3.6 DOE SITE FOR NEW ACCELERATOR(S) OR A NEW RESEARCH REACTOR

Under Alternative 3, DOE would construct one or two new accelerators for medical and industrial production, plutonium-238 production, and civilian nuclear energy research and development. In addition, DOE would construct a support facility for the processing of medical and industrial isotopes and for processing associated with research and development activities. Under Alternative 4, DOE would construct a new research reactor and support facility for this same purpose. Processing activities associated with plutonium-238 production would be performed at an existing DOE facility. The new accelerator(s), research reactor, and support facility would be located at an existing DOE site. No DOE site has been identified as the location of these facilities. If DOE were to select these alternatives, a follow-on EIS would be required to select the specific DOE site where the new accelerator(s), research reactor, and support facility would be located. In that document, DOE would identify site-specific environmental conditions, as well as evaluate the environmental impacts of facility construction and operation on the DOE sites being considered.

Because it is unreasonable for this NI PEIS to analyze all DOE sites, the environmental baseline was developed for a generic DOE site description that is representative of existing DOE sites. The generic DOE analysis does not include a specific DOE site for analysis in this NI PEIS. Any existing DOE site is a potential candidate for the new accelerator(s) or research reactor to support DOE's civilian missions for nuclear research and development and isotope production. One factor that would be considered in identifying candidate DOE sites would be the availability of existing facilities and infrastructure at the sites for support of the accelerator(s), research reactor, and support facility.

3.6.1 Land Resources

Land resources include land use and visual resources. Each of these resource areas is described for the site as a whole, as well as for the proposed facility locations.

3.6.1.1 Land Use

Land may be characterized by its potential for the location of human activities (land use). Natural resource attributes and other environmental characteristics could make a site more suitable for some land uses than for others. Changes in land use may have both beneficial and adverse effects on other resources such as ecological, cultural, geological, aquatic, and atmospheric.

DOE sites range from 165 hectares (408 acres) to 350,000 hectares (865,000 acres) in size. While these sites were established for a variety of reasons including nuclear weapons research, development, production, and testing, and energy research and development, the extent of development within each site varies greatly. Facilities located within smaller sites typically occupy a greater percentage of the site than on the larger sites, where from 1 to 25 percent of the site is developed. Undeveloped portions of the sites are used as buffers and in many cases represent land that has remained largely undisturbed since it first came under the jurisdiction of the Federal government. Depending upon the site, undeveloped land may be used for forestry, grazing, wildlife management, or for ecological research. For example, a number of the sites have areas designated as National Environmental Research Parks within their borders. These areas are devoted to research by the nation's scientific community on the impact of human activities on the natural environment. Land uses bordering DOE sites varies from developed urban areas to open spaces in which forestry, wildlife management, farming, grazing, and other rural land uses predominate. Many sites have developed land use plans and recently some have released land for redevelopment by the private sector.

3.6.1.2 Visual Resources

Visual resources are natural and human-created features that give a particular landscape its character and aesthetic quality. Landscape character is determined by the visual elements of form, line, color, and texture. All four elements are present in every landscape. The stronger the influence exerted by these elements in a landscape, the more interesting the landscape.

The visual environment of DOE sites is extremely varied. Certain sites are more highly developed and located near urban areas, while others are only sparsely developed and located many miles from human settlement. Smaller sites and developed portions of larger sites would have a Bureau of Management Visual Resource Management Class IV rating, indicating that the level of change to the characteristic landscape is high and that management activities dominate the view and are the major focus of viewer attention. The Visual Resource Management rating of undeveloped portions of larger DOE sites may range from Class II to Class III. In general, these ratings are characteristic of a less developed landscape and, although management activities may be seen, they should not attract the attention of the casual observer or dominate the view. Views of developed portions of sites located within the eastern United States are often limited due to screening by vegetation and terrain. In the western Unites States vegetation is generally more sparse and in many case the landscape is relatively flat. Thus, developed portions of these sites are typically visible from greater distances. Sites located near urban areas are viewed by more people than are the more isolated sites.

3.6.2 Noise

Existing noise sources and characteristics at a DOE site where the new accelerator(s), research reactor, and support facility might be sited can be expected to be similar to existing DOE sites and are generally described as follows. Major noise emission sources include various industrial facilities, equipment, and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, construction and materials-handling equipment, and vehicles). Most industrial facilities are a sufficient distance from the site boundary that noise levels at the boundary from these sources are not measurable, or are barely distinguishable from background noise levels.

