operations on housing would be SMALL.

In addition to the potential impact on housing markets, in-migration would also affect local community, and educational services employment to maintain existing levels of service in the two-county ROI. Accordingly, less than one police officer and less than one firefighter would be required in the first year of operations, 2022 (AES, 2010a). Fifty-seven additional school-age children would be expected in the two-county ROI in 2022, meaning an additional three teachers would be required to maintain existing student–teacher ratios in the local school system (AES, 2010a). These staffing increases would represent less than 0.1 percent of community service employment in each employment category expected in the two-county ROI in 2022; the impact of EREF operations on community and educational services employment would be SMALL.

4.2.12.4 Potential Effect on Property Values

Because it is not possible to accurately predict the response in regional property markets to the construction and operation of the proposed EREF, this section discusses how a facility such as the proposed EREF might affect property values based on findings from potentially hazardous facilities elsewhere in the United States. In general, potentially hazardous facilities have the potential to affect property values in two ways (Clark et al., 1997). First, negative perceptions associated with these facilities may reduce property values if potential buyers believe that any given facility poses a potential health risk. Negative perceptions may be based on individual sensitivities regarding risks associated with proximity to these facilities, and also on sensitivities at the community level that the presence of such a facility may adversely affect the prospects for local economic development. Even though potential buyers may not personally fear a potentially hazardous facility, they may offer less for a property in the vicinity of a facility if there is fear that the facility will reduce the rate of appreciation of housing in the area. Second, there may be a positive influence on property values associated with workplace accessibility for workers at the facility, with workers offering more for property close to the facility to minimize commuting times. Workers directly associated with the facility are likely to have considerably less fear of the technology and operations at the facility than the population as a whole. The importance of this influence on property values will vary with the size of the workforce involved.

While there is no evidence that uranium enrichment facilities impact local property values, a number of studies have assessed the impact of other potentially hazardous facilities on local property markets, including facilities such as nuclear power plants and spent nuclear fuel facilities (Clark and Nieves, 1994; Clark et al., 1997) and hazardous material and municipal waste incinerators and landfills (Kohlhase, 1991; Kiel and McClain, 1995). Many of these studies use a hedonic modeling approach[14] to take into account the wide range of spatial influences on property values near noxious facilities, including crime (Thaler, 1978), fiscal factors (Stull and Stull, 1991), and noise and air quality (Nelson, 1979). The general conclusion from these studies is that while there may be a small negative effect on property in the

[14] Hedonic modeling of property markets is a form of multivariate regression analysis that incorporates numerous potential influences on housing values, including housing quality and location, distance to regional employment and retail centers, the quality of regional transportation networks, and the quality and fiscal characteristics of regional educational and public service providers.

immediate vicinity of noxious facilities (i.e., less than 1 mile), this effect is often temporary, often coming with announcements related to specific project phases, such as site selection, the start of construction, the start of operations, etc. At larger distances and over the longer duration of the each project, no significant enduring negative property value effects have been found in these studies. Given these findings, it is unlikely that the proposed EREF would have a significant impact on local property values in the long term.

4.2.13 Environmental Justice Impacts

As described in Sections 4.2.1 through 4.2.12 above and in Section 4.2.15 below, the impacts of the proposed EREF would mostly be SMALL for the resource areas evaluated. For these resources areas, the impacts on all human populations would be SMALL. The NRC staff has concluded that potential impacts would be SMALL to MODERATE or MODERATE in a few cases, which could potentially affect environmental justice populations; and there would be LARGE, though intermittent, short-term impacts from fugitive dust during preconstruction. However, as there are no low-income or minority populations within the 4-mile area around the proposed facility, these impacts would not be disproportionately high and adverse for these population groups.

A brief description of impacts potentially affecting the general population in each resource area follows:

- *Land Use.* As described in Section 4.2.1, the proposed EREF would be located entirely on private land. The operation of a uranium enrichment facility is consistent with the county's zoning. Current agricultural uses of the proposed EREF property would be curtailed, but similar activities would continue over large land areas surrounding the proposed EREF property and vicinity. For example, it is not anticipated that EREF preconstruction, construction, and operation would have any effect on the current land uses found on the surrounding Federal lands administered by the U.S. Bureau of Land Management. Land use impacts resulting from preconstruction, construction, and operation would be SMALL.

- *Historic and Cultural Resources.* As described in Section 4.2.2, there are 13 cultural resource sites in the immediate vicinity of the proposed EREF. Only one of these sites is eligible for listing on the *National Register of Historic Places*, the John Leopard Homestead (site MW004). This site is within the construction footprint of the proposed EREF. Preconstruction activities would destroy site MW004, and the resulting impacts would be LARGE, but were considered MODERATE because the appropriate mitigation involving professional excavation of, and data recovery at, site MW004 was implemented by AES and other homestead sites of this type exist in the region (WCRM, 2010; Idaho SHPO, 2010b; Gilbert, 2010). Other than for site MW004, the impacts of the proposed project on historic and cultural resources would be SMALL.

- *Visual and Scenic Resources.* As described in Section 4.2.3, preconstruction and construction equipment and the industrial character of the proposed EREF buildings would create significant contrast with the surrounding visual environment of the primarily agricultural and undeveloped rangeland. The proposed facility would be approximately 2.4 kilometers (1.5 miles) from public viewing areas such as US 20 and the Hell's Half Acre Wildlife Study Area (WSA), thus the impact on views would be SMALL to MODERATE.

- *Air Quality*. As described in Section 4.2.4, preconstruction and construction traffic and operation of construction equipment are projected to cause a temporary increase in the concentrations of particulate matter. These impacts would be SMALL. However, fugitive dust from land clearing and grading operations could result in large releases of particulate matter for temporary periods of time. Such impacts would be MODERATE to LARGE during certain preconstruction periods and activities. Facility operations could produce small gaseous releases associated with operation of the process that could contain uranium compounds and hydrogen fluoride. Small amounts of nonradioactive air emissions consisting of carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM), volatile organic compounds (VOCs), and sulfur dioxide (SO_2). Air quality impacts during operations would be SMALL.

- *Geology and Soil.* As described in Section 4.2.5, impacts would result primarily during preconstruction and construction from surface grading and excavation activities that loosen soil and increase the potential for erosion by wind and water. Soil compaction as a result of heavy vehicle traffic would also increase the potential for soil erosion by increasing surface runoff. Spills and inadvertent releases during all project phases could contaminate site soils. Implementation of mitigation measures identified by AES would ensure that these impacts would be SMALL.

- *Water Resources*. As described in Section 4.2.6, the water supply for the proposed facility would be from onsite wells, and water usage would be within the water appropriation for the proposed EREF property. The plant would also have no discharges to surface water or groundwater. The impact of the proposed EREF on water resources would be SMALL.

- *Ecological Impacts*. As described in Section 4.2.7, impacts would occur primarily as a result of preconstruction and construction activities, which would mean the removal of shrub vegetation and the relocation and displacement of wildlife presently on the proposed site as a result of noise, lighting, traffic, and human presence. Collisions with vehicles, construction equipment, and fences may cause some wildlife mortality. No rare or unique communities or habitats or Federally-listed threatened or endangered species have been found or are known to occur on the proposed site. The impact of the proposed EREF on ecological resources would be SMALL to MODERATE.

- *Noise*. As described in Section 4.2.8, increased noise associated with the operation of construction machinery is expected during preconstruction and construction, with noise levels of between 80 to 95 dBA at the highway entrances, access roads, and the Visitor Center. Construction noise would be temporary and would be reduced to about 51 to 66 dBA at the nearest hiking trail point on the Hell's Half Acre WSA. Impacts would be SMALL. Impacts during the operation of the proposed facility itself would also be SMALL.

- *Transportation*. As described in Section 4.2.9, the primary impact of preconstruction, construction and operation on transportation resources is expected to be increased traffic on nearby roads and highways due to truck shipments and site worker commuting. Transportation impacts during preconstruction and construction, and during facility operation would be SMALL to MODERATE on adjacent local roads (due to the potentially significant increase in average daily traffic), but regional impacts would be SMALL.

- *Public and Occupational Health*. As described in Section 4.2.10, the analysis of nonradiological impacts during preconstruction and construction includes estimated numbers of injuries and illnesses incurred by workers and an evaluation of impacts due to exposure to chemicals and other nonradiological substances, such as particulate matter (dust) and vehicle exhaust. All such potential nonradiological impacts would be SMALL. No radiological impacts are expected during preconstruction and initial facility construction, prior to radiological materials being brought onsite. Operation of the proposed EREF could release of small quantities of UF_6 during normal operations. Total uranium released to the environment via airborne effluent discharges is anticipated to be less than 10 grams (6.84 µCi or 0.253 MBq) per year. No liquid effluent wastes are expected from facility operation. For a hypothetical member of the public at the proposed property boundary, the annual dose was estimated to be approximately 0.014 millisievert per year (1.4 millirem per year). Doses attributable to normal operation of the proposed EREF would be small compared to the normal background dose range of 2.0 to 3.0 millisievert (200 to 300 millirem). Radiological impacts during operations would be SMALL.

- *Waste Management*. As described in Section 4.2.11, small amounts of hazardous waste and approximately 6116 cubic meters (8000 cubic yards) of nonhazardous and nonradioactive wastes would be generated during preconstruction and construction activities. During operations, approximately 75,369 kilograms (165,812 pounds) of solid nonradioactive waste would be generated annually, including approximately 5062 kilograms (11,136 pounds) of hazardous wastes. Approximately 146,500 kilograms (322,300 pounds) of radiological and mixed waste would be generated annually, of which approximately 100 kilograms (220 pounds) would be mixed waste. All wastes would be transferred offsite to licensed waste facilities with adequate disposal capacity for the wastes from the proposed EREF. Overall, impacts would be SMALL.

- *Socioeconomics*. As described in Section 4.2.12, there would be increases in regional employment and income and tax revenue during preconstruction, construction, and operation. Although these impacts would be SMALL compared to the 11-county economic baseline, they are generally considered to be positive. Impacts on housing and local community services, which could be negative if significant in-migration were to occur, would also be SMALL.

- *Accidents*. As described in Section 4.2.15, six accident scenarios were evaluated in this EIS as a representative selection of the types of accidents that are possible at the proposed EREF. The representative accident scenarios selected vary in severity from high- to intermediate-consequence events and include accidents initiated by natural phenomena (earthquake), operator error, and equipment failure. The consequence of a criticality accident would be high (fatality) for a worker in close proximity. Worker health consequences are low to high from the other five accidents that involve the release of UF_6. Radiological consequences to a maximally exposed individual (MEI) at the Controlled Area Boundary (proposed EREF property boundary) are low for all six accidents including the criticality accident. Uranium chemical exposure to the MEI is high for one accident and low for the remainder. For HF exposure to an MEI at the proposed property boundary, the consequence of three accidents is intermediate, with a low consequence estimated for the remainder. All accident scenarios predict consequences to the collective offsite public of less than one lifetime cancer fatality. Impacts from accidents would be SMALL to MODERATE.

4.2.14 Separation of Preconstruction and Construction Impacts

As described in Section 1.4.1, the NRC has granted an exemption for AES to conduct certain preconstruction activities, and previous sections have provided estimates (where applicable) of the fractions of such impacts that are attributable to preconstruction and construction. Table 4-29 summarizes those estimates and compares the environmental impacts of preconstruction (which is not part of the proposed action) and construction (which is part of the proposed action).

4.2.15 Accident Impacts

The operation of the proposed EREF would involve risks to workers, the public, and the environment from potential accidents. The regulations in 10 CFR Part 70, Subpart H, "Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material," require that each applicant or licensee evaluate, in an ISA, its compliance with certain performance requirements. The NRC staff has conducted a confirmatory analysis (NRC, 2010f) to independently evaluate the consequences of potential accidents identified in AES's ISA (AES, 2010c). The accidents evaluated are a representative selection of the types of accidents that are possible at the proposed EREF.

The analytical methods used in this consequence assessment are based on NRC guidance for analysis of nuclear fuel-cycle facility accidents (NRC, 1990, 1991, 1998, 2003b). The NRC staff analyzed accidents that involve the release of UF_6 liquid and/or gas from process systems, components, and containers. Such accidents, if unmitigated, pose a chemical and radiological risk to workers, the public, and the environment. A generic nuclear criticality accident was also analyzed.

4.2.15.1 Accidents Considered

AES's ISA (AES, 2010c) and its Emergency Plan (AES, 2010d) describe potential accidents that could occur at the proposed EREF. Accident descriptions are provided for two groups of events according to the severity of the accident consequences: high-consequence events and intermediate-consequence events.

The NRC selected a range of possible accidents for detailed evaluation to assess the potential human health impacts associated with accidents. The representative accident scenarios selected vary in severity from high- to intermediate-consequence events and include accidents initiated by natural phenomena (earthquake), operator error, and equipment failure. The ISA considered all credible accidents at the proposed EREF. Evaluation of most accident sequences resulted in identification of design bases and design features that prevent criticality events or chemical releases to the environment. The accident scenarios evaluated were as follows:

- Generic Inadvertent Nuclear Criticality

Table 4-29 Summary and Comparison of Environmental Impacts from Preconstruction and Construction

Resource Area	Preconstruction	Construction
Land Use	SMALL. Restrictions on land use would begin when preconstruction begins, when all grazing and agriculture would cease on the proposed EREF property. This constitutes 90 percent of the impacts to land use. The loss of the grazing and agricultural land is not considered a major impact due to the large amount of land locally available for agriculture and grazing.	SMALL. Most impacts to land use (i.e., restricting land use) would have already occurred during preconstruction. Access restrictions would only increase during construction. Land use impacts from construction are expected to be a continuation of those from preconstruction. Only 10 percent of the land use impacts are expected during construction.
Historic and Cultural Resources	MODERATE. The greatest potential for impacts on historic and cultural resources would occur during initial ground-disturbing activities, and constitutes 90 percent of the impacts on these resources. Site MW004, located within the footprint of the proposed EREF, was found to be eligible for listing on the NRHP. It would not be possible to avoid this site during preconstruction. With proper mitigation, the impact on historical and cultural resources would be MODERATE.	SMALL. The majority of impacts to historic and cultural resources in the proposed EREF site would have occurred during preconstruction, when most of the ground disturbances would occur. It is estimated that 10 percent of the impacts would occur during construction.
Visual and Scenic Resources	SMALL. Visual impacts could result from increased traffic entering the proposed site. Fugitive dust could also create visual impacts along US 20. Because preconstruction activities would not significantly alter the overall appearance of the area, impacts would be SMALL. Only 20 percent of the impacts on visual and scenic resources are expected during preconstruction because most activities will occur at ground level.	SMALL to MODERATE. Visual impacts would result from increased traffic entering the proposed site. Fugitive dust would also create visual impacts along US 20. Eighty percent of the impacts on visual and scenic resources would occur during construction because the tallest and most visible components of the proposed project (i.e., industrial buildings) would be constructed at this time.

Table 4-29 Summary and Comparison of Environmental Impacts from Preconstruction and Construction (Cont.)

Resource Area	Preconstruction	Construction
Air Quality	SMALL to LARGE. Impacts on ambient air quality from preconstruction would be SMALL for all HAPs and all criteria pollutants except particulates, but would be MODERATE to LARGE for particulates during certain periods of preconstruction, despite application of appropriate mitigations. Collectively, preconstruction activities are expected to constitute as much as 90 percent of the overall air quality impacts from preconstruction and construction.	SMALL. Impacts on ambient air quality from construction would be SMALL for all HAPs and all criteria pollutants. Because construction activities are expected to occur on a relatively small disturbed land area and utilize a much reduced construction workforce, and with the major pollutant-emitting activities being completed during preconstruction, construction activities are expected to constitute 10 percent of the overall impacts from preconstruction and construction.
Geology and Soils	SMALL. The terrain change on the proposed site, from gently sloping to flat, would result in SMALL impacts on soils. Short-term impacts such as an increase in soil erosion and compaction of soils would be SMALL. The majority of soil-disturbing activities (e.g., blasting and mass rock excavation) would occur during the preconstruction period; therefore, it is estimated that about 95 percent of the impacts on geology and soils would be attributed to the preconstruction phase of development.	SMALL. Because the majority of soil-disturbing activities would have occurred during the preconstruction period, it is estimated that about 5 percent of the impacts on geology and soils would be attributed to the construction phase of development.
Water Resources	SMALL. The preconstruction period is estimated to occur during an 8-month period within the first year of the overall construction period; therefore, it is estimated that about 10 percent of the impacts on water resources would be attributed to the preconstruction phase of development.	SMALL. During the 7 years of heavy construction, the annual maximum usage rate would be within the annual water right appropriation that has been transferred to the proposed EREF property for use as industrial water. As a result, impacts on the groundwater supply would be SMALL. About 90 percent of the impacts on water resources would be attributed to the construction phase of development.

Table 4-29 Summary and Comparison of Environmental Impacts from Preconstruction and Construction (Cont.)

Resource Area	Preconstruction	Construction
Ecological Resources	MODERATE. Preconstruction would result in direct impacts due to habitat loss and wildlife mortality as well as indirect impacts primarily from fugitive dust and wildlife disturbance. Preconstruction activities on the proposed site would result in most (95 percent) of the habitat losses associated with development of the proposed EREF. The development of the proposed facility is expected to extend over an 84-month time period, with the preconstruction phase estimated to comprise 10 percent of that period. Because the greatest ecological impacts during facility development would be attributable to habitat loss and mortality associated with preconstruction activities, the estimated contribution from preconstruction would be 80 percent.	SMALL. Impacts associated with construction of facility components would primarily include wildlife disturbance and fugitive dust. Approximately 5 percent of habitat loss would be attributable to the construction of facility components. Facility component construction would comprise 90 percent of the 84-month construction period. Some impacts, such as wildlife disturbance due to noise and human presence, would occur throughout the long facility construction phase. The estimated contribution from facility construction to overall ecological impacts during the construction period would be 20 percent.
Noise	SMALL. Construction noise from the proposed EREF would be highest during construction of the highway entrances, access roads, and visitor center, and would range from 80 to 95 dBA. Construction noise would be temporary and would be reduced to about 51 to 66 dBA at the nearest hiking trail point on the Hell's Half Acre Wilderness Study Area. Noise resulting from highway interchange, proposed site access road, and visitor center construction may occur at offsite locations at levels above values suggested in Federal standards as acceptable, albeit for relatively short periods. Notwithstanding short-term noise impulse events such as blasting, adequate mitigation controls would ensure noise impacts during preconstruction would all be below recommended standards at the closest human receptor. Most of the major noise-producing activities would occur during preconstruction.	SMALL. Construction noise emanating from activities within the industrial footprint is expected to be attenuated to acceptable levels at the proposed facility boundaries. Adequate mitigation controls would ensure noise impacts during facility construction would all be below recommended standards at the closest human receptor.

Table 4-29 Summary and Comparison of Environmental Impacts from Preconstruction and Construction (Cont.)

Resource Area	Preconstruction	Construction
Transportation	SMALL to MODERATE. The primary impact on transportation resources is expected to be increased traffic on nearby roads. Impacts from access road construction would be SMALL but temporary (i.e., occurring only during the period of access road construction). Approximately 10 percent of estimated transportation impacts would be attributable to preconstruction activities.	SMALL to MODERATE. Construction activities at the proposed EREF would result in a 55 percent increase in traffic volume over current levels (including the period when construction and operations overlap). Approximately 90 percent of estimated transportation impacts would be attributable to construction activities.
Public and Occupational Health	SMALL. No radiological impacts are expected during the preconstruction period. Approximately 10 percent of the total occupational injury and nonradiological impacts would occur from preconstruction activities. This value is based on AES's estimate that preconstruction activities would be completed within the first 8 months of a total 84-month construction schedule. This 10 percent estimate is likely an upper bound, as fewer workers would be expected to be involved during preconstruction than during the main construction phase.	SMALL. No radiological impacts are expected during the initial phase of facility construction. Some radiological impacts to construction workers would occur during the time period when construction and operations overlap. Approximately 90 percent of the total occupational injury and nonradiological impacts would occur from facility construction activities.
Waste Management	SMALL. Solid nonhazardous wastes generated during preconstruction would be very similar to wastes from other construction sites of industrial facilities. These wastes would be transported offsite to an approved local landfill with sufficient capacity. Approximately 10 percent of estimated waste impacts would be attributable to preconstruction activities.	SMALL. Solid nonhazardous wastes generated during construction would be very similar to wastes from other construction sites of industrial facilities and would be transported offsite to an approved local landfill. The hazardous wastes generated in association with the construction of the proposed facility due to the maintenance of construction equipment and vehicles, painting, and cleaning would be packaged and shipped offsite to licensed facilities in accordance with Federal and State environmental and occupational regulations. Approximately 90 percent of estimated waste impacts would be attributable to construction activities.

Table 4-29 Summary and Comparison of Environmental Impacts from Preconstruction and Construction (Cont.)

Resource Area	Preconstruction	Construction
Socioeconomics	SMALL. Wage and salary spending and expenditures associated with materials, equipment, and supplies would produce income and employment and local and State tax revenue, while the migration of workers and their families into a community would affect housing availability, area community services such as healthcare, schools, and law enforcement, and the availability and cost of public utilities such as electricity, water, sanitary services, and roads. Preconstruction activities would produce total (direct and indirect) employment of 308 jobs and $11.9 million in income. Preconstruction activities would constitute less than 1 percent of total two-county ROI employment. Proposed EREF preconstruction activities (2010–2011) would contribute 5 percent of the impacts during preconstruction and construction.	SMALL. Wage and salary spending and expenditures associated with materials, equipment, and supplies would produce income and employment and local and State tax revenue, while the migration of workers and their families into a community would affect housing availability, area community services, and the availability and cost of public utilities. Construction would create 1687 jobs and $65.0 million in income the peak year. Peak year construction activities would constitute less than 1 percent of total two-county ROI employment. Proposed EREF construction activities would contribute 95 percent (2012–2022) of the impacts during preconstruction and construction.
Environmental Justice	SMALL. The environmental impacts associated with preconstruction of the proposed EREF would be mostly SMALL, and generally would be mitigated. For these resources areas, the impacts on all human populations would be SMALL. Potential impacts would be SMALL to MODERATE or MODERATE in a few cases, which could potentially affect environmental justice populations; and there would be LARGE, though intermittent, short-term impacts from fugitive dust during preconstruction. However, as there are no low-income or minority populations within the 4-mile area around the proposed facility, these impacts would not be disproportionately high and adverse for these population groups.	SMALL. For the same reasons discussed in the Preconstruction column, construction of the proposed EREF is not expected to result in disproportionately high or adverse impacts on minority or low-income populations.

- Heater Controller Failure (Hydraulic Rupture of Vessel) in the Centrifuge Test Facility

- Natural Phenomena Hazard – Earthquake

- Sampling Manifold Release of UF_6 to Room

- Large Facility Fire Propagating between Areas

- Sampling Cylinder Release

Due to its nature, inadvertent nuclear criticality is the only one of the accidents that does not involve a significant release of UF_6. The accident analysis does not include an estimate of the probability of occurrence of accidents, which, in combination with consequences, would reflect the overall importance of accident types; rather, analyzed accidents are assumed to occur.

4.2.15.2 Accident Consequences

Accidents involving release of UF_6 liquids or vapors were analyzed, in general, by identifying the quantity of a containerized material at risk inside the proposed facility, the amount of material released into a room as vapor or particulates under the accident scenario, the fraction of released material that is of respirable size, and the fraction of material exhausted to the atmosphere through an available pathway, typically a building ventilation system. The dispersion of released material in the atmosphere and transport to onsite locations were calculated using guidance provided in Regulatory Guide 1.111 (NRC, 1977). Dispersion and transport to offsite locations were then analyzed using the GENII computer model (PNNL, 2007) with conservative inputs for exposure parameters and atmospheric transport factors. These methods estimated direct exposures to members of the public from an airborne plume, as well as exposures over a year's time from deposited uranium materials, to determine accident consequences to the public. Impacts on the public from a criticality accident were analyzed similarly, but for radioactive gases that would be released from a criticality event in a vessel inside the proposed facility, including fission products and radioiodine.

The performance requirements in 10 CFR Part 70, Subpart H, define acceptable levels of risk of accidents at nuclear fuel-cycle facilities, such as the proposed facility. The regulations in Subpart H require that the applicant reduce the risks of credible high-consequence and intermediate-consequence events, and assure that under normal and credible abnormal conditions, all nuclear processes are subcritical. Threshold consequence values that define the high- and intermediate-consequence events, except for criticality events, are described in Table 4-30 as taken from AES's Safety Analysis Report (SAR) (AES, 2010b).

Receptors located at the Restricted Area Boundary (RAB) within the proposed site and at the Controlled Area Boundary (CAB) (property boundary) represent worst-case exposures to nonradiological workers at the proposed facility and members of the public, respectively.

Table 4-30 Definition of High- and Intermediate-Consequence Events

Receptor	Intermediate Consequence[a]	High Consequence
Worker – radiological	>25 rem (0.25 Sv)	>100 rem (1 Sv)
Worker – chemical (10-minute exposure)	>AEGL-2 for UF_6 >AEGL-2 for HF (>19 mg U/m^3)[b] (>78 mg HF/m^3) = (95 ppm)	>AEGL-3 for UF_6 >AEGL-3 for HF (>147 mg U/m^3) (>139 mg HF/m^3) = (170 ppm)
Environment at the restricted area boundary	>24-hour average release greater than 5000 times the values in Table 2 of Appendix B of 10 CFR Part 20 (=1.5×10^{-8} µCi/mL)	NA[b]
Individual at the controlled area boundary – radiological	>5 rem (0.05 Sv)	>25 rem (0.25 Sv)
Individual at the controlled area boundary – chemical (30-minute exposure)	>4.06 mg soluble U intake >AEGL-1 for HF (>2.4 mg U/m^3) (>0.8 mg HF/m^3) = (0.98 ppm)	>21 mg soluble U intake >AEGL-2 for HF (>13 mg U/m^3) (>28 mg HF/m^3) = (34.23 ppm)

[a] AEGL: Acute Exposure Guideline Levels are public and private sector derived consensus values intended to describe the risk to humans resulting from once-in-a-lifetime, or rare, exposure to airborne chemicals (EPA at http://www.epa.gov/oppt/aegl/).
[b] U = uranium; NA = not applicable.

Table 4-31 presents the consequences from the hypothetical accidents. Consequences were evaluated against the above criteria. For the criticality accident, a worker within a few feet of the event would likely be killed. A maximally exposed individual at the CAB would receive a radiation dose of 5.7 millisieverts (0.57 rem) total effective dose equivalent, which represents a low consequence to an individual (<0.05 sievert [<5 rem]). The collective dose to the offsite population to the east-southeast, as determined using GENII (PNNL, 2007), is estimated to be 4.51 person-sieverts (451 person-rem). This population dose would cause an estimated 0.3 lifetime cancer fatalities, or less than one fatality. Thus, the risk of health effects to the offsite public from this accident would be MODERATE.

The consequences of the five accident scenarios involving a release of UF_6 vary widely, as shown in Table 4-31. Worker consequences are intermediate (between 0.05 and 0.25 sievert [5 and 25 rem]) for the scenario involving a hydraulic rupture of a Centrifuge Test Facility (CTF) feed vessel and high for the scenario involving a sampling cylinder release (>0.25 Sv [25 rem]).

Consequences to the maximally exposed member of the public located at the CAB would be low for the hydraulic rupture of a feed vessel scenario and for the sampling manifold release scenario (<2.5 milligrams per cubic meter uranium and <0.8 milligrams per cubic meter HF). Consequences to this receptor are intermediate for the earthquake and facility-wide fire scenarios on the basis of HF exposure (between 0.8 and 28 milligrams per cubic meter), but low for uranium exposure (<2.4 milligrams per cubic meter). Consequences to this receptor are high for the sampling cylinder release on the basis of uranium exposure (>13 milligrams per cubic meter) and intermediate for HF exposure (between 0.8 and 28 milligrams per cubic meter).

Table 4-31 Summary of Health Effects Resulting from Accidents[a]

Accident	Worker[b]		Environment at RAB	Individual at CAB,		Collective Dose		
	U, mg/m^3 (rem)	HF, mg/m^3	µCi/mL	U, mg/m^3 (rem)	HF, mg/m^3	Direction	Person-rem	LCFs
Inadvertent nuclear criticality	(High[c])	Not applicable	18.4[d] (ratio >1)	(0.57)[e]	NA	ESE	451	0.3
Hydraulic rupture of a CTF feed vessel[f]	2.03×10^4 (14.2)	6.83×10^3	4.23×10^{-9}	1.43 (0.006)	0.54	ESE	0.632	4×10^{-4}
Earthquake	9.59 (0.136)	32.2	1.28×10^{-9}	0.274 (0.001)	2.08	ESE	0.47	3×10^{-4}
Facility-wide fire	13 (0.805)	4.36	2.57×10^{-9}	0.549 (0.002)	2.08	ESE	0.94	6×10^{-4}
Sampling manifold release	89 (0.062)	29.9	2.85×10^{-10}	4.07×10^{-2} (<0.001)	1.54×10^{-2}	ESE	4.27×10^{-2}	3×10^{-5}
Sampling cylinder release	1.74×10^5 (122)	5.85×10^4	4.82×10^{-7}	69.8 (0.293)	26.4	ESE	72	4×10^{-2}

[a] A safety evaluation (NRC, 2010f) has been conducted as part of the facility licensing process to identify Items Relied On For Safety (IROFS) for which changes in facility design may be required. Health effect impact estimates are based on calculations assuming the current design prior to any IROFS determinations. These results will be used to identify which, if any, IROFS are to be incorporated into facility designs or procedures to reduce the risks to workers, the public, and the environment to acceptably low levels.

[b] Worker exits after 5 minutes in all cases but the earthquake in which the exit is assumed to occur in 2.5 minutes. U = uranium.

[c] High consequence could lead to a fatality.

[d] Pursuant to 10 CFR 70.61(c)(3), this value is the sum of the fractions of individual fission product radionuclide concentrations over 5000 times the concentration limits that appear in 10 CFR Part 20, Appendix B, Table 2.

[e] The dose to the individual at the CAB is the sum of internal and external doses from fission products released from the criticality.

[f] Though the consequences of the rupture of a liquid-filled UF_6 vessel would be high, redundant heater-controller trips would make this event highly unlikely to occur.

Total consequences to the public in terms of radiation dose to the population in the east-southeast direction (toward Idaho Falls) and resultant total lifetime cancer fatalities are given under Collective Dose in Table 4-31. All the accident scenarios predict less than one lifetime cancer fatality in this population.

Of the accident scenarios analyzed by the NRC staff, the most significant accident consequences are those associated with the release of UF_6 caused by rupturing an overfilled or overheated cylinder and a nuclear criticality. Facility design reduces the risk (likelihood) of the rupture event by using redundant heater controller trips. In addition, the proposed facility Emergency Plan (AES, 2010d) addresses this type of event and all other lower-risk, high- and intermediate-consequence events. The NRC staff concludes that through the combination of plant design, passive and active engineered controls (Items Relied on for Safety [IROFS]), administrative controls, and management of these controls, accidents at the proposed facility pose an acceptably low risk to workers, the environment, and the public.

4.2.15.3 Mitigation Measures

NRC regulations and AES's operating procedures for the proposed EREF are designed to ensure that the high and intermediate accident scenarios would be highly unlikely (10 CFR Part 70, Subpart H, and AES [2010f]). The NRC staff assesses the safety features and operating procedures required to reduce the risks from accidents. The combination of responses by IROFS that mitigate or prevent emergency conditions and the implementation of emergency procedures and protective actions in accordance with the proposed EREF Emergency Plan (AES, 2010d) would limit the consequences and reduce the likelihood of accidents that could otherwise extend beyond the proposed EREF site and property boundaries. The following mitigation measures have been identified by AES to reduce the risks posed by accidents at the proposed EREF (AES, 2010c).

Preventative and mitigative measures within the proposed facility relevant to a fire/explosion and UF_6 release scenario would include: (1) fire alarm and detection systems, possibly including a fire suppression system; (2) fire barriers preventing propagation of fires into and out of areas holding quantities of uranium materials; (3) reliable protection features to prevent overheating of UF_6 cylinders; and (4) explicit design bases to minimize the impacts of initiating events, such as those for a seismic event. Preventative measures to guard against a criticality accident include the use of safe-by-design components (AES, 2010c).

Mitigative measures relevant to radiological accidents would include: (1) radiation protection systems to alert workers and isolate systems when parameters exceed set limits; (2) physical separation of areas within the facility designed to prevent or reduce exposure; (3) controlled positive or negative air pressures within designated areas to control air flow; (4) carbon absorbers, HEPA filters, and automatic trips on ventilation systems to prevent releases outside of affected areas; and (5) limited building leakage paths to the outside environment through appropriate door and building design. These features are designed to contain UF_6 vapors within specified building areas and attenuate any release to the environment. Preventative controls for a nuclear criticality accident would include maintaining a safe geometry of all vessels, containers, and equipment that contain fissile material and ensuring that the amount of such material in these vessels does not exceed set limits. Mitigative controls would include criticality monitoring and alarm systems and emergency response training (AES, 2010a).

4.2.16 Decontamination and Decommissioning Impacts

This section summarizes the potential environmental impacts of decontamination and decommissioning of the proposed EREF site through comparison with normal operational impacts. Decontamination and decommissioning would involve the removal and disposal of all operating equipment while leaving the structures and most support equipment decontaminated to free release levels in accordance with 10 CFR Part 20.

Decommissioning activities are generally described in Section 2.1.4.3 of this EIS based on the information provided by AES in the SAR (AES, 2010b). However, a complete description of actions taken to decommission the proposed EREF at the expiration of its NRC license period cannot be fully determined at this time. In accordance with 10 CFR 70.38, AES must prepare and submit a decommissioning plan to the NRC at least 12 months prior to the expiration of the NRC license for the proposed EREF. AES would submit a final decommissioning plan to the NRC prior to the start of decommissioning. This plan would be the subject of further NEPA review, as appropriate, at the time the decommissioning plan is submitted to the NRC. Decontamination and decommissioning activities would be conducted to comply with all applicable Federal and State regulations in effect at the time of these activities.

The decommissioning process is expected to occur over a 9-year period. The SBMs would be decommissioned in the first 8 years, and there would be one additional year for final site surveys and activities (AES, 2010b). SBM 1 is scheduled to be the first to operate and would be the first to undergo decontamination and decommissioning. The other SBMs would follow in turn. A single SBM is assumed by AES to take 4.5 years to decommission, with 3 years for decommissioning of the centrifuges and associated equipment and 1.5 years for decontamination of the structure (AES, 2010b). SBM 4 would be the last module to operate and to be decommissioned. The remaining plant systems and buildings would be decommissioned after final shutdown of SBM 4.

The decontamination and decommissioning would include:

- installation of decontamination facilities

- purging of process systems

- dismantling and removal of equipment

- decontamination and destruction of confidential and secret restricted data material

- sales of salvaged materials

- disposal of wastes

- completion of a final radiation survey

The primary environmental impacts of the decontamination and decommissioning of the proposed EREF site include changes in releases to the atmosphere and surrounding environment and disposal of industrial trash and decontaminated equipment. The types of impacts that may occur during decontamination and decommissioning would be similar to many of those that would occur during the initial construction of the proposed facility. Some impacts, such as water usage and the number of truck trips, could increase during the decontamination and disposal phase of the decommissioning but would be less than during the construction phase; thus they would be bounded by the impacts in Sections 4.2.4 through 4.2.9.

4.2.16.1 Land Use

As discussed in Section 4.2.1, the proposed AES property is zoned for uses such as the proposed EREF. The potential for impacts on land use is greatest during preconstruction and construction of the proposed EREF. The decontamination and decommissioning of the proposed facility would not be expected to result in a change in land use from operation. The land use would remain restricted to industrial uses. Since decontamination and decommissioning is not expected to affect land use, the impacts would be SMALL.

4.2.16.2 Historic and Cultural Resources

Ground-disturbing activities have the greatest potential for impacting historic and cultural resources. Ground disturbance at the proposed EREF site affecting cultural resources would have occurred during preconstruction for the proposed EREF. Any area disturbed during decontamination and decommissioning would be expected to no longer have the potential for historic and cultural resources. Therefore, it is not expected that any historic and cultural resources would be affected by decontamination and decommissioning of the proposed EREF; therefore, the impact would be SMALL.

4.2.16.3 Visual and Scenic Resources

The decontamination and decommissioning of the proposed EREF would have little additional effect on visual and scenic resources. Many buildings and the perimeter lighting would remain in place as part of the decontamination and decommissioning. Thus, the overall visual and scenic landscape would not be altered drastically from operations. Therefore, the impacts on visual and scenic resources of decontamination and decommissioning would be SMALL to MODERATE.

4.2.16.4 Air Quality

Decontamination and decommissioning activities would result in air quality impacts similar to those resulting from preconstruction and construction, although to a lesser magnitude and for a substantially shorter duration. Primary sources of air impacts during decontamination and decommissioning would include the operation of various construction equipment, onsite fueling and maintenance of construction equipment, the use of explosives to remove foundations if necessary, material handling and stockpiling, commuting to the proposed site (by a workforce that is expected to be substantially smaller than the initial construction workforce), and offsite transfer of recyclable materials and equipment and wastes destined for offsite treatment and disposal facilities. The most significant sources of fugitive dust expected in preconstruction and construction, cut-and-fill operations and travel on unpaved onsite roads, would either not be operative during decontamination and decommissioning or would be undertaken at substantially reduced levels. Unique aspects of the decontamination and decommissioning plan, such as whether buried utilities and improvements are removed or abandoned in place, can be expected to have incremental impacts on associated air quality impacts.

The absence of a specific decontamination and decommissioning plan prevents a quantitative analysis of decontamination and decommissioning impacts on air quality. The NRC staff concludes that air impacts from preconstruction and construction would be bounding (see Tables 4-1 through 4-3 in Section 4.2.4.1 of this EIS) and that air impacts from decontamination and decommissioning would be less. The NRC staff therefore concludes that air impacts from decontamination and decommissioning would be SMALL.

4.2.16.5 Geology and Soils

Impacts to geology and soils during the decontamination and decommissioning phase would result from short-term disturbances of land (e.g., clearing and grading) for equipment laydown and disassembly. Land disturbance could temporarily increase the potential for soil erosion at the proposed EREF site, resulting in impacts similar to (but less than) those described for the preconstruction/construction phase (see Section 4.2.5.1). Mitigation measures would be implemented to minimize soil erosion and to control fugitive dust. Thus, impacts to geology and soils due to decontamination and decommissioning activities would be SMALL.

4.2.16.6 Water Resources

The water supply for the decontamination and decommissioning of the proposed EREF would be obtained from one or more onsite wells already completed in the ESRP aquifer. No surface water sources would be used. During this phase, water would be consumed for potable and sanitary needs, and for building and equipment rinsing (decontamination). Other water uses would include dust control, compaction of fill, and watering of vegetation. None of this water would be returned to its original source.

Water use rates would vary during the 9-year decontamination and decommissioning period but would not exceed annual usage during normal operations, because less than half as many workers would be onsite during decontamination and decommissioning (AES, 2010a) and water usage would be within the capacity of the water right appropriation throughout this phase. Liquid effluent quantities from decontamination and decommissioning activities are expected to be higher than during normal operations (AES, 2009b). All liquid effluents, including the spent citric acid solution used for building and equipment rinsing, would be treated and discharged by evaporation to the atmosphere in the Liquid Effluent Treatment System Evaporator. Once the Liquid Effluent Collection and Treatment System is removed from service, temporary skid-mounted systems would be used to process any remaining liquid wastes. No process effluents would be discharged to the stormwater retention/detention basins or into surface water (AES, 2009b).

Runoff from paved areas and building roofs would continue to be diverted to three stormwater detention/retention basins for evaporation during the decontamination and decommissioning phase. At the end of this phase, mud or soil in the bottom of these basins would be tested for contamination and disposed of accordingly. The basins and berms would then be leveled to restore the land to its natural contour.

The Liquid Effluent Treatment System Evaporator would remain in operation throughout most of the decontamination and decommissioning phase. Liquids used to clean and decontaminate buildings and equipment would be treated and discharged by evaporation to the atmosphere in the system evaporator. Once the decontamination process has concluded and all effluents have evaporated, sludge and soil in the bottom of the evaporator would be tested and disposed of in accordance with regulatory requirements and in such as way as to meet the standards for releasing the proposed site for unrestricted use, as defined in 10 CFR 20.1402.

Since the usage and discharge impacts to water resources during the decontamination and decommissioning phase would be similar to those during operations, the impacts to water resources would be SMALL.

4.2.16.7 Ecological Resources

Plant communities and wildlife that became established near the proposed facility during the operational period could be affected by decontamination and decommissioning activities. Although the structures of the proposed EREF would be left in place, vegetation would be removed from land areas disturbed during decontamination and decommissioning activities, such as regraded basin areas. During the decontamination and decommissioning period, wildlife in the vicinity of the proposed facility would be disturbed by noise associated with decommissioning activities, and many species would be displaced to adjacent habitats. Noise levels generated by decommissioning would likely be similar to those during preconstruction and initial facility construction. Wildlife use of the proposed site would increase following the termination of decommissioning activities. Ecological impacts from decontamination and decommissioning would be SMALL.

4.2.16.8 Noise

Noise sources and levels would be similar to noise during site preconstruction and construction, and peaking noise levels would be expected to occur for short durations, primarily during preconstruction. Although a detailed decontamination and decommissioning plan has not yet been developed, major noise sources can be expected to include: the operation of heavy-duty construction equipment; traffic noise resulting from the commuting decontamination and decommissioning workforce and delivery vehicles used to transport disassembled components and waste materials to offsite facilities for redeployment, recycling, or disposal; the potential use of explosives or impact hammers to break up some structures if necessary, such as foundations, roads, and pavements; excavations of buried utilities and components; and cut-and-fill operations designed to return the proposed site to its original grades and contours in some areas.