Existing site-related noises of public significance would be from the transportation of people and materials to and from the site. Noise measurements taken near the site would likely indicate that noise levels are consistent with nearby land uses which are primarily rural. Noise levels along roads and access routes to the site would be higher and may result in some annoyance at residences and other noise sensitive land uses near the roads, especially during peak traffic hours.

3.6.3 Air Quality

Ambient air quality at a generic DOE site would be expected to be in compliance with the NAAQS and with the state ambient air quality regulations. A range of ambient air concentrations for criteria pollutants representative of existing DOE sites are presented in **Table 3–43**.

The primary sources of criteria air pollutants could include steam and power generation facilities, incinerators, waste processing sources, various other process sources, vehicles, temporary emissions from construction activities, and fugitive dust from coal piles, construction activities, and waste disposal operations.

Table 3–43 Comparison of Baseline Ambient Air Concentrations with NAAQS at a Generic DOE Site

Pollutant	Averaging Period	NAAQS (micrograms per cubic meter)[a]	Baseline Concentration Range (micrograms per cubic meter)
Criteria pollutants			
Carbon monoxide	8 hours 1 hour	10,000 40,000	8 to 119 27 to 265
Lead	Calendar quarter	1.5	0.05
Nitrogen dioxide	Annual	100	1 to 14
Ozone	1 hour	235	(b)
PM_{10}	Annual 24 hours	50 150	1 to 2 1 to 13
Sulfur dioxide	Annual 24 hours 3 hours	80 365 1,300	1 to 5 1 to 36 2 to 112

a. NAAQS (40 CFR Part 50), other than those for ozone, particulate matter, and lead, and those based on annual averages, are not to be exceeded more than once per year. The annual arithmetic PM_{10} mean standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.
b. Not directly emitted or monitored by the site.
Note: EPA revised the ambient air quality standards for particulate matter and ozone in 1997 (62 FR 38856, 62 FR 38652); however, these standards are currently under litigation, but could become enforceable during the life of this project.
Source: 40 CFR Part 50.

3.6.4 Water Resources

Major surface water features in the vicinity of a generic DOE site could range from seasonally ephemeral (intermittent) streams to perennial streams and rivers more characteristic of an eastern site. These surface waters would be classified and protected by regulation for specified uses (e.g., water supply, agriculture, fish and wildlife uses, recreation). Existing facilities would have NPDES permits that specify the concentrations of pollutants for liquid effluents and stormwater runoff discharged to surface waters. However, some surface waters could have been impacted from historic waste management activities. Process and sanitary effluents from existing facilities would be managed by wastewater treatment plants and/or by seepage or evaporation ponds. Routine and compliance monitoring of discharges would be conducted with results reported in annual site environmental reports. Some generic DOE site locations could potentially be affected by flooding (DOE 1996b:3-115, 3-194–3-196).

Groundwater could occur in aquifers comprised of strata ranging from interbedded volcanic rocks and sediments to sedimentary rocks consisting of limestone, sandstone, siltstone, and shale. Classifications of major aquifers range from Class I to Class II. Groundwater could also occur as perched groundwater. Depth to groundwater could average from about 60 to 300 meters (200 to 1,000 feet) at a western generic DOE site to about 5 to 9 meters (16 to 30 feet) beneath eastern sites. Portions of some aquifer systems, and perched groundwater tables, could have been impacted by radiological and nonradiological contaminants. Like surface waters, routine monitoring of groundwater would be conducted with results reported in annual site environmental reports (DOE 1996b:3-115–3-117, 3-196–3-199).

Water supply for a generic DOE site could be obtained from either surface water or groundwater sources (DOE 1996b:3-115, 3-194).

3.6.5 Geology and Soils

The physiography of a generic DOE site could range from the high, flat to rolling plateaus and plains underlain by nearly horizontal rock strata of the western physiographic provinces to the alternating valleys and ridges comprised of weakly to strongly folded strata of the eastern Valley and Ridge physiographic province. Surficial geology could range from relatively young (Miocene to Holocene) strata consisting of interlayered volcanic rocks (basalt, rhyolite) and unconsolidated sediments to the older (Cambrian to Ordovician), consolidated sedimentary rocks (limestone, sandstone, shale) of the eastern valleys and ridges (DOE 1996b:3-121–3-123, 3-200; 1999e:3-69, 3-70).

The generic DOE site could be located in regions that may have a low to moderate seismic risk as a result of an earthquake based on historical seismic activity. The location of the nearest capable fault could range from about 19 kilometers (12 miles) to more than 480 kilometers (298 miles) (DOE 1996b:3-200; 1999e:3-70, 3-71). The nearest known center of a potentially damaging earthquake to an accelerator(s) or research reactor at a generic DOE site could range from less than 10 kilometers (6 miles) to more than 100 kilometers (62 miles) away (DOE 1996b:3-200; 1999e:3-70, 3-71). New seismic hazard maps have been developed as part of the National Seismic Hazard Mapping Project which have been adapted for use in the new *International Building Code* (ICC 2000) (Figures 1615(1) and 1615(2) in the code) (see Section 3.2.5.1). These maps depict maximum considered earthquake ground motion of 0.2- and 1.0-second spectral response acceleration, respectively, based on a 2 percent probability of exceedance in 50 years. Based on these maps, a generic DOE accelerator(s) or reactor site could be located anywhere within the 0.35g to 0.60g mapping contours for a 0.2-second spectral response acceleration and the 0.10g to 0.15g contours for a 1.0-second spectral response acceleration.

Future risks of volcanic activity affecting a generic site range from a low risk in the west to no risk in the east, with the closest volcanic features occurring 20 kilometers (12 miles) away from a DOE site (DOE 1996b:3-200; 1999e:3-71).

Soil types could range from sands to loams and clays with depths ranging from shallow to deep. The soils developed from materials ranging from volcanic to sedimentary rocks including limestone, sandstone, shale, and siltstone. The soils are largely well drained. Shrink-swell potential generally ranges from low to moderate. In general, most soils are acceptable for standard construction techniques (Barghusen and Feit 1995:2.3-20, 2.8-14, 2.8-15; DOE 1996b:3-123, 3-200).

3.6.6 Ecological Resources

Ecological resources include terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. The nature of these resources in the vicinity of a generic DOE site is highly dependent upon site location. Therefore, the following discussion addresses only the broad ecological characteristics of the regions within which potential DOE sites fall. If the new accelerator(s) or research reactor alternative were selected, site-specific details would be addressed in NEPA documentation tiered to this NI PEIS.

3.6.6.1 Terrestrial Resources

Terrestrial resources in the vicinity of a generic DOE site would include those plant and animal communities typical of the ecoregion within which the facility is located. Ecoregions are characterized by distinctive flora, fauna, climate, landform, soil, vegetation, and ecological climax (Bailey 1976). Within such a region, ecological relationships between plant species, and soil and climate are essentially similar. Provinces are subdivisions that are a broad vegetation region with the same type or types of zonal soils. DOE sites are located in a broad range of provinces, including, but not limited to: Eastern deciduous forest, Southeastern mixed forest, Great plains short-grass prairie, Rocky Mountain forest, Colorado plateau, and Intermountain sagebrush. These provinces are further subdivided by Bailey (1976), based on specific climax vegetation.

3.6.6.2 Wetlands

The presence of wetlands on DOE sites vary, depending upon whether the site is located in the eastern United States where rainfall is plentiful or the western part of the country where it is sparse. Wetlands are common at eastern sites and generally uncommon at western locations. Major types of wetlands which could occur at a generic DOE site include freshwater marshes, shrub swamps, and wooded swamps. Wetlands may be either permanent or intermittent depending upon local rainfall and soil conditions. The existence of manmade wetlands associated with some sites is dependent on continued site operations. Wetlands serve a variety of important functions including maintaining water quality, controlling floodwaters, stabilizing shorelines, and providing recreational uses such as hunting and fishing. They are also important in providing habitat for terrestrial and aquatic organisms including migratory birds and threatened and endangered plants and animals.

3.6.6.3 Aquatic Resources

Aquatic resources vary greatly between potential DOE sites located in the eastern United States and those located in the western part of the country. In the eastern United States, ample rainfall results in the presence of permanent water bodies varying from small streams to major rivers. Natural and manmade ponds and reservoirs are more prominent on or in the vicinity of eastern sites. Numerous species of aquatic flora and fauna occur at these sites. DOE sites located in the western United States typically experience limited rainfall and therefore, have few aquatic resources. In many cases the only water bodies present are evaporation and waste ponds, although major rivers do occur in the vicinity of some sites. Western sites typically have fewer species of aquatic organisms than eastern sites.

3.6.6.4 Threatened and Endangered Species

Threatened and endangered species could be present at a generic DOE site; however, the species involved would be highly dependent on site location. At present, there are 1,233 federally listed threatened and endangered species in the United States (FWS 2000). States also typically identify threatened and endangered, as well as other special status species, found within their borders. Endangered plants and animals often rely on sensitive environments, such as wetlands, for habitat. Critical habitats, areas that are considered essential to the conservation of a species and that could require special management consideration or protection, can be designated and protected under the Endangered Species Act. Protection of threatened and endangered species and their habitat is important for maintaining biodiversity, which is essential for full ecological function.