Offsite noise impacts can be expected to be similar to those for preconstruction and construction (see Section 4.2.8.1). Noise associated with excavation and removal of buried utilities would not occur for those belowground components that are abandoned in place. Based on detailed information currently available, the NRC staff concludes that noise impacts from decommissioning would be less than those expected to occur in the preconstruction and construction phases and would therefore be SMALL.

4.2.16.9 Transportation

Traffic during the initial portion of the decontamination and decommissioning activities would be approximately the same as during the period when construction and facility operation overlap (AES, 2010a). Traffic after the cessation of facility operation would be less than the volume experienced during either construction or operation. Site roads, if properly maintained, would be adequate to accommodate the additional traffic volume, and the increased traffic would have a SMALL to MODERATE impact on the current traffic on US 20. However, the number of heavy trucks would be substantial for brief periods of time as waste materials were removed; therefore, transportation impacts for construction would be bounding.

If the depleted UF_6 has not been removed prior to the cessation of operations, it would be shipped offsite during the decommissioning phase. As shown in Table 2-2 in Section 2.1.4.2 of this EIS, the operation of the proposed EREF would generate up to 25,718 Type 48Y cylinders of depleted UF_6 tails during its operational lifetime. Type 48Y cylinders would be shipped one cylinder per truck for disposal. Assuming that all of the material is shipped during the first 8 years of decommissioning (the final radiation survey and decontamination would occur during the final year of decommissioning), approximately 4205 truckloads per year would be shipped from the proposed EREF. If the trucks are limited to weekday, nonholiday shipments, approximately 17 trucks per day would leave the proposed site for the depleted UF_6 conversion facility. Section 4.2.9 presents the impacts of shipping depleted UF_6 to the conversion facility, which would be SMALL.

4.2.16.10 Public and Occupational Health

Occupational Injuries and Illnesses

Occupational injuries and illnesses would be expected to be incurred during decontamination and decommissioning of the proposed EREF. The staged decommissioning is expected to take 9 years to complete. The nature of decontamination and decommissioning activities, which would involve dismantling some structures and equipment, would be similar to those for preconstruction and construction of the proposed facility, while the job classification used to estimate construction injuries in Section 4.2.12.1, North American Industry Classification System Code 237, "Other Heavy and Civil Engineering Construction," should also apply to dismantlement. In addition, the expected 9-year duration for decontamination and decommissioning is similar to the expected 7-year heavy construction period, and impacts from occupational injuries and illnesses during decontamination and decommissioning would be similar to those during construction. Chemical exposures would be controlled to below levels of concern through removal of hazardous chemicals from process lines and equipment. Thus, public and occupational health impacts would be SMALL.

Radiological Impacts

Exposures during decontamination and decommissioning would be bounded by the potential exposures during operation because standard quantities of uranium material (i.e., UF_6 in Type 48Y cylinders) would be handled during the portion of the decontamination and decommissioning operations that purges the gaseous centrifuge cascades of UF_6. Once this decontamination operation is completed, UF_6 would be present only in residual amounts and handled significantly less than during operations. Because systems containing residual UF_6 would be opened, decontaminated (with the removed radioactive material processed and packaged for disposal), and dismantled, an active environmental monitoring and dosimetry (external and internal) program would be conducted to maintain ALARA doses and doses to individual members of the public as required by 10 CFR Part 20. Therefore, the impacts to public and occupational health would be SMALL.

4.2.16.11 Waste Management

The waste management and recycling programs used during operations would also apply to decontamination and decommissioning. Materials eligible for recycling would be sampled or surveyed to ensure that contaminant levels would be below release limits. Enrichment equipment would be removed, depleted UF_6 would be transported to a conversion facility, buildings and other structures would be decontaminated, and debris would be shipped offsite for disposal. Radioactive material from decontamination and contaminated equipment would be packaged and shipped offsite to an appropriately licensed facility. Staging and laydown areas would be segregated and managed to prevent contamination of the environment and creation of additional wastes. Long-term storage and monitoring of wastes at the proposed EREF site would be avoided, as the generated wastes would not require delayed removal from the site. Disposal volumes of the various waste streams are anticipated to be similar to those for the NEF, including 7700 cubic meters (10,070 cubic yards) of low-level radioactive waste (AES, 2010a). Due to the availability of adequate disposal capacity for Class A low-level radioactive waste over the long term (GAO, 2004), the waste management impacts of decontamination and decommissioning would be SMALL.

4.2.16.12 Socioeconomics

Decontamination and decommissioning of the proposed EREF would provide continuing employment opportunities for some of the existing operations workforce and for other residents of the 11-county ROI. Additional specialized decommissioning workers would be required from outside the 11-county ROI. Although at a lower level than during operations, expenditures on salaries and materials would contribute to the area economy, and the State would continue to collect sales tax and income tax revenues. As was the case with the preconstruction, construction, and operations phases of the proposed project, the socioeconomic impact of decommissioning activities would be SMALL.

4.2.16.13 Environmental Justice

As described in Sections 4.2.16.1 through 4.2.16.12, the impacts of the proposed action during decontamination and decommissioning would be SMALL for all of the resource areas evaluated, and would not potentially affect environmental justice populations. Even where environmental impacts would be SMALL, the behaviors of some subpopulations may lead to disproportionate exposure through inhalation or ingestion (e.g., higher participation in outdoor recreation, home gardening, and subsistence fishing). However, because impacts on the general population would be SMALL, and because there are no Census block groups in which the low-income population either exceeds 50 percent of the total population and/or is more than 20 percentage points higher than the State or county percentage, decontamination and decommissioning of the proposed facility would not, therefore, produce any environmental justice concerns.

Overall, therefore, decontamination and decommissioning of the proposed EREF is not expected to result in disproportionately high or adverse impacts on minority or low-income populations.

4.2.16.14 Mitigation Measures

AES identified the measures listed below to mitigate impacts of decontamination and decommissioning activities (AES, 2010a). These measures should be considered preliminary because decontamination and decommissioning would occur more than 20 years in the future.

- *Ecological resources*: Mitigation measures would be taken to protect migratory birds during decommissioning, e.g., clearing or removal of habitat, such as sagebrush, including buffer zones, would be performed outside of the migratory bird breeding and nesting season; additional areas to be cleared would be surveyed for active nests during migratory bird breeding and nesting season; activities would be avoided in areas containing active nests of migratory birds; the FWS would be consulted to determine the appropriate actions regarding the taking of migratory birds, if needed.

- *Noise*: Mitigation of noise impacts from decommissioning would include sequencing noise-producing activities to minimize the overall noise and vibration impacts.

- *Public and occupational health*: Mitigation measures during decontamination and decommissioning operations are similar to those for the operational period. The goal of the mitigation measures would be to reduce the spread of radioactive contamination which would then reduce the unnecessary exposure or overexposure. These mitigation measures would be implemented by adapting design concepts that would minimize/prevent the spread of contamination from room to room. In addition, the creation of unrestricted and restricted areas would possibly reduce the spread of contamination by limiting the numbers of personnel within the work area. In addition, the creation of design features such as providing curbing and other barriers around tanks and other components containing liquids in order to limit spills would possibly reduce the spread of contamination.

4.2.17 Greenhouse Gas Emissions Associated with the Proposed EREF

This section presents an assessment of the effect preconstruction, construction, operation, and decommissioning of the proposed EREF can be expected to have on carbon dioxide and other greenhouse gas emissions.

4.2.17.1 Greenhouse Gases

Greenhouse gases (GHGs) include those gases, such as carbon dioxide (CO_2), water vapor, nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation from the earth's surface. The net effect over time is a trapping of absorbed radiation and a tendency to warm the planet's surface and the boundary layer of the earth's atmosphere, which constitute the "greenhouse effect" (IPCC, 2007). Some direct GHGs [15] (CO_2, CH_4, and N_2O) are both naturally occurring and the product of industrial activities, while others such as the hydrofluorocarbons are man-made and are present in the atmosphere exclusively due to human activities. Each GHG has a different radiative forcing potential

[15] Direct GHGs are those gases that can directly affect global warming once they are released into the atmosphere.

(the ability to affect a change in climatic conditions in the troposphere, expressed as the amount of thermal energy [in watts] trapped by the gas per square meter of the earth's surface) (IPCC, 2007). The radiative efficiency of a GHG is directly related to its concentration in the atmosphere.

As a way to compare the radiative forcing potentials of various GHGs without directly calculating changes in their atmospheric concentrations, an index known as the Global Warming Potential (GWP) (IPCC, 2007) has been established with CO_2, the most abundant of GHGs released to the atmosphere (after water vapor),[16] established as the reference point. GWPs are calculated as the ratio of the radiative forcing that would result from the emission of 1 kilogram (2.2 pounds) of a GHG to that which would result from the emission of 1 kilogram (2.2 pounds) of CO_2 over a fixed period of time. GWPs represent the combined effect of the amount of time each GHG remains in the atmosphere and its ability to absorb outgoing thermal infrared radiation. As the reference point in this index, CO_2 has a GWP of 1. On the basis of a 100-year time horizon, GWPs for other key GHGs are as follows: 21 for CH_4, 310 for N_2O, 11,700 for HFC-23, and 23,900 for SF_6 (IPCC, 2007).

Indirect GHGs, carbon monoxide (CO), nitrogen oxides (NO_x),[17] nonmethane volatile organic compounds (NMVOCs), and sulfur dioxide (SO_2), indirectly affect terrestrial solar radiation absorption by influencing the formation and destruction of tropospheric and stratospheric ozone or, in the case of SO_2, by affecting the absorptive characteristics of the atmosphere.

4.2.17.2 Greenhouse Gas Emissions and Sinks in the United States

The EPA is responsible for preparation and maintenance of the official U.S. Inventory of Greenhouse Gas Emissions and Sinks[18] to comply with existing commitments under the United Nations Framework Convention on Climate Change (UNFCCC). GHG emissions[19] are reported in sectors, using the GWPs established in the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).[20] Preconstruction, construction, operation, and decommissioning of the proposed EREF would result in the release of GHGs as a result of the same human activities that were identified by EPA as the sources of GHGs in the

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[16] Water vapor is the most abundant and most dominant greenhouse gas in the atmosphere. However, it is neither long-lived nor well mixed in the atmosphere, varying spatially from 0 to 2 percent.

[17] NO_x represents all thermodynamically stable oxides of nitrogen, excluding nitrous oxide (N_2O).

[18] GHG sinks are those activities or processes that can remove GHGs from the atmosphere.

[19] In keeping with the GWP convention that names CO_2 as the reference gas, assigning it a GWP of 1, GWPs of other direct GHGs are expressed as equivalents (Eq.) of CO_2, expressed in teragrams (Tg) of CO_2 equivalent (Tg CO_2 Eq.). One teragram is equal to 10^{12} grams, or one million metric tons (1.12 million tons).

[20] IPCC assessment reports are a compilation of separate reports of the various working groups that are established by the Panel. IGCC periodically updates assessment reports to incorporate newly established data, including revisions to GWPs and radiative forcing potentials of GHGs. The latest is the Fourth Assessment Report, published in 2007. Revised GWPs are contained in the report of Working Group I (IPCC, 2007). However, to provide for the analysis of trends of GHG emissions and sinks over time, nations responsible for GHG inventories continue to use the GHG GWPs established in the Second Assessment Report published in 1996.

U.S. Inventory. Results of the most recent report on the U.S. Inventory of GHG Emissions and Sinks (EPA, 2009b) for direct GHGs that are most relevant to the proposed EREF include:

- The primary GHG emitted by human activities in the United States was CO_2, representing approximately 85.4 percent of the total GHG emissions.

- In 2007, total U.S. GHG emissions were 7150.1 Tg CO_2 Eq., an increase of 17 percent from 1990.

- Overall emissions of GHGs rose from 2006 to 2007 by 1.4 percent (9 Tg CO_2 Eq.).

- CO_2 emissions for 2007 were 6103.4 Tg CO_2 Eq., 5735.8 of which was the result of combustion of fossil fuel primarily related to electricity generation (2397.2), transportation (1887.4), industrial applications (845.4), residential heating (340.6), and commercial applications (214.4).

- Sixty percent of the CO_2 emissions related to transportation were the result of consumption of gasoline in privately owned vehicles; the remainder was from combustion of fuels in diesel trucks and aircraft.

- Emissions of methane in 2007 as a result of combustion of fossil fuels in mobile sources were 2.3 Tg CO_2 Eq.

- Emissions of nitrous oxide in 2007 as a result of combustion of fossil fuels in mobile sources were 30.1 Tg CO_2 Eq.

- Emissions of HFCs (released from equipment) in 2007 were 108.3 Tg CO_2 Eq.

- Emissions of SF_6 in 2007 as a result of electrical transmission and distribution[21] were 12.7 Tg CO_2 Eq.

- The primary GHG sinks functional in 2007 included carbon sequestration in forests, trees in urban areas, agricultural soils, and landfilled yard trimmings and food scraps, all of which, in aggregate, offset 14.9 percent of the total GHG emissions in 2007.

- The most significant emissions of indirect GHGs in 2007 included:

  - 14,250 Tg CO_2 Eq. of NO_x primarily from mobile fossil fuel combustion (7831), stationary fuel combustion (5445), and industrial processes (520).
  - 63,875 Tg CO_2 Eq. of CO primarily from mobile fossil fuel combustion (54,678), stationary fossil fuel combustion (4792), and industrial processes (1743).
  - 13,747 Tg CO_2 Eq. of NMVOCs primarily from mobile fossil fuel combustion (5672), solvent use (3855), industrial processes (1878), and stationary fossil fuel combustion (1470).

[21] SF_6 is a gas at standard conditions and is used as a dielectric medium in high-voltage electrical equipment.

– 11,725 Tg CO_2 Eq. of SO_2 primarily from stationary fossil fuel combustion (10,211), industrial processes (839), and mobile fossil fuel combustion (442).

As noted above, consumption of fossil fuels for electricity generation represents the single greatest source of CO_2 emissions in 2007 (5735.8 Tg CO_2 Eq.). The CO_2 equivalents represented in the electricity that was delivered to end users in four sectors in 2007 include: transportation (1892.2), industrial (1553.4), residential (1198.0), and commercial (1041.4). The total gross GHG emissions in the United States from all sectors in 2007 were 7150 Tg CO_2 Eq. Net emissions (including all emissions and sinks) were 6087.5 Tg CO_2 Eq.

4.2.17.3 Greenhouse Gas Emissions and Sinks in Idaho

A review of statewide emissions of GHGs can provide an understanding of the impact anticipated GHG emissions from the proposed EREF would have in a regional context. Among States, Idaho ranks 47th with respect to emissions of GHGs and 39th in population (based on 2003 data) (NextGenerationEarth, 2009). However, Idaho's emissions of GHGs increased by 31 percent over the period 1990 to 2005 while GHG emissions on a national level increased by only 16 percent (IDEQ, 2009). The Idaho Department of Environmental Quality, in collaboration with the Center for Climate Strategies (CCS),[22] published a report in the spring of 2008 on Idaho's Greenhouse Gas Inventory and Reference Case projections for the period 1990–2020 (CCS, 2008). The relevant data from that report appear in Table 4-32. Table 4-33 provides the most recent comparison of GHG inventories by sector in Idaho vs. the United States for calendar year 2000.

4.2.17.4 Projected Impacts from Preconstruction, Construction, Operation, and Decommissioning of the Proposed EREF on Carbon Dioxide and Other Greenhouse Gases

Preconstruction, construction, operation, and decommissioning of the proposed EREF can be expected to result in emissions of CO_2 and other GHGs through various mechanisms, primarily from combustion of fossil fuels in both mobile and stationary sources. Individual contributions of preconstruction, construction, operation, and decommissioning are discussed below. Transportation volumes used in the following sections were established in Section 4.2.10 and are applied here without modification.

Estimated GHG Emissions during Preconstruction and Construction

During preconstruction and construction, fossil fuels would be consumed onsite to support construction vehicles and equipment, as a result of commuting to and from the proposed site by the construction workforce and by delivery vehicles bringing materials and equipment to the proposed site and removing construction-related wastes from the proposed site to area landfills and treatment/disposal facilities.

[22] The Center for Climate Strategies is a public-purpose, nonprofit, nonpartisan 501(c)(3) partnership organization established in 2004 to assist in climate policy development at the Federal and State levels.

Table 4-32 Idaho Historical and Reference Case GHG Emissions, by Sector[a]

Sector	Carbon Dioxide Equivalents (million metric tons)				
	1990	2000	2005	2010	2020
Energy	**16.6**	**22.2**	**22.1**	**23.4**	**26.8**
Electricity production	0.0	0.1	0.6	0.6	0.9
Coal	0.00	0.00	0.00	0.00	0.00
Natural gas	0.00	0.09	0.62	0.64	0.92
Oil	0.00	0.00	0.00	0.00	0.00
Net imported electricity	3.9	4.8	4.7	4.6	5.5
Electricity consumption based	**3.9**	**4.9**	**5.3**	**5.2**	**6.4**
Residential/commercial/industrial (RCI) fuel use	**5.1**	**6.8**	**6.1**	**6.7**	**7.7**
Coal	0.96	1.29	0.96	1.01	1.00
Natural gas	2.17	3.47	3.09	3.42	4.05
Wood (CH_4 and N_2O)	0.05	0.06	0.05	0.06	0.06
Transportation	7.3	10.1	10.2	11.0	12.2
Motor gasoline	5.25	7.13	6.98	7.25	7.67
Diesel	1.47	2.48	2.79	3.29	4.01
Natural gas, LPG, other	0.07	0.07	0.07	0.07	0.09
Jet fuel and aviation gasoline	0.46	0.36	0.35	0.37	0.38
Fossil fuel industry	**0.3**	**0.4**	**0.4**	**0.5**	**0.6**
Natural gas industry	0.32	0.45	0.42	0.46	0.55
Oil industry	0.00	0.00	0.00	0.00	0.00
Coal mining (methane)	0.00	0.00	0.00	0.00	0.00
Industrial processes	**0.4**	**0.8**	**1.1**	**1.3**	**1.9**
Cement manufacture (CO_2)	0.06	0.06	0.13	0.14	0.16
Lime manufacture (CO_2)	0.03	0.03	0.06	0.07	0.08
Limestone & dolomite use (CO_2)	0.00	0.00	0.01	0.01	0.01
Soda Ash (CO_2)	0.01	0.01	0.01	0.01	0.01
ODS substitutes (HFC, PFC, and SF_6)	0.08	0.21	0.13	0.09	0.05
Semiconductor manufacturing (HFC, PFC, and SF_6)	0.08	0.21	0.13	0.09	0.05
Electric power T&D (SF_6)	0.19	0.11	0.09	0.07	0.04

Table 4-32 Idaho Historical and Reference Case GHG Emissions, by Sector[a] (Cont.)

Sector	Carbon Dioxide Equivalents (million metric tons)				
	1990	2000	2005	2010	2020
Waste management	**1.0**	**1.2**	**1.4**	**1.5**	**1.8**
Solid waste management	0.85	1.09	1.19	1.31	1.59
Wastewater management	0.13	0.16	0.17	0.18	0.21
Agriculture	**6.8**	**9.0**	**9.1**	**9.9**	**10.0**
Enteric fermentation	2.26	2.81	3.19	3.52	3.52
Manure management	0.70	1.50	1.97	2.33	2.33
Soils and residue burning	3.88	4.66	3.97	4.04	4.15
Forestry and land use	**3.6**	**3.6**	**3.6**	**3.6**	**3.6**
Total gross emissions	**28.4**	**36.8**	**37.2**	**39.6**	**44.1**
Increase relative to 1990		30%	31%	40%	56%
Agriculture soils	**–1.2**	**–1.2**	**–1.2**	**–1.2**	**–1.2**
Net emissions (including sinks)	**27.2**	**35.6**	**36.0**	**38.4**	**42.9**

[a] Totals may not equal exact sum of subtotals shown in this table due to independent rounding. LPG = liquefied petroleum gas; ODS = ozone-depleting substance; T&D = transmission and distribution; SF_6 = sulfur hexafluoride.
Source: CCS, 2008.

AES (2010a) has estimated that over the 7-year period of preconstruction and heavy construction when the most construction activity would take place (50 weeks per year, 250 days per year), gasoline and diesel fuel would be consumed at rates of 1325 liters (350 gallons) per week and 37,854 liters (10,000 gallons) per week, respectively (assumed to be an average over each year of the 7-year preconstruction and heavy construction period). Total amounts of fuels consumed throughout the expected 350 weeks of the preconstruction and heavy construction period were then estimated to be 463,713 liters (122,500 gallons) of gasoline and 13,248,941 liters (3,500,000 gallons) of diesel (AES, 2010a). Following the IPCC guidelines for calculating emission inventories,[23] gasoline combustion is expected to occur at 99 percent efficiency, each gallon releasing 8.8 kilograms (19.4 pounds) of CO_2. Likewise, diesel fuel burned at the same combustion efficiency would release 10.0 kilograms (22.2 pounds) of CO_2 per gallon. The resulting CO_2 emissions from onsite consumption of fossil fuels are shown in Table 4-34.

[23] IPCC guidelines for emission calculations can be found at the following EPA Web sites: http://www.epa.gov/OMS/climate/420f05001.htm and http://www.epa.gov/otaq/climate/index.htm. Consumption of one gallon of gasoline will result in the release of 8.8 kilograms (19.4 pounds) of CO_2; one gallon of diesel fuel will yield 10.4 kilograms (22.2 pounds) of CO_2 (EPA, 2005b).

Table 4-33 Comparison of Idaho vs. U.S. GHG Emissions by Sector[a]

Sector	% of State Total GHG Emissions	% of U.S. GHG Emissions
Transportation	27	26
Agriculture	24	7
Electricity consumption	13	32
Industrial fuel use	11	14
Forestry	10	NA[b]
Residential/commercial fuel use	7.8	9
Waste	3.4	4
Industrial processes	2.1	5
Fossil fuel industry (CH_4)	1.2	3

[a] All data, calendar year 2000.
[b] At a national level, forests act as a net GHG sink (i.e., absorbing more GHG than they emit) and thus are not displayed as a national GHG emission source.
Sources: CCS, 2008; EPA, 2009b.

During each of the 3 peak years of heavy construction, an estimated 590 workers would commute to and from the proposed site an average daily trip distance of 80.5 kilometers (50 miles) for 250 days each year. Over the 3-year peak construction period, workforce commuting would amount to 35,606,736 kilometers (22,125,000 miles). To calculate the resulting CO_2 emissions associated with workforce commuting, it is assumed that 80 percent of the vehicles used will be gasoline-fueled with an average mileage of 20 miles per gallon (mpg) (accounting for 472 daily round trips) and 20 percent of the commuting vehicles will be diesel-fueled with an average mileage of 15 mpg (118 daily round trips) and that no credit is extended for busing or carpooling. During each of the 3 peak years, delivery trucks (presumed to be diesel-fueled long-haul semi-trailer trucks averaging 10 mpg) would make 31 delivery trips per day (at an average round trip distance of 80.5 kilometers [50 miles]) to transport materials and equipment and remove wastes, making for 7720 delivery and waste trips for each of the 3 peak activity years, and traveling a total of 1,870,862 kilometers (1,162,500 miles) over the 3-year peak heavy construction period. Table 4-35 shows the total amount of CO_2 released from commuting of the workforce and as a result of delivery vehicle activities.

Finally, onsite storage and dispensing of fuels during the period of preconstruction and construction will result in minor GHG emissions as NMVOCs. AES (2010a) estimates that approximately 150 gallons each of gasoline and diesel fuels would be dispensed each week during this period. Applying the EPA algorithm for estimating GHG emissions from fuel handling (EPA, 2005b) results in estimated annual CO_2 emissions of 73 tons (66 metric tons [MT]) and 83 tons (76 MT) for gasoline and diesel, respectively.

Table 4-34 CO_2 Emissions from Onsite Fuel Consumption over the Preconstruction and Heavy Construction Period

		Fuel Consumption Rate		Total Fuel Consumption		CO_2 Emission Factor		Total CO_2 Emissions (7 years)		Annual CO_2 Emissions	
Activity	**Fuel Type**	**(gal/wk)**	**(liter/wk)**	**(gal)**	**(liter)**	**(lb/gal)**	**(kg/liter)**	**(ton)**	**(MT)**	**(ton)**	**(MT)**
Heavy equipment	Gasoline	350	1327	122,500	464,275	19.4	2.3	1188	1078	170	154
	Diesel	10,000	37,900	3,500,000	13,265,000	22.2	2.7	38,850	35,318	5550	5046
Subtotal for onsite fuel consumption								40,038	36,396	5720	5200

Table 4-35 Emissions from Workforce Commuting and Delivery Activities over the Preconstruction and Construction Period

Activity	Fuel Type	Total Distances for 3 Peak Yrs		Total Fuel Consumption		CO_2 Emission Factor		Total CO_2 Emissions (3 years of peak construction)		Annual CO_2 Emissions (entire 7-year preconstruction/ construction period) [a]	
		(mi)	(km)	(gal)	(liter)	(lb/gal)	(kg/liter)	(ton)	(MT)	(ton)	(MT)
Commuting traffic	Gasoline	17,700,000	28,485,389	885,000	3,350,089	19.4	2.3	8585	7788	1840	1669
	Diesel	4,425,000	7,121,347	295,000	1,116,696	22.2	2.7	3275	2977	702	638
Delivery truck traffic	Diesel	1,162,500	1,870,862	116,250	440,054	22.2	2.7	1290	1173	277	252
Subtotal for workforce commuting and deliveries		22,125,000	35,606,736	1,180,000	4,466,786			13,149	11,938	2818	2559

[a] To calculate an annual average over the entire 7-year preconstruction and heavy construction period, it is assumed that that the 2 years following the 3-year peak construction period will have activity levels (including workforce reductions) approximately 50 percent of peak years, and the last 2 years of heavy construction will have activity levels (including workforce reductions) 25 percent of peak construction years.

Therefore, the total CO_2 emissions expected during preconstruction and heavy construction are:

- 5720 tons (5189 MT) per year (averaged) from onsite fuel consumption

- 2818 tons (2556 MT) per year from workforce commuting and materials/equipment deliveries and waste removals during preconstruction and heavy construction

- 8537 tons (7745 MT) per year (averaged) for each year of the 7-year preconstruction and heavy construction period

- 59,759 tons (54,215 MT) over the entire 7-year preconstruction and heavy construction period.

Estimated GHG Emissions during Operation

During operation, GHG emissions would result from commuting of the operational workforce, deliveries of feedstock to the proposed facility, deliveries of enriched product to fuel fabrication facilities, return of empty feedstock containers to their points of origin, and delivery of operational wastes to designated offsite disposal facilities. An incidental amount of GHG emissions also results from the onsite storage and dispensing of fossil fuels to support operations.

A workforce of 550 is assumed to commute a round-trip distance of 80.5 kilometers (50 miles), assuming 250 round trips per year and no credit for carpooling or busing, with a commuting vehicle fleet comprised of 90 percent gasoline-fueled vehicles averaging 20 miles per gallon (mpg) and 10 percent diesel-fueled vehicles averaging 15 mpg. The resulting annual travel distances are 9,957,816 kilometers (6,187,500 miles) for the gasoline-fueled vehicles and 1,106,424 kilometers (687,500 miles) for the diesel-fueled vehicles. The total fuels consumed are estimated to be 1,171,112 liters (309,375 gallons) of gasoline and 173,498 liters (45,833 gallons) of diesel.

Daily deliveries to support facility operation include deliveries of nonradiological materials from vendors in the local area and shipments of nonradiological solid wastes to area landfills; deliveries of (natural) UF_6 feedstock from UF_6 production facilities in Metropolis, Illinois, and Port Hope, Ontario, Canada; delivery of enriched UF_6 product to any of three fuel fabrication facilities in Richland Washington; Wilmington, North Carolina; or Columbia, South Carolina; and shipments of low-level radioactive (process) wastes (LLRW) to the waste disposal facility at Portsmouth, Ohio.[24] Because it is difficult to anticipate the proportion of shipments among the three feedstock suppliers and the three recipients of enriched product, and in order to establish a conservative (worst-case, bounding) scenario of deliveries and shipments with respect to GHG emissions, it is presumed that the longest routes would always be selected, maximizing the total distance traveled by delivery trucks.[25] It is further assumed that separate shipments would be initiated to return empty cylinders and waste containers to their points of origin and that all delivery vehicles will be diesel-fueled with an average mileage of 10 mpg.

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[24] Process-related waste will also be delivered to Oak Ridge, Tennessee; however, those shipments are not included in these GHG emission calculations because the quantities would be very small.

[25] See distances between EREF and each facility in Appendix D, Table D-7.

In addition to deliveries and shipments, fossil fuels would be consumed onsite to support miscellaneous activities: 568 liters (150 gallons) per week each of gasoline and diesel, making for 28,391 liters (7500 gallons) per year,[26] and a small amount of GHG will be emitted from the onsite storage and dispensing of fossil fuels. Applications of the operational parameters offered by AES and the assumptions discussed above result in the estimates of CO_2 emissions during operation from workforce commuting and deliveries shown in Tables 4-36 and 4-37, respectively. It is assumed that onsite gasoline and diesel fuel dispensing will occur on approximately 50 days each year for each fuel, resulting in emissions of 66 MT (73 tons) of CO_2 from gasoline dispensing and 76 MT (83 tons) of CO_2 from diesel fuel dispensing for an annual total of 142 MT (156 tons) of NMVOCs released during each year of operation as a result of onsite fossil fuel handling.

The estimated annual emissions of CO_2 from EREF operation, therefore, are 26,136 MT (28,809 tons).

<u>Estimated GHG Emissions during Decommissioning</u>

Activities associated with decommissioning are generally described in Section 2.1.4.3. GHG emissions associated with decommissioning would result primarily from three activities: (1) the onsite consumption of fossil fuels in vehicles and equipment used to dismantle and in some cases demolish existing structures or excavate buried utilities and components, (2) the transportation of waste materials and salvage materials from the proposed site to appropriate offsite disposal or recycling facilities, and (3) the commuting to the proposed site of the decommissioning workforce. The absence of a detailed decommissioning plan[27] precludes detailed quantification of GHG emissions associated with decommissioning. However, AES's general descriptions of the expected decommissioning strategy and schedule can provide some insight into potential GHG impacts and allow for the application of conservative assumptions to estimate bounding conditions.

AES has indicated that decommissioning would take approximately 8 years, including a brief period at the start of decommissioning when limited facility operation is still ongoing. In its Final SAR (AES, 2010b), AES further estimated the volume of LLRW that would be generated to be approximately 7700 cubic meters (10,070 cubic yards)[28] and estimated the workforce in the overlap period to be approximately the same as the operating workforce, 590 individuals.

[26] The onsite storage of fossil fuels would also result in the release of insignificantly small amounts of NMVOCs from the normal venting of the storage tanks. However, because neither the specific volume nor the chemical speciation of these evaporative losses can be firmly known, resulting GHG emissions cannot be estimated.

[27] A detailed decommissioning plan will be submitted to the NRC near the end of the operating license, in accordance with 10 CFR 70.38.

[28] AES anticipates processing some wastes for the purposes of volume reduction prior to shipments to offsite disposal or recycling facilities (AES, 2010b). However, specific details were not provided and no credit is therefore extended for any anticipated waste volume reductions in this GHG analysis.

Table 4-36 Annual CO_2 Emissions as a Result of Workforce Commuting during EREF Operation

Activity	Fuel Type	Total Workers	RT Distance (mi)	RT Distance (km)	Working Days/y	Total Distances per Year (mi)	Total Distances per Year (km)	Total Fuel Consumption (gal)	Total Fuel Consumption (liter)	Annual CO_2 Emissions (ton)	Annual CO_2 Emissions (MT)
Commuting traffic	Gasoline	495	50	80.5	250	6,187,500	9,957,816	309,375	1,171,112	3001	2722
	Diesel	55	50	80.5	250	687,500	1,106,424	45,833	173,498	509	462
Subtotal of CO_2 emissions from workforce commuting		550				6,875,000	11,064,240	355,208	1,344,610	3510	3184

Table 4-37 Annual CO_2 Emissions as a Result of Deliveries during EREF Operation

Material	Origin/ Destination	One-way Trip Distance (mi)	One-way Trip Distance (km)	Annual Number of Trips	Annual Traveled Distance (mi)	Annual Traveled Distance (km)	Fuel Consumption @10 mpg (gal)	Fuel Consumption @10 mpg (liter)	Annual CO_2 Emissions (ton)	Annual CO_2 Emissions (MT)
Process-related nonradiological, nonhazardous wastes	Local vendors/ Idaho Falls and vicinity	25	40	3889	194,450	312,937	19,445	73,607	216	196
(Natural) UF_6 feedstock	Port Pope, Ontario, Canada	2314	3724	1424	6,590,272	10,606,015	659,027	2,494,689	7315	6636
Enriched UF_6 product	Columbia, SC	2359	3796	516	2,434,488	3,917,929	243,449	921,554	2702	2451
Depleted UF_6 tails	Portsmouth, OH	2101	3381	1222	5,134,844	8,263,730	513,484	1,943,750	5700	5171
LLRW	Licensed TSDFs (Oak Ridge, TN)	1907	3068	16	30,512	49,088	3051	11,533	34	31
Empty feedstock cylinders	Port Pope, Ontario, Canada	2314	3724	712	3,295,136	5,303,007	329,514	1,247,345	3658	3318
Empty product cylinders	Colombia, SC	2359	3796	516	2,434,488	3,917,929	243,449	921,554	2702	2451
Empty tails containers	Portsmouth, OH	2101	3381	611	2,567,422	4,131,865	256,742	971,875	2850	2585
Subtotal of CO_2 emissions related to deliveries				8906	22,651,900	36,454,699	2,265,190	8,574,677	25,177	22,840

The following are conservative reasonable assumptions that can be made relative to EREF decommissioning and that can be used to estimate GHG impacts associated with decommissioning:

- CO_2 emissions from shipments of enriched uranium product and operational waste shipments still occurring during the initial period of decommissioning are treated as operational GHG impacts.

- Shipments of wastes or recycling materials would occur by diesel-fueled trucks averaging 10 mpg.

- Annual CO_2 emissions from onsite consumption of fossil fuels is expected to be less than the average annual emissions of CO_2 experienced during facility preconstruction and construction, as presented in Table 4-34 above.

- LLRW resulting from decontamination activities would be substantially greater in volume than LLRW resulting from routine EREF operation.

- Assuming an average density for the decommissioning waste and an expected weight for individual shipments, an estimated 4205 shipments of LLRW will occur annually over the 8-year period of decommissioning, for an annual total of 33,640 trip miles to the LLRW treatment, storage, and disposal facility (TSDF) in Oak Ridge, Tennessee. This will result in total trip length of 206,415,040 kilometers (128,302,960 miles) and the consumption of 484,985,188 liters (12,830,296 gallons) of diesel fuel, and estimated CO_2 emissions of 129,469 MT (142,416 tons) over the entire decommissioning period.

- All nonradioactive and nonhazardous solid wastes are presumed to be delivered to the same area landfills and treatment facilities that received wastes of similar nature during EREF operation. Assuming successful decontamination of the majority of EREF equipment and structures, a significantly higher number of annual trips would occur throughout the 8-year decommissioning phase than would have occurred annually during EREF operation, and the resulting CO_2 emissions would be at least an order of magnitude greater than the values for such waste shipments appearing in Table 4-37.

- All nonradioactive hazardous waste generated during EREF operations would already have been delivered to permitted TSDFs, and the CO_2 emissions of such deliveries would be credited to the EREF operational phase. The amount of nonradioactive hazardous waste newly generated as a result of decommissioning activities is expected to be very small and would likely be delivered to the same TSDF that received similar waste during EREF operation. It is further assumed that an appropriately permitted TSDF will be located within a reasonable distance from the proposed EREF, resulting in limited amounts of GHG emissions from transport.

- Except for the brief period at the beginning of decommissioning when some operations are still ongoing, the decommissioning workforce is expected to be similar in size to the operational workforce – 550 individuals. For the early years of decommissioning, parameters of workforce commuting are therefore assumed to be the same as those described above for commuting impacts during operation, resulting in an annual release of

CO_2 related to workforce commuting similar in magnitude to the values displayed in Table 4-36 above, 3184 MT (3510 tons). In the early years when operations and decommissioning are coincident, CO_2 emissions from workforce commuting are expected to be proportionally higher.

Indirect Positive Impacts from EREF Facility Operation

Nuclear power generated with fuel fabricated from the enriched uranium generated at the proposed EREF would indirectly displace GHG emissions that would otherwise be released from fossil-fueled power plants. Accordingly, enriched UF_6 produced at the proposed EREF can be thought of as indirectly helping to avoid GHG emissions. AES estimates that, at full production, the proposed EREF would produce approximately 2252 metric tons (2482 tons) of enriched UF_6 annually, which would be equivalent to 1727 metric tons (1904 tons) of UO_2 fuel. A typical 1100-MWe pressurized water reactor (PWR) would have approximately 98 MT (108 tons) of UO_2 in its core (Nero, 1979). Thus, annual production of the proposed EREF could replace the fuel cores of 17.9 PWRs. Operating at a capacity factor of 95 percent, each PWR would be capable of producing 8322 megawatt hours per year (MWh/yr). Thus the total amount of power associated with the proposed EREF's annual enriched UF_6 production would be 146,467 MWh/yr.

In 2005, emission factors for CO_2 from coal-burning power plants ranged from a minimum of 1341.64 pounds per megawatt hour to a maximum of 2449.43 pounds per megawatt hour, with the U.S. composite value (representing an average of all operating coal plants) of 2134.64 pounds per megawatt hour (EPA, 2009b).[30] Thus, displacing power from coal-burning power plants with an equivalent amount of power produced in nuclear reactors from fuel fabricated from an annual amount of EREF-enriched UF_6 would have prevented the release of 3117×10^6 pounds of CO_2, or 1.42 million metric tons (1.56 million tons).

Carbon Dioxide and Other GHG Emissions Summary

Using calendar year 2005 as a reference point (the latest year for which Idaho GHG emission data are available), and as shown in Table 4-33, total net CO_2 emissions for Idaho for the year 2005 were 36.0 million metric tons of CO_2 equivalents. For the United States for that same year, total net CO_2 emissions were 5985.9 million metric tons (6584.5 million tons) (EPA, 2009a). By comparison, during all of the 3 peak activity years of construction, EREF CO_2 emissions are projected to be 11,929 metric tons (13,149 tons), or 0.03 percent of Idaho's statewide output and 0.0002 percent of the projected nationwide CO_2 emissions for the same period.

During any typical year of EREF operation, CO_2 emissions are projected to be 26,136 MT (28,809 tons), approximately 0.07 percent of the Idaho statewide output or 0.00044 percent of the nationwide emissions for calendar year 2005. The NRC staff concludes that, even without giving credit to the proposed EREF for contributing to the avoidance of CO_2 emissions as

[30] Coal-burning power plants in Idaho had the lowest CO_2 emission factor in 2005; however, because fuel fabricated from EREF-enriched uranium could conceivably be installed in any nuclear reactor operating within the North American Electric Reliability Corporation (NERC) geographic area of authority, the composite emission factor is the most representative value for use in this comparison.

discussed above, impacts from the preconstruction, construction, operation, and decommissioning of the proposed EREF from the emissions of CO_2 and other GHGs would be SMALL.

4.2.18 Terrorism Consideration

This section discusses the potential environmental impacts of a hypothetical terrorist attack at the proposed EREF. The terrorism threats that were considered are associated with releases to the environment of radioactive and hazardous material at the proposed EREF and of radioactive and hazardous material transported to and from the proposed EREF. In this terrorism analysis, radioactive and hazardous material includes natural, enriched, and depleted uranium (all as UF_6) that would be present in large quantities during onsite storage and shipment to and from the proposed EREF site.

4.2.18.1 Background Information

In its *Notice of Hearing and Order* in the matter of the proposed AES EREF (74 FR 38052, July 30, 2009) (NRC, 2009c), the Commission directed, and provided relevant guidance to, the NRC staff to address in the EIS the environmental impacts of a terrorist attack at the proposed EREF. Consistent with the Commission's guidance, the terrorism consideration presented herein has been developed using available information in agency records and other available information on the proposed EREF design, mitigations, and security arrangements that have a bearing on likely environmental consequences, in accordance with the requirements of NEPA and the regulations for the protection of sensitive unclassified and classified information.

Also, consistent with the Commission's guidance, this terrorism consideration relies on as much publicly available information as practicable and makes public as much of its environmental analysis as feasible recognizing, however, that it may prove necessary to withhold certain NRC staff findings and conclusions as sensitive unclassified and classified information. In addition, the analysis relies, where appropriate, on qualitative rather than quantitative considerations.

In the case of the proposed EREF, the terrorism consideration uses publicly available information from accident analyses conducted for the proposed facility and similar facilities, as well as certain security-related information not available to the public. Whether the release of radioactive and hazardous material into the environment occurs because of an explosion or other cause due to an accidental sequence of events or to a series of premeditated terrorist activities, the results would be similar given an explosion or other incident of the same magnitude and the same amount of material involved, regardless of the initiating event. Thus, a range of potential impacts from hypothetical terrorist acts can be estimated from a range of potential accidents with similar characteristics and consequences, as further discussed below.

Section 4.2.18.2 discusses potential terrorism impacts, and Section 4.2.18.3 discusses mitigative measures intended to defeat a terrorist attack and reduce potential consequences.

4.2.18.2 Potential Impacts of Terrorist Events

Terrorist events leading to the dispersion of radioactive and hazardous material into the environment could occur during transportation of such materials to or from the proposed EREF or at the proposed EREF site. In either case, impacts ranging from minor incidents to wider spread releases of contamination are possible. As discussed below, the resulting quantities of radioactive and hazardous material potentially released by a terrorist event would be similar to those for transportation accidents as analyzed in this EIS in Section 4.2.9.2 and in Appendix D, Section D.5, and for facility accidents as analyzed in Section 4.2.15.

Unlike the accident analysis, which considers potential accidents with some likelihood of occurrence, the consideration of terrorist events provides an estimate of the potential consequences of such events without attempting to assess the likelihood that any one specific scenario would be attempted or would succeed. There are limitless potential scenarios involving a specific initiating event whereby radioactive and hazardous material could be released as a result of a terrorist attack. The likelihood of occurrence of any terrorist scenario is speculative and cannot be determined. However, there are certain classes of events that may be identified and qualitatively analyzed to provide estimates of a potential range of impacts. In addition, any estimate of the likelihood of a terrorist attack would not account for any security measures that might be implemented to assist in the prevention of such attacks. Thus, the comparison of terrorist events with accidents in the following sections addresses the potential consequences should a terrorist act occur and does not discuss the likelihood of such events.

As part of the analysis, a literature review of available studies by the NRC and DOE was conducted, which considered potential accidents at current or proposed uranium enrichment facilities. The consequences associated with these potential accidents were reviewed and compared against potential consequences from terrorist attacks at the proposed EREF and at other uranium enrichment facilities.

Transportation Impacts

A terrorist attack on vehicles transporting radioactive and hazardous material to and from the proposed EREF would result in the threat for partial or complete release of transported material to the environment. The consequences of such a terrorist act depend on the quantity of material that could be released, on the chemical, radiological, and physical properties of the material involved, how it is packaged, and its ease of dispersion. Consequences also depend on the surrounding environment, land use, and population density in the vicinity of the event. Radioactive and hazardous material would be transported through areas of varying population density and land use, to the proposed EREF as natural uranium in 14-ton 48Y cylinders and from the proposed EREF as enriched uranium in 2.5-ton 30B cylinders (in protective Type B overpacks) and depleted uranium in 48Y cylinders.

A number of studies have been published by DOE on the potential impacts should these types of shipments become involved in a serious accident (DOE, 1999, 2004a,b). In these studies, accident scenarios were characterized by extreme mechanical and thermal forces. In all cases, these accidents would result in a release of radioactive and hazardous material to the environment. The accidents corresponding to those with the highest accident severity represent low-probability, high-consequence accident events. Regardless of the initiating event, the highest potential impacts from terrorist acts would be similar to severe transportation accident impacts.

To account for terrorist events that could occur in a range of population densities, the impacts have been estimated for generic rural, suburban, and urban locations with assumed population densities of 6 persons/km^2, 719 persons/km^2, and 1600 persons/km^2, respectively. From accident consequence estimates (DOE, 2004a), the collective population dose from a single, 14-ton 48Y cylinder shipment of depleted UF_6 (one cylinder per truck) involved in a severe accident in a highly populated urban area corresponds roughly to one latent cancer fatality. Impacts in rural and suburban areas would be lower because of their lower population densities (DOE, 2004a). Acute fatalities from radioactive exposure to depleted UF_6 are not expected under any scenario. Impacts from a similar incident involving a natural uranium shipment are expected to be approximately the same because natural uranium is also shipped in 48Y cylinders (one per truck).

In addition, a severe transportation incident would restrict the use of the affected road and of surrounding land, homes, and businesses that would have been contaminated from the incident. Use of the land, housing, or businesses would resume after completion of cleanup activities and permission for use is allowed by authorities.

Socioeconomic impacts will depend on the location of the event along the transportation route within a generic rural, suburban, and urban area. The specific use of the area (e.g., agricultural, retail, service, commercial, industrial (manufacturing), residential, or mixed use) will determine the specific socioeconomic impacts in the affected area. The temporary closing of businesses will have direct and indirect impacts on the employment from these businesses, which is expected to last until cleanup activities are complete. In addition to loss of employment, other impacts could occur. For example, in the case of manufacturing or agricultural areas, the loss of material goods or produce that would have been generated during the cleanup period could result in higher cost of goods in the area due to a loss in supply; contaminated housing could result in relocation of residents until cleanup efforts are complete; or a contaminated transportation link (e.g., a subway station) could result in disruption of the commuter network while cleanup activities are under way.

Acute chemical fatalities from exposure to HF formed following a release of UF_6 would be possible, depending on the proximity of the nearest individuals. For the same potential incident, DOE (2004a) estimated that as many as several to several hundred or more adverse impacts could occur, but only up to three irreversible adverse health effects were estimated. Adverse effects range from mild and transient effects, such as respiratory irritation or skin rash (associated with lower chemical concentrations), to irreversible (permanent) effects which could include death or impaired organ function (associated with higher chemical concentrations). For exposures to uranium and HF, it was estimated that the number of fatalities occurring would be about 1 percent of the number of irreversible adverse effects (DOE, 1999); therefore, in this case no fatalities are expected.

Similar impacts would be expected from terrorist events involving shipments of natural or enriched uranium. The UF_6 enrichment results in no additional effect on any potential chemical-related impacts, nor is it expected to have any significant effects on the radiological impacts, because of the relatively small amount of U-235 compared to that of U-238.

According to AES (2010a), shipments involving enriched uranium would occur with two cylinders per truck in smaller (2.5-ton) Type 30B cylinders in protective Type B overpacks, resulting in a reduced amount of UF_6 released as the result of a severe terrorist incident. Therefore, the results from a terrorist act involving a shipment of natural or enriched uranium is expected to be less than that from a depleted uranium shipment. Appendix D of this EIS includes a discussion of the differences between the shipping configurations for the different types of cylinders.

Facility Impacts

Section 4.2.15 of this EIS discusses potential accidents considered at the proposed EREF and the resulting health effects. The accidents evaluated are representative of the types of accidents that are possible at a uranium enrichment facility, covering a range of initiating events. The consequences of these events are directly affected by the type and amount of material released at different locations at the proposed EREF. Therefore, similar consequences are expected from similar incidents involving the same material resulting from a terrorist attack. Thus, consequences from potential accidents discussed in Section 4.2.15, including health effects to workers and the public, are also applicable to potential terrorist attacks.

Chemical impacts to workers at the proposed EREF associated with a potential terrorist attack could range from no adverse effects to adverse effects to the majority of workers. Similarly, DOE (1999) estimated that chemical impacts to members of the general public could range from no adverse health effects to adverse health effects to less than 1900 members of the public. However, it is expected that much fewer than 1900 members of the public could be affected in the vicinity of the proposed EREF because the DOE analysis was for a location with a higher population density (>34,000 people within 16 kilometers [10 miles]) than that of the proposed EREF location, which has no appreciable population within 16 kilometers [10 miles] (see Table 4-22).

A terrorist attack on the proposed EREF that causes a release of UF_6 to the air would result in an airborne contamination plume in the prevailing wind direction during the release. The plume would eventually precipitate and settle on the ground surface. The resulting areal extent of the ground contamination would depend on the wind speed and degree of vertical mixing (stability class) during the release. In any case, the extent of the plume containing uranium compounds and ground contamination would be limited by the expected high deposition rate of uranium in any chemical form. UF_6 would be rapidly converted to particulate uranyl fluoride (UF_2O_2) through reaction with moisture in the air. HF, which is also produced in this reaction, would not have any residual effects following an incident because of its relatively low concentration and because it will quickly react in air or upon deposition. However, dependent on the amount of UF_6 released, the airborne HF plume generated in the vicinity of the release point could cause fatality to humans and animals from inhalation, but would rapidly disperse downwind. Lethal air concentrations of HF immediately following a release of UF_6 would not be expected at the proposed EREF site boundary as supported by the results of the accident analysis in Section 4.2.15.

Uranium contamination deposited on the ground would be initially confined to a thin surface layer on vegetation and surface soil. Uranium concentrations in soil and vegetation near the release point would be expected to be similar to those measured following the accidental rupture of 14-ton cylinders containing liquid UF_6 at fuel cycle facilities (DOE, 1978; NRC, 1986). Based on this historical data and supported by atmospheric dispersion models, a plume might be expected to extend on the order of 1 to 2 kilometers (0.6 to 1.2 miles) in the primary wind direction, with rapidly decreasing contaminant concentrations moving away from the source. For the proposed EREF, the highest ground and vegetation concentrations would be expected to be confined to the proposed EREF property because of the large distance from the proposed facility to the property boundary. The resultant environmental concentrations beyond a few tens of meters from the release point after the plume has passed by and deposition has occurred would not be expected to cause any long-term chemical or radiological effects to humans, wildlife, or vegetation. In the short term, resuspension of uranium particulates could result in a small inhalation hazard, but weathering processes (e.g., wind and precipitation) would be expected to reduce average concentration levels. However, some concentration of the uranium could occur in certain areas due to preferential flow of water runoff during heavy precipitation events.

The actual extent of any plume would be determined with high precision using appropriate radiation surveys following an incident. The amounts of uranium and HF directly deposited on plants near the release point would be measured and the consumption of vegetation by humans and/or animals restricted as necessary (NRC, 1986). The restrictions in consumption would occur for a defined time interval and would be removed after new measurements indicate safe use of vegetation by humans and/or animals. In addition, if necessary, exposures to the public would be prevented by restricting access. Survey data would be used to compute risks to the public and environment, and appropriate cleanup actions would be taken. Exposure analysis would include direct and indirect pathways, including food chain analyses.

Cleanup conducted in a timely manner would minimize migration of contamination to greater soil depths or to surface water or groundwater. Little or no surface water exists in area of the proposed EREF, which is primarily rangeland and farmland. Depending on the extent of the contamination, cleanup could include decontamination and repair of damaged equipment and buildings, possible excavation of a thin surface layer of soil, and removal of vegetation. Wastes from cleanup activities would be shipped offsite for disposal at a licensed low-level waste facility. Such cleanup would reduce residual risks to acceptably low levels, likely to background levels if soil were removed. Depending on the extent of the contamination and damage, cleanup costs could reach into the tens of millions of dollars or more for decontamination and cleanup of the local area, costs for repair of damaged facilities, (DOE, 2007; see Appendix H for construction costs), and remediation of the surrounding area, if uranium and soil concentrations in soil and vegetation are considered excessive.

A terrorist act would interrupt facility operations until the essential cleanup activities are complete. This would have an impact on the economic activity in the area because people would be out of work for the duration of the cleanup activities. At the same time, some economic activity will take place, such as employment of workers to conduct the cleanup activities. The duration of these cleanup activities and the number of personnel required would depend on the severity of the contamination.

4.2.18.3 Mitigative Measures

Mitigative measures proposed for potential releases under accident conditions as described in Section 4.2.15.3 would also be applied, as appropriate, as mitigative measures against terrorist attack. Such measures identified by AES include, but are not limited to, process system(s) and building construction designed to minimize the quantity of radioactive material at any given location and to isolate that material from the outside environment and detection and alarm systems for radiation and fire hazards, in conjunction with barriers designed to prevent the spread of material within the proposed facility (AES, 2010c). While adversaries might seek to defeat some of the listed elements of the mitigative controls, the protective system would be designed to provide defense-in-depth and would be robust to limited degradation.

Prior to operation of the proposed EREF, AES would also be required to fully implement security measures required by 10 CFR Parts 73, 74, and 95 of the regulations and additional security requirements issued by order. The NRC anticipates imposing additional security measures on AES to address the current threat environment (NRC, 2010e). Under the additional security measures, AES would need to identify critical target areas, if any, and provide a means for protecting these areas. Critical target areas would be determined based on hazards related to licensed radioactive materials. In addition, these measures would include, for example, information protection, personnel trustworthiness and access authorization, material control and accounting, and physical protection systems and programs. Compliance with these security measures would mitigate potential consequences of adversary actions.

4.3 Cumulative Impacts

The CEQ regulations implementing NEPA define cumulative impacts, or effects, as “the impact on the environment which results from the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR 1508.7). In the following analysis, cumulative impacts are assessed from the anticipated impacts of the proposed EREF project when added to other identified projects, facilities, or activities in the region that have impacts that affect the same resources or human populations. Effects from the various sources may be direct or indirect and they may be additive or interactive. Such effects are assessed that, when on their own, may be minor, but in combination with other effects may produce a cumulative effect that is of greater concern.

To identify the activities in the region that could contribute to cumulative impacts, an ROI was defined for each resource that is expected to be impacted by the proposed EREF project. An ROI for a particular resource is the size of the surrounding area within which impacts from multiple sources may be additive or interactive. The sizes of the ROIs may be different for various resources, and some resources may be remote from the proposed site, such as a waste disposal facility or a receiving water body downstream of the proposed project. Still others might cover large areas, such as a watershed or airshed. The resource ROIs are discussed further later in this section. For the proposed EREF, an ROI radius of 16 kilometers (10 miles) was identified for all resources except socioeconomics, for which an ROI radius of 80 kilometers (50 miles) was identified. Impacts on the full extent of the resources affected, such as an ecoregion, were analyzed, even if the resource extends beyond the identified ROIs.

A search was conducted to identify projects or activities in the region that would contribute to cumulative effects. This review included existing activities in the region that would affect the same resources as the proposed EREF project, known past impacts on these resources, and reasonably foreseeable proposed new projects, activities, or facilities that would impact these resources. Foreseeable development in the region was assessed through consultation with local development boards and agencies with which proposed plans for projects must be filed. Past impacts have resulted primarily from the development of agriculture in the region and the development of the INL near the proposed project site. The main INL facilities lie outside the 16-kilometer (10-mile) ROI, but within the 80-kilometer (50-mile) ROI for socioeconomics.

Impacts from preconstruction activities for the proposed EREF are addressed as cumulative impacts in this EIS, as these actions are not part of the proposed action. These impacts are discussed within the various resource area discussions in Section 4.2 so that they can be presented alongside similar impacts from construction of the proposed facility, which are part of the proposed action. For the purposes of cumulative impacts analysis in this EIS, preconstruction activities are considered past activities because they occur prior to the main aspects of facility construction and prior to facility operation.

Also considered in this section is the construction and operation of the proposed 161-kilovolt (kV) electrical transmission line and associated substation installation and upgrades to provide electrical power for the operation of the proposed EREF. Rocky Mountain Power (RMP) proposes to build a 161-kV transmission line that would extend westward from the existing Bonneville Substation 14.5 kilometers (9 miles) along an existing 69-kV transmission line ROW to the existing Kettle Substation near the proposed EREF site and continue a total 7.6 kilometers (4.75 miles) further to the proposed new Twin Buttes Substation within the proposed EREF property, a total length of 22.1 kilometers (13.75 miles). This proposed project would involve a rebuild/replacement of the 14.5-kilometer (9-mile) long 69-kV line portion to include a double circuit line, with one side energized at 69 kV and the other side at 161 kV to provide service to the proposed Twin Buttes Substation. The proposed Twin Buttes Substation will be located within a 15-acre area on the proposed EREF site that would be excavated during preconstruction activities. The proposed project would also include modifications at the Bonneville Substation. The details of the route as well as other critical parameters of the transmission line construction that would impact air quality are contained in Appendix H to the EREF ER (AES, 2010a), and the proposed transmission line is further described in Section 2.1.3.2.

No additional ongoing or planned developments were identified within 16 kilometers (10 miles) ROI of the proposed project location. However, several ongoing and proposed developments within 80 kilometers (50 miles) have been identified that could contribute to a regional socioeconomic impact in combination with the proposed project. A listing of these projects and potential cumulative socioeconomic impacts are presented in Section 4.3.12 below. Among these is the proposed Mountain States Transmission Intertie, a proposed 500-kV transmission line running between western Montana and southeastern Idaho (NorthWestern Energy, 2008). The project is currently undergoing environmental review under NEPA. The preferred route lies approximately 40 kilometers (25 miles) to the west of the proposed EREF site, running north-south. Two alternate routes lie closer, the nearest running adjacent to the western boundary of the proposed EREF property just outside of INL property, and the other route crossing US 20 about 10 miles east of the proposed EREF site. Construction of this transmission line is planned to begin in 2010 and be completed in early 2013, with service starting in 2013. Assuming that the preferred route will be selected, cumulative impacts would occur only to socioeconomics in the region. If one of the closer alternative routes is selected, cumulative impacts on other resources would have to be considered.

The following sections present assessments of the potential cumulative impacts of the construction and operation of the proposed EREF for each resource area. Under the no-action alternative, the proposed site would continue to be used for agriculture and cumulative impacts would be equivalent to current impacts and generally less than those for the proposed action, except in terms of local job creation. Therefore, except for socioeconomic impacts, the cumulative impacts of the no-action alternative are not discussed in detail.

4.3.1 Land Use

The EREF is being proposed on private land located in a remote location. The area is zoned for grazing, which in Bonneville County allows for industrial activities such as construction and operation of a uranium enrichment facility. Cumulative land use impacts would result if land use designations were altered through incremental development. The proposed EREF project is consistent with other development that has occurred in the county on INL land under the current zoning. No future development activities are reasonably foreseeable that would result in a cumulative alteration to land use designations. Therefore, cumulative land use impacts would be SMALL.

The proposed installation of the 161-kV transmission line to power the proposed EREF would be entirely on private land (AES, 2010a). Current land use within the proposed transmission line corridor is agricultural and open rangeland (USGS, 2009), and is not expected to be restricted as a result of the installation of the transmission line. Cumulative land use impacts associated with the construction and operation of the proposed transmission line would be SMALL.

4.3.2 Historic and Cultural Resources

The proposed EREF would be constructed on private land in a remote location. No additional development is currently known for the region. The Wasden Complex archaeological site is located in the general vicinity of the proposed EREF. In the event that additional development did take place, there could be the potential for impacts to occur to the viewshed associated with this significant historic and cultural resource. Cumulative impacts could also occur to historic and cultural resources if a particular site type was systematically removed. The significant cultural resource site known on the proposed EREF site, site MW004, is a historic homestead. This site type is found throughout the region (Gilbert, 2010), and the potential for this site type to be removed entirely from the region is unlikely. Therefore, cumulative impacts to historic and cultural resources would be SMALL.

The Area of Potential Effect (APE) for the proposed 161-kV transmission line project is 202.3 hectares (500 acres) for the line itself. The fenced area at the proposed modified Bonneville Substation is 1.3 hectares (3.1 acres), and the proposed new Twin Buttes Substation on the proposed EREF site itself would occupy a 2.1-hectare (5.2-acre) fenced area. Portions of the proposed Twin Buttes Substation and of the proposed transmission line adjacent to the proposed EREF were surveyed previously as part of the survey for the main portion of the proposed EREF site (Ringoff et al., 2008). Site MW004 was identified during this survey near the location of the proposed Twin Buttes Substation. See Section 4.2.2.1 for a discussion of the effects on the site MW004 and the mitigation approach. The ROW for the proposed 161-kV transmission line has been surveyed for the presence of historic and cultural resources

(Harding, 2010). The survey examined the 202.3-hectare (500-acre) APE which is derived from the 22.12-kilometer (13.74-mile) transmission line and 45.72 meters (150 feet) on either side of the centerline (91.4-meter [300-foot] total width). No historic and cultural resources were identified in these surveys. It is currently unclear whether additional areas would be needed for some aspects of the transmission line construction (e.g., pulling and tensioning sites). AES has stated that an unanticipated discoveries and monitoring plan will be in place during construction (AES, 2010e). Consultation between the NRC and the Idaho SHPO is ongoing concerning historic and cultural resources along the proposed transmission line ROW and at the substations (NRC, 2010b). The Shoshone-Bannock Tribes was also contacted to determine if it had issues of importance to the tribe concerning the proposed transmission line project (NRC, 2010c).

4.3.3 Visual and Scenic Resources

Cumulative impacts to visual and scenic resources would occur if additional development resulted in a significant change in the visual qualities of the region. No additional development is planned for the region. In the event that additional industrial development occurred in the vicinity of the proposed EREF, it could have a negative impact on the scenic qualities of the Wasden Complex archaeological site and the Hell's Half Acre WSA. The natural character of the area is currently intact. A series of industrial developments could alter the visual qualities of the area, which would not be consistent with the BLM VRM class currently in place for the Hell's Half Acre WSA. However, no additional development is reasonably foreseeable for the area; therefore, the cumulative impact would be SMALL.

The proposed transmission line to be constructed for the proposed EREF has the potential to affect visual and scenic resources. The proposed transmission line largely follows an existing ROW for an existing 69-kV line. The proposed transmission line is a 161-kV line that will replace the 69-kV line. It will be mounted on poles that can be as much as 24.4 meters (80 feet) tall (AES, 2010a). The new transmission line would be plainly visible from US 20. However, there are no specific key observation points along most of the route. The closest key observation point is the trailhead for the Twenty Mile Trail at the Hell's Half Acre WSA, but most of the proposed transmission line would not be visible from this trailhead. The only portion of the proposed line that would be visible is where this line enters the proposed EREF site. The cumulative visual impact from the proposed transmission line would be SMALL.

4.3.4 Air Quality

Some expansions of local businesses can be expected to occur in support of construction and operation of the proposed EREF. However, the air impacts from such expansions are expected to be negligible. No other major facility is expected to be constructed in the local area specifically to support, or as a direct result of, EREF operations. However, operation of the proposed EREF would result in increased energy requirements for the local area. Air impacts could result from expansions of existing sources of energy generation or construction of new energy generating sources to meet increased electricity demands or as a result of modifications to electricity distribution networks. However, no specific plans are known to exist for any such activities, so it is not possible to quantify the air impacts to the local airshed. Activities at the preexisting major sources of air pollution in the four-county area (see Section 3.5.3.2) are not expected to be affected by the construction and operation of the proposed EREF, and extant emissions of criteria pollutants from those major sources are expected to remain unchanged.

To provide electrical power to the proposed EREF, RMP proposes to build a 161-kV transmission line as discussed earlier in Section 2.1.3.2. Air quality impacts associated with construction of this transmission line would include the release of criteria pollutants from the operation of reciprocating internal combustion engines of the construction vehicles and equipment, the delivery trucks that bring components to the job site, and the vehicles used by the construction workforce to commute to and from the job site (AES, 2010a). Fugitive dust would be created during construction of access roads, vegetation clearing of the proposed transmission line ROW and ground clearing and/or grading to create equipment laydown areas and staging areas for cranes and conductor pulling/tensioning equipment, and ground clearing and excavations associated with constructing foundations for the support towers. Similar impacts would occur during construction of new or modified substations. Some additional criteria pollutant emissions and fugitive dust would be associated with ancillary activities such as production of concrete for foundations. During operation, air impacts would result from vehicles traveling to and within the ROW for regular inspections, repairs, and occasional component replacements and from corona discharges from the conductors that would produce negligible amounts of ozone and nitrogen oxides (AES, 2010a).

According to AES (2010a), critical aspects of the planned construction from an air quality perspective include: a relatively small workforce (6–8 persons), a relatively short construction time frame (4 months for the proposed transmission line, 6 months to complete construction of the proposed Twin Buttes Substation and necessary upgrades to the Bonneville Substation), the relatively short commute of the workforce (from a hotel in Idaho Falls, a distance of 25 miles or less to any point along the proposed route or to a substation location), foundations for towers constructed with minimal ground surface disturbance (augered holes, backfilled with excavated materials and without concrete) (AES, 2010a). Also, RMP has proposed the use of mitigative measures such as watering the disturbed ground in construction areas and the unpaved access roads to reduce fugitive dust generation. Finally, except for one new unpaved 500-foot (152.4-meter) access road, existing paved roads and construction roads on the proposed EREF property would provide sufficient access to the ROW. Given the topography of the proposed route, the amount of grade alteration that would be required to create level areas for staging of cranes and conductor pulling/tensioning equipment is expected to be minimal. All of the scheduled construction activities that would result in air impacts are of relatively modest proportion and limited duration. Further, many of the air impacting activities typically associated with transmission line construction such as access road construction would occur to a very limited extent. The NRC staff concludes, therefore, that the air impacts from construction of the proposed transmission line would be of short duration and would be SMALL.

According to AES (2010a), during operation the proposed transmission line would undergo scheduled visual inspection once every two years with inspectors traveling from Shelly, Idaho, eight miles southwest of Idaho Falls. Maintenance actions would also result in the release of criteria pollutants and fugitive dust resulting from vehicle travel on access roads and within the ROW. Pole inspections would occur on a 10-year interval (AES, 2010a). It is reasonable to assume that pole replacements (similar in air impacts to initial construction) would occur only rarely, when found to be necessary. Given the nominal voltage of the line (161 kV), corona discharges that would result in the formation of ozone and nitrogen oxides would be negligible.

The NRC staff concludes that air impacts associated with operation of the proposed transmission line would be SMALL.

The NRC staff concludes that cumulative impacts to air quality from the construction and operation of the proposed EREF and from construction and operation of the proposed transmission line serving the proposed site would be SMALL.

4.3.5 Geology and Soils

The proposed EREF site is located in a region predominantly used for irrigated crops and grazing. Contamination of soils and the underlying aquifer have been reported at the INL site, just to the northwest of the proposed site (EPA, 2009c). Other sources of contamination in the region include animal feedlots, land applications (fertilizer, pesticide, wastewater, and sludge), storage tanks, waste tailings, landfills, and industrial facilities. Excessive irrigation in the region increases the potential for soil contaminant leaching and runoff (Shumar et al., 2007). Because of these concerns, the U.S. Department of Agriculture and the State of Idaho have partnered to create the Conservation Reserve Enhancement Program (CREP) to provide incentives to farmers who volunteer to take cropland and marginal pastureland out of agricultural production (USDA, 2006).

Potential soil contamination resulting from preconstruction, construction, and operation of the proposed EREF could be avoided or minimized by implementing BMPs and mitigation measures, such as those that would be described in the proposed facility's SPCC Plan (to be prepared by AES). Mitigation measures would also be implemented during all project phases to minimize soil erosion and control fugitive dust (AES, 2010a). In addition, potentially contaminated runoff from the storage pads would discharge only to lined stormwater retention basins, and solids carried in process effluents from plant operations would remain within the Liquid Effluent Treatment System Evaporator (AES, 2010a). For these reasons, NRC staff concludes that the proposed EREF project's contribution to cumulative impacts on soils would be SMALL.

For construction of the proposed 161-kV transmission line, soil impacts such as increased potential for erosion and compaction could result from soil-disturbing activities at pulling and tensioning sites, construction and staging yards, and structure sites, and along the new access road and substation construction site. Because soil impacts would occur primarily during the construction phase, they would be short in duration. Disturbance-related impacts could be avoided or minimized by implementing standard BMPs and mitigation measures, such as those that would be described in the proposed facility's SPCC Plan. Mitigation measures would also be implemented during all project phases to minimize soil erosion and control fugitive dust (AES, 2010a). Limiting heavy equipment and vehicles to designated areas (roads and staging areas) would minimize the extent of soil compaction. For these reasons, the NRC staff concludes that the proposed transmission line project's contribution to cumulative impacts on soils would be SMALL.

4.3.6 Water Resources

The ESRP aquifer is the source of water for the proposed EREF. Because it is the principal source of drinking water for southeastern and south-central Idaho, the ESRP aquifer was designated as a sole source aquifer in 1991 (EPA, 2009e). The IDEQ estimated that the ESRP aquifer contains as much as 1233 billion cubic meters (1 billion acre-feet) of water (IDEQ, 2005). Use of the regional water supply is regulated by the IDWR through appropriations that are granted by water rights. Water rights permit their holders to divert public waters for beneficial uses (IDWR, 2010).

The proposed EREF would be expected to use about 837,000 cubic meters (221 million gallons) of water during its first 12 years (see Table 4-10) and an average of 24,900 cubic meters (6.6 million gallons) of water annually during years 13 through 30 (AES, 2009a). Based on these projections, the total water usage would be as high as 1.3 million cubic meters (340 million gallons or 1043 acre-feet) of ESRP aquifer waters over the 30-year life of the proposed facility, taking into account industrial usage during preconstruction, construction, and operations (AES, 2010a). This constitutes a very small portion, less than 1 percent, of the 1233 billion cubic meters (1 billion acre-feet) of the ESRP aquifer reserves in the State of Idaho (IDEQ, 2006). Therefore, the NRC staff concludes that the proposed EREF project's contribution to cumulative impacts on the region's groundwater supply would be SMALL.

Portions of the ESRP aquifer have been contaminated, mainly as a result of the disposal operations at the INL site (Shumer et al., 2007; EPA, 2009c). Recent multilevel groundwater monitoring of INL wells conducted by the USGS INL project office indicates that contamination in the aquifer varies with depth and that wastewater constituents originating from INL (such as tritium and various VOCs) tend to sink to greater depths as groundwater moves to the southwest (downgradient). These data are consistent with models predicting that contaminants downgradient of the INL boundary are most concentrated in deeper zones of the aquifer, at depths beyond those of residential wells in southeastern Idaho (Roy Bartholomay as quoted in Lundquist, 2010). The vertical distribution of contaminants in the ESRP aquifer is attributed to variability in groundwater movement, which is influenced locally by geologic conditions and patterns of recharge (e.g., precipitation, wastewater returns, streamflow infiltration, irrigation infiltration, inflow from adjoining drainage basins, underflow from drainage basins, and groundwater upwelling) and discharge, including heavy pumpage for irrigation (Bartholomay and Twining, 2010).

Land applications of fertilizer and pesticides and excessive irrigation are the main causes of contamination in shallow aquifers, and present a future concern for the ESRP aquifer (Shumer et al., 2007). Potential groundwater contamination resulting from the operation of the proposed EREF could be avoided or minimized by implementing BMPs and mitigation measures, such as those that would be described in the proposed facility's SPCC Plan. In addition, potentially contaminated runoff from the storage pads would discharge only to lined stormwater retention basins, and no process effluents would be discharged to the stormwater basins or into surface water (AES, 2010a). For these reasons, the NRC staff concludes that the proposed EREF project's contribution to cumulative impacts on surface water and groundwater quality would be SMALL.

Impacts to water resources from construction of the proposed 161-kV transmission line would occur in areas where soil-disturbing activities would change natural drainage patterns or increase surface runoff (and sedimentation potential) offsite. (Poles are not likely to be installed deep enough to create conduits to groundwater.) Accidental releases of hazardous materials and wastes (such as those used in voltage transformers) could impact the quality of surface water or groundwater. Because soil-disturbing activities would occur primarily during the construction phase, they would be short in duration. Water quality-related impacts could be avoided or minimized by implementing standard BMPs and mitigation measures, such as those that would be described in the proposed facility's SPCC Plan. Mitigation measures also would be implemented during all project phases to minimize surface runoff and soil erosion and the potential for inadvertent spills or releases (AES, 2010a). For these reasons, the proposed transmission line's contribution to cumulative impacts on water resources would be SMALL.

4.3.7 Ecology

Past and ongoing impacts to sagebrush steppe, the predominant community type in the Eastern Snake River Basalt Plains ecoregion, and wildlife have resulted primarily from habitat losses, such as from agriculture, fragmentation, and decreases in habitat quality due to livestock grazing (Connelly et al., 2004; BLM/DOE, 2004; ISAC, 2006). Invasive species and changes in fire regimes have also impacted sagebrush steppe in the region. Large areas of sagebrush habitat have been replaced by non-native grasses, through range improvement efforts or by wildfires. All of these factors, as well as roadway construction, have contributed to fragmentation of sagebrush habitat within the ecoregion. Increasing fragmentation decreases the patch size of undisturbed habitat, increases edge area, and decreases habitat connectivity (NorthWestern Energy, 2008). Species that require large contiguous habitat areas may decline. Some sagebrush obligate bird species, for example, can show declines within 100 meters (328 feet) of roadways, and mule deer and elk are affected by the proximity of roads (NorthWestern Energy, 2008).

These land uses and associated impacts are expected to continue into the foreseeable future. Additional future losses of habitat may result from additional conversion to cropland or development. Impacts to habitat and wildlife in the region could result from the construction of the Mountain States Transmission Intertie. An alternative route of that transmission line would be located adjacent to the proposed EREF property (MDEQ, 2010). The proposed action would contribute a loss of approximately 75 hectares (185 acres) to the cumulative impacts on sagebrush steppe habitat (AES, 2010a). This area represents approximately 0.7 percent of the sagebrush steppe within 8 kilometers (5 miles) and 0.2 percent within 16 kilometers (10 miles), and would result in a minor contribution to losses of sagebrush habitat within the area and ecoregion. The contribution to habitat fragmentation would be small due to the location of the proposed facility adjacent to previously disturbed nonirrigated pasture and cropland. Greater sage-grouse (*Centrocercus urophasianus*), a sagebrush obligate species and a candidate for Federal listing, have experienced severe long-term population declines in Idaho and throughout their range. These declines have been due in large part to the loss, degradation, and fragmentation of sagebrush habitat (Connelly et al., 2004; BLM/DOE, 2004; ISAC, 2006). Throughout the region, sagebrush communities have been converted to farmland and grasslands and have been lost or severely degraded by wildfires (Connelly et al., 2004; BLM/DOE, 2004; ISAC, 2006). As noted in Section 3.8, approximately 98 percent of the BLM Upper Snake Field Office Planning Area, which includes the proposed EREF property, is sagebrush steppe. Approximately 20,725 hectares (51,213 acres) of cultivated cropland and 3892 hectares (9617 acres) of recently burned grassland and introduced annual grasses occur within 16 kilometers (10 miles) of the proposed EREF (Landscape Dynamics Lab, 2009). Based on surrounding areas, these, along with other disturbed areas, likely represent losses of what had been mostly sage-grouse habitat. As discussed in Section 4.2.7, the proposed action would result in a minor contribution to losses and fragmentation of sagebrush habitat within the area and ecoregion. Sage-grouse would also likely avoid areas near the proposed facility during construction and operations, creating a somewhat larger area of effective loss of habitat. This loss would be a small incremental addition to the cumulative impacts on sage-grouse habitat within the 16-kilometer (10-mile) area and within the ecoregion, and would continue throughout the license period and potentially beyond, depending on post-decommissioning use of the site. Therefore, the contribution to cumulative impacts from the proposed EREF project on sage-grouse and other ecological resources would be SMALL.

For construction of the proposed 161-kV transmission line, vegetation would be cut where necessary for equipment operation at work areas for pole locations and pulling and tensioning sites. Pole location work areas would be 1444 square meters (15,625 square feet) in area; pulling and tensioning site work areas would be 7442 square meters (80,000 square feet) or 5978 square meters (64,000 square feet) in area (AES, 2010a). At some pulling and tensioning sites, ground disturbance could occur within a 150-meter (500-foot) radius (AES, 2010a). Disturbed soil in work areas would be graded to blend with natural contours and reseeded as necessary (AES, 2010a). One new access road, a 2-track dirt road, would be constructed on the east side of the proposed EREF site. Larger shrubs within the ROW or access roads would be cut to allow equipment access, while shorter shrubs would be driven over.

Vegetation types within a 91-meter (300-foot) wide corridor surveyed for the proposed transmission line route are similar to those of the proposed EREF site and include 48 hectares (118 acres) of sagebrush steppe, 155 hectares (382 acres) of irrigated cropland, and small areas of nonirrigated pasture planted with crested wheatgrass (AES, 2010a). Approximately 3.2 hectares (7.9 acres) of sagebrush steppe habitat would be permanently removed for access road and structure locations. Most of the sagebrush steppe within the corridor occurs within the existing ROW between the Bonneville and Kettle Substations. This habitat has been previously fragmented by the existing 69-kV transmission line and access roads. Expansion of the Bonneville Substation would primarily affect cropland. The location of the new Twin Buttes Substation on the proposed EREF site would be cleared and graded during EREF preconstruction. The loss of 3.2 hectares (7.9 acres) of sagebrush steppe habitat would contribute incrementally to the loss of this habitat type in the region, including the loss of 75 hectares (185 acres) associated with construction of the proposed EREF, and would result in a small contribution to cumulative impacts on this habitat type.

Indirect effects on sagebrush steppe habitat of transmission line construction and operation could also include erosion, sedimentation, spread of invasive species, reduction in habitat quality, and habitat fragmentation. Populations of sagebrush steppe species that are cut or crushed by heavy equipment in work areas, such as at pulling and tensioning sites, may require considerable periods of time to return to pre-disturbance levels, and some species may not recover. Some mortality of big sagebrush or other species would likely occur. In addition, non-native species occurring in the area or introduced to the sites could become established or expand into areas disturbed by construction activities. The habitat quality of these areas may subsequently be reduced. Invasive species, such as cheatgrass, can greatly change the fire regime, increasing the frequency and intensity of fires, adversely affecting native habitats such as sagebrush steppe. Transmission line ROWs can promote the spread of invasive species (BPA, 2000). Erosion of disturbed soils or from cut-over areas may contribute to reduction in sagebrush steppe habitat or habitat quality. Sedimentation from disturbed soils may degrade habitat along drainages or in wetlands that occur downstream. Erosion and sedimentation impacts would be reduced, however, by planned mitigation measures. Although habitat fragmentation can occur as a result of transmission line construction, the sagebrush steppe along the proposed transmission line route would be predominantly included within an existing ROW or would be located adjacent to the proposed EREF. Small portions of the proposed transmission line route east of the proposed EREF would be located in undisturbed areas and would contribute to the fragmentation of sagebrush steppe habitat. These indirect impacts would result in a small contribution to cumulative impacts on native habitats within the region.

Impacts of transmission line construction and operation could also include wildlife disturbance and wildlife mortality. The proposed transmission line route includes potentially suitable habitat for sagebrush obligate species, including migratory bird species, although much of this habitat has been affected by the existing transmission line and access roads. These species could be affected by the permanent loss of 3.2 hectares (7.9 acres) of sagebrush steppe habitat and the temporary loss of habitat in work areas and reduction in habitat quality of disturbed areas of sagebrush steppe in work areas. No sage-grouse leks have been found in the immediate vicinity of the new transmission line route (North Wind, 2010).

Wildlife would also be disturbed by noise and human presence during the construction of the proposed transmission line and expansion of the Bonneville Substation. Migratory birds nesting in the vicinity of the transmission line construction could be affected if nest abandonment occurs. The new transmission line would be approximately 150 meters (490 feet) closer to the nearest sage-grouse lek, compared to the proposed EREF. As with EREF construction, however, noise levels associated with transmission line construction would not be expected to affect sage-grouse at the lek. These indirect impacts would result in a small contribution to cumulative impacts on wildlife populations within the region.

The construction of a new transmission line could contribute to avian mortality as a result of bird collisions with the power lines, and could affect migratory bird species. Sage-grouse and sharp-tailed grouse, which are known to occur in the area, could be impacted due to the proximity of US 20 and movements between habitat north and south of the highway and proposed transmission line, or when migrating between seasonal use areas. While bald eagles, which nest along the Snake River, could potentially be affected by collisions with the transmission lines, such impacts are unlikely because of the distance from nesting and foraging areas. In addition, raptors, such as hawks and eagles, may perch on transmission line support structures, potentially resulting in mortality from electrocution. Ferruginous hawks, which nest in the region, could be also affected by the new transmission lines. However, RMP would implement design measures for the protection of raptors and other bird species, reducing potential impacts (AES, 2010a). Most of the proposed transmission line would be included within the existing 69-kV transmission line ROW, with about 7.6 kilometers (4.75 miles) of new ROW between the Kettle Substation and the proposed Twin Buttes Substation. The number of birds affected by the new line within the existing ROW could be greater than those currently affected. Relatively few birds would be expected to be affected by the new line within the proposed 161-kV transmission line ROW, much of which would be located within or adjacent to the proposed EREF site. The contribution of the proposed new transmission line to cumulative impacts on bird populations in the ecoregion would be SMALL.

Because support structures can provide perch sites for raptors and corvids (ravens and crows), construction of the proposed transmission line may increase predation by raptors and corvids in the area. Populations of prey species, such as sage-grouse or pygmy rabbits, which may occur in the area, could be impacted by increased predation.

4.3.8 Noise

With the exception of the construction of the proposed transmission line connecting the proposed EREF with the transmission grid operated by RMP, no major industrial facilities are expected to be constructed in the vicinity of the proposed EREF property. Noise impacts will occur from the construction of the proposed transmission line, but those impacts would be sporadic and SMALL. The noise impacts on the proposed EREF property associated with the continuing activities at INL would be SMALL. Cumulative impacts to noise from preconstruction, construction, and operation of the proposed EREF, from the construction and operation of the proposed transmission line that would serve the proposed EREF, and from activities at INL would be SMALL.

4.3.9 Transportation

The impacts of construction (including preconstruction activities) and operation of the proposed EREF due to increased traffic from commuting construction workers would be SMALL to MODERATE, although no highway upgrades would be required other than safety enhancements on US 20 such as the construction of turning/acceleration/deceleration or a grade-separated interchange for entry to and exit from the proposed EREF. As noted in the introduction to Section 4.3, there are no planned or proposed/future actions the vicinity of the proposed EREF that would contribute to cumulative transportation impacts (i.e., affect traffic levels. Current activities that would contribute to cumulative transportation impacts include the shipment of radioactive materials from INL to Idaho Falls along US 20 (approximately 25–40 shipments per month) (INL, 2010). Because the INL shipments comprise less than 2 percent of current traffic flow on US 20 in the vicinity of the proposed EREF and the population density along this route is low, the cumulative effects on transportation would be SMALL.

Construction and maintenance of the proposed 161-kV transmission line and the substation work would require access to the ROW from US 20. Traffic volume could increase along US 20, and slowing or accelerating construction and maintenance vehicles could result in intermittent disruption of high-speed traffic flow (see Section 3.10.1). However, only two access points from US 20 are anticipated (both of which currently exist near the proposed EREF site); the remaining access points are from an adjacent county road. Less than 10 vehicles would be used at any one time during construction of the proposed transmission line and new substation (AES, 2010a), and large construction equipment would not likely travel to and from work sites on a daily basis during construction period. The additional number of daily vehicle-trips resulting from these activities would represent less than 2 percent of the anticipated peak increase in daily traffic to and from the proposed EREF site during preconstruction and construction (see Section 4.2.9.1). In addition, this impact would occur during the construction phase of the proposed EREF and would be short in duration. The NRC staff concludes that transportation impacts associated with transmission line construction and operation would be SMALL.