3.6.7 Cultural and Paleontological Resources

Cultural and paleontological resources include prehistoric resources, historic resources, Native American resources, and paleontological resources. The presence or absence of such resources at a generic accelerator(s) or research reactor site is highly dependent upon the specific location of the DOE site involved. In accordance with applicable Federal and state laws and regulations, any site selected for the accelerator(s) or research reactor would have to be surveyed before construction could begin. Also, consultation with State Historic Preservation Officers and tribal representatives would be required.

3.6.7.1 Prehistoric Resources

Prehistoric resources in the vicinity of a generic DOE site may include sites, districts, or isolated artifacts. Archaeological sites may represent occupation during the Archaic through later prehistoric periods and can include hunting and butchering sites, cemeteries, campsites, and tool manufacturing areas. They may yield artifacts such as stone tools and associated manufacturing debris, and ceramic potsherds. Some prehistoric sites may be included on the National Register of Historic Places, while others may be eligible for listing.

3.6.7.2 Historic Resources

Historic resources potentially present on a generic DOE site include cemeteries, remains of commercial or residential structures, standing structures, or routes used by settlers during westward expansion. While some of these sites may already be on the National Register of Historic Places, others may be eligible for listing. DOE sites may also contain more recent structures of historic significance including those associated with the Manhattan Project and the Cold War era.

3.6.7.3 Native American Resources

Native American resources can include cemeteries, geological or geographic elements (such as mountains or creeks), certain species of animals or plants, architectural structures (such as pueblos), battlefields, or trails. Such resources are important to Native American groups for religious or historical reasons. Many DOE sites contain Native American resources and some sites have signed agreements with local tribes that designate certain rights to those tribes.

3.6.7.4 Paleontological Resources

Paleontological resources are the physical remains, impressions, or traces of plant or animals from a former geological age. Paleontological remains consist of fossils and their associated geological information. The presence of such resources at a generic DOE site is dependent upon the past geologic history of the site.

3.6.8 Socioeconomics

The socioeconomic characteristics of a generic DOE site will vary widely depending on whether the site is located near a large urbanized area or in a remote rural area. Statistics for employment and regional economy are defined for the regional economic area. Statistics for population, housing and community services are defined for the region of influence, which include the counties where nearly 90 percent of the DOE site's employees reside. Since the region of influence population for a generic DOE site could range from nearly 2,000,000 people for a site located in a large metropolitan area, to less than 200,000 for a site located in a small rural community, the socioeconomic impacts of the proposed action will vary immensely. The construction and operation of one or two new accelerators or a new research reactor at a generic DOE site are more likely to have an impact on housing and community services in a remote rural community than one located near a large metropolitan area. Likewise, the impacts on the regional economy and employment could also vary widely. Taking the unemployment rate into account, siting the new accelerator(s) or research reactor at a generic DOE site located in a rural area would have more of an impact on the economy than one located near a large metropolitan area.

If DOE were to select an alternative to build one or two new accelerators or a new research reactor, another EIS would be required to select the specific DOE site to locate the facility. In that document, DOE would perform a thorough evaluation of the socioeconomic impacts of the sites under consideration.

3.6.9 Existing Human Health Risk

3.6.9.1 Radiation Exposure and Risk

Major sources and levels of background radiation exposure to individuals in the vicinity of the generic site where the new accelerator(s) and research reactor could be located are shown in **Table 3–44**. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population changes as the population size changes. Background radiation doses are unrelated to accelerator(s) or reactor site operations.

Table 3–44 Sources of Radiation Exposure to Individuals in the Vicinity Unrelated to Operation at the Accelerator(s) or Reactor Site

Source	Effective Dose Equivalent (millirem per year)
Natural background radiation	
Cosmic radiation	27 to 48
External terrestrial radiation	28 to 74
Radon in homes (inhaled)	200
Internal terrestrial radiation	40
Other background radiation	
Diagnostic x-rays and nuclear medicine	53
Weapons test fallout	Less than 1
Air travel	1
Consumer and industrial products	10
Total	360 to 427

Note: Value of radon is an average for the United States.
Source: Evans et al. 1998:4-19; Hamilton et al. 1999.

Releases of radionuclides to the environment from accelerator(s) or reactor site operations provide another source of radiation exposure to individuals in the vicinity of the site. Types and quantities of radionuclides released from accelerator(s) or reactor site operations are listed in the annual radiological effluent release reports for the reference sites. The doses to the public resulting from these releases are presented in **Table 3–45.** (The data provides a range of consequences to the public based on those associated with DOE sites whose offsite consequences are expected to bound those from the accelerator(s) or reactor site.) These doses fall within radiological guidelines and limits (DOE Order 5400.5) and are small in comparison to background radiation.