4.3.10 Public and Occupational Health

Public and occupational health impacts that might contribute to cumulative impacts would be associated with the construction and operation of the proposed 161-kV transmission line that would serve the proposed EREF. It is estimated that 30 workers would complete the construction of the proposed transmission line within one year (AES, 2010a). This level of effort represents less than 1 percent of the total FTE-years estimated to construct the proposed facility (see Table 4-14). Maintenance of the line and ROW during its operational life would add minimally to already small occupational injury rates for operating the proposed EREF (see Table 4-15). Since the public and occupational impacts of facility construction and operation would be SMALL, the small incremental addition of the transmission line construction and operation would only negligibly contribute to cumulative impacts.

With regard to cumulative impacts from fluoride emissions during facility operation, there are currently very low levels of exposure to the public from industrial chemical emissions in the region surrounding the proposed facility in general and no other known or anticipated sources of fluoride emissions. Thus cumulative effects on the public of the minor HF emissions expected from the proposed facility in combination with other chemical emissions in the region would be SMALL.

The annual collective population dose from operations was estimated to be approximately 1.7×10^{-5} person-sievert (1.7×10^{-3} person-rem) in Section 4.2.10.2. Such a dose is so low that it cannot be monitored, as is the case for the annual collective population dose from operations at the nearby INL, as discussed in Section 3.11.1. Exposure of individuals that may be near the proposed EREF property boundary would also be low. Thus, cumulative impacts to the public from radiological sources at the proposed EREF and other nearby sources would be SMALL.

4.3.11 Waste Management

As shown in Section 4.2.11, the impact of disposal of hazardous, nonhazardous solid, and solid low-level radioactive wastes from the proposed EREF at the appropriate facilities would be SMALL given past and present conditions. Based on available capacities at low-level radioactive and hazardous waste treatment and disposal sites, in conjunction with the expectation that there will be no large developments in the Idaho Falls area that would cause a significant increase in municipal waste disposal volume, the cumulative impacts from hazardous and solid waste generation would be SMALL.

Nonhazardous and sanitary wastes would be generated during construction and maintenance of the proposed 161-kV transmission line and the new and upgraded substations. Nonhazardous construction wastes (including debris from the dismantled 69-kV transmission line) would be recycled or transported to an approved landfill such as the Bonneville County Hatch Pit (see Section 4.2.11.1). Sanitary waste would be collected locally in portable systems. The generation of hazardous waste is not anticipated, but hazardous materials that are typical of a high-voltage application (including oil in transformers, sulfuric acid in batteries, diesel fuel in generators, and sulfur hexafluoride gas in circuit breakers) would be used and could require disposal at an approved disposal facility (AES, 2010a). Because the number and volume of waste shipments from construction of the proposed transmission line and new substation would represent less than 1 percent of those from preconstruction and construction of the proposed

EREF, the NRC staff concludes that the cumulative waste management impacts of transmission line construction and operation would be SMALL.

4.3.12 Socioeconomics

A number of other development projects have been proposed for the two-county ROI that could produce cumulative socioeconomic impacts in association with the proposed EREF, depending upon project scope and development schedules of the additional projects. (Note: These projects are all located within the 80.5-kilometer [50-mile] radius ROI for socioeconomics, but, with the exception of the proposed EREF transmission line, outside the 16-kilometer [10-mile] ROI for all other environmental resources.) The construction of the proposed 13.75-mile, 161-kv transmission line to support the proposed EREF would produce 57 jobs and produce $2.8 million in income, $0.1 million in direct sales taxes, and $0.1 million in direct income taxes in the region including Bingham and Bonneville Counties (AES, 2010a). Jobs, income, and tax revenues produced during transmission line operations would be small. In Bonneville County, additional developments could include the Snake River Landing planned community, the Taylor Crossing planned community, The Narrows mixed-use office/residential development, the Central Valley development, the McNeil Development that includes a Marriott Hotel and condominiums, the Sleep Inn Hotel, and the West Broadway soccer complex presently under construction (AES, 2009a). In Bingham County, planned developments would include the construction of a 150-unit wind power development (AES, 2009a).

These projects would provide additional employment opportunities for construction workers and would increase the economic activity in the region. Depending upon the timing of construction and operation of each of these projects, however, there could be a number of negative impacts. Although competition for the hiring of construction and operations workers may lead to wage inflation in the area, the size of the regional labor force is likely large enough to prevent this being a major issue. The development of additional projects would also lead to long-term employment opportunities and might result in in-migration into the area. Depending on the timing of construction for these projects and the type and quantity of construction materials needed, there could be supply shortages of some materials, leading to price increases. However, the magnitude of these impacts would likely be SMALL. Given all these considerations, the cumulative socioeconomic impacts of the proposed EREF project would be SMALL.

4.3.13 Environmental Justice

Minority and low-income populations occur within a 4-mile radius of the proposed EREF site (see Section 3.13) and within a two-mile buffer either side of the proposed 13.75-mile transmission line ROW that would be constructed to support the proposed EREF (Table 4-38). However, none of the Census block groups associated with the proposed EREF or the proposed transmission line route have minority or low-income populations that exceed county or State averages by more than 20 percentage points, or exceed 50 percent of total block group population. Preconstruction, construction, and operation of the proposed EREF and construction and operation of the associated transmission line would not produce high and adverse impacts to the general population, and so would not disproportionately impact minority and low-income populations. Accordingly, the cumulative impacts on minority and low-income populations would be SMALL.

Table 4-38 Minority and Low-Income Populations within the 2-mi (3.2-km) Buffer Associated with the Proposed Transmission Line

Parameter	
Total population	1777
White, non-Hispanic	1470
Hispanic or Latino	266
Non-Hispanic or Latino minorities	41
One race	22
Black or African American	6
American Indian or Alaskan Native	2
Asian	13
Native Hawaiian or other Pacific Islander	1
Some other race	0
Two or more races	19
Total minority	307
Low-income	178
Percent minority	17.3
County percent minority	10.5
State percent minority	9.0
Percent low-income	10.2
County percent low-income	10.1
State percent low-income	11.8

Source: U.S. Census Bureau (2010).

Although minority and low-income populations occur in the vicinity of the proposed EREF site (see Section 3.13), construction and operation of the proposed EREF would not affect such populations. Accordingly, the cumulative impacts on environmental justice populations would be SMALL.

4.4 Impacts of the No-Action Alternative

As presented in Section 2.2 of this EIS, the no-action alternative would be to not construct, operate, and decommission the proposed EREF in Bonneville County, Idaho. As discussed in the introduction to Section 4.2, the NRC has granted an exemption for AES to conduct certain preconstruction activities in advance of a formal licensing decision. If the NRC does not grant a construction and operating license for the proposed EREF, some or all of the preconstruction activities granted under the exemption approval (NRC, 2010a) are expected to have already occurred. It follows that the impacts associated with these preconstruction activities, as described in Section 4.2, will also have occurred. There may be additional activities occurring at the proposed site in the future under the no-action alternative that may have adverse or beneficial impacts on the environment. The impacts associated with these activities would depend on what AES would decide to do with the proposed site or any improvements (e.g., access roads) already constructed on the site. The impact conclusions presented in this section for the no-action alternative address the impacts of denying the license, but do not include the impacts of the NRC-approved preconstruction activities, some or all of which are expected to have already occurred.

Under the no-action alternative, nuclear electricity generation customers would continue to depend on existing suppliers (i.e., existing uranium enrichment facilities, foreign sources, and the Megatons to Megawatts Program) to fulfill uranium enrichment needs. In addition, three future domestic sources of enriched uranium are planned – two of which are currently under construction (American Centrifuge Plant [ACP] and NEF) and the third is planned and seeking a license from the NRC (GLE Facility). Current U.S. demand for low-enriched uranium is about 12 to 14 million SWU annually (EIA, 2009). USEC is currently the only domestic supplier of enrichment services, providing enriched uranium to both domestic and foreign users. Existing USEC enrichment activities include operation of the Paducah Gaseous Diffusion Plant (GDP), the downblending of highly enriched uranium under the Megatons to Megawatts Program that is managed by USEC and scheduled to expire in 2013, and the import of foreign-enriched product. By combining its domestic enrichment facilities and the downblending of foreign highly enriched uranium, USEC can provide for approximately 56 percent of the U.S. enrichment market needs (USEC, 2004) while foreign suppliers provide the remaining 44 percent.

Under the no-action alternative, the Paducah GDP, including the Megaton to Megawatts Program, would serve as the only domestic source of low-enriched uranium. Reliance on one domestic source for enrichment services could result in disruptions to the supply of low-enriched uranium, and consequently to reliable operation of U.S. nuclear energy production, should there be any disruptions to foreign supplies and/or the operations of domestic suppliers (i.e., if the ACP, NEF, or GLE Facility would not be constructed and operated and the Megatons to Megawatts Program would not be extended beyond 2013).

If the license application for the proposed EREF is not granted, nuclear electricity generation using enriched uranium from the proposed EREF could be replaced with other power generation sources (e.g., fossil-fuel plants), which would present of range of impacts that are outside the scope of this EIS. Alternatively, enriched uranium could be provided by sources constructed at other locations. Therefore, impacts similar to those quantified in this EIS would simply occur at a different location. Should another domestic enrichment facility be constructed at an alternate location, environmental impacts would occur and could range from SMALL to LARGE. These impacts could be similar to those of the proposed action, but would depend on various factors, e.g., the type of facility and the affected environment at the alternate location.

The site-specific impacts of the no-action alternative for each resource area are discussed in the following sections.

4.4.1 Land Use

Under the no-action alternative, AES would purchase the property and restrictions on grazing and agriculture would occur. The zoning designation for the property would remain G-1 Grazing whether or not the proposed EREF is constructed. Current land uses of grazing and farming could potentially resume. Impacts to local land use would be SMALL.

4.4.2 Historic and Cultural Resources

Under the no-action alternative, the proposed EREF would not be constructed. No visual effects or noise would affect the Wasden Complex. Nevertheless, it is assumed that AES would purchase the property and undertake preconstruction activities that would destroy site MW004. However, site MW004 would not be affected by the Federal (NRC) licensing action and the NHPA would not apply. However, the removal of site MW004, which has already occurred, resulted in a LARGE impact because the site no longer exists; but because AES removed this site through professional excavation and data recovery and there are other homestead sites of this type found in the region, the impact has been mitigated to a MODERATE level (WCRM, 2010; Idaho SHPO, 2010b; Gilbert, 2010). The impact on historic and cultural resources would be SMALL to MODERATE under the no-action alternative.

4.4.3 Visual and Scenic Resources

Under the no-action alternative, impacts to visual and scenic resources would be SMALL. The proposed EREF would not be constructed. AES would purchase the property and clear the vegetation; however, these activities are not expected to alter the viewshed. No major visual intrusions to the existing landscape would occur because no large industrial structures would be constructed. The existing natural character of the area would largely remain intact. The lack of development would be consistent with the BLM VRM Class 1 designation for the Hell's Half Acre WSA. No visual intrusions to the Wasden Complex viewshed would occur.

4.4.4 Air Quality

Under the no-action alternative, the air quality impacts associated with the construction, operation, and decommissioning of the proposed EREF would not occur. The proposed site could revert to agricultural activities, which would impact ambient air quality through the release of criteria pollutants from the operation of agricultural vehicles and equipment and the release of fugitive dust from the tilling of soils. Those impacts are expected to be substantially less than impacts resulting from preconstruction and the proposed action. The NRC staff concludes that local air impacts associated with the no-action alternative would be SMALL.

4.4.5 Geology and Soils

Under the no-action alternative, no additional land disturbance from construction would occur and the land on the proposed EREF site could revert to crop and grazing activities. Wind and water erosion would continue to be the most significant natural processes affecting the geology and soils at the proposed site. Impacts to geology and soils would therefore be expected to be SMALL.

4.4.6 Water Resources

Under the no-action alternative, additional water use may or may not occur, depending on future plans for the property. Water resources would be unchanged. Water usage could continue at the current rate, should agricultural activities resume at the proposed site, and impacts on the ESRP aquifer and downgradient water users would be SMALL. No changes to surface water quality would be expected, and the natural (intermittent) surface flow of stormwater on the proposed site would continue. No additional groundwater use or adverse changes to groundwater quality would be expected. Impacts therefore would be SMALL.

4.4.7 Ecological Resources

Most impacts on ecological resources would occur during the preconstruction phase. However, such impacts would also occur under the proposed action. The potential impacts associated with the construction, operation, and decommissioning of the proposed EREF would not occur. The land on the proposed EREF site could revert to crop and grazing activities. Denying the license would not result in additional land disturbance on the proposed EREF property. Revegetation of the site could occur with renewal of some wildlife habitat. Anticipated impacts on ecological resources from the no-action alternative would be SMALL.

4.4.8 Noise

Under the no-action alternative, none of the noise impacts associated with construction, operation, and decommissioning at the proposed EREF would occur. Land uses on the proposed EREF site could revert to previous applications, livestock grazing and/or crop production, with concomitant noise impacts. Impacts would be SMALL.

4.4.9 Transportation

Under the no-action alternative, traffic volumes and patterns would remain the same as described in the affected environment section. The current volume of radioactive material and chemical shipments to/from facilities other than the proposed EREF would not increase. Transportation impacts would be SMALL.

4.4.10 Public and Occupational Health

Under the no-action alternative, public and occupational health impacts would be SMALL. Occupational health impacts from construction, operation, and decommissioning would not occur. Associated worker and public impacts from chemical and radioactive hazards would also not occur. Should the land be returned to grazing and agriculture, the impacts would be SMALL.

4.4.11 Waste Management

Under the no-action alternative, since construction, operation, and decommissioning of the proposed EREF would not occur, new wastes including sanitary, hazardous, low-level radioactive, or mixed wastes would not be generated that would require disposition. Impacts from waste management would be SMALL.

4.4.12 Socioeconomics

Under the no-action alternative, any positive or adverse consequences of the construction, operation, and decommissioning of the proposed EREF would not occur and socioeconomic conditions in the ROI would remain unchanged. As a result, the impact of no action on social and economic conditions in the region would be SMALL.

Population in the area surrounding the proposed EREF, Bingham and Bonneville Counties, is expected to grow in accordance with current projections, with total population in the region projected to be approximately 156,491 in 2013 and 168,331 in 2017 (AES, 2010a). In addition to population growth, the social characteristics of the region, including housing availability, school enrollment, availability of health service resources, and law enforcement and firefighting resources, are expected to change over time. However, future changes in these characteristics are difficult to quantify, and no projections of their future growth are available.

4.4.13 Environmental Justice

The no-action alternative would not be expected to cause any high and adverse impacts; it should not raise any environmental justice issues. Therefore, any impacts would be SMALL.

4.4.14 Accidents

There would be no facility accidents during operation if the proposed EREF is not constructed. Therefore, impacts would be SMALL.

4.5 References

(AES, 2009a) AREVA Enrichment Services, LLC. Letter from Sam Shakir (President and CEO, AES) to the U.S. Nuclear Regulatory Commission dated June 17, 2009. "Subject: Request for Exemption from 10 CFR 70.4, 10 CFR 70.23(a)(7), 10 CFR 30.4, 10 CFR 30.33(a)(5), 10 CFR 40.4, and 10 CFR 40.32(e) Requirements Governing 'Commencement of Construction.'" ADAMS Accession No. ML091770390.

(AES, 2009b) AREVA Enrichment Services, LLC. Letter from Jim Kay (Licensing Manager, AES) to the U.S. Nuclear Regulatory Commission dated September 9, 2009. "Subject: Response to Requests for Additional Information – AREVA Enrichment Services LLC Environmental Report for the Eagle Rock Enrichment Facility." AES-O-NRC-09-01234-0. ADAMS Accession No. ML092530636.

(AES, 2010a) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Environmental Report, Rev. 2." Bethesda, Maryland. April.

(AES, 2010b) AREVA Enrichment Services, LLC. "Final Safety Analysis Report, Rev. 2." Bethesda, Maryland.

(AES, 2010c) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Integrated Safety Analysis." Revision 2.

(AES, 2010d) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Emergency Plan." Revision 2.

(AES, 2010e) AREVA Enrichment Services, LLC. Letter from J.A. Kay (Licensing Manager, AES) to U.S. Nuclear Regulatory Commission dated February 19, 2010. "Subject: Treatment Plan for Historic Site MW004 and Analysis of Obsidian Artifacts."

(AES, 2010f) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Revision 2 to License Application." April. ADAMS Accession No. ML101610549.

(AES, 2010g) AREVA Enrichment Services. Letter from J.A. Kay (Licensing Manager, AES) to Sharon W. Kiefer (Assistant Director-Policy, IDFG) dated December 7, 2010. "Subject: Response to IDFG Comments to NRC Related to the EREF Transmission Line." ADAMS Accession No. ML103420579.

(ATSDR, 2003) Agency for Toxic Substances and Disease Registry. "Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluorine." September.

(Bartholomay and Twining, 2010) Bartholomay, R.C., and B.V. Twining. "Chemical Constituents in Groundwater from Multiple Zones in the Snake River Plain Aquifer at the Idaho National Laboratory, Idaho, 2005-2008." U.S. Geological Survey Scientific Investigations Report 2010-5116, prepared in cooperation with the U.S. Department of Energy (DOE/ID-222111). ADAMS Accession No. ML103410204.

(BEA, 2010) U.S. Bureau of Economic Analysis. "Regional Economic Accounts: RIMS II Multipliers." <https://www.bea.gov/regional/rims/rimsii/> (Accessed April 19, 2010).

(Biwer and Butler, 1999) Biwer, B.M., and J.P. Butler. "Vehicle Emission Unit Risk Factors for Transportation Risk Assessments." *Risk Analysis* 19:1157–1171.

(Biwer et al., 2001) Biwer, B.M., F.A. Monette, L.A. Nieves, and N.L. Ranek. "Transportation Impact Assessment for Shipment of Uranium Hexafluoride (UF_6) Cylinders from the East Tennessee Technology Park to the Portsmouth and Paducah Gaseous Diffusion Plants." ANL/EAD/TM-112. Argonne National Laboratory. October. <http://web.ead.anl.gov/uranium/pdf/ANL-EAD-TM-112.pdf> (Accessed March 1, 2010).

(BLM, 2007) U.S. Bureau of Land Management. "Manual 8400 Visual Resource Management." <http://www.blm.gov/nstc/VRM/8400.html> (Accessed September 27, 2009). ADAMS Accession No. ML101790184.

(BLM/DOE, 2004) U.S. Bureau of Land Management and U.S. Department of Energy. "Final Management Plan, INEEL Sagebrush Step Ecosystem Reserve." EA ID-074-02-067. May.

(BLS, 2008a) U.S. Bureau of Labor Statistics. "Incident Rates of Nonfatal Occupational Injuries and Illnesses by Industry and Case Types 2007." October 23. <http://data.bls.gov/cgi-bin/print.pl/news.release/osh.t01.htm> (Accessed July 20, 2009).

(BLS, 2008b) U.S. Bureau of Labor Statistics. "Fatal Occupational Injuries, Employment, and Rates of Fatal Occupational Injuries by Selected Worker Characteristics, Occupations, and Industries, 2007." <http://www.bls.gov/iif/oshcfoi1.htm#rates> (Accessed July 20, 2009).

(Boggs, 2010) Personal communication from W. Boggs (U.S. Bureau of Land Management) to D. O'Rourke, B. Biwer, and R. Van Lonkhuyzen (Argonne National Laboratory). February 12. ADAMS Accession No. ML110340433.

Bonneville County, 2006) Bonneville County, Idaho. "Hatch Pit Operation Plan." 2006 Revision. May. <http://www.co.bonneville.id.us/%5Cforms%5CPW-HatchPitOperation Plan.pdf> (Accessed July 21, 2009).

(Bonneville County, 2009) Bonneville County Public Works Department, Solid Waste Division. Personal Communication from K. Eckersell (Bonneville County Public Works) to B. Biwer (Argonne National Laboratory). November 23.

(BPA, 2000) Bonneville Power Administration. "Transmission System Vegetation Management Program Final Environmental Impact Statement." DOE/EIS-0285. U.S. Department of Energy, Portland, Oregon. May.

(Braun et al., 2005) Braun, C.E., J.W. Connelly, and M.A. Schroeder. "Seasonal Habitat Requirements for Sage-Grouse: Spring, Summer, Fall, and Winter." In: *Sage-Grouse Habitat Restoration Symposium Proceedings*, June 4–7, Boise, ID. USDA Forest Service, Rocky Mountain Research Station, Proceedings RMRS-P-38. November.

(Carlsen, 2009) "Transfer No. 75268, Water Right No(s): 35-2642 – Transfer Approval Notice." From E. Carlsen (Water Resource Program Manager, Idaho Department of Water Resources) to AREVA NC, Inc., Bethesda, Maryland. July 2.

(CCS, 2008) Center for Climate Studies. "Idaho Greenhouse Gas Inventory and Reference Case Projections 1990–2020." Principal authors: R. Strait, S. Roe, A. Bailie, H. Lindquist, and A. Jamison. Idaho Department of Environmental Quality. Spring. <http://www.climate strategies.us> (Accessed November 17, 2009).

(Clark and Nieves, 1994) Clark, D., and L. Nieves. "An Interregional Hedonic Analysis of Noxious Facility Impacts on Local Wages and Property Values." *Journal of Environmental Economics and Management* 27:235–253.

(Clark et al., 1997) Clark, D., L. Michaelbrink, T. Allison, and W. Metz. "Nuclear Power Plants and Residential Housing Prices." *Growth and Change* 28:496–519.

(Connelly et al., 2000) Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. "Guidelines to Manage Sage Grouse Populations and Their Habitats." *Wildlife Society Bulletin* 28(4):967–985.

(Connelly et al., 2003) Connelly, J. W., K.P. Reese, and M.A. Schroeder. "Monitoring of Greater Sage-grouse Habitats and Populations." Station Bulletin 80. University of Idaho College of Natural Resources Experiment Station, Moscow, Idaho.

(Connelly et al., 2004) Connelly, J.W., S.T. Knick, M.A. Schroeder, and S.J. Stiver. "Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats." Unpublished report. Western Association of Fish and Wildlife Agencies, Cheyenne, Wyoming.

(Dechant et al., 1999) Dechant, J.A., M.L. Sondreal, D.H. Johnson, L.D. Igl, C.M. Goldade, A.L. Zimmerman, and B.R. Euliss. "Effects of Management Practices on Grassland Birds: Ferruginous Hawk." Revised 2002. Northern Prairie Wildlife Research Center. Jamestown, North Dakota.

(DNFSB, 1995a) Defense Nuclear Facility Safety Board. "Integrity of Uranium Hexafluoride Cylinders." Technical Report DNFSB/TECH-4. May 5.

(DNFSB, 1995b) Defense Nuclear Facility Safety Board. "Improved Safety of Cylinders Containing Depleted Uranium." Recommendation 95-1 to the Secretary of Energy. May 5.

(DNFSB, 1999) Defense Nuclear Facility Safety Board. Letter from J. Conway (Defense Nuclear Facility Safety Board) to B. Richardson, Secretary of Energy. "Closing of Recommendation 95-1." December 16. <http://www.hss.doe.gov/DepRep/1999/fb99d16a.pdf> (Accessed March 1, 2010).

(DOE, 1978) U.S. Department of Energy. "Investigation of Occurrence Involving Release of Uranium Hexafluoride from a Fourteen-Ton Cylinder at the Portsmouth Gaseous Diffusion Plant on March 7, 1978." ORO-757. Oak Ridge Operations Office. June.

(DOE, 1999) U.S. Department of Energy. "Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride." DOE/EIS-0269. Office of Nuclear Energy, Science, and Technology, Washington, D.C. April.

(DOE, 2002) U.S. Department of Energy. "A Graded Approach to Evaluating Radiation Doses to Aquatic and Terrestrial Biota." DOE-STD-1153-2002. Washington, D.C. July.

(DOE, 2004a) U.S. Department of Energy. "Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site." DOE/EIS-0359. Office of Environmental Management. June. <http://www.gc.energy.gov/NEPA/finalEIS-0359.htm> (Accessed March 1, 2010).

(DOE, 2004b) U.S. Department of Energy. "Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site." DOE/EIS-0360. Office of Environmental Management. June. <http://www.gc.energy.gov/NEPA/finalEIS-0360.htm> (Accessed March 1, 2010).

(DOE, 2007) U.S. Department of Energy. "Uranium Enrichment and Decontamination & Decommissioning Fund, 2007 Report to Congress." Oak Ridge Office and Portsmouth/Paducah Project Office. <http://www.em.doe.gov/pdfs/5th_triennial_report_final.pdf> (Accessed April 16, 2010). ADAMS Accession No. ML103490664.

(EIA, 2009) Energy Information Administration, U.S. Department of Energy. "Annual Energy Outlook 2009 with Projections to 2030." DOE/EIA-0383(2009). Washington, D.C. March. <http://www.eia.doe.gov/oiaf/archive/aeo09/index.html> (Accessed August 21, 2009).

(Ennes, 2010) Ennes, M. E-mail from M. Ennes (BLM) to S. Lemont (NRC) dated February 4, 2010. "Subject: RE: Discussions with BLM."

(EPA, 1980) U.S. Environmental Protection Agency. "Guidelines for Considering Noise in Land Use and Planning Control." EPA 550-9-81-423. Federal Interagency Committee on Urban Noise. <http://www.nonoise.org/epa/> (Accessed March 19, 2010).

(EPA, 1995) U.S. Environmental Protection Agency. "AP-42 Fifth Edition Volume I, Miscellaneous Sources, Chapter 13.2.3, Heavy Construction Operations." January. <http://www.epa.gov/ttn/chief/ap42/ch13/index.html> (Accessed April 2010).

(EPA, 1999) U.S. Environmental Protection Agency. "Cancer Risk Coefficients for Environmental Exposure to Radionuclides." Federal Guidance Report No. 13. EPA 402-R-99-001. Prepared by Oak Ridge National Laboratory for U.S. Environmental Protection Agency, Office of Radiation and Indoor Air. September. <http://www.epa.gov/rpdweb00/docs/federal/402-r-99-001.pdf> (Accessed March 1, 2010).

(EPA, 2003) U.S. Environmental Protection Agency. "User's Guide to MOBILE6.1 and MOBILE6.2 Mobile Source Emission Factor Model." EPA 420-R-010. August.

(EPA, 2005a) U.S. Environmental Protection Agency. "40 CFR Part 51 Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule." *Federal Register* 70(216):68218–68261. November 9. <http://www.epa.gov/scram001/guidance/guide/appw_05.pdf> (Accessed June 10, 2010).

(EPA, 2005b) U.S. Environmental Protection Agency. "Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel." EPA 420-F-05-001. February. <http://www.epa.gov/OMS/climate/420f05001.htm#calculating> (Accessed November 16, 2009).

(EPA, 2006a) U.S. Environmental Protection Agency. Chapter 7.1, "Organic Liquid Storage Tanks," in: *AP-42, Fifth Edition Volume I, Liquid Storage Tanks*. November. <http://www.epa.gov/ttn/chief/ap42/ch03/index.html> (Accessed April 2010).

(EPA, 2006b) U.S. Environmental Protection Agency. "TANKS Emissions Estimation Software, Version 4.09D." October 5. Free software available for download. <http://www.epa.gov/ttnchie1/software/tanks/> (Accessed April 2010).

(EPA, 2006c) U.S. Environmental Protection Agency. Chapter 13.2.2, "Unpaved Roads," in: *AP-42 Fifth Edition Volume I, Miscellaneous Sources*." November. <http://www.epa.gov/ttn/chief/ap42/ch13/index.html> (Accessed April 2010).

(EPA, 2006d) U.S. Environmental Protection Agency. Chapter 13.2.4, “Aggregate Handling and Storage Piles,” in: *AP-42 Fifth Edition Volume I, Miscellaneous Sources*. November. <http://www.epa.gov/ttn/chief/ap42/ch13/index.html> (Accessed April 2010).

(EPA, 2007) U.S. Environmental Protection Agency, “Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices.” EPA 841-F-07-006. December. ADAMS Accession No. ML110270042.

(EPA, 2009a) U.S. Environmental Protection Agency. “e-GRID 2007, Version 1.1 United States File, Year 2005 Data.” <http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html> (Accessed November 19, 2009).

(EPA, 2009b) U.S. Environmental Protection Agency. “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2007.” EPA430-R-09-004. April 15. <http://www.epa.gov/climatechange/emissions/usinventoryreport.html> (Accessed November 16, 2009).

(EPA, 2009c) U.S. Environmental Protection Agency. “Region 10 – National Priorities List Site Listing (Idaho National Laboratory).” <http://yosemite.epa.gov/r10/nplpad.nsf/> (Accessed April 22, 2010).

(EPA, 2009d) U.S. Environmental Protection Agency. “Radiation Risk Assessment Software: CAP88 and CAP88 PC.” <http://www.epa.gov/rpdweb00/assessment/CAP88/index.html> (Accessed May 3, 2010).

(EPA, 2009e) U.S. Environmental Protection Agency. “Region 10 Sole Source Aquifer Program.” <http://yosemite.epa.gov/r10/water.NSF/Sole+Source+Aquifers/SSA> (Accessed October 6, 2009). ADAMS Accession No. ML101790288.

(EPA, 2010a) Letter from EPA NOI Processing Center to Edgar T. Randol (URS Nuclear LLC) dated October 26, 2010. “Subject: Permit Number: IDR10CI01.” ADAMS Accession No. ML103410191.

(EPA, 2010b) U.S. Environmental Protection Agency. “National Pollutant Discharge Elimination System (NPDES) – Stormwater Discharges from Construction Activities, Overview.” <http://cfpub1.epa.gov/npdes/stormwater/const.cfm> (Accessed April 21, 2010).

(Estes and Raley, 2009) Estes, M.B., and J. Raley. “Amendment to: A Class III Cultural Resource Inventory of the Proposed Eagle Rock Enrichment Facility Bonneville County, Idaho.” Western Cultural Resource Management, Inc., Sparks, Nevada. August 28.

(FWS, 2007) U.S. Fish and Wildlife Service. “National Bald Eagle Management Guidelines.” <http://www.fws.gov/migratorybirds/baldeagle.htm> (Accessed May, 17, 2010).

(FWS, 2009) U.S. Fish and Wildlife Service. Letter from Damien Miller (Supervisor, Eastern Idaho Field Office, U.S. Fish and Wildlife Service) to Gloria Kulesa (NRC).

(FWS, 2010) U.S. Fish and Wildlife Service. Letter from Gary Burton (Acting Supervisor, Eastern Idaho Field Office, U.S. Fish and Wildlife Service) to Andrea Kock (NRC).

(GAO, 2004) U.S. General Accounting Office. “Low-Level Radioactive Waste: Disposal Availability Adequate in the Short Term, But Oversight Needed to Identify Any Future Shortfalls.” Report to the Chairman, Committee on Energy and Natural Resources, U.S. Senate. GAO-04-604. June. <http://www.gao.gov/new.items/d04604.pdf> (Accessed March 1, 2010).

(GAO, 2007) U.S. Government Accountability Office. “Low-Level Radioactive Waste Management: Approaches Used by Foreign Countries May Provide Useful Lessons for Managing U.S. Radioactive Waste.” Report to the Chairman and Ranking Minority Member, Committee on Energy and Natural Resources, U.S. Senate. GAO 07 221. March. <http://hps.org/govtrelations/documents/gao_llrw_foreignapproach.pdf> (Accessed June 15, 2010).

(Gilbert, 2010) Personal communication from H. Gilbert (Idaho National Laboratory) to D. O’Rourke (Argonne National Laboratory) dated April 26, 2010. “Subject: Uniqueness of Late 19th Century Homestead Sites in the General Vicinity of the EREF Property.”

(GLE, 2009) GE-Hitachi Global Laser Enrichment, LLC. Letter from A. Kennedy (GE-Hitachi Global Laser Enrichment, LLC) to A. Kock (U.S. Nuclear Regulatory Commission) dated November 11, 2009. “Subject: GE-Hitachi Global Laser Enrichment Response (#2) to Request for Additional Information Related to NRC Review of GLE Environmental Report.” Adams Accession No. ML093220060.

(Harding, 2010) Harding, W.M. “Archaeological and Historic Survey Report Archaeological Survey of Idaho.” In: *Eagle Rock Enrichment Facility Transmission Line*. NWI 10247.001. North Wind, Inc. January 21.

(Hlohowskyj et al., 2004) Hlohowskyj, I., J. Francis, and J. Kuiper. “Characterization of the Effects of Use Authorizations on Soil, Vegetation, Prey and Raptors at the Orchard Training Area, Idaho.” Prepared by the Environmental Assessment Division, Argonne National Laboratory, for the U.S. Bureau of Land Management, Lower Snake River District.

(HUD, 2009) U.S. Housing and Urban Development. “Chapter 2: The Noise Regulation.” In: *The Noise Guidebook*. 24 CFR 51.103. <http://www.hud.gov/offices/cpd/environment/training/guidebooks/noise/index.cfm> (Accessed September 14, 2009).

(IAC, 2008) *Idaho Administrative Code*, 58.01.05. “Rules and Standards for Hazardous Waste.” <http://adm.idaho.gov/adminrules/rules/idapa58/0105.pdf> (Accessed March 1, 2010).

(IAC, 2010) Idaho Administrative Code, 58.01.01. “Rules for the Control of Air Pollution in Idaho.” <http://adm.idaho.gov/adminrules/rules/idapa58/0101.pdf> (Accessed June 10, 2010).

(Idaho SHPO, 2009) Idaho State Historic Preservation Office. Letter from K.C. Reid (Idaho SHPO) to G. Harper (AES) dated September 29, 2009. “Re: Class III Cultural Resource Inventory of the Proposed Eagle Rock Enrichment Facility, Bonneville County, and Amendment.” ADAMS Accession No. ML092810293.

(Idaho SHPO, 2010a) Idaho State Historic Preservation Office. Letter from S. Pengilly (Idaho Deputy SHPO) to S. Lemont (NRC) dated May 3, 2010. “Re: AREVA Eagle Rock Enrichment Facility, Bonneville County, Idaho.” ADAMS Accession No. ML101330126.

(Idaho SHPO, 2010b) Idaho State Historic Preservation Office. Letter from S. Pengilly (Idaho Deputy SHPO) to J. Kay (AES) dated November 26, 2010. “Re: Geotechnical Borings at the Proposed Twin Buttes Substation within Cultural Resource Site 10BV246 (MW004), Eagle Rock Enrichment Facility, Bonneville County, Idaho.” ADAMS Accession No. ML110240061.

(IDEQ, 2005) Idaho Department of Environmental Quality. “State of Idaho Oversight Monitor: Idaho’s Treasure – the Eastern Snake River Plain Aquifer.” Idaho INL Oversight Program. Boise, Idaho. May.

(IDEQ, 2006) Idaho Department of Environmental Quality. “State of Idaho Oversight Monitor – East Snake River Plain Aquifer.” Published by the State of Idaho’s INL Oversight & Radiation Control Division. March.

(IDEQ, 2007) Idaho Department of Environmental Quality. “2006 Air Quality Monitoring Data Summary.” August. <http://www.deq.state.id.us/air/data_reports/publications.cfm> (Accessed April 9, 2010).

(IDEQ, 2008) Idaho Department of Environmental Quality. “2007 Air Quality Monitoring Data Summary.” October. <http://www.deq.state.id.us/air/data_reports/publications.cfm> (Accessed May 6, 2009).

(IDEQ, 2009) Idaho Department of Environmental Quality. “Climate Change and the Role of State Government in Reducing Greenhouse Gases.” <http://www.deq.idaho.gov/air/prog_issues/climate_change/ghg_state_government.cfm> (Accessed November 18, 2009).

(IDEQ, 2010) Idaho Department of Environmental Quality. “Hazardous Waste Management in Idaho: 2009.” February. http://www.deq.state.id.us/waste/data_reports/haz_waste/haz_waste_2009.pdf> (Accessed April 22, 2010).

(IDFG, 2005) Idaho Department of Fish and Game. “Idaho Comprehensive Wildlife Conservation Strategy.” Idaho Conservation Data Center. Boise, Idaho. <http://fishandgame.idaho.gov/cms/tech/CDC/cwcs.cfm> (Accessed November 16, 2009).

(IDFG, 2009) Idaho Department of Fish and Game. Letter from Sharon W. Kiefer (Assistant Director-Policy, Idaho Department of Fish and Game) to Andrea Kock (NRC).

(IDFG, 2010) Idaho Department of Fish and Game. Email from Sharon W. Kiefer (Assistant Director-Policy, Idaho Department of Fish and Game) to Stephen Lemont (NRC). ADAMS Accession No. ML101270044.

(IDWR, 2010) Idaho Department of Water Resources. “Water Management: Water Rights General Information.” <http://www.idwr.idaho.gov/WaterManagement/WaterRights/default.htm> (Accessed April 22, 2010).

(INL, 2010) Idaho National Laboratory. Personal communication from B. Angle (Idaho National Laboratory) to R. Van Lonkhuyzen (Argonne National Laboratory). March 10.

(IPCC, 2007) Intergovernmental Panel on Climate Change. "Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change." S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). Cambridge University Press, Cambridge, United Kingdom, and New York, New York. <http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm> (Accessed November 17, 2009).

(ISAC, 2006) Idaho Sage-Grouse Advisory Committee. "Conservation Plan for the Greater Sage-Grouse in Idaho." ADAMS Accession No. ML101800045.

(ITD, 2009) Idaho Transportation Department. "Facts & Figures 2009." <http://itd.idaho.gov/Publications/ITD_FactBook_2009.pdf> (Accessed June 30, 2009).

(ITD, 2010) Idaho Transportation Department. Personal communication from M. Davison (Idaho Transportation Department) to K. Fischer (Argonne National Laboratory) dated February 26.

(Johnson and Michelhaugh, 2003) Johnson, P.E., and R.D. Michelhaugh. "Transportation Routing Analysis Geographic Information System (TRAGIS) User's Manual." ORNL/NTRC-006 Rev. 0. Prepared by Oak Ridge National Laboratory, National Transportation Research Center, for U.S. Department of Energy. June. <https://tragis.ornl.gov/TRAGISmanual.pdf> (Accessed March 1, 2010).

(Kesner, 1992). "Recent Discovery of Secondary Mineral Deposits in an Idaho Lava Tube," in: *Proceedings for the Sixth International Symposium on Vulcanospeleology*. G. Thomas Rea (editor). Hilo, Hawaii. August, 1991.

(Kiel and McClain, 1995) Kiel, K., and K. McClain. "House Prices during Siting Decision Stages: The Case of an Incinerator from Rumor through Operation." *Journal of Environmental Economics and Management* 28:241–255.

(Kohlhase, 1991) Kohlhase, J. "The Impact of Toxic Waste Sites on Housing Values." *Journal of Urban Economics* 30:1–26.

(Landscape Dynamics Lab, 1999) Landscape Dynamics Lab. "Idaho Land Cover, Version 2.1." Idaho Cooperative Fish and Wildlife Research Unit. Moscow, ID. February 10. ADAMS Accession No. ML101800245.

(Leonard et al., 2000) Leonard, K.M., K.P. Reese, and J.W. Connelly. "Distribution, Movements, and Habitats of Sage Grouse *Centrocercus urophasianus* on the Upper Snake River Plain of Idaho: Changes from the 1950s to the 1990s." *Wildlife Biology* 6(4):265–270.

(LES, 2005) Louisiana Energy Services. "National Enrichment Facility Environment Report." Revision 4. NRC Docket No. 70-3103. April.

(Lundquist, 2010) Lundquist, L., "Studies Show Water Contaminated by INL Too Deep for Concern." Times-News Magicvalley.com. September 13. ADAMS Accession No. ML110270047.

(MDEQ, 2010) Montana Department of Environmental Quality. "Mountain States Transmission Intertie." <http://svc.mt.gov/deq/wmamsti/> (Accessed April 22, 2010).

(Monsen et al., 2004) Monsen, S.B., R. Stevens, and N.L. Shaw. "Restoring Western Ranges and Wildlands." General Technical Report RMRS-GTR-136. Rocky Mountain Research Station, U.S. Forest Service. Fort Collins, Colorado. September.

(MRI, 2006) Midwest Research Institute. "Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors." February 1, 2006. Finalized November 1. <http://www.epa.gov/ttnchie1/ap42/ch13/> (Accessed July 14, 2009).

(MWH, 2008a) MWH. "Sage Grouse Survey Report, Proposed Site for the Eagle Rock Enrichment Facility, Bonneville, Idaho." Revision 1. Prepared by MWH, Fort Collins, Colorado, for AREVA, Bethesda, Maryland. Attachment to the Environmental Report. December 8.

(MWH, 2008b) MWH. "Ecology Field Study Report, Proposed Site for the Eagle Rock Enrichment Facility, Bonneville, Idaho." Revision 1. Prepared by MWH, Fort Collins, Colorado, for AREVA, Bethesda, Maryland. Attachment to the Environmental Report. December 8.

(MWH, 2008c) MWH. "Ecology Field Study Report, Proposed Site for the Eagle Rock Enrichment Facility, Bonneville, Idaho, Fall 2008 Survey." Revision 1. Prepared by MWH, Fort Collins, Colorado, for AREVA, Bethesda, Maryland. Attachment to the Environmental Report. December 8.

(MWH, 2009) MWH. "Ecology Field Study Report, Proposed Site for the Eagle Rock Enrichment Facility, Bonneville, Idaho, Winter and Spring 2009 Surveys." Revision 1. Prepared by MWH, Fort Collins, Colorado, for AREVA, Bethesda, Maryland. Attachment to the Environmental Report. July 28.

(Nelson, 1979) Nelson, J. "Airport Noise, Location Rent and the Market for Residential Amenities." *Journal of Environmental Economics and Management* 6:357–369.

(Nero, 1979) Nero, A.V., Jr. "A Guidebook to Nuclear Reactors, Reactors, Fuel Cycles: The Issues of Nuclear Power." University of California Press, Berkeley and Los Angeles, California.

(Newman and Redente, 2001) Newman, G.J., and E.F. Redente. "Long-Term Plant Community Development as Influenced by Revegetation Techniques." *Journal of Range Management* 54(6):717–724.

(NextGenerationEarth, 2009) Earth Institute at Columbia University. "U.S. State Impacts to Climate Change." <http://www.nextgenerationearth.org/usstates/statelist/> (Accessed November 18, 2009).

(NIOSH, 1996) National Institute for Occupational Safety and Health. “Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs): Uranium.” <http://www.cdc.gov/niosh/idlh/uranium.html> (Accessed October 5, 2009).

(NIOSH, 2005) National Institute for Occupational Safety and Health. “NIOSH Pocket Guide to Chemical Hazards: Uranium.” <http://www.cdc.gov/niosh/npg/npgd0651.html> (Accessed October 5, 2009).

(North Wind, 2010) North Wind, Inc. “Sage Grouse Survey Report, Eagle Rock Enrichment Facility.” May 13.

(NorthWestern Energy, 2008) NorthWestern Energy. “Mountain States Transmission Intertie (MSTI).” Project brochure. <http://www.northwesternenergy.com/documents/msti/msti.pdf> (Accessed February 26, 2010).

(NPS, 2009) National Park Service. Letter from Rory Westberg (Acting Regional Director, Pacific West Region, National Park Service) to Andrea Kock (U.S. Nuclear Regulatory Commission) dated December 28. “Re: Application for License for Proposed Uranium Enrichment Facility North of Hell’s Half-Acre Lava Field National Landmark.” ADAMS Accession No. ML100070377.

(NPS, 2010) National Park Service. “Night Sky Quality Monitoring Report: Craters of the Moon NM, Idaho.” <http://www.nature.nps.gov/air/lightscapes/monitorData/crmo/iC20040911.cfm> (Accessed March 2, 2010).

(NRC, 1977) U.S. Nuclear Regulatory Commission. “Final Environmental Impact Statement on the Transportation of Radioactive Material by Air and Other Modes.” NUREG-0170. December.

(NRC, 1986) U.S. Nuclear Regulatory Commission. “Assessment of the Public Health Impact from the Accidental Release of UF_6 at the Sequoyah Fuels Corporation Facility at Gore, Oklahoma.” NUREG-1189, Vols. 1 & 2.

(NRC, 1990) U.S. Nuclear Regulatory Commission. “Control Room Habitability System Review Models.” NUREG/CR-5659. December.

(NRC, 1991) U.S. Nuclear Regulatory Commission. “Chemical Toxicity of Uranium Hexafluoride Compared to Acute Effects of Radiation.” NUREG-1391. February.

(NRC, 1994) U.S. Nuclear Regulatory Commission. “Final Environmental Impact Statement for the Construction and Operation of Claiborne Enrichment Center, Homer, Louisiana.” NUREG-1484. Office of Nuclear Material Safety and Safeguards, Washington, D.C.

(NRC, 1998) U.S. Nuclear Regulatory Commission. “Nuclear Fuel Cycle Facility Accident Analysis Handbook.” NUREG/CR-6410. March.

(NRC, 2003a) U.S. Nuclear Regulatory Commission. “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs, Final Report.” NUREG-1748. Office of Nuclear Material Safety and Safeguards, Washington, D.C. August.

(NRC, 2003b) U.S. Nuclear Regulatory Commission. “SECPOP2000: Sector Population Land Fraction and Economic Estimation Program.” NUREG/CR-6525, Rev. 1. Office of Nuclear Regulatory Research, Washington, D.C. August.

(NRC, 2003c) U.S. Nuclear Regulatory Commission. “Potentially Defective 1-Inch Valves for Uranium Hexafluoride Cylinders,” NRC Bulletin 2003-03, Office of Nuclear Material Safety and Safeguards, Washington, D.C. August.

(NRC, 2004) U.S. Nuclear Regulatory Commission. “Environmental Impact Statement for the Proposed Idaho Spent Fuel Facility at the Idaho National Engineering and Environmental Laboratory in Butte County, Idaho.” NUREG-1773. January. <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1773> (Accessed March 1, 2010).

(NRC, 2005) U.S. Nuclear Regulatory Commission. “Environmental Impact Statement on the Construction and Operation of a Mixed Oxide Fuel Fabrication Facility at the Savannah River Site, South Carolina.” Final Report. NUREG-1767, Vol. 1. January. <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1767> (Accessed March 1, 2010).

(NRC, 2006) U.S. Nuclear Regulatory Commission. “Environmental Impact Statement for the Proposed American Centrifuge Plant in Piketon, Ohio. NUREG-1834. Office of Nuclear Material Safety and Safeguards. Washington, D.C. April. <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1834/> (Accessed March 26, 2009).

(NRC, 2009a) U.S. Nuclear Regulatory Commission. “Final Interim Staff Guidance COL/ESP-ISG-004 on the Definition of Construction and on Limited Work Authorizations.” February 23. ADAMS Accession No. ML090430435.

(NRC, 2009b) U.S. Nuclear Regulatory Commission. “Trip Report for AREVA Eagle Rock Enrichment Facility Site Visit and Agency Meetings, June 2–4, 2009.” December 18. ADAMS Accession No. ML093440020.

(NRC, 2009c) U.S. Nuclear Regulatory Commission. “Notice of Receipt of Application for License; Notice of Consideration of Issuance of License; Notice of Hearing and Commission Order and Order Imposing Procedures for Access to Sensitive Unclassified Non-Safeguards Information and Safeguards Information for Contention Preparation; In the Matter of AREVA Enrichment Services, LLC (Eagle Rock Enrichment Facility),” *Federal Register*, Vol. 74, No. 145, pp. 38052–38062, July 30.

(NRC, 2010a) U.S. Nuclear Regulatory Commission. Letter from D. Dorman (U.S. Nuclear Regulatory Commission) to G. Harper (AREVA Enrichment Services, LLC) dated March 17, 2010. “Subject: Approval of AREVA Enrichment Services LLC Exemption Request Related to Requirements Governing Commencement of Construction (TAC L32730).”

(NRC, 2010b) U.S. Nuclear Regulatory Commission. Letter from A. Kock (U.S. Nuclear Regulatory Commission) to Chairman Cohy (Shoshone-Bannock Tribes) dated February 19, 2010. “Subject: Continuing Consultation under the National Historic Preservation Act Section 106 Process for the Proposed AREVA Eagle Rock Enrichment Facility.”

(NRC, 2010c) U.S. Nuclear Regulatory Commission. Letter from A. Kock (U.S. Nuclear Regulatory Commission) to Janet Gallimore (Idaho State Historical Society) dated February 19, 2010. “Subject: Continuing Consultation under the National Historic Preservation Act Section 106 Process for the Proposed AREVA Eagle Rock Enrichment Facility.”

(NRC, 2010d) U.S. Nuclear Regulatory Commission. Letter from M. Bartlett (U.S. Nuclear Regulatory Commission) to J.J. Miller (International Isotopes, Inc.) dated February 23, 2010. “Subject: License Application for International Isotopes Fluorine Products, Inc. Facility – Acceptance Review (TAC Nos. L32739 and L32740).” ADAMS Accession No. ML100480302.

(NRC, 2010e) U.S. Nuclear Regulatory Commission. Letter from Breeda Reilly (U.S. Nuclear Regulatory Commission) to Don Parker (AREVA Enrichment Services, LLC) dated March 10. “Subject: AREVA Enrichment Services Physical Protection Guidance (TAC NO. L32707).” ADAMS Accession No. ML100290352.

(NRC, 2010f) U.S. Nuclear Regulatory Commission. “Safety Evaluation Report for the Eagle Rock Enrichment Facility in Bonneville County, Idaho.” Docket No. 70-7015, AREVA Enrichment Services, LLC, NUREG-1951, Office of Nuclear Material Safety and Safeguards. September. ADAMS Accession No. ML102710296.

(NRCS, 2009) Natural Resources Conservation Service. “Custom Soil Resource Report for Bonneville County Area, Idaho.” U.S. Department of Agriculture Web Soil Survey. <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm> (Accessed May 16, 2009).

(Paine and Connors, 2009) Paine, K., and J. Connors. “Progress Report: Low Wind Speed Evaluation Study.” Paper 2009-A-406 AWMA. Paper presented at the 102nd Air and Waste Management Association Annual Meeting, Detroit. June 24.

(Paschke et al., 2005) Paschke, M.W., K. Topper, R.B. Brobst, and E.F. Redente. “Long-Term Effects of Biosolids on Revegetation of Disturbed Sagebrush Steppe in Northwestern Colorado.” *Restoration Ecology* 13(3):545–551.

(Pierson et al., 1999) Pierson, E.D., M.C. Wackenhut, J.S. Altenbach, P. Bradley, P. Call, D.L. Genter, C.E. Harris, B.L. Keller, B. Lengus, L. Lewis, B. Luce, K.W. Navo, J.M. Perkins, S. Smith, and L. Welch. “Species Conservation Assessment and Strategy for Townsend’s Big-eared Bat (*Corynorhinus townsendii townsendii* and *Corynorhinus townsendii pallescens*).” Idaho Conservation Effort, Idaho Fish and Game. Boise, Idaho.

(PNNL, 2007) Pacific Northwest National Laboratory. “GENII Version 2 Users Guide.” PNNL-14583, Rev. 2. March.

(Reynolds, 2010) Personal communication from W. Reynolds (U.S. Bureau of Land Management) to D. O’Rourke, B. Biwer, and R. Van Lonkhuyzen (Argonne National Laboratory) dated February 12. ADAMS Accession No. ML101800326.

(Ringhoff et al., 2008) Ringhoff, M., E.J. Stoner, C.C. Chambellan, and S. Mehls. "A Class III Cultural Resource Inventory of the Proposed Eagle Rock Enrichment Facility, Bonneville County, Idaho." Prepared by Western Cultural Resource Management, Inc. for AREVA Enrichment Services, LLC. November.

(Saricks and Tompkins, 1999) Saricks, C.L., and M.M. Tompkins. "State-Level Accident Rates of Surface Freight Transportation: A Reexamination." ANL/ESD/TM-150. Argonne National Laboratory, Center for Transportation Research. April. <http://www.doeal.gov/SWEIS/OtherDocuments/442%20ANL%20ESD%20TM-150%20state%20lvl%20accdnt%20rat.pdf> (Accessed March 1, 2010).

(Serr, 2009) E-mail from S. Serr (Bonneville County, Idaho) to B. Biwer (Argonne National Laboratory) dated July 8, 2009. "Subject: G-I Zone."

(Shoshone-Bannock, 2009) Comment submitted by W. Preacher (Director Shoshone-Bannock Department of Energy Program) and C. Cutler (Tribal DOE Environmental Specialist) to NRC dated June 19, 2009. "Subject: Notice of Intent and Opportunity to Provide Written Comments AREVA Enrichment Services LLC Eagle Rock Enrichment Idaho Falls, ID." ADAMS Accession No. ML091810022.

(Shumar et al., 2007) Shumar, M., et al. "Idaho 2002 Water Quality Status Integrated Report for Groundwater." State Technical Services Office of the Idaho Department of Environmental Quality. October 9 (partially updated in May 2007).

(S.M. Stoller Corporation, 2001) S.M. Stoller Corporation. "Idaho National Laboratory Environmental Surveillance, Education, and Research Program." <http://www.stoller-eser.com/index.htm> (Accessed October 5, 2009). ADAMS Accession No. ML101800424.

(Stoner et al., 2009) Stoner, E., T.J. Lennon, and C.C. Chambellon. "Archaeological Monitoring and Discovery Plan for the Eagle Rock Enrichment Facility, AREVA Enrichment Services, LLC, in Bonneville County, Idaho." Prepared by Western Cultural Resource Management, Inc. for AES. September 17.

(Stull and Stull, 1991) Stull, W., and J. Stull. "Capitalization of Local Income Taxes." *Journal of Urban Economics* 29:182–190.

(Thaler, 1978) Thaler, R. "A Note on the Value of Crime Control: Evidence from the Property Market." *Journal of Urban Economics* 5:137–145.

(URENCO, 2003) URENCO (Capenhurst) Limited. "Health, Safety and Environmental Report, 2003."

(URENCO, 2004) URENCO (Capenhurst) Limited. "Health, Safety and Environmental Report, 2004."

(URENCO, 2005) URENCO (Capenhurst) Limited. "Health, Safety and Environmental Report, 2005."

(URENCO, 2006) URENCO (Capenhurst) Limited. "Health, Safety and Environmental Report, 2006."

(URENCO, 2007) URENCO (Capenhurst) Limited. "Health, Safety and Environmental Report, 2007."

(U.S. Census Bureau, 2010) U.S. Census Bureau. "American Fact Finder. <http://factfinder.census.gov> (Accessed March 16, 2010).

(USDA, 2006) U.S. Department of Agriculture. "Fact Sheet – Conservation Reserve Enhancement Program, Idaho Eastern Snake Plain Aquifer." May. <http://www.fsa.usda.gov/Internet/FSA_File/crepid06.pdf> (Accessed May 7, 2010).

(USEC, 2004) United States Enrichment Corporation. "Investor Fact Sheet." Spring 2004. <http://media.corporate-ir.net/media_files/NYS/USU/presentations/Spring_2004.pdf> (Accessed July 19, 2004).

(USGS, 2009) U.S. Geological Survey. "Gap Analysis Program Northwest." <http://gap.uidaho.edu/index.php/gap-home/Northwest-GAP> (Accessed March 16, 2010).

(USGS, 2010) U.S. Geological Survey. "Estimated Use of Water in the United States – County Level Data for 2005." <http://water.usgs.gov/watuse/data/2005> (Accessed February 24, 2010). ADAMS Accession No. ML101830107.

(USSLWG, 2009) Upper Snake Sage-grouse Local Working Group. "Plan for Increasing Sage-grouse Populations." June.

(WCRM, 2010) Western Cultural Resources Management, Inc. Letter from J. Sigler (WCRM) to K. Reid (Idaho Deputy SHPO) dated November 17, 2010. "To Summarize Western Cultural Resource Management's Data Recovery Activities for the Eagle Rock Enrichment Facility Project Located in Bonneville County, Idaho." ADAMS Accession No. ML103280087.

(Weiner et al., 2008) Weiner, R.F., D.M. Osborn, D. Hinojosa, T.J. Heames, J. Penisten, and D. Orcutt. "RADCAT 2.3 User Guide." SAND2006-6315. Sandia National Laboratories. April. <https://radtran.sandia.gov/docs/RadCat2_3UserGuide_Rev1.pdf> (Accessed July 21, 2009).

(White and Thurow, 1985) White, C.M., and T.L. Thurow. "Reproduction of Ferruginous Hawks Exposed to Controlled Disturbance." *The Condor* 87:14–22.

(X5 Monte Carlo Team, 2003) X5 Monte Carlo Team. "MCNP – A General Monte Carlo N-Particle Transport Code, Version 5." LA-UR-0301987. April 24.

5 MITIGATION

This chapter identifies possible measures to mitigate potential environmental impacts from preconstruction and the proposed action, as required by Appendix A of Title 10, "Energy," Part 51, of the U.S*.* *Code of Federal Regulations* (CFR) (10 CFR Part 51). Under Council on Environmental Quality (CEQ) regulation 40 CFR 1500.2(f), Federal agencies shall, to the fullest extent possible, "use all practicable means consistent with the requirements of the *National Environmental Policy Act* and other essential considerations of national policy to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions on the quality of the human environment." The CEQ regulations define mitigation to include activities that (1) avoid the impact altogether by not taking a certain action or parts of an action; (2) minimize impacts by limiting the degree or magnitude of the action and its implementation; (3) repair, rehabilitate, or restore the affected environment; (4) reduce or eliminate impacts over time by preservation or maintenance operations during the life of the action; or (5) compensate for the impact by replacing or substituting resources or environments (40 CFR 1508.20). This definition has been used in identifying potential mitigation measures. As such, mitigation measures are those actions or processes (e.g., process controls and management plans) that would be implemented to control and minimize potential impacts associated with the proposed Eagle Rock Enrichment Facility (EREF).

AREVA Enrichment Services, LLC (AES) must comply with applicable laws and regulations, including obtaining all appropriate construction and operating permits. A complete discussion of applicable laws and regulations is included in Chapter 1 of this Environmental Impact Statement (EIS). The mitigation measures identified by AES (AES, 2010a), many of which are compliance related, are discussed in Section 5.1. Further, based on the potential impacts identified in Chapter 4 (Environmental Impacts) of this EIS, the U.S. Nuclear Regulatory Commission (NRC) staff has identified additional potential mitigation measures for impacts of the proposed EREF project. These measures are described in Section 5.2.

The mitigation measures identified in this chapter do not include environmental monitoring activities. Environmental monitoring activities are described in Chapter 6 of this EIS.

5.1 Mitigation Measures Identified by AES

Tables 5-1 and 5-2 summarize those mitigation measures that were identified in AES's Environmental Report (ER) for the proposed EREF (AES, 2010a) as applicable to the preconstruction/construction and operations phases, respectively. The information in Tables 5-1 and 5-2 is taken largely from the ER. These mitigation measures were identified by AES to reduce the potential environmental impacts of preconstruction and the proposed action. AES did not identify mitigation measures for socioeconomics or environmental justice for either construction or operations because the socioeconomic impacts of the proposed project are mostly positive and the proposed project will result in no disproportionately high impacts on low-income and minority populations (see Sections 4.2.12 and 4.2.13). Additional mitigation measures may be considered by AES as a result of AES's consultations and/or permitting activities with Federal, State, and local regulatory agencies other than the NRC.

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts

Impact Area	Activity	Mitigation Measures
Land Use	Land disturbance	Use the following best management practices (BMPs) to mitigate short-term increases in soil erosion and fugitive dust (additional discussion is provided below under Geology and Soils): • minimize the construction footprint to the extent practicable • limit site slopes to a horizontal-vertical ratio of four to one, or less • use a sedimentation detention basin • protect undisturbed areas with silt fencing and straw bales, as appropriate • use site stabilization practices such as placing crushed stone on disturbed soil in areas of concentrated runoff • water onsite construction roads at least twice daily, when needed, to control fugitive dust emissions • after construction is complete, stabilize the site with natural low-water consumption, low-maintenance landscaping, and pavement
Historic and Cultural Resources	Disturbance of prehistoric archaeological sites and sites eligible for listing on the *National Register of Historic Places*	Educate workers on the regulations governing cultural resources, stressing that unauthorized collecting is prohibited. Use onsite cultural resource monitors during construction activities. Implement procedures to address unexpected discoveries of human remains or previously unidentified archaeological materials during ground-disturbing activities and procedures for the evaluation and treatment of these resources. Cease construction activities in the area around any discovery of human remains or other item of archaeological significance and notify the State Historic Preservation Officer to make the determination of appropriate measures to identify, evaluate, and treat the discoveries. Treatment/mitigation plan for site MW004 (recommended eligible for inclusion in the *National Register of Historic Places*) to recover significant information on that site (professional excavation and data recovery have been conducted).

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Visual and Scenic Resources	Potential visual intrusions in the existing landscape character	Use accepted natural, low-water-consumption landscaping techniques to limit any potential visual impacts. Such techniques will incorporate, but not be limited to, the use of native landscape plantings and crushed stone pavements on difficult-to-reclaim areas. Use prompt revegetation or covering of bare areas with natural materials. Paint the proposed facility in colors that would blend with the surrounding vegetation to reduce the contrast between the proposed EREF plant and the surrounding landscape. Create earthen berms or other types of visual screens made of other natural material to help reduce the visibility of the proposed facility. Focus all perimeter lights to be downfacing to minimize light pollution.
Air Quality	Fugitive dust and point-source releases of criteria pollutants	Apply construction BMPs to minimize fugitive dust, including: • apply water twice daily (when needed) to unpaved onsite roads, excavation areas, and clearing and grading areas • use alternative dust palliatives (inorganic salts, asphaltic products, synthetic organics) • establish and enforce speed limits for onsite roads • suspend certain dust-producing activities during windy conditions • apply gravel to the unpaved surfaces of onsite haul roads as an interim measure before permanent pavements are installed • apply erosion mitigation methods in areas of disturbed soils • use water sprays at material drop and conveyor transfer points • limit the height and disturbance of material stockpiles • apply water to the surfaces of stockpiles • cover open-bodied trucks that transport materials that could be sources of airborne dust

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Air Quality (Cont.)		• promptly remove earthen materials deposited on paved roadways by wind, trucks, or earthmoving equipment • promptly stabilize or cover bare areas resulting from roadway or highway interchange construction Apply BMPs to the design and operation of onsite vehicle and equipment fueling activities to minimize the release to the atmosphere of nonmethane hydrocarbons and mitigate the potential impact of spills or accidental releases; including: • equip storage tanks with appropriate VOC controls, liquid level gauges, and overfill protection • provide training to fuel delivery drivers • post appropriate warning signs at the fuel dispensing facility • pave fuel unloading and dispensing areas and equip them with curbs to control small spills • ensure delivery contractors carry spill kits and are required to address minor spills during fuel deliveries Maintain all internal combustion engines and their pollution control devices in good working order.
Geology and Soil Resources	Soil disturbance	Use BMPs to reduce soil erosion (e.g., earth berms, dikes, and sediment fences). Promptly revegetate or cover bare areas with natural materials. Use water to control fugitive dust emissions. Use standard drilling and blasting techniques to minimize impact to bedrock, reducing the potential for over-excavation, thereby minimizing damage to the surrounding rock and protecting adjacent surfaces that are intended to remain intact. Place soil stockpiles generated in a manner to reduce erosion. Reuse onsite excavated materials whenever possible. Use a stormwater detention basin.

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Geology and Soil Resources (Cont.)		Follow the requirements of a Spill Prevention Control and Countermeasures (SPCC) Plan to reduce the potential impacts from chemical spills or releases around vehicle maintenance and fueling locations, storage tanks, and painting operations, and ensure prompt and appropriate cleanup. Follow appropriate waste management procedures to minimize the impacts on soils from solid waste and hazardous materials that would be generated during all phases. Where practicable, implement a recycling program for materials suitable for recycling.
Water Resources	Water quality	Employ BMPs to control the use of hazardous materials and fuels. Maintain construction equipment in good repair without visible leaks of oil, greases, or hydraulic fluids. Control and mitigate spills in conformance with the Spill Prevention Control and Countermeasure (SPCC) Plan. Ensure discharges to surface impoundments meet the standards for stormwater and treated domestic sanitary wastewater, and that no radiological discharges are made. Use BMPs to control stormwater runoff to prevent releases to nearby areas to the extent possible. Use BMPs for dust control associated with excavation and fill operations. Water conservation will be considered when deciding how often dust suppression sprays will be applied. Use silt fencing and/or sediment traps. Use only water (no detergents) for external vehicle washing. Place stone construction pads at entrance/exits where an unpaved construction access adjoins a State road. Arrange all temporary construction basins and permanent basins to provide for the prompt, systematic sampling of runoff in the event of any special needs. Control water quality impacts by compliance with the National Pollution Discharge Elimination System (NPDES) Construction General Permit requirements and by applying BMPs as detailed in the proposed site's Stormwater Pollution Prevention Plan (SWPPP).

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Water Resources (Cont.)		Implement a SPCC Plan for the proposed facility to identify potential spill substances, sources, and responsibilities. Berm or self-contain all aboveground gasoline and diesel storage tanks. Construct curbing, pits, or other barriers around tanks and components containing radioactive wastes. Handle any hazardous materials by approved methods and ship offsite to approved disposal sites. Handle sanitary wastes by portable systems until the Domestic Sanitary Sewage Treatment Plant is available for site use. Provide an adequate number of these portable systems. Require control of surface water runoff for activities covered by the NPDES Construction General Permit.
	Water use	Use low-water-consumption landscaping rather than conventional landscaping to reduce water usage. Implement conservation practices when spraying water for dust control.
Ecological Resources	Habitat and wildlife disturbance	Manage unused open areas (i.e., leave undisturbed), including areas of native grasses and shrubs, for the benefit of wildlife. Use native plant species (i.e., low-water-consuming plants) to revegetate disturbed areas, to enhance wildlife habitat. Fence the stormwater discharge basins to limit access by wildlife. Reduce vehicle speeds onsite. Use BMPs to minimize dust. Apply water at least twice daily, when needed, to control dust in construction areas, in addition to other fugitive dust prevention and control methods. Focus all lights downward.

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Ecological Resources (Cont.)		Improve the existing boundary fence to ensure pronghorn access to the remaining habitat on the proposed site. The fence would include a smooth top wire no more than 42 inches above the ground, adequate wire spacing to prevent wildlife entanglement, a smooth bottom wire approximately 16 to 18 inches above the ground, and durable markers to increase wire visibility (AEA, 2010b). Remove livestock to improve sagebrush habitat. Take the following measures during construction and decommissioning of the proposed EREF to protect migratory birds: • perform clearing or removal of habitat, such as sagebrush, including buffer zones, outside of the migratory bird breeding and nesting season • survey additional areas to be cleared for active nests during migratory bird breeding and nesting season • avoid activities in areas containing active nests of migratory birds • consult the U.S. Fish and Wildlife Service (FWS) to determine the appropriate actions regarding the taking of migratory birds, if needed Use no herbicides during construction. Repair and stabilize any eroded areas, and collect sediment in a stormwater detention basin. Follow BMPs for temporary and permanent erosion and runoff control methods (as identified under Land Use). Consider all recommendations of appropriate State and Federal agencies, including the Idaho Department of Fish and Game and the FWS.

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Noise	Exposure of workers and the public to noise	Restrict most of US 20 use after twilight through early morning hours to minimize noise impacts to the nearest residence. Restrict usage of heavy truck and earthmoving equipment after twilight through early morning hours during construction of the access roads and highway entrances, to minimize noise impacts on the Hell's Half Acre Wilderness Study Area. Perform construction or decommissioning activities with the potential for noise or vibration at residential areas that could have a negative impact on the quality of life, during the daytime hours (7:00 am–7:00 pm). If it is necessary to perform an activity that could result in excessive noise or vibration in a residential area after hours, notify the community in accordance with site procedures. Use engineered and administrative controls for equipment noise abatement, including the use of equipment and vehicle mufflers, acoustic baffles, shrouding, barriers, and noise blankets. Sequence construction or decommissioning activities to minimize the overall noise and vibration impact (e.g., establish the activities that can occur simultaneously or in succession). Use blast mats, if necessary. Create procedures for notifying State and local government agencies, residents, and businesses of construction or decommissioning activities that may produce high noise or vibration that could affect them. Post appropriate State highway signs warning of blasting. Create a Complaint Response Protocol for dealing with and responding to noise or vibration complaints, including entering the complaints into the proposed site's Corrective Action Program. Establish and enforce onsite speed limits.

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Transportation	Traffic volume	Use the following BMPs to reduce traffic volumes, minimize noise, and minimize wildlife mortality: • encourage carpooling to minimize traffic due to employee travel • stagger shift changes to reduce the peak traffic volume on US 20 • construct acceleration and deceleration lanes at the entrances to the proposed EREF site to improve traffic flow and safety on US 20 • maintain low speed limits onsite to reduce noise and minimize impacts to wildlife
	Deposition on roadways	Use the following measures to minimize the release of dirt and other matter onto US 20: • promptly remove earthen materials on paved roads carried onto the roadway by wind, trucks, or earthmoving equipment • promptly stabilize or cover bare earthen areas once roadway and highway entrance earthmoving activities are completed • build gravel pads at the proposed EREF's entry/exit points along US 20 in accordance with the Idaho Department of Environmental Quality (IDEQ) *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties, Volume 2, Erosion and Sediment Controls* (IDEQ, 2009) • apply periodic top dressing of clean stone to the gravel pads, as needed, to maintain the effectiveness of the stone voids • perform tire washing, as needed, on a stabilized stone (gravel) area that drains to a sediment trap • prior to entering US 20, inspect vehicles for cleanliness from dirt and other matter that could be released onto the highway • cover open-bodied trucks (e.g., install tarps over open beds) to prevent debris from falling off or blowing out of vehicles onto the highway

Table 5-1 Summary of Mitigation Measures Identified by AES for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Waste Management	Generation of industrial and hazardous wastes (air and liquid emissions in Air Quality and Water Resources above)	Develop a construction phase recycling program.

Source: AES, 2010a.

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts

Impact Area	Activity	Mitigation Measures
Visual and Scenic Resources	Potential visual intrusions in the character of the existing landscape	Use aesthetically pleasing screening measures such as berms and earthen barriers, natural stone, and other physical means to soften the impact of the buildings. Use neutral colors for structures. Limit lighting to that necessary to meet security requirements; focus lighting downward to reduce night lighting in the surrounding area.
Air Quality	Facility emissions of hazardous gases	Apply BMPs to the design and operation of onsite vehicle and equipment fueling activities to minimize the release to the atmosphere of nonmethane hydrocarbons and mitigate the potential impact of spills or accidental releases; including: • equip storage tanks with appropriate VOC controls, liquid level gauges, and overfill protection • provide training to fuel delivery drivers • post appropriate warning signs at the fuel dispensing facility • pave fuel unloading and dispensing areas and equip them with curbs to control small spills • ensure delivery contractors carry spill kits and are required to address minor spills during fuel deliveries Install the Separations Building Module (SBM) Safe-by-Design Gaseous Effluent Vent System (GEVS) and SBM Local Extraction GEVS, which are designed to collect and clean all potentially hazardous gases from the plant prior to release to the atmosphere. Provide instrumentation to detect and signal, via alarm, all nonroutine process conditions, including the presence of radionuclides or hydrogen fluoride (HF) in the exhaust stream that will trip the system to a safe condition in the event of effluent detection beyond routine operational limits.

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Air Quality (Cont.)		Install the Technical Services Building (TSB) GEVS, which is designed to collect and clean all potentially hazardous gases in the serviced areas from the TSB prior to release to the atmosphere. Provide instrumentation to detect and signal the Control Room, via alarm, regarding all nonroutine process conditions, including the presence of radionuclides or HF in the exhaust stream. Operators would then take appropriate actions to mitigate the release. Install the Centrifuge Test and Postmortem Facilities GEVSs, which are designed to collect and clean all potentially hazardous gases in the serviced areas from the Centrifuge Assembly Building prior to release to the atmosphere. Provide instrumentation to detect and signal the Control Room, via alarm, regarding all nonroutine process conditions, including the presence of radionuclides or HF in the exhaust stream. Operators would then take appropriate actions to mitigate the release. Design the TSB Contaminated Area heating, ventilating, and air conditioning (HVAC) system, the Ventilated Room HVAC System in the Blending, Sampling, and Preparation Building (BSPB), and the Centrifuge Test and Postmortem Facilities Exhaust Filtration System to collect and clean all potentially hazardous gases in the serviced areas prior to release to the atmosphere.
	Fugitive dust and equipment emissions	Apply gravel to the unpaved surface of the secondary access road. Impose speed limits on the unpaved secondary access road. Maintain air concentrations of criteria pollutants resulting from vehicle emissions and fugitive dust below the National Ambient Air Quality Standards.
Geology and Soil Resources	Soil disturbance	Follow the requirements of a Spill Prevention Control and Countermeasures (SPCC) Plan to reduce the potential impacts from chemical spills or releases around vehicle maintenance and fueling locations, storage tanks, and painting operations, and ensure prompt and appropriate cleanup. Follow appropriate waste management procedures to minimize the impacts on soils from solid waste and hazardous materials that would be generated. Where practicable, implement a recycling program for materials suitable for recycling.

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Water Resources	Water quality	Employ BMPs to control the use of hazardous materials and fuels. Control and mitigate spills in conformance with the SPCC Plan. Ensure discharges to surface impoundments meet the standards for stormwater and treated domestic sanitary wastewater, and that no radiological discharges are made. Use BMPs to control stormwater runoff to prevent releases to nearby areas to the extent possible. Use only water (no detergents) for external vehicle washing. Arrange all temporary construction basins and permanent basins to provide for the prompt, systematic sampling of runoff in the event of any special needs. Berm or self-contain all aboveground gasoline and diesel storage tanks. Construct curbing, pits, or other barriers around tanks and components containing radioactive wastes. Handle any hazardous materials by approved methods and ship offsite to approved disposal sites. Handle sanitary wastes by portable systems until the Domestic Sanitary Sewage Treatment Plant is available for site use. Provide an adequate number of these portable systems. Use evaporators in the Liquid Effluent Collection and Treatment System, thereby eliminating the need to discharge treated process water to an onsite basin.
	Water use	Use low-water-consumption landscaping rather than conventional landscaping to reduce water usage. Install low-flow toilets, sinks, and showers to reduce water usage. Implement localized floor washing using mops and self-contained cleaning machines rather than conventional washing with a hose to reduce water usage. Incorporate closed-loop cooling systems instead of cooling towers, thereby eliminating evaporative losses and cooling tower blowdown, resulting in reduced water usage.

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Ecological Resources	Habitat disturbance	Reduce vehicle speeds onsite. Focus all lights downward. Use herbicides in limited amounts during operations along access roads, industrial area, and security fence surrounding the proposed facility. Use herbicides according to government regulations and manufacturer's instructions to control noxious weeds. Reseed cropland areas on the proposed site with native species when the proposed EREF becomes operational. Consider all recommendations of appropriate State and Federal agencies, including the Idaho Department of Fish and Game and the FWS.
Noise	Exposure of workers and the public to noise	Mitigate operational noise sources primarily by plant design, whereby cooling systems, valves, transformers, pumps, generators, and other facility equipment are located mostly within plant structures and the buildings absorb the majority of the noise located within. Restrict most of US 20 use after twilight through early morning hours to minimize noise impacts to the nearest residence. Establish preventative maintenance programs that ensure all equipment is working at peak performance.
Transportation	Traffic volume	Encourage carpooling to minimize traffic due to employee travel. Stagger shift changes to reduce the peak traffic volume on US 20. Maintain low speed limits onsite to reduce noise and minimize impacts to wildlife.

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Public and Occupational Health	Nonradiological effects	Design process systems that handle uranium hexafluoride (UF_6) to operate at subatmospheric pressure, to minimize outward leakage of UF_6.
		Direct process off-gas from UF_6 purification and other operations through cold traps to solidify and reclaim as much UF_6 as possible. Pass remaining gases through high-efficiency filters and chemical absorbers to remove HF and uranic compounds.
		Monitor all UF_6 process systems by instrumentation that will activate alarms in the Control Room and will either automatically shut down the proposed facility to a safe condition or alert operators to take the appropriate action to prevent release in the event of operational problems.
		Investigate alternative solvents or apply control technologies for methylene chloride solvent use.
		Use administrative controls, practices, and procedures to assure compliance with the proposed EREF's Health, Safety, and Environmental Program. Design the program to ensure safe storage, use, and handling of chemicals to minimize the potential for worker exposure.
	Radiological effects	Put in place radiological practices and procedures to ensure compliance with the proposed EREF's Radiation Protection Program. Design the program to achieve and maintain radiological exposure to levels that are as low as reasonably achievable (ALARA).
		Conduct routine facility radiation and radiological surveys to characterize and minimize potential radiological dose/exposure.
		Monitor all radiation workers by use of dosimeters and area air sampling to ensure that radiological doses remain within regulatory limits and are ALARA.
		Provide radiation monitors in the gaseous effluent vents to detect and alarm and effect the automatic safe shutdown of process equipment in the event contaminants are detected in the system exhaust. Design systems to automatically shut down, switch trains, or rely on operator actions to mitigate the potential release.

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Public and Occupational Health (Cont.)		Design the proposed facility to delay and reduce UF_6 releases inside the buildings in a potential fire incident from reaching the outside environment, including automatic shutoff of room HVAC systems during a fire event. Design process systems that handle uranium hexafluoride (UF_6) to operate at subatmospheric pressure, to minimize outward leakage of UF_6. Move UF_6 cylinders only when cool and when UF_6 is in solid form, to minimize the risk of inadvertent release due to mishandling. Direct process off-gas from UF_6 purification and other operations through cold traps to solidify and reclaim as much UF_6 as possible. Pass remaining gases through high-efficiency filters and chemical absorbers to remove HF and uranic compounds. Separate uranic compounds and various other heavy metals in waste material generated by decontamination of equipment and systems. Use liquid and solid waste handling systems and techniques to control wastes and effluent concentrations. Pass gaseous effluent through pre-filters, high-efficiency particulate air (HEPA) filters and activated carbon filters to reduce the radioactivity in the final discharged effluent to very low concentrations. Route process liquid waste to collection tanks and treat through a combination of precipitation, evaporation, and ion exchange to remove most of the radioactive material prior to a final evaporation step to preclude any liquid effluent release from the proposed facility. Monitor all UF_6 process systems by instrumentation that will activate alarms in the Control Room and will either automatically shut down the proposed facility to a safe condition or alert operators to take the appropriate action to prevent release in the event of operational problems.

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Waste Management	Generation of industrial, hazardous, radiological, and mixed wastes (air emissions are addressed under Air Quality and liquid emissions are addressed under Water Resources)	Design system features to minimize the generation of solid waste, liquid waste, and gaseous effluent (gaseous effluent design features are described above under Public and Occupational Health). Store waste in designated areas of the proposed facility until an administrative limit is reached, then ship offsite to a licensed disposal facility; no disposal of waste onsite. Dispose of all radioactive and mixed wastes at offsite licensed facilities. Maintain a cylinder management program to monitor storage conditions on the Full Tails Cylinder Storage Pads, to monitor cylinder integrity by conducting routine inspections for breaches and to perform cylinder maintenance and repairs as needed. Store all tails cylinders filled with depleted UF_6 on saddles of concrete, or other suitable material, that do not cause corrosion of the cylinders. Place saddles on a concrete pad. Segregate the storage pad areas from the rest of the proposed enrichment facility by barriers, such as vehicle guard rails. Double stack depleted uranium tails cylinders on the storage pad, arrayed to permit easy visual inspection of all cylinders. Survey depleted uranium tails cylinders for external contamination (wipe test) prior to being placed on a Full Tails Cylinder Storage Pad or transported offsite. Fit depleted uranium tails cylinder valves with valve guards to protect the cylinder valves during transfer and storage. Make provisions to ensure that depleted uranium tails cylinders will not have defective valves (identified in NRC Bulletin 2003-03, "Potentially Defective 1-inch Valves for Uranium Hexafluoride Cylinders") (NRC, 2003) installed. Perform touch-up application of paint coating on depleted uranium tails cylinders if coating damage is discovered during inspection (UF_6 cylinder manufacturing will include abrasive blasting and coating with anticorrosion primer/paint, as required by specification).

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Waste Management (Cont.)		Allow only designated vehicles, operated by trained and qualified personnel, on the Full Tails Cylinder Storage Pads, Full Feed Cylinder Storage Pads, Full Product Cylinder Storage Pad, and the Empty Cylinder Storage Pad (refer to the Integrated Safety Analysis Summary, Section 3.8, for controls associated with vehicle fires on or near the Cylinder Storage Pads. Inspect depleted uranium tails cylinders for damage prior to placing a filled cylinder on a storage pad. Annually reinspect depleted uranium tails cylinders for damage or surface coating defects. These inspections will verify that: • lifting points are free from distortion and cracking • cylinder skirts and stiffener rings are free from distortion and cracking • cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion • cylinder valves are fitted with the correct protector and cap • cylinders are inspected to confirm that the valve is straight and not distorted, two to six threads are visible, and the square head of the valve stem is undamaged • cylinder plugs are undamaged and not leaking If inspection of a depleted uranium tails cylinder reveals significant deterioration or other conditions that may affect the safe use of the cylinder, transfer the contents of the affected cylinder to another cylinder in good condition and discard the defective cylinder. Determine the root cause of any significant deterioration and, if necessary, make additional inspections of cylinders. Make available onsite proper documentation on the status of each depleted uranium tails cylinder, including content and inspection dates. Use the lined Cylinder Storage Pads Stormwater Retention Basins to capture stormwater runoff from the Full Tails Cylinder Storage Pads. Minimize power usage by efficient design of lighting systems, selection of high-efficiency motors, and use of proper insulation materials.

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Waste Management (Cont.)		Control process effluents by means of the following liquid and solid waste handling systems and techniques: • follow careful application of basic principles for waste handling in all of the systems and processes • collect different waste types in separate containers to minimize contamination of one waste type with another; carefully package materials that can cause airborne contamination; provide ventilation and filtration of the air in the area as necessary; confine liquid wastes to piping, tanks, and other containers; use curbing, pits, and sumps to collect and contain leaks and spills • store hazardous wastes in designated areas in carefully labeled containers; also contain and store mixed wastes separately • neutralize strong acids and caustics before they enter an effluent stream • decontaminate and/or reuse radioactively contaminated wastes to reduce waste volume as far as possible • reduce the volume of collected waste such as trash, compressible dry waste, scrap metals, and other candidate wastes at a centralized waste processing facility • include administrative procedures and practices in waste management systems that provide for the collection, temporary storage, processing, and disposal of categorized solid waste in accordance with regulatory requirements • design handling and treatment processes to limit wastes and effluent. Perform sampling and monitoring to assure that plant administrative and regulatory limits will not be exceeded • monitor gaseous effluent for HF and radioactive contamination before release • sample and/or monitor liquid wastes in liquid waste treatment systems • sample and/or monitor solid wastes prior to offsite treatment and disposal

Table 5-2 Summary of Mitigation Measures Identified by AES for Operations Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Waste Management (Cont.)		• return process system samples to their source, where feasible, to minimize input to waste streams Implement a spill control program for accidental oil spills. Prepare a Spill Prevention Control and Countermeasure (SPCC) Plan prior to the start of operation of the proposed facility or prior to the storage of oil on the proposed site in excess of *de minimis* quantities, which will contain the following information: • identification of potential significant sources of spills and a prediction of the direction and quantity of flow that will likely result from a spill from each source • identification of the use of containment or diversionary structures such as dikes, berms, culverts, booms, sumps, and diversion ponds, at the proposed facility to control discharged oil • procedures for inspection of potential sources of spills and spill containment/diversion structures • assigned responsibilities for implementing the plan, inspections, and reporting • as part of the SPCC Plan, other measures will include control of drainage of rain water from diked areas, containment of oil and diesel fuel in bulk storage tanks, aboveground tank integrity testing, and oil and diesel fuel transfer operational safeguards Implement a nonhazardous materials waste recycling plan during operation. Perform a waste assessment to identify waste reduction opportunities and to determine which materials will be recycled. Contact brokers and haulers to find an end-market for the materials. Perform employee training on the recycling program so that employees will know which materials are to be recycled. Purchase and clearly label recycling bins and containers. Periodically evaluate the recycling program (i.e., waste management expenses and savings, recycling and disposal quantities) and report the results to the employees.

Source: AES, 2010a.

5.2 Potential Mitigation Measures Identified by the NRC

This section presents additional potential mitigation measures that were identified by the NRC staff, following their evaluation of the potential environmental impacts of the proposed EREF in Chapter 4. Tables 5-3 and 5-4 list the NRC-identified mitigation measures for preconstruction/construction and operations, respectively.

5.3 References

(AES, 2010a) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Environmental Report, Rev. 2." Bethesda, Maryland. April.

(AES, 2010b) AREVA Enrichment Services, LLC. Letter from J.A. Kay (Licensing Manager, AES) to Sharon W. Kiefer (Assistant Director-Policy, IDFG) dated December 7, 2010. "Subject: Response to IDFG Comments to NRC Related to the EREF Transmission Line." ADAMS Accession No. ML103420579.

(IDEQ, 2009) Idaho Department of Environmental Quality. "Catalog of Stormwater Best Management Practices for Idaho Cities and Counties, Volume 2: Erosion and Sediment Controls."

(NRC, 2003) U.S. Nuclear Regulatory Commission. "Potentially Defective 1-Inch Valves for Uranium Hexafluoride Cylinders." NRC Bulletin 2003-03. August.

Table 5-3 Summary of Potential Mitigation Measures Identified by NRC for Preconstruction and Construction Environmental Impacts

Impact Area	Activity	Mitigation Measures
Air Quality	Point source releases of criteria pollutants	Ensure vehicles and equipment with internal combustion engines are properly tuned and pollution control devices are functional. Install hard-surface pavements, curbs, scupper drains, and drainage ways at fuel dispensing island that will channel spilled fuels to fire-safe containment sumps; require delivery drivers to remain in attendance throughout all fuel deliveries; place spill containment/response equipment at fuel dispensing stations. Provide first responder training to selected workers; ensure storage tanks are equipped with fully functional overflow and vapor control features. Install emergency shut-offs for fuel dispensing pumps; post spill response directives at the fuel dispensing islands; provide spill cleanup materials at the fuel dispensing islands for cleanup of small spills; ensure the fuel dispensing islands have adequate lighting. Adopt a policy that requires prompt cleanup of all spilled materials. Identify and select construction-related products and chemicals that are free of volatile solvents. Suspend high fugitive dust-generating activities during early morning hours with calm winds and during windy periods.
Geology and Soil	Soil disturbance	Minimize the construction footprint to the extent possible. Cover stockpiles to reduce exposure to wind and rain. Limit routine vehicle traffic to paved or gravel roads.
Water Resources	Stormwater management	Reduce the size of impervious surfaces (parking lots, roads, and roofs) to the extent possible; implement a “fix-it-first” infrastructure policy to set spending priorities on the repair of existing infrastructure over the installation of new infrastructure; and employ low-impact development strategies and practices during construction activities.

Table 5-3 Summary of Potential Mitigation Measures Identified by NRC for Preconstruction and Construction Environmental Impacts (Cont.)

Impact Area	Activity	Mitigation Measures
Ecological Resources	Habitat disturbance	Plant disturbed areas and irrigated crop areas with native sagebrush steppe species to establish native communities and prevent the establishment of noxious weeds. Plant immediately following the completion of disturbance activities and the abandonment of crop areas. Develop and implement a noxious weed control program to prevent the establishment and spread of invasive plant species. Hose down tires and undercarriage of off-road vehicles prior to site access to dislodge seeds or other propagules of noxious weeds. Monitor for noxious weeds throughout the construction and operations phases and immediately eradicate new infestations. Minimize indirect impacts of weed control activities, such as herbicide effects on nontarget species, and soil disturbance and fire hazards from vehicle operation in undisturbed areas during weed control activities.
Noise	Exposure of workers and the public to noise	Suspend the use of explosives during periods when meteorological conditions (e.g., low cloud cover) can be expected to reduce sound attenuation.

Table 5-4 Summary of Potential Mitigation Measures Identified by NRC for Operations Environmental Impacts

Impact Area	Activity	Mitigation Measures
Water Resources	Stormwater management	Reduce the size of impervious surfaces (parking lots, roads, and roofs) to the extent possible. Implement a "fix-it-first" infrastructure policy to set spending priorities on the repair of existing infrastructure over the installation of new infrastructure. Employ low-impact development strategies and practices during operations.
Ecological Resources	Wildlife protection	Develop areas that will retain water of suitable quality for wildlife and provide wildlife access to such areas with suitable water quality. For basins with water quality unsuitable for wildlife, use animal-friendly fencing and netting or other suitable material over basins to prevent use by migratory birds. Place metal reflectors on the top wire of the fence along the AES property boundary, to reduce sage-grouse mortality resulting from collisions with the fence. Coordinate with Idaho National Laboratory in monitoring risks to sage-grouse and other sensitive species and identifying measures to reduce risks and protect these species and their habitat, particularly sagebrush steppe. Coordinate with Idaho Department of Fish and Game to determine corrective action or mitigation for the offsite public lands lost to wildlife due to project effects.
Transportation	Traffic volume	Consider working with INL to operate a joint bus system. Establish shift changes outside of INL peak commuting periods.
Public and Occupational Health	Radiological effects	Store "empty" cylinders with heels in the middle of a storage pad between full tail cylinders to reduce external exposure to workers.

6 ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

This chapter describes the proposed measurement and monitoring programs that would be used by AREVA Enrichment Services, LLC (AES) to characterize the effects on human health and the environment of radiological and nonradiological releases from the proposed Eagle Rock Enrichment Facility (EREF) in Bonneville County, Idaho. This proposed program includes direct monitoring of radiological and physiochemical (i.e., chemical and meteorological properties that affect measurements) gaseous and liquid effluents from facility operations, and monitoring and measurement of ambient air, surface water, groundwater, stormwater, soil, sediment, and direct radiation in the vicinity of the proposed EREF during preconstruction, construction, and operation.

6.1 Radiological Measurements and Monitoring Program

The U.S. Nuclear Regulatory Commission (NRC) requires that a radiological monitoring program be established for the proposed EREF to monitor and report the release of radiological gaseous and liquid effluents to the environment. These requirements are specified in Title 10, "Energy," of the U.S. *Code of Federal Regulations* (10 CFR) Part 20, Appendix B, and10 CFR 70.59. Table 6-1 lists the NRC guidance documents that apply to the radiological monitoring program. The NRC staff has reviewed engineering designs and proposed operational procedures submitted by AES in order to identify the locations and activities associated with potential emissions and effluents with radiologic character, and has verified that the pathways for these releases to the environment are appropriately represented in the proposed radiological monitoring program. Those pathways for environmental release are summarized below.

Radiological monitoring at the proposed EREF would be addressed through the Effluent Monitoring Program (EMP) and the Radiological Environmental Monitoring Program (REMP). The EMP addresses the monitoring, recording, and reporting of data for radiological contaminants emitted from specific points. Physical samples collected for analysis in this program would include exhaust vent air sampler filters, filters from mobile air monitors, and liquid condensate from the evaporator exhaust vent. Corrective actions would be implemented if action levels are exceeded. The REMP addresses the monitoring of general environmental media (i.e., soil, sediment, groundwater, biota, and ambient air) within and outside the proposed EREF property boundary. The REMP will be initiated at least two years prior to the start of plant operations in order to develop a baseline (AES, 2010a). In addition, the REMP may be enhanced as necessary to maintain the collection and reliability of environmental data based on changes to regulatory requirements or facility operations (AES, 2010a). Every six months, AES will submit a summary report of the environmental sampling program at the proposed EREF to the NRC (AES, 2010a). Monitoring locations are shown in Figure 6-1. Data collected under this program would be used to assess radiological impacts on the environment and estimate potential impacts on the public. The REMP would be used to confirm the effectiveness of the effluent controls and the EMP and to verify that facility operations do not result in detrimental radiological impacts on the environment.

As discussed in the following sections, radiological measurement and monitoring would include monitoring of air emissions, ambient air quality, wastewater discharge, stormwater and basin sediment, groundwater, and soil and vegetation, along with direct gamma radiation monitoring.

Table 6-1 NRC Guidance Documents Relevant to Radiological Monitoring Programs

Guidance	Purpose and Content
Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment"[a]	Provides acceptable methods for designing a program to ensure the quality of the results of measurements for radioactive materials in the effluents and the environment outside of nuclear facilities during normal operations.
Regulatory Guide 4.16, "Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants"[b]	Provides descriptions of acceptable methods for submitting semiannual reports that specify the quantity of each principal radionuclide released to unrestricted areas to estimate the maximum potential annual doses to the public resulting from such releases.

[a] NRC, 1979.
[b] NRC, 1985.

6.1.1 Air Emissions Monitoring

The Air Emissions Monitoring Program would monitor each individual point source or pathway of potential radioactive airborne release to the atmosphere from the proposed EREF. Radioactive airborne releases of gaseous effluents could result from the following events or activities:

- controlled releases of gaseous effluents from ventilation stacks
- controlled gaseous releases from the uranium enrichment equipment during decontamination and maintenance of equipment
- handling, temporary storage, and transportation of uranium hexafluoride (UF_6) feed cylinders, product cylinders, and depleted uranium cylinders

Monitoring for radioactive air emissions from the proposed EREF is conducted as part of the EMP, which would monitor, report, and record data on radiological contaminants released to the atmosphere from specific point sources. Gaseous effluents from the proposed EREF that have the potential for airborne radioactivity would be discharged from the sources listed below, and monitoring and sampling at these locations would be conducted in accordance with NRC Regulatory Guide 4.16 (NRC, 1985). These sources would all lie within the industrial footprint of the proposed EREF; however, the precise locations of these effluent points have been withheld as security-related information. Table 6-2 provides a summary of the EMP for gaseous discharges (AES, 2010a). Additional details on the exhaust vents enrolled in the monitoring program are provided below.

- **Separations Building GEVSs.** Each of the four Separations Building Modules (SBMs) would have exhaust vents on its roof. Each vent would be continuously monitored for alpha radiation and hydrogen fluoride (HF).[1] In addition, samples would undergo uranium isotopic

[1] In the strict sense, HF is not released as a result of EREF operations. Instead, trace amounts of UF_6 could be released from the pollution control devices installed on building and processing area ventilation systems. The UF_6 would be immediately hydrolyzed by the humidity in the ambient air, resulting in the formation of HF.

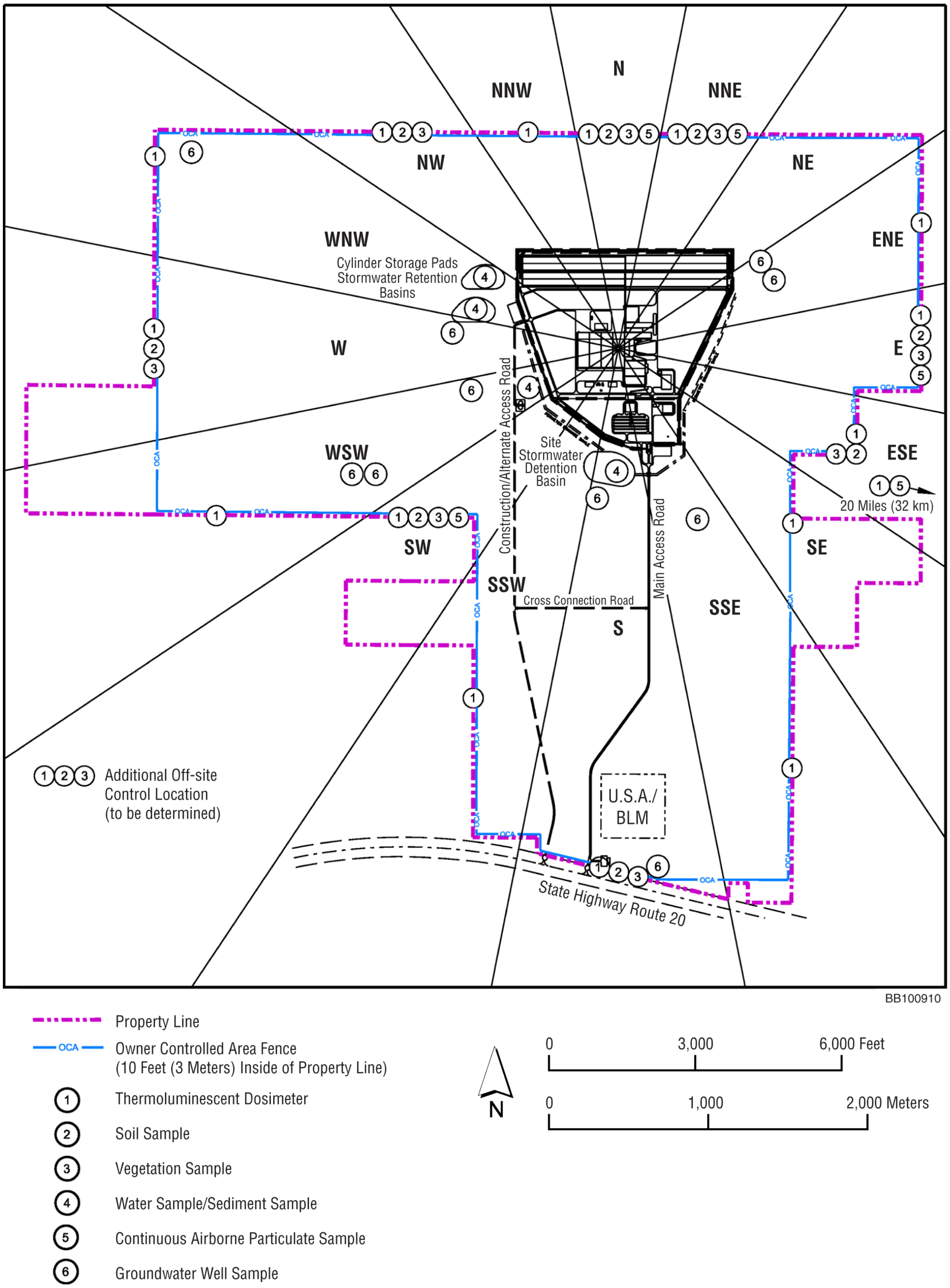

Figure 6-1 Proposed Radiological Sampling Stations and Monitoring Locations (AES, 2010a)

Table 6-2 EREF Proposed Gaseous Effluent Monitoring Program

Sample Location	Sample Type	Analysis/ Frequency
• Separation Building GEVS exhaust vents • TSB GEVS exhaust vent • TSB Contaminated Area HVAC System exhaust vent • Centrifuge Test and Postmortem Facilities GEVS exhaust vent[a] • Centrifuge Test and Postmortem Facilities exhaust filtration system exhaust vent[a] • Ventilated Room HVAC System exhaust vent	Continuous air monitoring for particulates	Gross alpha/beta weekly; isotopic analysis on quarterly composite sample[b]
Evaporator	Continuous liquid condensate from exhaust vent	Gross alpha/beta weekly; isotopic analysis on quarterly composite sample[b]
Process areas[c]	Local area continuous air particulate filter[d]	Gross alpha/beta weekly; isotopic analysis on quarterly composite sample[b]
Nonprocess areas[c]	Local area continuous air particulate filter[d]	Gross alpha/beta on quarterly composite sample[b]

[a] Continuous sampling protocols are in effect only when this proposed facility is operational.
[b] Isotopic analyses for uranium isotopes (^{238}U, ^{236}U, ^{235}U, and ^{234}U) would commence whenever gross alpha and gross beta activities indicate that an individual radionuclide could be present in a concentration >10 percent of the specified concentrations in Table 2 of Appendix B to 10 CFR Part 20.
[c] Process areas include any area or facility at which UF_6 transfers between feed, product, or tails cylinders occur, including areas where cylinders containing UF_6 are opened for testing, inspection, or sampling. A nonprocess area is any area or facility where uranic material is present in an open form.
[d] Mobile devices may be used to collect the necessary samples.
Source: AES, 2010a.

analysis quarterly or if the gross alpha and gross beta activities indicate that an individual radionuclide could be present in a concentration greater than 10 percent of the concentrations specified in Table 2, Appendix B, of 10 CFR Part 20.

- **Technical Services Building GEVS.** This system would discharge to a vent on the Technical Support Building (TSB) roof. The vent would be continuously monitored for alpha radiation and HF. In addition, samples would undergo uranium isotopic analysis quarterly or if the gross alpha and gross beta activities indicate that an individual radionuclide could be present in a concentration greater than 10 percent of the concentrations specified in Table 2, Appendix B, of 10 CFR Part 20.

- **Centrifuge Test and Postmortem Facilities GEVS.** This system would discharge through an exhaust vent on the roof of the Centrifuge Assembly Building (CAB). The Centrifuge

Test and Postmortem Facilities GEVS vent-sampling system would provide for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust vent. The exhaust vent would be continuously monitored for alpha radiation and HF. In addition, samples would undergo uranium isotopic analysis quarterly or if the gross alpha and gross beta activities indicate that an individual radionuclide could be present in a concentration greater than 10 percent of the concentrations specified in Table 2 of Appendix B to 10 CFR Part 20.

- **Centrifuge Test and Postmortem Facilities Exhaust Filtration System.** When operational, this system would maintain a negative pressure with the Centrifuge Test and Postmortem Facilities, thus reducing the potential for radiologic contamination of adjacent areas. The system would discharge through an exhaust vent on the roof of the CAB. Sampling of this vent for alpha radiation and HF would occur only when the Centrifuge Test Facility or the Centrifuge Postmortem Facility are in operation.

- **TSB Contaminated Area HVAC System.** This vent would be continuously monitored for alpha radiation and HF. In addition, samples would undergo uranium isotopic analysis quarterly or if the gross alpha and gross beta activities indicate that an individual radionuclide could be present in a concentration greater than 10 percent of the concentrations specified in Table 2, Appendix B, of 10 CFR Part 20.

- **BSPB Ventilated Room HVAC System.** The vent would be continuously monitored for alpha radiation and HF. In addition, samples would undergo uranium isotopic analysis quarterly or if the gross alpha and gross beta activities indicate that an individual radionuclide could be present in a concentration greater than 10 percent of the concentrations specified in Table 2, Appendix B, of 10 CFR Part 20.

In addition to the specific exhaust vents described above, all HVAC systems serving process areas where radioactive airborne contamination is possible would be designed to allow access for periodic sampling of exhaust air in accordance with NRC Regulatory Guide 4.16 (NRC, 1985). Periodic sampling would also occur in nonprocess areas, and may include the use of mobile continuous air monitors (see Table 6-2).

Sample analysis would employ methodologies with minimum detectable concentrations (MDC) of 1.8×10^{-9} becquerel per milliliter (5.0×10^{-14} microcurie per milliliter), a value representing 5 percent of the limit of 1.0×10^{-12} microcurie per milliliter set by the NRC in 10 CFR Part 20, Appendix B, Table 2, "Effluent Concentrations (retention Class W)."

In addition, a separate vent on the TSB roof would be designed to allow for the capture and sampling of air and condensate from saturated air delivered to the TSB vent from the evaporator of the Liquid Effluent Collection and Treatment System. Periodic sampling of both the discharge air and condensate for isotopic uranium would take place. The evaporator condensate samples would be analyzed to a MDC equivalent to 5 percent or less of the 10 CFR Part 20, Appendix B, Table 2, Column 1 (Air), value for retention Class W.

In addition to the pollution control devices affixed to each point source of potential radiological effluent release, administrative action levels would be established for effluent samples and monitoring instrumentation as an additional element of the effluent control procedure. All action levels would be established sufficiently low so as to permit implementation of corrective actions before regulatory limits are exceeded. Effluent sample analytical results that exceed the action levels would precipitate an investigation into the source of elevated radioactivity. For example, radiological analyses would be performed more frequently on ventilation air filters if there were a significant increase in gross radioactivity or when a process change or other circumstances cause significant changes in radioactivity concentrations. Additional corrective actions would be implemented based on the level, automatic shutdown programming, and operating procedures that would be developed in the detailed alarm design phase. Under routine operating conditions, controls and interventions would ensure that radioactive material in gaseous effluents discharged from the proposed facility would comply with regulatory release criteria at all times.

Compliance with regulatory release criteria would be demonstrated through effluent and environmental sampling data. Meteorological data from an onsite station would be continuously collected and used to assess the impacts of accidental releases.

As part of the proposed EREF EMP, the gaseous effluent sampling program supports the determination of the quantity and concentration of radionuclides discharged from the proposed facility as well as the collection of other information required to be reported to the NRC or to demonstrate compliance with State and Federal regulations and permits. All potentially radioactive effluents from the proposed EREF would be discharged through monitored pathways. All effluent monitoring instruments would be capable of attaining a minimum detectable concentration (MDC) of at least 1.8×10^{-9} becquerel per milliliter (5.0×10^{-14} microcurie per milliliter) and would be subject to periodic maintenance and calibration, functional tests to verify operability, and appropriate quality controls.

Uranium compounds expected in the gaseous effluent could include depleted hexavalent uranium, triuranium octaoxide (U_3O_8), and uranyl fluoride (UO_2F_2), and the uranium isotopes uranium-238 (^{238}U), uranium-236 (^{236}U), uranium-235 (^{235}U), and uranium-234 (^{234}U) would be expected to be the prominent radionuclides. Representative samples would be collected from each release point identified above. Effluent data would be maintained, reviewed, and assessed by the EREF Radiation Protection Manager to ensure that gaseous effluent discharges comply with regulatory release criteria for uranium.

6.1.2 Ambient Air Quality Monitoring

While the EMP's Air Emissions Monitoring Program described above (Section 6.1.1) monitors each individual point source or pathway of potential radioactive airborne release to the atmosphere from the proposed EREF, the REMP's Ambient Air Quality Monitoring Program monitors general air quality within and beyond the proposed EREF property boundary, collecting data at various locations around and outside the property.

Continuous monitoring for airborne radioactive particulate would be conducted at five locations – two along the north property boundary of the proposed EREF; one along the south boundary at a point closest to the industrial area; one on the east property boundary in the direction of the closest residence, approximately 8 kilometers (5 miles) away (Figure 6-1); and one located 32 kilometers (20 miles) to the east in Idaho Falls. These sampling locations have been selected in accordance with the NUREG-1302, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors" (NRC, 1991) and are based on consideration of the locations of effluent point sources within the proposed EREF industrial area, meteorological data (the most prevalent wind directions experienced at the proposed site), and current and projected surrounding land uses. In addition, because particulate releases can be expected to behave primarily as ground-level plumes with particulate concentrations diminishing rapidly and uniformly with distance from the source, and because radioactive emissions during routine operations are expected to be very low, sampling at the proposed property boundaries, rather than at locations more distant from the sources, is expected to represent worst-case conditions and the best opportunity to detect released radioactivity.

Particulate monitoring is an element of the proposed EREF REMP and is designed to collect representative samples that yield data that demonstrate the effectiveness of effluent controls and the EMP. Samples would be retrieved biweekly; however, periods of heavy concentrations of airborne dust may require more frequent sample retrieval. All samples collected from the particulate monitors would be analyzed in the onsite laboratory; however, for quality control purposes and as a contingency, samples may sometimes be shipped to an independent offsite laboratory for analysis.

Sample analysis for gross alpha would employ methodologies with MDC of 1.8×10^{-9} becquerel per milliliter (5.0×10^{-14} microcuries per milliliter), a value representing 5 percent of the limit of 1.0×10^{-12} microcurie per milliliter set by the NRC in 10 CFR Part 20, Appendix B, Table 2, "Effluent Concentrations (retention Class W)." Quality controls on sample recovery, handling, and analysis would be sufficient to validate results in accordance with Regulatory Guide 4.15 (NRC, 1979).

6.1.3 Wastewater Discharge Monitoring

The proposed EREF design includes liquid waste processing to remove uranic material from the waste stream by precipitation, filtration, and evaporation. There would be no direct discharge of process liquid waste effluents onsite or offsite. Therefore, no sampling of liquid process waste effluents, beyond that described in Table 6-3, is planned. Potentially contaminated liquid wastes would be processed via the facility's Liquid Effluent Collection and Treatment System. Uranic material would be removed from liquid waste effluents through two stages of precipitation and filtration. Liquid waste effluents would be sampled on an as-needed basis for isotopic analysis before being discharged to the Liquid Effluent Treatment System Evaporator. The final process stage of evaporation would release the resulting distillate steam directly to the atmosphere without condensing vapor out of the air stream. Since multiple stages of precipitation, filtration, and evaporation would be used to treat liquid effluents, no significant releases of uranic material to the environment would be expected. However, liquid condensate in the treatment system evaporator exhaust vent would be sampled periodically as part of the proposed site's radiological monitoring program to confirm that no uranic releases have occurred (Table 6-3). The composition of the sediment layer of the Liquid Effluent Treatment System Evaporator would also be characterized periodically by isotopic analysis. This data would be evaluated along with nearby air monitoring data to identify any potential resuspension of particles in the air (AES, 2010a).

The Domestic Sanitary Sewage Treatment Plant would receive only domestic sanitary wastes. No plant process-related effluents would be introduced and no releases of uranic material to the environment would be expected. However, sampling of liquid sanitary waste effluents for

Table 6-3 Radiological Sampling and Analysis Program for Liquid Waste Effluents

Sample Type	Location	Sampling Frequency	Type of Analysis
<u>Wastewater Discharge</u>			
Liquid effluent	Collection tanks	TBD[a]; liquid	Isotopic analysis[b]
Liquid condensate	Treatment system evaporator exhaust vent	Weekly	Gross alpha/beta
	Treatment system evaporator exhaust vent	Quarterly; composite sample	Isotopic analysis[b]
Sediment	Evaporator	TBD[a] 1 to 2 kg (2.2 to 4.4 lb) sediment	Isotopic analysis[b]
Treated domestic sanitary wastewater	TBD[c]	Semiannually; 1 to 2 kg (2.2 to 4.4 lb) solid fraction	Isotopic analysis[b]
<u>Stormwater and Basin Sediment</u>			
Stormwater	Once from each of the three stormwater basins	Quarterly; 4-L (1.1-gal) samples	Isotopic analysis[b]
Sediment	One from each of three stormwater basins	Quarterly; 1 to 2 kg (2.2 to 4.4 lb) sediment	Isotopic analysis[b]
<u>Groundwater</u>			
Groundwater	Nine deep wells and one shallow well located downgradient, cross gradient, and upgradient of proposed EREF	Semiannually; 4-L (1.1-gal) samples	Isotopic analysis[b]

[a] TBD = to be determined, as needed.
[b] Isotopic analysis for ^{234}U, ^{235}U, ^{236}U, and ^{238}U.
[c] TBD = to be determined (but prior to discharge to retention basin).
Source: AES, 2010a.

isotopic analysis prior to discharge (to the Cylinder Storage Pads Stormwater Retention Basins) is planned as part of the proposed site's radiological monitoring program to confirm that no uranic releases have occurred (AES, 2010a).

6.1.4 Stormwater and Basin Sediment Monitoring

Three stormwater basins would collect stormwater runoff at the proposed EREF: one Site Stormwater Detention Basin, which would receive general site runoff, and two Cylinder Storage Pads Stormwater Retention Basins, which would receive stormwater runoff from the Cylinder Storage Pads and treated discharge from the Domestic Sanitary Sewage Treatment Plant. All three basins would be included in the proposed site's radiological monitoring program for liquid waste effluents (AES, 2010a).

Discharge from the Site Stormwater Detention Basin would occur only by evaporation and infiltration into the ground. Although the basin would be designed to have an outlet structure for overflow, if needed during a storm event exceeding the design basis, it is not expected that runoff from this overflow would reach surface water bodies offsite (AES, 2010a). Therefore, no sampling of stormwater effluents other than for the stormwater basins listed in Table 6-3 is planned. Since the Site Stormwater Detention Basin would only receive stormwater runoff from paved surfaces (not including the Cylinder Storage Pad area), building roofs, and landscaped areas, no significant releases of uranic material to the environment would be expected. However, stormwater and sediment from the basin (when present) would be sampled periodically as part of the proposed site's radiological monitoring program to confirm that no uranic releases have occurred (Table 6-3).

Discharge from the Cylinder Storage Pads Stormwater Retention Basins would occur only by evaporation. Although the basin would collect treated sanitary effluents and stormwater runoff from the concrete-paved areas in the cylinder storage areas, it would not receive process-related effluents. Therefore, no significant releases of uranic material to the environment would be expected. However, stormwater and sediment from these basins (when present) would be sampled periodically as part of the proposed site's radiological monitoring program to confirm that no uranic releases have occurred (Table 6-3).

6.1.5 Groundwater Monitoring

Groundwater samples from onsite monitoring wells would be collected semiannually for isotopic analysis as part of the proposed site's radiological monitoring program (AES, 2010a). Section 3.7.2.4 discusses the baseline monitoring for groundwater currently taking place on the proposed EREF property (baseline monitoring characterizes groundwater prior to construction and provides a basis for comparison once the plant becomes operational). The locations of the groundwater monitoring wells are shown in Figure 6-1. Monitoring well locations are based on the predominant direction of groundwater flow under the proposed EREF site, which is from the northeast to the southwest, and their proximity to key facility structures. During operation, samples would be collected twice a year from the same eight monitoring wells that were used for baseline monitoring and two new deep aquifer wells, which would be installed to the west and south of the facility footprint. These 10 wells would be used to characterize groundwater downgradient, cross gradient, and upgradient of the proposed EREF. Groundwater samples would be analyzed for uranium isotopes (Table 6-3). The minimum detectable concentrations (MDCs) for uranium analysis would be 1.1×10^{-4} becquerel per milliliter (3.0×10^{-9} microcuries per milliliter), a value representing less than 2 percent of the annual limit of 3.0×10^{-7} microcuries per milliliter for uranium isotopes in groundwater set by the NRC in 10 CFR Part 20, Appendix B, Table 2 (AES, 2010a).

The Idaho Department of Environmental Quality (IDEQ) has a statewide network of wells it monitors to evaluate the overall quality of groundwater throughout the State to meet the objectives of the State's *Ground Water Quality Protection Act*. Any monitoring outside of the proposed EREF property boundary, therefore, would occur under the aegis of the State's groundwater quality monitoring program.

6.1.6 Soil and Vegetation Sampling

Prior to the startup of operations at the proposed EREF, baseline vegetation and soil sampling would be conducted for the REMP. Samples would be collected quarterly from each sector at locations near the Owner Controlled Area fence line. The sectors, shown on Figure 6-1, are the areas identified with the 16 compass directions centered on the proposed EREF. Following the commencement of facility operations, sampling would be conducted semiannually from nine sample locations. One sample would be collected from each of eight sectors, three of which would be those with the highest predicted atmospheric deposition (see Figure 6-1). Samples would also be collected from an offsite control location. Vegetation and soil samples would be collected in the same vicinity. Vegetation samples may include vegetable crops and grass, according to availability. Vegetation and soil samples would each consist of 1–2 kilograms (2.2–4.4 pounds) of the sampled materials and would undergo isotopic analysis for uranium (AES, 2010a).

6.1.7 Direct Gamma Radiation Monitoring

The only significant sources of gamma emitting radionuclides would be due to the decay of ^{235}U and ^{238}U progeny associated with the stored UF_6 cylinders. Thermoluminescent dosimeters (TLDs) combined with computer modeling would be used to extrapolate dose from direct gamma radiation. The environmental TLDs would be placed along the Owner Controlled Area fence line. In addition, two TLDs would be placed at offsite locations for control purposes (AES, 2010a).

The offsite TLD control samples would provide information on regional changes of the background radiation levels. The TLDs along the fence line would provide a combined reading of background as well as above background readings associated with the UF_6 cylinders. The dosimeters would be analyzed quarterly. The offsite dose equivalent associated with direct gamma radiation would be estimated through extrapolation of the TLD data using the Monte Carlo N-Particle (MCNP) (X5 Monte Carlo Team, 2003) or similar computer program (AES, 2010a).

6.1.8 Monitoring Procedures and Laboratory Standards

The monitoring procedures implemented in the radiological monitoring program would conform with the guidance found in NRC Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) – Effluent Streams and the Environment" (NRC, 1979).

The monitoring procedures would employ well-known and acceptable sampling and analytical methods. Instrument maintenance and calibration programs would be developed on the basis of the given instrument in accordance with the manufacturers' recommendations. Sampling and measuring equipment would be properly maintained and calibrated at regular intervals. These maintenance and calibration procedures would include ancillary equipment such as airflow meters. The radiological monitoring program implementation procedures would include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition.

AES would periodically audit the effluent monitoring program. Quality assurance procedures would be implemented to ensure representative sampling, proper use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples.

Regulatory Guide 4.15 calls for the use of established standards such as those provided by the National Institute of Standards and Technology (NIST) as well as standard analytical procedures such as those provided by the National Environmental Laboratory Accreditation Conference (NELAC).

The proposed EREF would ensure that the onsite laboratory and any contractor laboratory participate in third-party intercomparison programs such as the Mixed Analyte Performance Evaluation Program (MAPEP), U.S. Department of Energy (DOE) Quality Assurance Program (DOEQAP), and the Analytics Inc. Environmental Radiochemistry Cross-Check Program. The proposed EREF would require that all radiological vendors are certified by the National Environmental Laboratory Accreditation Program (NELAP) or an equivalent State laboratory accreditation agency for the analytes being tested.

6.1.9 Reporting

As required by 10 CFR 70.59, the proposed EREF would submit a semiannual summary report of the environmental sampling program to the NRC with all associated data. The report would include:

- types of samples obtained
- quantities of samples
- frequency of environmental measurements
- radionuclide identities of facility-related radionuclides
- radionuclide activity concentrations of facility-related radionuclides obtained from environmental sample

Also, the semiannual report would publish the minimal detectable concentrations for the analyses and the error associated with each measurement. Significant positive trends in activity concentrations would be presented in the report as well as potential adjustments to the sampling program, unavailable samples, and deviations to the sampling program.

6.2 Nonradiological Measurements and Monitoring Program

Monitoring and measurement of nonradiological effluents would be conducted under the proposed facility’s Physiochemical Monitoring Program to verify the effectiveness of effluent control measures. Nonradiological monitoring encompasses physiochemical measurements in general, as well as a number of specific monitoring programs. Physiochemical monitoring would routinely sample chemical contaminants in effluent streams and environmental media.

Specific monitoring programs would address liquid effluents, stormwater, environmental media, meteorology, and biota. These topics are summarized in the following sections.

6.2.1 Physiochemical Monitoring

A physiochemical monitoring program would be conducted during the operation of the proposed EREF as part of an environmental protection program to control chemical and other nonradiological emissions and effluent discharges from the proposed facility. This monitoring program would confirm that effluent controls are working properly and would alert operators when they are not, so that corrective measures can be taken. Controls for gaseous and liquid effluents that would be in place in the proposed facility are discussed in Sections 4.2.4 and 4.2.6, respectively.

Physiochemical monitoring would be conducted by sampling stormwater, soil, sediment, surface water (if present in intermittent drainages), vegetation, and groundwater as defined in Table 6-4. Sampling locations are shown in Figure 6-2. Physiochemical monitoring would include effluent streams directly, as well as potentially affected environmental media, including soil, sediments, groundwater, surface water, and biota. Specific parameters monitored would include heavy metals, industrial organic compounds, and pesticides. Water effluents would also be sampled for fluoride, while gaseous effluents would be also sampled for HF as the fluoride ion. Additional chemicals may also be monitored, as required by permits, regulations, or other requirements.

Sampling would be conducted on a routine basis, such as monthly or quarterly, while provisions would be in place to respond to emergency situations, accidents, or increased emission levels found in routine sampling. Sampling frequency and locations would be determined by the proposed EREF environmental staff in accordance with any permit requirements, such as an NPDES permit for industrial stormwater (Section 6.2.1.2), to demonstrate compliance. All liquid, solid, and gaseous wastes from enrichment-related processes and decontamination operations would be analyzed for chemical and radiological properties to determine appropriate disposal methods or treatment requirements (AES, 2010a). In the event of any accidental release from the proposed EREF, sampling protocols would be initiated immediately and on a continuing basis to document the extent and impact of the release until conditions are abated and mitigated (AES, 2010a).

Effluent compliance levels would be set primarily in the respective permits issued and administered by U.S. Environmental Protection Agency (EPA) Region 10 and the Idaho Department of Environmental Quality (IDEQ), namely the NPDES permits issued under provisions of the *Clean Water Act*. In order to ensure meeting these levels, administrative action levels set below permitted levels would be established for all measured parameters prior to starting operations. Response actions for elevated measurements would be set at three levels of priority: (1) sample value exceeds three times normal background level, (2) sample value exceeds any administrative action level, and (3) sample value exceeds any regulatory limit. Appropriate response actions would be conducted accordingly, ranging from increasing monitoring frequency to performing corrective actions to prevent exceeding regulatory compliance levels.

Table 6-4 Physiochemical Sampling and Analysis Program

Media	Number of Locations	Monitoring Frequency	Sample Type	Monitored Parameters[a]
Groundwater	Nine deep wells and one shallow well (for baseline monitoring)	Semiannually for deep wells and for shallow wells when water is present	Grab	Metals, organics, and pesticides; water level elevations
Soil/sediment	Three minimum soil samples at location to be determined; 1 soil/ sediment sample at the detention basin outfall	Quarterly near vegetation sample locations; one sample at each location	Surface grab	Metals, organics, pesticides, and fluoride uptake
	Retention and detention basin sediments at discharge points to the basins	Quarterly; one sample at each location	Surface grab	Metals, organics, pesticides, and fluoride uptake
Surface water	Potential location in intermittent drainages on southwestern corner of proposed property	Quarterly, if water is present	Grab	Metals, organics, and pesticides
Stormwater	Retention and detention basins at locations to be determined	Quarterly, if water is present	Grab	See Table 6-5
Vegetation[b]	Four minimum	Quarterly, if present (i.e., during growing seasons); one sample at each location	Surface grab	Fluoride uptake
Meteorology	One onsite station augmented by records from nearby meteorological stations	Daily	Continuous	Wind direction and speed, temperature, and humidity

[a] Analyses would meet EPA lower limits of detection, as applicable, and would be based on the baseline surveys and the type of matrix (sample type).
[b] Location to be established by AES's Environmental, Health, Safety, and Licensing staff.
Source: AES, 2010a.

Samples would be analyzed mainly in an onsite laboratory in the Technical Services Building using methods and instrumentation specified in permits or otherwise meeting measurement quality and performance requirements. A laboratory quality control and quality assurance program would be implemented that would include written calibration and analysis procedures, use of laboratory quality control samples, and comparison studies with certified third-party laboratories. Some specialty analytical services, such as bioassays, may be contracted to an offsite laboratory as the need arises.

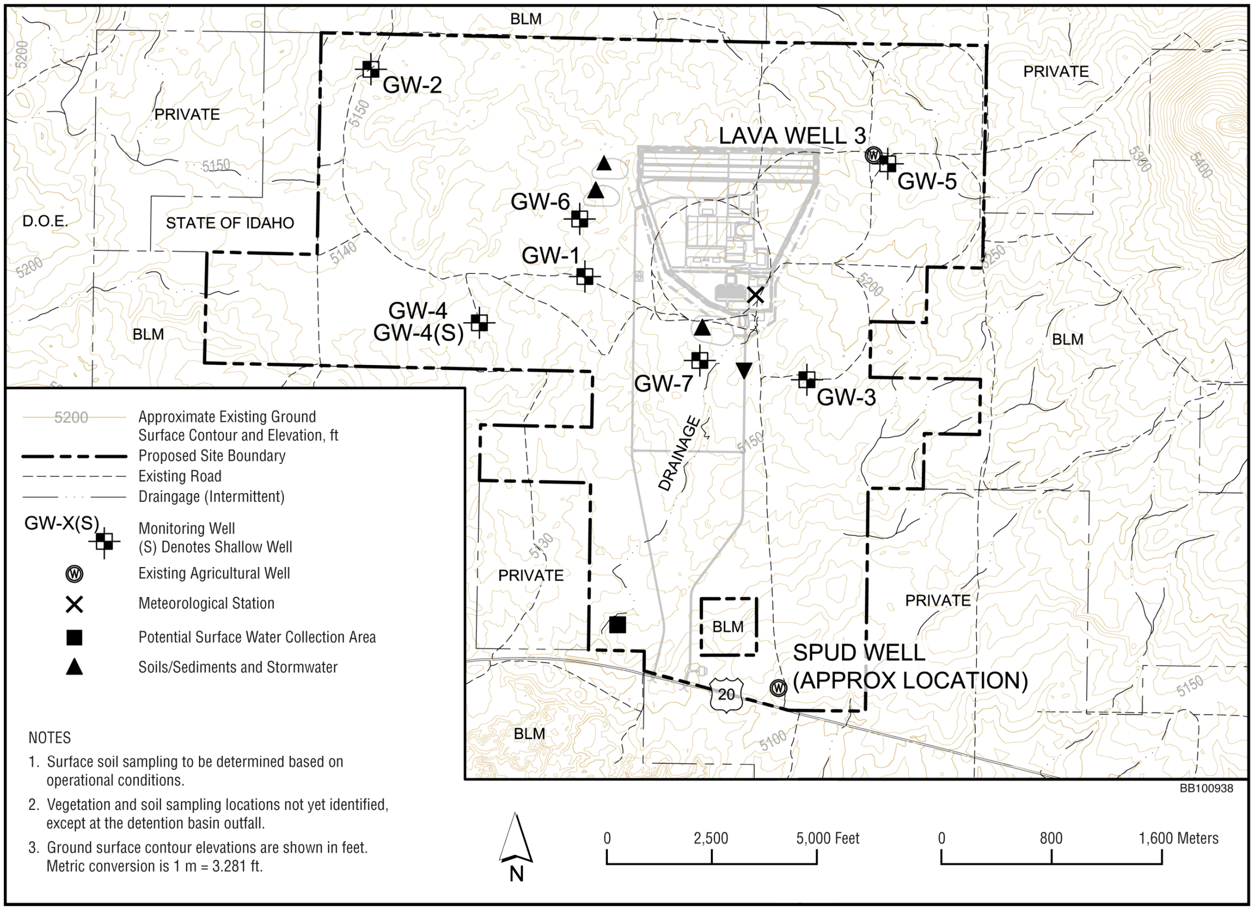

Figure 6-2 Proposed Physiochemical Monitoring Locations (AES, 2010a)

During implementation of the monitoring program, some samples could be collected in a different manner than what is specified in Table 6-4. Reasons for these deviations could include severe weather events, changes in the length of the growing season, and changes in the amount of vegetation present. Under these circumstances, documentation would be prepared to describe how the samples were collected and the rationale for any deviations from normal monitoring program methods. If a sampling location has frequent unavailable samples or deviations from the schedule, then another location could be selected or other appropriate actions taken. Each year, the AES would submit a summary of the environmental program and associated data to the IDEQ and/or EPA Region 10, as required under its NPDES permits issued under IDAPA 58.01.16 and 40 CFR Part 122, respectively. This summary would include the types, numbers, and frequencies of samples collected (AES, 2010a).

The Potential to Emit (PTE) criteria and hazardous air pollutants of each of the proposed EREF's stationary emission sources would be inconsequential with respect to impacts on ambient air quality, and no operating permits are expected to be necessary for those emission sources that would require monitoring for ambient air quality impacts. Official ambient air quality monitoring stations in Idaho Falls operated by the IDEQ would continue to operate. Given the expected minimal impact on ambient air quality from proposed EREF operations and the current attainment status of the area with respect to all NAAQS, no additional ambient air quality monitoring specific to proposed EREF operations and release of nonradioactive pollutants would be warranted during routine facility operation.

During preconstruction and construction, AES would establish and operate particulate monitoring stations at locations along the north, south, and east proposed boundaries. These locations would continue in use during proposed EREF operation to monitor for airborne radioactive particulates (see Figure 6-1). AES would also review particulate monitoring data from the State-run monitoring station 20 miles to the east in Idaho Falls to identify impacts from preconstruction and construction activities at the proposed EREF. No releases of hazardous air pollutants (HAPs) related to construction have been projected by AES. Based on AES's description of the preconstruction and construction activities, NRC staff concurs that no HAPs would be released. Consequently, no monitoring programs have been suggested and the staff believes that no HAP monitoring during these phases is necessary.

6.2.1.1 Liquid Effluent Monitoring

Liquid effluent monitoring would be conducted at various locations throughout the proposed EREF to characterize potential releases other than those associated with wastewater discharge, which are covered in the radiological monitoring program (Section 6.1.3). Liquid effluent monitoring would involve both liquid (groundwater, surface water, and stormwater) and solid (soil or basin sediment) media (Table 6-4). Grab samples would be collected on a semiannual (groundwater) and quarterly (soil/sediment, surface water, and stormwater) basis and analyzed for metals, organics, and pesticides (and fluoride uptake in the case of soils and sediments). For groundwater, water level elevations would also be recorded for both deep wells and shallow wells (if water is present). Treated sanitary effluents would be sampled for isotopic analysis prior to being discharged to the retention basins (see Section 6.1.3; Table 6-3). Because treated sanitary wastewater discharges to the stormwater retention basins, nonradiological liquid effluent monitoring for sanitary discharge falls under the nonradiological (physiochemical) stormwater monitoring presented in Tables 6-4 and 6-5 and described in Section 6.2.1.2.

6.2.1.2 Stormwater Monitoring

A stormwater monitoring program would be initiated during preconstruction and construction of the proposed EREF. Data collected as part of the monitoring program would be used to evaluate the effectiveness of measures taken to prevent the contamination of stormwater and to retain sediments within property boundaries. A temporary detention basin would be used as a sediment control basin during preconstruction and construction as part of the proposed facility's overall sedimentation erosion control plan.

During operation of the proposed EREF, the water quality of stormwater discharge would be typical of runoff from building roofs and paved areas. Except for small amounts of oil and grease typically found in runoff from paved roadways and parking areas, the discharge would not be expected to contain contaminants. Stormwater monitoring would continue with the same frequency upon initiation of operation. During plant operation, samples would be collected from the two Cylinder Storage Pads Stormwater Retention Basins and the Site Stormwater Detention Basin (used as a temporary detention basin during preconstruction and construction) to demonstrate that runoff would not contain any contaminants. Table 6-5 lists the parameters that would be monitored and their monitoring frequencies. The stormwater monitoring program

Table 6-5 Stormwater Monitoring Program for Detention and Retention Basins[a]

Monitored Parameter	Monitoring Frequency	Sample Type	LLD[b]
Oil and grease	Quarterly, if standing water exists	Grab	0.5 ppm
Total suspended solids	Quarterly, if standing water exists	Grab	0.5 ppm
Five-day biological oxygen demand	Quarterly, if standing water exists	Grab	2 ppm
Chemical oxygen demand	Quarterly, if standing water exists	Grab	1 ppm
Total phosphorus	Quarterly, if standing water exists	Grab	0.1 ppm
Total kjeldahl nitrogen	Quarterly, if standing water exists	Grab	0.1 ppm
pH	Quarterly, if standing water exists	Grab	0.01
Nitrate plus nitrite nitrogen	Quarterly, if standing water exists	Grab	0.2 ppm
Metals	Quarterly, if standing water exists	Grab	Varies by metal

[a] Site Stormwater Detention Basin, Cylinder Storage Pads Stormwater Retention Basins, and any temporary basin(s) used during preconstruction and construction.
[b] LLD = lower limit of detection; analyses would meet EPA LLDs, as applicable, and would be based on the baseline surveys and the type of matrix (sample type).
Source: AES, 2010a.

would be refined to reflect the requirements of the NPDES Construction General Discharge Permit and the General Permit for Industrial Stormwater that AES would obtain from the EPA Region 10 (AES, 2010a).

6.2.1.3 Environmental Monitoring

An environmental surveillance sampling program would be implemented with the objective of detecting and monitoring any discernible and relevant effects of plant operations on the surrounding environment so that appropriate actions could be taken to mitigate effects if necessary. As noted above, the chemical constituents analyzed would be in accordance with permits and could include other process or site-related chemicals of interest. Soils, sediments, surface water, groundwater, and biota would be sampled in areas potentially impacted by process effluents or runoff from the proposed facility. Sampling would be conducted both onsite and offsite.

Sampling locations would be selected based on wind patterns, surface runoff patterns, and at, or down-gradient of, discrete discharge points, including the outfall at the Stormwater Detention Basin. Groundwater samples would be collected from a series of wells installed around the facility, as shown in Figure 6-2. Stormwater would be sampled from the Cylinder Storage Pads Stormwater Retention Basins and from the intermittent stream drainage at the southwest corner of the proposed property.

Vegetation sampling would include grasses and locally grown vegetable crops. Soils would be sampled at the same locations as vegetation, including at the outlet at the Stormwater Detention Basin described in Section 4.2.6. Sediment samples would be collected at the discharge points of the various collection basins that would exist onsite (AES, 2010a).

6.2.1.4 Meteorological Monitoring

Meteorological parameters of wind speed and direction, air temperature, and humidity would be continuously monitored at an onsite meteorological tower. Instruments would be located on the tower at an elevation of 40 meters (132 feet). The tower would be located such that the instruments would be at the same approximate elevation as effluent emission points and would be sufficiently distant from buildings and other structures so as not to be influenced by turbulence caused by those structures. The exact location of the meteorological tower has been withheld as security-related information. A "clear area" would be maintained for a distance of at least ten times the height of obstructions located within the prevailing wind directions from the tower. Quality control programs would use formalized procedures to provide for instrument calibrations, preventative maintenance and corrective actions, and redundant data capture and storage such that a data recovery rate of at least 90 percent would be maintained over time. Real-time meteorological data would be displayed in the Control Room where instrument malfunctions could be quickly identified and addressed. Real-time data would available for use in dispersion modeling for both routine and nonroutine (accident) conditions.

6.2.1.5 Local Flora and Fauna

The physiochemical monitoring program would include quarterly sampling of grasses and locally grown vegetable crops, which would be analyzed for fluoride uptake (Table 6-4). Sampling locations would be established by AES's Environmental, Health, Safety, and Licensing staff. Section 6.2.2 provides a discussion of the monitoring of impacts to biotic communities.

6.2.1.6 Quality Assurance

The onsite analytical laboratory would implement a formal quality assurance/quality control program to monitor, assess, control, and report to the appropriate agencies the performance of chemical analyses so that they meet required performance standards specified in permits or within the standard procedures employed. Generally recognized good laboratory practices would be employed in all aspects of the analysis. The quality assurance program for nonradiological analyses would employ similar quality assurance principles as that for radiological analyses presented in Sections 6.1.8 and 6.1.9. Radiological and nonradiological programs have traditionally been administered separately at the laboratory level, owing to technical differences, laboratory access controls, analyst training, and to separate guidance from different Federal agencies providing technical oversight. Quality assurance programs for the two technical areas at the proposed EREF would be administered within a single overarching sampling and analysis organization. Different third-party laboratories would be involved in separate quality assurance measurement programs involving external parties.

The quality assurance program for both radiological and nonradiological measurements would be headed by a qualified quality assurance officer and would employ formal written procedures for all phases of method performance, from sample collection through data management and reporting. Recognized standard methods would be used that are known to produce results of the required quality. Chain-of-custody procedures would be followed during handling and transfer of samples and results. Both field samples and laboratory quality control samples would be analyzed, including appropriate blank, duplicate, and spiked samples, as well as laboratory calibration and sample recovery standards. Performance standards would be set to meet the requirements of the measurement program, and would include standards for lower limits of detection, sample recovery, and reproducibility of analysis.

Employed outside contract laboratories would have relevant EPA and Idaho certifications. Such laboratories would likewise follow a formal quality assurance program, including participation in third-party comparison studies, and would employ methods approved by the proposed EREF's laboratory quality assurance officer.

6.2.2 Ecological Monitoring

The ecological monitoring program would characterize changes that may occur in the composition of biotic communities as a result of preconstruction, construction, and operation of the proposed EREF.

The program would focus on observable changes in habitat characteristics and wildlife populations.

The ecological monitoring program would be carried out in accordance with generally accepted monitoring practices and the requirements of the Idaho Department of Fish and Game and the U.S. Fish and Wildlife Service. Under the program, data would be collected, recorded, stored, and analyzed. Procedures would be established, as appropriate, for data collection, storage, analysis, reporting, and corrective actions. Actions would be taken as necessary to reconcile anomalous results (AES, 2010a).

6.2.2.1 Monitoring Program Elements

The elements that would be included in the ecological monitoring program are vegetation, birds, mammals, and herpetiles (reptiles and amphibians). There are currently no action levels or reporting levels for any of these elements. However, consultations would continue with all appropriate agencies, such as the U.S. Fish and Wildlife Service, Bureau of Land Management, and Idaho Department of Fish and Game. Agency recommendations, based on future consultations and reviews of monitoring program data, would be considered in the development of action levels and/or reporting levels for each element (AES, 2010a).

In addition, to reduce potential impacts on birds and other wildlife, AES would periodically monitor the proposed site during the preconstruction, facility construction, and operation phases, including sampling of detention-basin and retention-basin waters. Measures would be taken to release any entrapped wildlife. The monitoring program would include an assessment of the effectiveness of entry barriers and release features (AES, 2010a). In addition, for the first five years following the completion of the new transmission line, AES would conduct annual surveys of the transmission line route for avian mortalities, including sage-grouse, due to collision or electrocution (AES, 2010b). These surveys would consist of in-vehicle observations while driving along the transmission line right-of-way. Remedial measures, such as high-visibility line markers, would be considered if surveys indicate the need. If perching of raptors or corvids that would imperil sage-grouse populations is discovered, remedial measures, such as anti-perching devices, would be considered.

6.2.2.2 Observations and Monitoring Program Design

The overall monitoring program would include preconstruction, construction, and operations monitoring programs. The preconstruction monitoring program would be conducted prior to the initiation of construction activities and would establish the baseline ecological conditions on the proposed EREF property. The monitoring procedures used to characterize the vegetation, bird, mammal, and herpetile communities during preconstruction monitoring would also be used for the construction and operations monitoring programs (AES, 2010a).

Surveys for the construction and operations monitoring program would use the same monitoring locations established for the preconstruction monitoring program. These surveys are designed to detect broad changes in the composition of the biotic communities that may be associated with the construction and operation of the proposed EREF. Changes resulting from natural succession processes would be considered in the interpretation of the results of the construction and operations monitoring program, because it is expected that plant communities on the proposed property would undergo successional changes, even in the absence of the proposed EREF project, with concomitant changes in the bird, mammal, and herpetile communities (AES, 2010a).

No specific monitoring equipment would be needed for the ecological monitoring, due to the type of monitoring proposed for the program as described above (AES, 2010a). Data collected for the ecological monitoring program would be recorded on paper and/or electronic forms. These data would be kept on file for the life of the proposed facility (AES, 2010a).

The monitoring program analyses would include descriptive statistics that would include the mean, standard deviation, standard error, and confidence interval for the mean. For each study, the sample size would be indicated. These standard descriptive statistics would be used to assess sample variability. For these studies, a significance level of 5 percent would be used, resulting in a 95 percent confidence level (AES, 2010a).

The data collected for the ecological monitoring program would be analyzed by the Environment, Health, and Safety Manager or a staff member reporting to the manager. A summary report would be prepared and would include spatial and temporal information regarding species composition and distribution and the relative abundance of key species (AES, 2010a).

Vegetation

Monitoring plant communities would include estimates of ground cover at about 20 permanent monitoring locations. The establishment of permanent monitoring locations would allow for the long-term evaluation of vegetation trends and characteristics of the proposed EREF property. Monitoring would be conducted annually in June, coinciding with the flowering period of the dominant perennial species. The selected monitoring locations would be positioned within the proposed EREF property, outside the proposed facility footprint. Global Positioning System coordinates would be recorded and used to identify and relocate the monitoring points (AES, 2010a). Figure 6-3 shows the positions of the monitoring locations.

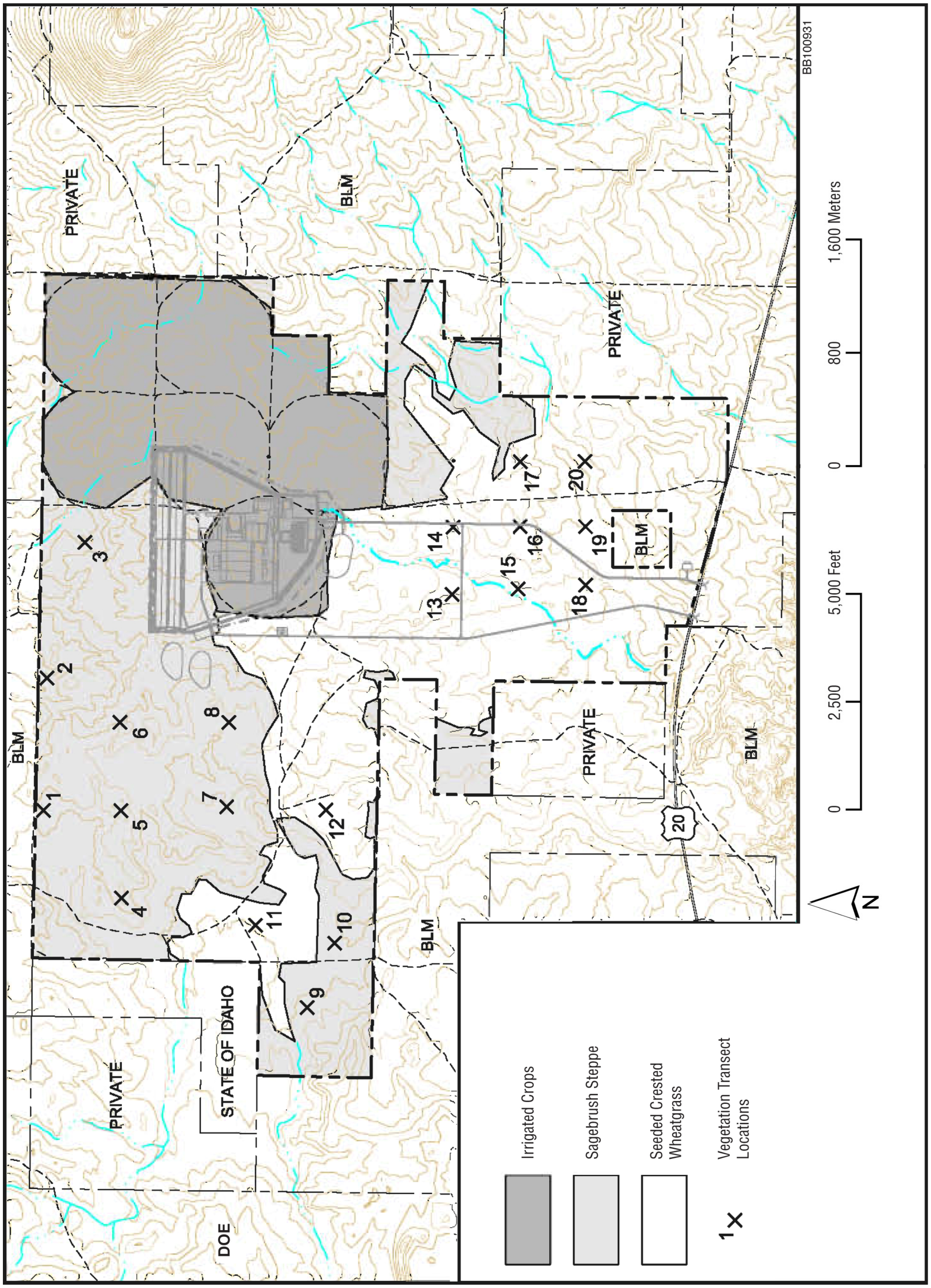

Figure 6-3 Vegetation Sampling Locations (AES, 2010a)

Using the point-transect method, monitoring data would be collected from the sagebrush steppe and disturbed sagebrush steppe habitats. Two 50-meter (164-foot) transect lines would extend from a randomly selected point at each monitoring location, one transect oriented to the east and the other to the south. Observation data would be collected at points located at intervals along the transect lines. Ground surface data (e.g., bare soil, leaf litter) on overstory and understory species that are intersected by the data points would be recorded. Data analysis would determine species composition and ground surface characteristics. In addition to preconstruction and construction monitoring, operations monitoring would initially be conducted through at least the first 3 years of plant operation. Subsequently, changes to the monitoring program may be initiated based on operational experience (AES, 2010a).

Wildlife

Wildlife monitoring surveys would be conducted to record the presence of mammals, birds, and herpetiles in the vicinity of the proposed EREF site. Wildlife monitoring would be designed to identify species and provide estimates of abundance. The surveys would be conducted annually in late spring/early summer and late fall/early winter. Data recorded each sampling day would include weather conditions (e.g., temperature, wind speed and direction, humidity, cloud cover). Changes in weather conditions during sampling would also be recorded. No surveys would be conducted when weather conditions (e.g., rain, heavy snow, high winds) reduce the likelihood of wildlife observations due to reduced animal activity or reduced visibility (AES, 2010a).

Permanent parallel transects, 1.6 kilometers (1.0 mile) in length and separated by 0.4 to 0.8 kilometers (0.25 to 0.50 miles), would be located in the sagebrush steppe and disturbed sagebrush steppe habitats. Transects would be walked from 30 minutes before sunrise to 1.5 hours after sunrise and 1.5 hours before sunset to 30 minutes after sunset. Data collected would include visual observations of animals, signs (e.g., tracks, droppings, feathers, nests, burrows), and calls. Species composition and relative abundance would be determined. Gender and age (e.g., juvenile, adult) would be recorded when possible. Data would also include behavior (flight, singing, territory establishment, nesting, perching). In addition to preconstruction and construction monitoring, operations monitoring would initially be conducted through at least the first 3 years of plant operation. Subsequently, changes to the monitoring program may be initiated based on operational experience (AES, 2010a).

Birds

Surveys of bird populations would be conducted twice each year, in late spring during breeding, nesting, and brood rearing seasons, and also during the winter. Recorded data would include species and numbers of individuals observed, as well as behavior. Data would be compared to information regarding birds listed in Table 6-6 as potentially using the proposed EREF property (AES, 2010a).

Mammals

Surveys of mammal populations would be conducted twice each year, in late spring during breeding and nursing season and during late fall/winter during migration and movements to winter range. Recorded data would include species and numbers of individuals observed, as

Table 6-6 Birds Potentially Using the Proposed EREF Property

Common Name	Scientific Name	Summer Breeder	Wintering	Resident	Migrant
Turkey vulture	*Cathartes aura*	U[a]	U	–[a]	A[a]
Osprey	*Pandion haliaetus*	–	–	–	R[a]
Bald eagle	*Haliaeetus leucocephalus*	–	U	–	R
Northern harrier	*Circus cyaneus*	–	–	C[a]	–
Sharp-shinned hawk	*Accipiter striatus*	R	R	–	R
Cooper's hawk	*Accipiter cooperii*	U	R	–	R
Swainson's hawk	*Buteo swainsoni*	U	R	–	U
Red-tailed hawk	*Buteo jamaicensis*	U	R	–	R
Ferruginous hawk	*Buteo regalis*	U	R	–	R
Rough-legged hawk	*Buteo regalis*	C	A	–	C
Golden eagle	*Aquila chrysaetos*	U	C	–	U
American kestrel	*Falco sparverius*	C	U	–	C
Merlin	*Falco columbarius*	–	–	R	–
Peregrine falcon	*Falco peregrinus*	–	–	R	–
Gyrfalcon	*Falco rusticolus*	–	–	–	A
Prairie falcon	*Falco mexicanus*	–	–	U	–
Chukar	*Alectoris chukar*	–	–	U	–
Greater sage-grouse	*Centrocercus urophasianus*	–	–	C	–
Kildeer	*Charadrius vociferus*	C	–	–	C
Long-billed curlew	*Numenius americanus*	U	–	–	U
Franklin's gull	*Larus pipixcan*	U	–	–	U
Ring-billed gull	*Larus delawarensis*	U	–	–	U
California gull	*Larus californicus*	R	–	–	U
Herring gull	*Larus argentatus*	U	–	–	U
Mourning dove	*Zenaida macroura*	C	R	–	C
Great horned owl	*Bubo virginianus*	–	–	U	–
Burrowing owl	*Athene cunicularia*	U	A	–	U
Short-eared owl	*Asio flammeus*	U	–	–	U
Northern sawwhet owl	*Aegolius acadicus*	–	A	–	A
Common nighthawk	*Chordeiles minor*	C	–	–	U
Horned lark	*Eremophila alpestris*	C	C	–	C
Black-billed magpie	*Pica pica*	–	–	C	–
American crow	*Corvus brachyrhynchos*	–	–	U	–

Table 6-6 Birds Potentially Using the Proposed EREF Property (Cont.)

Common Name	Scientific Name	Summer Breeder	Wintering	Resident	Migrant
Common raven	*Corvus corax*	–	–	U	–
Rock wren	*Salpinctes obsoletus*	U	–	–	U
Canyon wren	*Catherpes mexicanus*	R	–	–	R
House wren	*Troglodytes aedon*	U	U	–	U
Western bluebird	*Sialia mexicana*	U	–	–	U
American robin	*Turdus migratorius*	C	–	–	C
Sage thrasher	*Oreoscoptes montanus*	C	–	–	C
Northern shrike	*Lanius excubitor*	–	R	–	U
Loggerhead shrike	*Lanius ludovicianus*	–	–	U	–
European starling	*Sturnus vlugaris*	–	–	C	–
Black-headed grosbeak	*Pheucticus melanocephalus*	R	–	–	R
Green-tailed towhee	*Pipilo chlorurus*	U	–	–	U
Rufous-sided towhee	*Pipilo erythrophthalmus*	U	–	–	U
Brewer’s sparrow	*Spizella breweri*	C	–	–	C
Lark sparrow	*Chondestes grammacus*	U	–	–	R
Black-throated sparrow	*Amphispiza bilineata*	R	–	–	R
Sage sparrow	*Amphispiza belli*	C	–	–	C
Lark bunting	*Calamospiza melanocorys*	R	–	–	R
White-crowned sparrow	*Zonotrichia leucophrys*	–	–	–	R
Vesper sparrow	*Pooecetes gramineus*	U	–	–	U
Chipping sparrow	*Spizella passerina*	–	–	–	R
Grasshopper sparrow	*Ammodramus savannarum*	U	–	–	U
Brown-headed cowbird	*Molothrus ater*	–	–	–	U
Snow bunting	*Plectrophenax nivalis*	–	R	–	R
Red-winged blackbird	*Agelaius phoeniceus*	U	–	–	U
Western meadowlark	*Sturnella neglecta*	C	U	–	C
Brewer’s blackbird	*Euphagus cyanocephalus*	C	R	–	C
Rosy finch	*Leucosticte arctoa*	–	R	–	R
House sparrow	*Passer domesticus*	C	U	–	C

[a] U = Species likely would be uncommon onsite if observed at all; C = Species likely would be common onsite; R = Species likely would be rare onsite if observed at all; A = Accidental occurrence; – = Not applicable.
Source: AES, 2010a.

well as behavior (e.g., fleeing, feeding, or resting). Data would be compared to information regarding mammals listed in Table 6-7 as potentially using the proposed EREF property (AES, 2010a).

Herpetiles

Surveys of reptile and amphibian populations would be conducted once each year, during the summer when these species are most active. Recorded data would include species and numbers of individuals observed, as well as behavior (e.g., breeding, display, feeding, resting, or thermoregulating). Data would be compared to information regarding reptiles and amphibians listed in Table 6-8 as potentially using the proposed EREF property (AES, 2010a).

6.3 References

(AES, 2010a) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Environmental Report, Rev. 2." Bethesda, Maryland. April.

(AES, 2010b) AREVA Enrichment Services, LLC. Letter from J.A. Kay (Licensing Manager, AES) to Sharon W. Kiefer (Assistant Director-Policy, IDFG) dated December 7, 2010, "Subject: Response to IDFG Comments to NRC Related to the EREF Transmission Line." ADAMS Accession No. ML103420579.

(NRC, 1979) U.S. Nuclear Regulatory Commission. "Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment." Regulatory Guide 4.15, Rev. 1. February.

(NRC, 1985) U.S. Nuclear Regulatory Commission. "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluent from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants." Regulatory Guide 4.16, Rev. 1. December.

(NRC, 1991) U.S. Nuclear Regulatory Commission. "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors." NUREG-1302. Generic Letter 89-01, Supplement No. 1.

(X5 Monte Carlo Team, 2003) X5 Monte Carlo Team. "MCNP – A General Monte Carlo N-Particle Transport Code, Version 5." LA-UR-0301987. April 24.

Table 6-7 Mammals Potentially Using the Proposed EREF Property

Common Name	Scientific Name	Preferred Habitat	Probable Occurrence
Little brown myotis	*Myotis lucifugus*	Coniferous forest, riparian areas in the mountains and lower valleys, woodlots, shelterbelts, and urban areas.	Unlikely to occur due to lack of suitable habitat.
Townsend's bigeared bat	*Plecotus townsendii*	Desert scrub, mixed conifer forest, and piñon-juniper habitat. Specifically associated with limestone caves, mines, lava tubes.	Unlikely to occur due to lack of suitable habitat.
White-tailed jack rabbit	*Lepus townsendii*	Found in open grasslands and montane shrublands generally above shrub steppe.	Probably occurs at the property in limited numbers due to lack of habitat.
Black-tailed jack rabbit	*Lepus californicus*	A habitat generalist, primarily found in arid regions supporting shortgrass habitats.	Likely occurs at the property.
Mountain cottontail	*Sylvilagus nattallii*	Brushy, rocky areas in dense sagebrush and streamside thickets and forest edges.	Likely occurs at the property.
Yellow-bellied marmot	*Marmota flaviventris*	Prefers montane meadows adjacent to talus slopes or rock outcrops; avoids tall vegetation.	Unlikely to occur due to lack of suitable habitat.
Pygmy rabbit	*Brachylagus idahoensis*	Big sagebrush habitat and secondarily in communities dominated by rabbitbrush.	Potentially occurs at the property.
Townsend's ground squirrel	*Spermophilus townsendii*	Arid environments with deep, friable, well-drained soils.	Likely occurs at the property.
Least chipmunk	*Eutamias minimus*	Sagebrush, bitterbrush, and other Great Basin shrub habitats.	Likely occurs at the property.
Northern pocket gopher	*Thomomys talpoides*	Mountain meadows, tundra, grasslands, sagebrush steppe, and agricultural fields – habitats lacking canopy cover but having abundant ground cover.	Probably occurs at the property in limited numbers due to lack of habitat.
Great basin pocket mouse	*Perognathus parvus*	Arid, sparsely vegetated plains and brushy areas.	Likely occurs at the property.
Ord's kangaroo rat	*Dipodomys ordii*	Semiarid, open habitats. Big sagebrush/crested wheatgrass range; disturbed sites.	Likely occurs at the property.
Beaver	*Castor canadensis*	Stable aquatic habitats providing adequate water, channel gradient of less than 15 percent, and quality food species.	Unlikely to occur due to lack of suitable habitat.

Table 6-7 Mammals Potentially Using the Proposed EREF Property (Cont.)

Common Name	Scientific Name	Preferred Habitat	Probable Occurrence
Western harvest mouse	*Reithrodontomys megalotis*	Open areas, including grasslands, prairies, meadows, and arid areas including deserts, sand dunes, and shrublands.	Likely occurs at the property.
Deer mouse	*Peromyscus maniculatus*	Most common habitats are prairies, bushy areas, and woodlands.	Likely occurs at the property.
Coyote	*Canis latrans*	Extremely adaptable; uses a wide range of habitats, including forests, grasslands, deserts.	Likely occurs at the property.
Long-tailed weasel	*Mustela frenata*	Upland brush, grasslands and woods to subalpine rock slides and semi-open forest areas.	Probably occurs at the property in limited numbers due to lack of habitat.
Badger	*Taxidea taxus*	Occurs primarily in grasslands, shrublands, and other treeless areas with friable soil and a supply of rodent prey.	Likely occurs at the property.
Canada lynx	*Lynx canadensis*	Canada lynxes require early, mid- and late-successional forests.	Unlikely to occur due to lack of suitable habitat.
Bobcat	*Lynx rufus*	Adapted to a wide variety of habitats, including canyons, deserts, and mountain ranges. Bobcats are found in desert environments if shade is available.	Probably occurs at the property in limited numbers due to lack of habitat.
Elk	*Cervus elaphus*	Found mostly in mountain or foothill areas; prefer alpine meadows in summer and then move to lower, wooded slopes or sagebrush steppe in winter.	Likely occurs at the property.
Mule deer	*Odocoileus hemionus*	Coniferous forests, shrub steppe, chaparral, and grasslands, from dry, open country to dense forests. Prefer arid open areas and rocky hillsides.	Probably occurs at the property in limited numbers due to lack of habitat.
Pronghorn	*Antilocapra americana*	Open plains and semi-deserts; often found on low, rolling, expansive lands with less than 30 percent slope.	Likely occurs at the property.

Source: AES, 2010a.

Table 6-8 Amphibians and Reptiles Potentially Using the Proposed EREF Property

Common Name	Scientific Name	Preferred Habitat	Probable Occurrence
Great Basin spadefoot toad	*Spea intermontana*	Sagebrush communities below 6,000 feet in elevation having loose soil in which to burrow. Breeding habitat is aquatic.	Unlikely to occur due to lack of aquatic habitat.
Long-nosed leopard lizard	*Gambelia wislizenii*	Arid and semi-arid plains with sagebrush, grass, and other low scattered vegetation. Prefers flat areas with open space for running, avoiding densely vegetated areas.	Probably occurs at the property in limited numbers due to lack of habitat.
Short-horned lizard	*Phrynosoma douglassi*	Open pine forests, pinion-juniper forests, shortgrass prairies, and sagebrush desert.	Likely occurs at the property.
Sagebrush lizard	*Sceloporus graciosus*	Sagebrush and other types of shrublands, in open areas with scattered low bushes and lots of sun.	Likely occurs at the property.
Western skink	*Eumeces skiltonianus*	Piñon-juniper forests, grassy areas, desert shrub, talus slopes, and canyon rims; often found in areas associated with water.	Unlikely to occur due to lack of suitable habitat.
Rubber boa	*Charina bottae*	Desert shrub to open pine forest. Often near water and near rocks, woody debris, or leaf litter that are used for cover.	Unlikely to occur due to lack of suitable habitat.
Desert striped whipsnake	*Masticophis taeniatus*	Occurs in open brushy country-desert scrub, sagebrush flats, and mixed woodlands. Often found along the edges of rivers or ponds.	Probably occurs at the property in limited numbers due to lack of habitat.
Gopher snake	*Pituophis catenifer*	Grassland, sagebrush, agricultural lands, riparian areas, woodlands, desert.	Likely occurs at the property.
Western terrestrial garter snake	*Thamnophis elegans*	Found statewide in habitats ranging from desert riparian areas to mountain lakes and meadows.	Probably occurs at the property in limited numbers due to lack of habitat.
Western rattlesnake	*Crotalus viridis*	Drier regions with sparse vegetation, usually with a rocky component.	Likely occurs at the property.

Source: AES, 2010a.

7 BENEFIT-COST ANALYSIS

A benefit-cost analysis can provide a rationale for deciding whether a project is likely to have a net positive economic impact, by aggregating each of the costs and benefits resulting from the project. A benefit-cost analysis involves valuing the benefits and costs associated with projects in monetary terms, to the extent possible. Depending on the extent of the data available, benefit-cost analyses may rely entirely or partially on qualitative data to assess the various costs and benefits, with the methodology employed for a benefit-cost analysis usually being dependent on the specific issues involved in a project. Costs and benefits are often separated into two categories, private and societal. Private costs and benefits are those that impact the owner of a project or facility, in this case AREVA Environmental Services, LLC (AES), while societal costs and benefits are those that impact society as a whole. Much of the data associated with preconstruction, construction, and operation of the proposed Eagle Rock Enrichment Facility (EREF) in Bonneville County, Idaho, that would be used to assess the private costs of the proposed EREF, the costs of constructing and operating the facility, are proprietary commercial information, withheld in accordance with Title 10, “Energy,” of the U.S. *Code of Federal Regulations* (10 CFR 2.390). These costs are presented in a proprietary appendix to this Environmental Impact Statement (EIS), Appendix H, and are not discussed in this chapter. As such, Appendix H is not included in the publicly available version of this EIS. Additional data associated with operation of the facility, regarding annual revenues from the sale of enriched uranium, was not available, meaning that no estimate of the private benefits of the facility can be made.

As a result of the lack of data that can be publicly disclosed or is otherwise available, the analysis in this chapter focuses on the various societal costs and benefits associated with preconstruction, the proposed action, and the no-action alternative using data provided by AES in its license application and Environmental Report (AES, 2010a). These data include the economic and fiscal benefits of preconstruction, facility construction, and operation to the region of influence (ROI) (defined in Section 7.1) in which the plant would be located, and to the Idaho State economy. Also discussed are the benefits of the plant in fulfilling the need for enriched uranium to meet domestic electricity requirements, for domestic supplies of enriched uranium for national energy security, and for upgraded uranium enrichment technology in the United States for energy generation with fewer emissions of criteria pollutants and carbon. Societal costs considered include those related to impacts on land use, historical and cultural resources, visual and scenic resources, air quality, geology and soil, water resources, ecological resources, environmental justice, noise, transportation, public and occupational health, waste management, and accidents.

The chapter compares the societal benefits and costs both quantitatively, in monetary terms where possible, and qualitatively. Section 7.1 weighs the costs and benefits associated with preconstruction and the proposed action. Section 7.2 then compares the costs and benefits for preconstruction and the proposed action relative to those of the no-action alternative. Section 7.3 combines these two sections in forming overall conclusions. Alternatives that have previously been ruled out for failing to meet the proposed project’s technical and policy objectives are described in Section 2.2.4 and are not revisited in this chapter.

7.1 Costs and Benefits of Preconstruction and the Proposed Action

The proposed action is for AES to construct, operate, and decommission a gas centrifuge uranium enrichment facility in Bonneville County, Idaho. To allow the proposed action to take place, the NRC would issue a license for AES under the provisions of the *Atomic Energy Act*. The license would authorize AES to possess and use special nuclear material, source material, and byproduct material at the proposed EREF for a period of 30 years, in accordance with the NRC's regulations in 10 CFR Parts 70, 40, and 30, respectively. The proposed EREF would be constructed over an eleven-year period. Enrichment operations would begin in 2014, continuing until 2041, when production would gradually decrease as decommissioning begins.

As discussed in Section 3.12 of this EIS, the principal socioeconomic benefit of the proposed EREF would be an increase in employment and income in the ROI, defined as the 11-county area in which workers at the proposed facility would live and spend their wages and salaries. Although the majority of the costs, and most of the socioeconomic impacts, of the various phases of development of the proposed EREF would occur in the 11-county ROI, the majority of the economic and fiscal benefits would occur in a 2-county ROI consisting of Bingham and Bonneville Counties. The uranium enrichment technology and energy security benefits of the facility would occur at the national level.

This section describes the costs and benefits of construction and operation of the proposed EREF and those associated with preconstruction. Quantitative estimates (in terms of dollars) are provided where possible. Other costs and benefits are described in qualitative terms.

7.1.1 Costs of Preconstruction and the Proposed Action

The direct costs associated with the proposed action may be categorized by the following life-cycle stages:

- facility construction
- facility operation
- depleted uranium disposal
- decommissioning

In addition to the costs of the proposed action, costs would be incurred for preconstruction under both the proposed action and the no-action alternative.

As the monetary costs associated with the preconstruction, construction, and operations phases of the proposed EREF are withheld under the provisions of 10 CFR 2.390, the costs associated with each of these life-cycle stage are discussed and summarized in a proprietary appendix, Appendix H, and summarized in Table H-1. As decommissioning activities for the proposed EREF are anticipated to occur more than 20 years in the future, costs associated with this phase of the proposed action cannot be estimated with any certainty at this time. It is expected, however, that annual decommissioning costs would be less than the annual costs of operating the facility.

In addition to monetary costs, preconstruction and the proposed action would result in impacts on various resource areas, which are considered “costs” for the purpose of this analysis. The resource areas and corresponding impacts are summarized below and described in more detail in Chapter 4 of this EIS. As summarized below, the impacts of preconstruction and the proposed action on the various resource areas would be mostly SMALL, with MODERATE impacts in a few cases. Any LARGE impacts would generally be very temporary and intermittent in nature, or would be reduced to MODERATE with the appropriate mitigation measures.

- *Land Use.* As described in Section 4.2.1, the proposed EREF would be located entirely on private land. The operation of a uranium enrichment facility is consistent with the county’s zoning. Current agricultural uses of the proposed EREF property would be curtailed, but similar activities would continue over large land areas surrounding the proposed EREF property and vicinity. For example, it is not anticipated that preconstruction, construction, and operation of the proposed EREF would have any effect on current land uses found on the surrounding Federal lands administered by the U.S. Bureau of Land Management. Land use impacts resulting from preconstruction, construction, and operation would be SMALL.

- *Historic and Cultural Resources.* As described in Section 4.2.2, there are 13 cultural resource sites in the immediate vicinity of the proposed EREF. Only one of these sites is eligible for listing on the *National Register of Historic Places*, the John Leopard Homestead (site MW004). This site is within the construction footprint of the proposed EREF. Preconstruction activities would destroy site MW004 and the resulting impacts would be LARGE, but were considered MODERATE because the appropriate mitigation, involving professional excavation of, and data recovery at, site MW004 was implemented by AES and other homestead sites of this type exist in the region (WCRM, 2010; Idaho, SHPO 2010b; Gilbert, 2010). Other than for site MW004, the impacts of the proposed project on historic and cultural resources would be SMALL.

- *Visual and Scenic Resources.* As described in Section 4.2.3, preconstruction and construction equipment and the industrial character of the proposed EREF buildings would create significant contrast with the surrounding visual environment of the primarily agricultural and undeveloped rangeland. The proposed facility would be about 2.4 kilometers (1.5 miles) from public viewing areas such as US 20 and the Hell’s Half Acre Wildlife Study Area (WSA); thus, the impact on views would be SMALL to MODERATE.

- *Air Quality*. As described in Section 4.2.4, preconstruction and construction traffic and operation of construction equipment are projected to cause a temporary increase in the concentrations of particulate matter. These impacts would be SMALL. However, fugitive dust from land clearing and grading operations could result in large releases of particulate matter for temporary periods of time. Such impacts would be MODERATE to LARGE during certain preconstruction periods and activities. Facility operations could produce small gaseous releases associated with operation of the process that could contain uranium compounds and hydrogen fluoride. Small amounts of nonradioactive air emissions would consist of carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM), volatile organic compounds (VOCs), and sulfur dioxide (SO_2). Air quality impacts during operations would be SMALL.

- *Geology and Soil.* As described in Section 4.2.5, impacts could result primarily during preconstruction and construction from surface grading and excavation activities that loosen soil and increase the potential for erosion by wind and water. Soil compaction as a result of heavy vehicle traffic could also increase the potential for soil erosion by increasing surface runoff. Spills and inadvertent releases during all project phases could contaminate site soils. Implementation of mitigation measures would ensure that these impacts would be SMALL.

- *Water Resources*. As described in Section 4.2.6, the water supply for the proposed facility would be from onsite wells, and water usage would be well within the water appropriation for the proposed property. Also, the plant would have no discharges to surface water or groundwater. Thus, water resource impacts would be SMALL.

- *Ecological Impacts*. As described in Section 4.2.7, impacts would occur primarily as a result of preconstruction and construction activities, which would mean the removal of shrub vegetation and the relocation and displacement of wildlife presently on the proposed site as a result of noise, lighting, traffic, and human presence. Collisions with vehicles, construction equipment, and fences may cause some wildlife mortality. No rare or unique communities or habitats or Federally listed threatened or endangered species have been found or are known to occur on the proposed site. The impact of the proposed EREF on ecological resources would be SMALL to MODERATE.

- *Noise*. As described in Section 4.2.8, increased noise associated with the operation of construction machinery is expected during preconstruction and construction, with noise levels of between 80 to 95 dBA at the highway entrances, access roads, and the Visitor Center. Construction noise would be temporary and would be reduced to about 51 to 66 dBA at the nearest hiking trail point on the Hell's Half Acre WSA. Impacts would be SMALL. Impacts during the operation of the facility itself would also be SMALL.

- *Transportation*. As described in Section 4.2.9, the primary impact of preconstruction, construction, and operation on transportation resources is expected to be increased traffic on nearby roads and highways due to truck shipments and site worker commuting. Transportation impacts during preconstruction, construction, and facility operation would be SMALL to MODERATE on adjacent local roads (due to the potentially significant increase in average daily traffic), but regional impacts would be SMALL.

- *Public and Occupational Health*. As described in Section 4.2.10, the analysis of nonradiological impacts during preconstruction and construction includes estimated numbers of injuries and illnesses incurred by workers and an evaluation of impacts due to exposure to chemicals and other nonradiological substances, such as particulate matter (dust) and vehicle exhaust. All such potential nonradiological impacts would be SMALL. No radiological impacts are expected during preconstruction and initial facility construction, prior to radiological materials being brought onsite. Operation of the proposed EREF could result in release of small quantities of UF_6 during normal operations. Total uranium released to the environment via airborne effluent discharges is anticipated to be less than 10 grams (6.84 μCi or 0.253 MBq) per year. No liquid effluent wastes are expected from facility operation. For a hypothetical member of the public at the proposed property boundary, the annual dose was estimated to be approximately 0.014 millisievert per year (1.4 millirem per year). Doses attributable to normal operation of the proposed EREF facility would be small compared to the normal background dose range of 2.0 to 3.0 millisievert (200 to 300 millirem). Radiological impacts during operations would be SMALL.

- *Waste Management*. As described in Section 4.2.11, small amounts of hazardous waste and approximately 6116 cubic meters (8000 cubic yards) of nonhazardous and nonradioactive wastes would be generated during preconstruction and construction activities. During operations, approximately 75,369 kilograms (165,812 pounds) of solid nonradioactive waste would be generated annually, including approximately 5062 kilograms (11,136 pounds) of hazardous wastes. Approximately 146,500 kilograms (322,300 pounds) of radiological and mixed waste would be generated annually, of which approximately 100 kilograms (220 pounds) would be mixed waste. All wastes would be transferred offsite to licensed waste facilities with adequate disposal capacity for the wastes from the proposed EREF. Overall, impacts would be SMALL.

- *Socioeconomics*. As described in Section 4.2.12, there would be increases in regional employment, income, and tax revenue during preconstruction, construction, and operation. Although these impacts would be SMALL compared to the 11-county economic baseline, they are generally considered to be positive. Impacts on housing and local community services, which could be negative if significant population in-migration were to occur, would also be SMALL.

- *Environmental Justice.* As described in Section 4.2.13, the majority of the environmental impacts associated with preconstruction, construction, and operation of the proposed EREF that would affect the population as a whole would be SMALL, and generally would be mitigated if they were negative. Environmental impacts are primarily those affecting historical and cultural resources, visual and scenic resources, air quality, transportation, and facility accidents. However, as there are no minority or low-income populations defined according to CEQ guidelines within the 4-mile area around the proposed facility, there would be no disproportionate impacts on these populations as a result of this proposed project.

- *Accidents*. As described in Section 4.2.15, six accident scenarios were evaluated in this EIS as a representative selection of the types of accidents that are possible at the proposed EREF. The representative accident scenarios selected vary in severity from high- to intermediate-consequence events and include accidents initiated by natural phenomena (earthquakes), operator error, and equipment failure. The consequence of a criticality accident would be high (fatality) for a worker in close proximity. Worker health consequences are low to high from the other five accidents that involve the release of UF_6. Radiological consequences to a maximally exposed individual (MEI) at the Controlled Area Boundary (proposed EREF property boundary) are low for all six accidents including the criticality accident. Uranium chemical exposure to the MEI is high for one accident and low for the remainder. For HF exposure to an MEI at the proposed property boundary, the consequence of three accidents is intermediate, with a low consequence estimated for the remainder. All accident scenarios predict consequences to the collective offsite public of less than one lifetime cancer fatality. Impacts from accidents would be SMALL to MODERATE.

7.1.2 Benefits of the Proposed Action

The proposed action would result in the annual production of up to a maximum of 6.6 million separative work units (SWUs) of enriched uranium between 2022 and 2041. As discussed in Section 1.3 of this EIS, this level of production would represent an augmentation of the domestic supply of enriched uranium and would meet the need for increased domestic supplies of enriched uranium for national energy security. Under the proposed action, enriched uranium production would be undertaken with the latest enrichment technology, and would facilitate the generation of electricity with lower emissions of criteria pollutants and carbon.

The proposed action would also result in small positive socioeconomic impacts in the 11-county ROI, as described in Section 4.2.12. Table 7-1 presents the estimated employment and tax revenue benefits associated with the proposed action. Employment in the 11-county ROI as a result of preconstruction activities is estimated at 308 full-time jobs. In addition, State income tax revenues would be $0.1 million, and State sales and use tax receipts would be $0.9 million during preconstruction. Average employment in the 11-county ROI during construction is estimated at 947 full-time jobs, with $0.4 million in State income tax revenues and $2.7 million in State sales taxes. During the construction/operations overlap period between 2014 and 2021, 1645 jobs would be created in the first year, lasting throughout the startup period; $0.7 million in income taxes would be generated annually for the State of Idaho; and $1.8 million in property taxes would be collected annually by Bonneville County. During the operations phase between 2022 and 2040, 3289 jobs would be created in the first year, lasting throughout the operating period, with fewer positions required in the last year of operations, 2041. During the operating period, the State of Idaho would benefit from $1.3 million annually in income taxes, while Bonneville County would collect $3.5 million annually in property tax receipts (AES, 2010a).

As the decommissioning phase of the proposed EREF would occur more than 20 years in the future, decommissioning costs cannot be estimated with any certainty at this time. Decommissioning impacts would be SMALL, with impacts likely to be less than the impacts of operating the facility.

Construction of an electrical transmission line to support the proposed EREF facility would produce 57 jobs, $0.1 million in direct sales taxes, and $0.1 million in direct income taxes.

Although it can be assumed that some portion of State sales and income taxes paid would be returned to the 11-county ROI under revenue-sharing arrangements between each county and State government, the exact amount that would be received by each county cannot be determined.

Beyond the economic and fiscal benefits of the proposed EREF in the 11-county ROI, the facility would also create fiscal benefits in the nation as a whole, primarily in the form of Federal income taxes on employee wages and salaries. Based on the distribution of employees in each salary category at the proposed facility, and current Federal marginal income tax rates, it is estimated that annual individual Federal income taxes during the peak year of facility construction would be $15.5 million, with $7.2 million produced annually during startup and $14.5 million generated annually during facility operations. Federal income taxes would amount to $2.8 million during preconstruction activities.

Table 7-1 Socioeconomic Benefits Associated with the Proposed EREF in the 11-County ROI

Project Phase	Annual Average Direct and Indirect Jobs Created (full-time jobs)	Direct Annual State Income Tax Revenues ($ million, 2008 $)	Direct Annual State Sales Tax Revenues ($ million, 2008 $)	Annual Local Government Property Tax Revenues ($ million, 2008 $)
Preconstruction	308	0.1	0.9	NA[a]
Construction	947	0.4	2.7	NA
Construction/Operations Overlap Period	1645	0.7	NA	1.8
Operation	3289	1.3	NA	3.5
Transmission Line	57	0.1	0.1	<0.1

[a] NA = not applicable.

Source: AES, 2010a.

7.1.3 Summary Regarding the Proposed Action

This analysis shows that although there are economic and fiscal benefits associated with preconstruction, construction, and operation of the proposed EREF in the ROI, these impacts would be SMALL. There would also be costs resulting from impacts on various resource areas, which are not possible to quantify. For the majority of these resource areas, impacts would be SMALL or SMALL to MODERATE in magnitude.

7.2 Comparative Benefit-Cost Analysis of Proposed Action Relative to No-Action Alternative

This section compares selected costs and benefits of the proposed action to those of the no-action alternative. This comparison focuses on the tradeoffs between constructing the proposed EREF compared to not constructing the facility. Other possible actions involving other domestic and foreign uranium enrichment suppliers at existing and proposed new facilities both in the United States and elsewhere are likely to be similar under the two alternatives, and are therefore not considered in the comparison.

As a result of the lack of data that can be publicly disclosed or is otherwise available on private benefits (facility revenues) and costs (preconstruction, facility construction, and operating costs), the analysis focuses on the societal benefits and costs of the facility, including the impacts on employment, income, and tax revenues during the construction and operations phases in the region of influence around the proposed site, and the contribution of the proposed facility to meeting policy and technical objectives.

7.2.1 No-Action Alternative

The proposed EREF would not be constructed, operated, and decommissioned under the no-action alternative; preconstruction activities at the proposed site that are not part of the proposed action could still take place (see Section 4.4). Preconstruction activities would include the disturbance of land associated with site clearing and preparation activities and the construction of ancillary facilities, meaning that some ecological, natural, and socioeconomic impacts would therefore occur. For the purposes of the no-action alternative, all potential local environmental impacts during the construction, operations, and decommissioning phases would be avoided. Similarly, all socioeconomic impacts related to employment, economic activity, population, housing, and community resources during the construction, operations, and decommissioning phases would not occur.

7.2.2 The Proposed Action

The benefits of preconstruction, construction, and operation of the proposed EREF on the economy in the 11-county ROI in which the plant is located, and on the State economy are described in Sections 4.2 and 7.1.2. Societal costs and impacts on land use, historical and cultural resources, visual and scenic resources, air quality, geology and soils, water resources, ecological resources, noise, transportation, public and occupational health, waste management, and environmental justice are described in Sections 4.2 and 7.1.1. In all cases, the impacts are too small to materially affect the comparative benefit-cost analysis.

Other non-monetary cost areas described in Section 7.1.1 are not included as part of this comparison because the effect of these impacts is assumed to be either (1) approximately equal for the proposed action and the no-action alternative as defined above or (2) too small in differential impact to materially affect the comparative benefit-cost analysis.

This analysis does not attempt to estimate the economic effects of a cheaper source of enriched uranium for nuclear power plants, or estimate the impact of lower enriched uranium prices on the ratio of nuclear and non-nuclear power in the domestic economy (1) on overall power demand and price and (2) on the potential economic benefits to consumers and suppliers.

7.2.3 Compliance with Policy and Technical Objectives

The following policy and technical objectives are relevant to the choice of an enrichment technology:

- the need for enriched uranium to fulfill domestic electricity requirements

- the need for domestic supplies of enriched uranium for national energy security

- the need for upgraded uranium enrichment technology in the United States

- the need for energy generation with fewer emissions of criteria pollutants and carbon

The following sections compare the proposed action and the no-action alternative in terms of how well they meet each of these objectives.

7.2.3.1 Meeting Demand for Enriched Uranium

Currently, the demand for enriched uranium in the United States for domestic electricity production is met from two categories of sources:

- domestic production of enriched uranium

- other foreign sources

The current 5-year average U.S. demand for enriched uranium is 14 million SWUs per year (EIA, 2010). From 2005 through 2009, the United States Enrichment Corporation delivered approximately 10 to 13.5 million SWUs to customers annually, of which 5.5 million SWUs per year were from the Megatons to Megawatts Program. Of the remaining 4.5 to 7.5 million SWUs, an average of approximately 2 million SWUs were sold for use in the United States and the balance exported (USEC, 2010). Therefore, of the amount sold for use in the United States, approximately 2 million SWUs (about 15 percent of U.S. demand) come from enrichment at the Paducah Gaseous Diffusion Plant (PGDP) and 5.5 million SWUs (about 38 percent of U.S. demand) come from downblending at the Megatons to Megawatts Program, which depends on deliveries from Russia (EIA, 2010; USEC, 2010). Capacity at the proposed EREF could theoretically be sold only to the U.S. market, thus reducing the overall foreign dependence to approximately 6 million SWUs (43 percent of U.S. demand).

7.2.3.2 National Energy Security

Currently, foreign sources supply as much as 85 percent of the U.S. demand for enriched uranium. The primary domestic production of enriched uranium currently takes place at a single plant – the Paducah Gaseous Diffusion Plant. The heavy dependence on foreign sources and the lack of diversification of domestic sources of enriched uranium represent a potential reliability risk for the domestic nuclear energy industry, which supplies 20 percent of national energy requirements. Interagency discussions led by the National Security Council have concluded that the United States should maintain a viable and competitive domestic uranium enrichment industry for the foreseeable future (DOE, 2002). The U.S. Department of Energy (DOE) has noted the importance of promoting the development of additional domestic enrichment capacity to achieve this objective (DOE, 2002).

It is anticipated that all gaseous diffusion enrichment operations in the United States will cease in 2012 due to the higher cost of aging facilities (DOE, 2007). Furthermore, the Megatons to Megawatts Program is scheduled to expire in 2013. As noted above, these two sources meet more than half of the current U.S. demand for low-enriched uranium (LEU). As a result, new domestic sources of enriched uranium are needed to reliably provide fuel to both the existing and future nuclear power plants in the United States. Thus, projected 6 million SWUs production from the proposed EREF has the potential to be crucial to meeting the nuclear power industry's needs and to increasing the nation's energy security. This benefit is potentially LARGE.

7.2.3.3 Technology Upgrade

A DOE–USEC agreement in 2002 regarding the proposed American Centrifuge Plant in Piketon, Ohio, was intended to "facilitate the deployment of new, cost-effective advanced treatment technology in the U.S. on a rapid scale" (NRC, 2006). Similarly, the proposed action represents the implementation of a technology that is contemporary, cost-effective, and reliable (such as the gas centrifuge technology to be used in the proposed EREF). The proposed action is therefore better able to address the objective of upgraded domestic uranium enrichment technology than the no-action alternative, in which no technology is implemented.

7.2.3.4 Energy Generation with Fewer Emissions of Criteria Pollutants and Carbon

Production of enriched uranium at the proposed EREF would support an increase in electricity production using nuclear technology. Compared to the most likely alternative, coal-fired power plants, nuclear electricity generation results in fewer emissions of criteria pollutants such as nitrogen oxides, sulfur dioxide, and particulate matter, as well as reduced emissions of carbon. In addition, the gas centrifuge technology being chosen for the proposed EREF is less energy-intensive than the existing gaseous diffusion technology. Therefore, regional air quality and environmental impacts would be further reduced. On a national basis, these environmental benefits of the proposed action would be MODERATE.

7.2.4 Conclusions Regarding the Proposed Action versus the No-Action Alternative

Based on consideration of local and national socioeconomic benefits, and the costs of preconstruction, construction, and operation of the proposed EREF on a range of environmental resources, and on public and occupational health, the proposed action is preferable relative to the no-action alternative in the following respects:

- The proposed action better satisfies DOE's policy and technical objectives for meeting future demand, national energy security, technological upgrades, and reducing emissions of criteria pollutants and carbon; and

- The proposed action would have positive impacts in the 11-county ROI on employment, income, and tax revenues during the preconstruction, construction, operations, and decommissioning phases.

7.3 Overall Benefit-Cost Conclusions

While there are national energy security and fiscal benefits associated with the proposed action, and local socioeconomic benefits in the 11-county ROI in which the proposed EREF would be located, there are also direct costs associated with the preconstruction, construction, and operation phases of the proposed project, as well as impacts associated with the proposed action on various resource areas. However, these impacts are estimated to be small in magnitude and small in comparison to the local and national benefits of the proposed action.

Although the no-action alternative would include the continuation of enriched uranium production using gaseous diffusion technology and imported enriched uranium supplies, in order to satisfy domestic demand, the proposed action better satisfies DOE's policy and technical objectives. These objectives require meeting future demand for enriched uranium and improved national energy security with the desired technology upgrades. Also, under the proposed action, there would be fewer emissions of criteria pollutants and carbon. The staff concludes that in comparison to the no-action alternative, the proposed action is associated with significant net positive benefits.

7.4 References

(AES, 2010a) AREVA Enrichment Services, LLC. "Eagle Rock Enrichment Facility Environmental Report, Rev. 2." April.

(AES, 2010b) AREVA Enrichment Service, LLC. Letter from J.A. Kay (Licensing Manager, AES) to U.S. Nuclear Regulatory Commission dated February 19. "Subject: Treatment Plan for Historic Site MW004 and Analysis of Obsidian Artifacts." ADAMS Accession No. ML100540684.

(DOE, 2002) U.S. Department of Energy. Letter from W.J. Magwood, IV (U.S. Department of Energy) to M.J. Virgilio (U.S. Nuclear Regulatory Commission) dated July 25. ADAMS Accession No. ML022350130.

(DOE, 2007) U.S. Department of Energy. "Uranium Enrichment Decontamination & Decommissioning Fund 2007 Report to Congress." Oak Ridge Office and Portsmouth/Paducah Project Office. <http://www.em.doe.gov/pdfs/5th_triennial_report_final.pdf> (Accessed April 16, 2010). ADAMS Accession No. ML103490664.

(EIA, 2010) Energy Information Administration, U.S. Department of Energy. "Uranium Marketing Annual Report." Washington, D.C. August. <http://www.eia.doe.gov/cneaf/nuclear/umar/umar.html> (Accessed November 15, 2010). ADAMS Accession No. ML103480604.

(Gilbert, 2010) Personal communication from H. Gilbert (Idaho National Laboratory) to D. O'Rourke (Argonne National Laboratory) dated April 26, 2010. "Subject: Uniqueness of Late 19th Century Homestead Sites in the General Vicinity of the EREF Property."

(Idaho SHPO, 2010b) Idaho State Historic Preservation Office. Letter from S. Pengilly (Idaho Deputy SHPO) to J. Kay (AREVA) dated November 26, 2010. "Re: Geotechnical Borings at the Proposed Twin Buttes Substation within Cultural Resource Site 10BV246 (MW004), Eagle Rock Enrichment Facility, Bonneville County, Idaho." ADAMS Accession No. ML110240061.

(NRC, 2006) U.S. Nuclear Regulatory Commission. "Environmental Impact Statement for the Proposed American Centrifuge Plant in Piketon, Ohio." NUREG-1834. Office of Nuclear Material Safety and Safeguards, Washington, D.C., April. <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1834/> (Accessed October 7, 2009).

(USEC, 2010) USEC, Inc. "Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange act of 1934 for the Fiscal Year Ended December 31, 2009." March 1. <http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MzcxMTE0fENoaWxkSUQ9MzY4MDY0fFR5cGU9MQ==&t=1> (Accessed December 9, 2010). ADAMS Accession No. ML103480637.

(WCRM, 2010) Western Cultural Resources Management, Inc. Letter from J. Sigler (WCRM) to K. Reid (Idaho Deputy SHPO) dated November 17, 2010. "To Summarize Western Cultural Resource Management's Data Recovery Activities for the Eagle Rock Enrichment Facility Project Located in Bonneville County, Idaho." ADAMS Accession No. ML103280087.

8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

On December 30, 2008, AREVA Enrichment Services, LLC (AES) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a license to construct, operate, and decommission the proposed Eagle Rock Enrichment Facility (EREF) (AES, 2008). AES proposes to locate the facility in Bonneville County, Idaho, approximately 32 kilometers (20 miles) west of Idaho Falls. Revisions to the license application were submitted on April 23, 2009 (Revision 1) (AES, 2009a) and April 30, 2010 (Revision 2) (AES, 2010a). If licensed, the proposed EREF would enrich uranium for use in commercial nuclear fuel for power reactors. Feed material would consist of non-enriched uranium hexafluoride (UF_6). AES would employ a gas centrifuge-based enrichment process to enrich uranium to up to 5 percent uranium-235 by weight, with a planned maximum target production of 6.6 million separative work units (SWUs) per year. The proposed EREF would be licensed in accordance with the provisions of the *Atomic Energy Act*. Specifically, an NRC license under Title 10, "Energy," of the U.S. *Code of Federal Regulations* (10 CFR) Parts 30, 40, and 70 would be required to authorize AES to possess and use byproduct material, source material, and special nuclear material at the proposed EREF.

AES expects to begin preconstruction in late 2010. If the license application is approved, AES expects to begin facility construction in 2011, which would continue for 11 years. AES anticipates commencing initial production in 2014 and reaching full production in 2022. Prior to license expiration in 2041, AES would decide to seek to renew its license to continue operating the facility or plan for the decontamination and decommissioning of the facility per the applicable licensing conditions and NRC regulations.

Section 102 of the *National Environmental Policy Act of 1969*, as amended (NEPA) (Public Law 91-190; Title 42, Section 4321 et seq., *United States Code* [42 U.S.C. 4321 et seq.]), directs that an Environmental Impact Statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. Section 102(2)(C) of NEPA requires that an EIS include information about the following:

- the environmental impacts of the proposed action

- any adverse environmental effects that cannot be avoided, should the proposal be implemented

- alternatives to the proposed action

- the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity

- any irreversible and irretrievable commitments of resources that would be involved if the proposed action is implemented

NRC's regulations under 10 CFR Part 51 implement the requirements of NEPA. In particular, 10 CFR 51.20(b)(10) states that issuance of a license for a uranium enrichment facility requires the NRC to conduct an environmental review and prepare an EIS. As part of its license application and two license application revisions, AES submitted an Environmental Report (ER) and ER Revisions 1 and 2. Information in the ERs and supplemental environmental documentation provided by AES has been reviewed and independently verified by the NRC and used, in part, by the NRC in preparing the EIS. ER Revision 2 (AES, 2010b) incorporates the supplemental environmental documentation provided by AES subsequent to the submittal of ER Revision 1, with the exception of some responses to requests for additional information (AES, 2009b) and supplemental information provided subsequent to ER Revision 2 (North Wind, 2010) that were also used in the preparation of this EIS.

The April 23, 2009, Revision 1 to the AES license application provided details on an expansion of the maximum annual production of the proposed EREF from 3.3 to 6.6 million SWUs per year. On June 17, 2009, AES submitted a request for an exemption from certain NRC regulations to allow commencement of certain preconstruction activities (e.g., site preparation) prior to issuance of the NRC license (AES, 2009c). On October 15, 2009, AES provided information that distinguishes between the environmental impacts of the preconstruction activities specified in its exemption request and those of NRC-authorized construction activities that will not be undertaken unless a license is granted (AES, 2009d). Supplemental information on the proposed transmission line required to power the proposed EREF was submitted by AES on February 18, 2010 (AES, 2010c). On March 17, 2010, the NRC granted an exemption (NRC, 2010) authorizing AES to conduct the preconstruction activities on the proposed EREF site, which AES had requested in its June 17, 2009, exemption request.

Upon acceptance of the ER, the NRC began the environmental review process described in 10 CFR Part 51 by publishing, on May 4, 2009, in the *Federal Register* (74 FR 20508) a Notice of Intent to prepare an EIS and conduct scoping. The purpose of the EIS scoping process was to assist in determining the range of actions, alternatives to the proposed action, and potential impacts to be considered in the EIS, and to identify significant issues related to the proposed action. Comments and information from the public and government agencies were obtained during the scoping period. As part of the scoping process, the NRC staff held a public scoping meeting on June 4, 2009, in Idaho Falls, Idaho. NRC staff considered the public comments received during the scoping process for preparation of this EIS; the summary of the EIS scoping process is provided in Appendix A (the September 2009 Scoping Summary Report).

In addition to reviewing AES's ER and supplemental documentation, the NRC staff consulted with appropriate Federal, State, and local agencies and Tribal organizations. On June 2–4, 2009, the NRC staff met with officials of a number of these agencies and organizations and also conducted a site visit and technical meetings with AES.

Further comments from the public and government agencies were received after the NRC staff issued a Draft EIS for public review and comment on July 21, 2010, and announced its availability in the *Federal Register* (75 FR 4266) in accordance with 10 CFR 51.73, 51.74, and 51.117. The public comment period ended on September 13, 2010. During the public comment period, the NRC staff held two public meetings – in Boise, Idaho, on August 9, 2010, and in Idaho Falls, Idaho, on August 12, 2010 – where oral comments from members of the public were received on the Draft EIS. In addition to oral comments received at the public meetings, the NRC staff received written comments on the Draft EIS at the public meetings and by postal mail and email during the public comment period. The transcripts of the public meetings and the written comments received are part of the public record for the proposed project and were considered by the NRC staff in preparing this EIS. Comment summaries and the NRC staff's responses are contained in Appendix I of this EIS.

Included in this EIS are (1) the results of the NRC staff's analyses, which consider and weigh the environmental effects of preconstruction and the proposed action; (2) mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the NRC staff's recommendation regarding the proposed action based on its environmental review.

Potential environmental impacts are evaluated in this EIS using the three-level standard of significance – SMALL, MODERATE, or LARGE – developed by the NRC using guidelines from the Council on Environmental Quality (CEQ) (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, provides the following definitions of the three significance levels:

- SMALL – Environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

- MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

- LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

8.1 Unavoidable Adverse Environmental Impacts

Section 102(2)(c)(ii) of NEPA requires that an EIS include information on any adverse environmental effects that cannot be avoided, should the proposed action be implemented. Unavoidable adverse environmental impacts are those potential impacts of the NRC action that cannot be avoided and for which no practical means of mitigation are available.

The environmental impacts associated with the proposed action and with the no-action alternative are described in detail in Chapter 4 for each resource area. The impacts of these two alternatives are summarized and compared in Section 2.4. Chapter 4 also discusses the mitigation measures that AES proposed in its ER to mitigate the potential impacts of the proposed action and the mitigation measures identified by the NRC. These two sets of mitigation measures are summarized in Chapter 5, Tables 5-1 and 5-2 and Tables 5-3 and 5-4, respectively. The cumulative impacts on the environment that would result from the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions, are described in Section 4.3.

As discussed in Chapter 4, the environmental impacts that would result if the proposed action were to be implemented as proposed by AES would mostly be SMALL and would, in most cases, be mitigated by the methods proposed by AES. The only resource areas in which certain impacts would be classified as SMALL to MODERATE would be visual and scenic resources, ecological resources, and transportation. In addition, impacts on historic and cultural resources as a result of preconstruction activities would be MODERATE with appropriate mitigation, and air quality impacts from fugitive dust would be MODERATE to LARGE on a temporary basis during preconstruction and construction activities.

The primary impact on historic and cultural resources would result from the destruction during EREF preconstruction activities of site MW004, the John Leopard Homestead, which has been recommended as eligible for listing in the *National Register of Historic Places*. However, the mitigation of this site by AES prior to its disturbance results in a MODERATE level for this impact.

The proposed EREF would create a significant contrast with the surrounding visual environment, presenting a MODERATE impact to visual and scenic resources. The extent of the proposed EREF and the industrial nature of its buildings are not in character with the surrounding viewshed, which includes the surrounding grazing and agricultural lands and the Hell's Half Acre Wilderness Study Area/National Natural Landmark approximately 2.4 kilometers (1.5 miles) to the south.

The impact level on ecological resources has been classified as MODERATE during preconstruction and construction activities because these activities would result in the removal of sagebrush steppe and nonirrigated pasture vegetation. Indirect impacts of preconstruction and construction would include the generation of fugitive dust, erosion of disturbed areas, and potential sedimentation of downgradient habitats. Also, preconstruction and construction activities would result in some wildlife mortality and cause other wildlife to relocate as a result of noise, lighting, traffic, and human presence. Collisions with vehicles or construction equipment may cause some wildlife mortality as well.

The transportation impacts on US 20 in the immediate vicinity of the proposed EREF would be SMALL to MODERATE due to increases in traffic density (primarily from commuting workers) during preconstruction and facility construction, and when facility construction and initial operations overlap.

The ground-disturbing activities during preconstruction and construction would result in increased fugitive dust emissions and cause MODERATE to LARGE air quality impacts. However, air quality impacts would be at the MODERATE to LARGE level only temporarily. The majority of the time, these impacts would be SMALL.

8.2 Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Consistent with the CEQ definition in 40 CFR 1502.16 and the definition provided in Section 5.8 of NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (NRC, 2003), this EIS defines short-term uses and long-term productivity as follows:

- Short-term uses generally affect the present quality of life for the public (i.e., the 30-year license period for the proposed EREF).

- Long-term productivity affects the quality of life for future generations on the basis of environmental sustainability (i.e., long-term is the period after license termination for the proposed EREF).

Preconstruction, construction, and operation of the proposed EREF would necessitate short-term commitments of resources. The short-term commitment of resources would include the use of materials required to construct new buildings and operation support facilities, transportation resources, and other materials and disposal resources for operations at the proposed EREF. Preconstruction, construction, operations, and decommissioning of the proposed EREF would also require the permanent commitment of energy and water resources. The short-term use of resources would result in potential long-term socioeconomic benefits to the local area and the region, such as improvements to the local economy and infrastructure supported by worker income and tax revenues and the maintenance and enhancement of a skilled worker base.

Workers, the public, and the environment would be exposed to increased amounts of radioactive and hazardous materials over the short term from the operation of the proposed EREF and the associated materials, including process emissions and the handling of waste. Construction and operation of the proposed EREF would require a long-term commitment of terrestrial resources, such as land, water, and energy. Impacts would be minimized by the application of proper mitigation measures and resource management. In closing the EREF, AES would decontaminate and decommission the buildings and equipment and restore them for unrestricted use. This work would make the buildings and the site available for other uses. The use of the site and the buildings for other industrial purposes would constitute a long-term benefit to the community and would increase long-term productivity. Continued employment, expenditures, and tax revenues generated during preconstruction, construction, and operation of the proposed EREF and from future site uses after the EREF is decommissioned would directly benefit the local, regional, and State economies and would be considered a long-term benefit.

8.3 Irreversible and Irretrievable Commitment of Resources

Irreversible commitment of resources refers to resources that are destroyed and cannot be restored, whereas an irretrievable commitment of resources refers to material resources that once used cannot be recycled or restored for other uses by practical means (NRC, 2003). The implementation of the proposed action as described in Section 2.1 would include the commitment of land, water, energy, raw materials, and other natural and manmade resources. About 240 hectares (592 acres) on the 1700-hectare (4200-acre) property to be purchased by AES would be used for the preconstruction, construction, and operation of the proposed EREF. AES has stated that following decontamination and decommissioning, all parts of the plant and site would be available for unrestricted use (AES, 2010b). Therefore, if the license is granted, the 240-hectare (592-acre) parcel of land would likely remain in industrial use beyond license termination.

Preconstruction, construction, and operation of the proposed EREF would use groundwater resources from the Eastern Snake River Plain (ESRP) aquifer. The proposed EREF is a consumptive water-use facility, meaning all water would be used and none would be returned to its original source. Although the amount of water from the ESRP aquifer that would be used by the proposed EREF represents a small percentage of the total capacity of the facility's water right appropriation, this water would be lost in three ways: (1) the water would evaporate from the liquid effluent treatment system evaporator and the two Cylinder Storage Pads Stormwater Retention Basins; (2) the water would evaporate or infiltrate into the ground from the Site Stormwater Retention Basin; and (3) infiltrated groundwater would undergo evapotranspiration. It is unlikely that any of the water used by the proposed EREF would replenish the ESRP aquifer or reach adjacent properties.

Energy expended would be in the form of fuel (gasoline and diesel) for equipment and electricity for facility preconstruction, construction, and operations. There are no plans to use natural gas at the proposed EREF. The electrical energy requirement for EREF operation would represent a small increase in the electrical energy demand of the area. Improvements in the local area's electrical power capacity to support the proposed EREF (i.e., the upgrade/addition of an electrical transmission line and substations) would contribute to a slight increase in the irreversible and irretrievable commitment of resources because of the dedication of a small portion of land and material that would be needed for such improvements and the expansion of services.

Resources that would be committed irreversibly or irretrievably during preconstruction, construction, and operation of the proposed EREF include materials that could not be recovered or recycled and materials that would be consumed or reduced to unrecoverable forms. Preconstruction and construction of the proposed EREF would involve the commitment of varying amounts of building materials. During operation, the proposed EREF would generate a small amount of nonrecyclable waste streams, such as hazardous and radiological wastes. Generation of these waste streams would represent an irreversible and irretrievable commitment of material resources.

Even though the land used to construct the proposed EREF would be returned to other productive uses after the facility is decommissioned, there would be some irreversible commitment of land at some offsite locations used to dispose of solid wastes generated at the proposed EREF. In addition, wastes generated during the conversion of depleted UF_6 produced at the proposed EREF and the depleted uranium oxide conversion product from the depleted UF_6 conversion would be disposed of at an offsite location (see Section 2.1.5). The land used for the disposal of these materials would also represent an irreversible commitment of land. No solid wastes or depleted uranium oxide conversion product originating from the proposed EREF would be disposed of on the EREF property.

When the facility is decommissioned, some of the materials used in its construction, such as concrete, steel, other metals, plastics, and other materials, would be recycled and reused. Other materials would be disposed of in licensed and approved offsite locations. The amount of land used to dispose of these materials would also be an irretrievable land resource.

During the operation of the proposed EREF, natural UF_6 would be used as the feed material. This would require the mining of uranium (not licensed by the NRC) and other operational steps in the front end of the uranium fuel cycle (licensed by the NRC) that result in the production of UF_6. The use of uranium minerals would be an irretrievable resource commitment. There would also be other irreversible and irretrievable commitments of resources during uranium fuel cycle operations that result in the production of natural UF_6 feed. As shown in Figure 1-2, there are several fuel cycle operations leading up to the production of the natural UF_6 that feed enrichment operations. These steps include the mining and processing of uranium ore, which result in the production of natural triuranium octaoxide (U_3O_8) and conversion of natural U_3O_8 to UF_6. All materials and energy used in the construction and operation of the facilities used to mine and process the uranium ore and convert natural U_3O_8 to natural UF_6 would constitute an irreversible and irretrievable commitment of resources.

8.4 References

(AES, 2008) AREVA Enrichment Services, LLC. “Eagle Rock Enrichment Facility, Application for a Uranium Enrichment Facility License Under 10 CFR 70, ‘Domestic Licensing of Special Nuclear Material.’” December. <http://adamswebsearch2.nrc.gov/idmws/doccontent.dll?library=PU_ADAMS^PBNTAD01&ID=090770339> (Accessed August 18, 2009). ADAMS Accession No. ML090300656.

(AES, 2009a) AREVA Enrichment Services, LLC. Letter from Sam Shakir (President and CEO, AES) to the U.S. Nuclear Regulatory Commission dated April 23, 2009. “Subject: Revision 1 to License Application for the Eagle Rock Enrichment Facility.” ADAMS Accession No. ML091210638.

(AES, 2009b) AREVA Enrichment Services, LLC. Letter from Jim Kay (Licensing Manager, AES) to the U.S. Nuclear Regulatory Commission dated September 9, 2009. “Subject: Response to Requests for Additional Information – AREVA Enrichment Services LLC Environmental Report for the Eagle Rock Enrichment Facility.” ADAMS Accession No. ML092530636.

(AES, 2009c) AREVA Enrichment Services, LLC. Letter from Sam Shakir (President and CEO, AES) to the U.S. Nuclear Regulatory Commission dated June 17. “Subject: Request for Exemption from 10 CFR 70.4, 10 CFR 70.23(a)(7), 10 CFR 30.4, 10 CFR 30.33(a)(5), 10 CFR 40.4, and 10 CFR 40.32(e) Requirements Governing ‘Commencement of Construction.’” ADAMS Accession No. ML091770390.

(AES, 2009d) AREVA Enrichment Services, LLC. Letter from Jim Kay (Licensing Manager, AES) to the U.S. Nuclear Regulatory Commission dated October 15. “Subject: Response to Request for Additional Information – AES Eagle Rock Enrichment Facility Exemption Request Related to Commencement of Construction (TAC L32730).” ADAMS Accession No. ML092920169.

(AES, 2010a) AREVA Enrichment Services, LLC. “Eagle Rock Enrichment Facility, Revision 2 to License Application.” Bethesda, Maryland. April. ADAMS Accession No. ML101610549.

(AES, 2010b) AREVA Enrichment Services, LLC. “Eagle Rock Enrichment Facility Environmental Report, Rev. 2.” Bethesda, Maryland. April. ADAMS Accession No. ML101610549.

(AES, 2010c) AREVA Enrichment Services, LLC. Letter from Jim Kay (Licensing Manager, AES) to the U.S. Nuclear Regulatory Commission dated February 18. “Subject: Environmental Report for the Eagle Rock Enrichment Facility; Supplemental Information - Revised Appendix H, EREF 161-KV Transmission Line Project.” ADAMS Accession No. ML100540134.

(North Wind, 2010) North Wind, Inc. “Sage Grouse Survey Report, Eagle Rock Enrichment Facility.” May 13. ADAMS Accession No. ML101390471.

(NRC, 2003) U.S. Nuclear Regulatory Commission. “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs.” NUREG-1748. August.

(NRC, 2010) U.S. Nuclear Regulatory Commission. Letter from D. Dorman (U.S. Nuclear Regulatory Commission) to G. Harper (AREVA Enrichment Services, LLC) dated March 17. “Subject: Approval of AREVA Enrichment Services LLC Exemption Request Related to Requirements Governing Commencement of Construction (TAC L32730).”

9 AGENCIES AND ORGANIZATIONS CONTACTED

The following sections list the agencies and organizations contacted by the U.S. Nuclear Regulatory Commission to discuss the Eagle Rock Enrichment Facility project and/or obtain comments, information, and data for use in preparing this Environmental Impact Statement. Position titles/functions of agency/organization personnel are included where known.

9.1 Federal Agencies

Advisory Council on Historic Preservation, Washington, D.C.
- Reid Nelson, Director, Office of Federal Agency Programs
- Tom McCulloch, Archaeologist
- Raymond V. Wallace, Historic Preservation Technician

U.S. Department of Energy (DOE), Headquarters, Washington, D.C.
- Carol Borgstrom, Director, Office of NEPA Policy and Compliance

U.S. Department of Energy, Idaho National Laboratory (INL), Idaho Falls, Idaho
- Bruce Angle, Environmental Management System Manager
- Miriam Taylor, Transportation Specialist

U.S. Department of Energy, Idaho Operations Office, Idaho Falls, Idaho
- Jack Depperschmidt, NEPA Compliance Officer
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U.S. Department of Energy, Loan Programs Office, Washington, D.C.
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- Joseph Montgomery, Consultant

U.S. Department of the Interior, Washington, D.C.
- Director, Office of Environmental Policy and Compliance

U.S. Department of the Interior, Bureau of Land Management, Idaho Falls District, Idaho Falls, Idaho
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- Karen Rice, Associate District Manager

U.S. Department of the Interior, Bureau of Land Management, Upper Snake River Field Office, Idaho Falls, Idaho
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- Mark Ennes, District NEPA Coordinator
- Mark Kennison, District NEPA Coordinator
- Stephanie Balbarini, Solicitor
- William Boggs, Visual Resource Management Coordinator

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Gary Burton, Acting Supervisor
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U.S. Department of the Interior, National Park Service, Craters of the Moon National Monument & Preserve, Arco, Idaho

Doug Neighbor, Superintendent

U.S. Department of the Interior, National Park Service, National Natural Landmarks Program, Sedro Woolley, Washington

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Kelly Powell, Realty Specialist

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9.2 Federally Recognized Indian Tribes

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Nathan Small, Chairman, Fort Hall Business Council (FHBC)
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Tino Batt, Member, FHBC
Devon Boyer, Member, FHBC
Blaine Edmo, Member, FHBC
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Sharon W. Kiefer, Assistant Director – Policy
Lance Hebdon, Inter-Governmental Policy Coordinator
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- A. Ladd Carter, Commissioner – District 3
- Donavan Harrington, Commissioner – District 2
- Cleone Jolley, Commissioner – District 1
- W. Brower, Former Commissioner

Bonneville County Commissioners, Idaho Falls, Idaho
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- Lee Staker, Commissioner – District 3

Bonneville County Planning and Zoning Department, Idaho Falls, Idaho
- Steven Serr, Planning and Zoning Director

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Bonneville Metropolitan Planning Organization, Idaho Falls, Idaho
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City of Blackfoot, Idaho
- Mike Virtue, Mayor

City of Boise, Office of the Mayor, Boise, Idaho
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City of Idaho Falls, Idaho
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10. SUPPLEMENTARY NOTES
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11. ABSTRACT *(200 words or less)*

AREVA Enrichment Services LLC (AES) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a license to construct, operate, and decommission the proposed Eagle Rock Enrichment Facility (EREF) near Idaho Falls in Bonneville County, Idaho. If licensed, the proposed facility would enrich uranium for use in commercial nuclear fuel for power reactors. Feed material would be non-enriched uranium hexafluoride (UF6). AES would employ a gas centrifuge process to enrich uranium up to 5 percent uranium-235 by weight, with a planned maximum target production of 6.6 million separative work units (SWUs) per year. The proposed EREF would be licensed in accordance with the provisions of the Atomic Energy Act. Specifically, an NRC license under Title 10, "Energy," of the U.S. Code of Federal Regulations (10 CFR) Parts 30, 40, and 70 would be required to authorize AES to possess and use special nuclear material, source material, and byproduct material at the proposed EREF site.

This Environmental Impact Statement (EIS) was prepared in compliance with the National Environmental Policy Act (NEPA) and the NRC regulations for implementing NEPA (10 CFR Part 51). This EIS evaluates the potential environmental impacts of the proposed action and its reasonable alternatives.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

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