Based on a risk estimator of 500 cancer deaths per 1 million person-rem to the public, the latent cancer fatality risk to the maximally exposed member of the public due to radiological releases from operations at the accelerator(s) or reactor site is estimated to range from 1.1×10^{-8} to 2.2×10^{-6} per year. That is, the estimated probability of this person dying of cancer at some point in the future from radiation exposure associated with 1 year of accelerator(s) or reactor site operations ranges from about 1 in 90 million to 1 in 450,000. Note that it takes several to many years from the time of exposure to radiation for a cancer to manifest itself.

Based on the same risk estimator, a range of 1.2×10^{-4} to 3.0×10^{-2} excess fatal cancers is projected in the population living within 80 kilometers (50 miles) of the accelerator(s) or reactor site from normal operations. To place these numbers into perspective, they can be compared with the numbers of fatal cancers expected in these populations from all causes. The 1990 mortality rate associated with cancer for the entire U.S. population was 0.2 percent per year. Based on this mortality rate, the number of fatal cancers expected from all causes in the population living within 80 kilometers (50 miles) of the accelerator(s) or reactor site

Table 3–45 Radiation Doses to the Public from Normal Operation at the Accelerator(s) or Reactor Site (Committed Effective Dose Equivalent)

Members of the Public	Atmospheric Releases		Liquid Releases		Total	
	Standard[a]	Actual	Standard[a]	Actual[b]	Standard[a]	Actual
Maximally exposed individual (millirem)	10	0.021 to 0.73	4	0 to 2.7	100	0.021 to 4.4[c]
Population within 80 kilometers (person-rem)	None	0.23 to 12.3	None	0 to 48	None	0.23 to 60.3
Average individual within 80 kilometers (millirem)[d]	None	0.0019 to 0.014	None	0 to 0.055	None	0.0019 to 0.069

a. The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10-millirem-per-year limit from airborne emissions is required by the Clean Air Act, and the 4-millirem-per-year limit is required by the Safe Drinking Water Act; for this NI PEIS, the 4-millirem-per-year value is conservatively assumed to be the limit for the sum of doses from all liquid pathways. The total dose of 100 millirem per year is the limit from all pathways combined. The 100-person-rem value for the population is given in proposed 10 CFR Part 834, as published in 58 FR 16268. If the potential total dose exceeds the 100-person-rem value, it is required that the contractor operating the facility notify DOE.
b. These doses are mainly from drinking water and eating fish.
c. This total dose includes a conservative value of 1 millirem per year from direct radiation exposure.
d. Obtained by dividing the population dose by the number of people living within 80 kilometers (50 miles) of the site.
Source: Evans et al. 1998:4-19; Hamilton et al. 1999.

ranged from 243 to 1,760. These numbers of expected fatal cancers are much higher than the estimated range of 1.2×10^{-4} to 0.030 fatal cancers that could result from operations at the accelerator(s) or reactor site.

At the accelerator(s) or reactor site, workers receive the same dose as the general public from background radiation but also receive an additional dose from working at the site. The range of the average worker and total worker dose from operations at the accelerator(s) or reactor site are presented in **Table 3–46**. These doses fall within radiological regulatory limits (10 CFR Part 20). Based on a risk estimator of 400 fatal cancers per 1 million person-rem among workers, the number of excess fatal cancers to accelerator(s) or reactor site workers from operations is estimated to range from 0.031 to 0.046 per year (DOE 1999d).

Table 3–46 Annual Doses to Workers from Normal Operation at the Accelerator(s) or Reactor Site (Committed Effective Dose Equivalent)

Occupational Personnel	Onsite Releases and Direct Radiation	
	Standard[a]	Actual
Average worker (millirem)	ALARA[b]	48 to 101
Total workers[c] (person-rem)	ALARA	78 to 115

a. The radiological limit for an individual worker is 5,000 millirem per year. However, DOE's goal is to maintain radiological exposure as low as is reasonably achievable. It has therefore established the Administrative Control Level of 2,000 millirem per year; the site must make reasonable attempts to maintain individual worker doses below this level.
b. As low as is reasonably achievable.
c. The number of badged workers ranges from 1,141 to 1,614.
Source: 10 CFR Section 835.202; DOE 1999d.

3.6.9.2 Chemical Environment

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact, for example, surface waters during swimming and soil through direct contact or via the food pathway.

Carcinogenic Effects. Health effects in this case are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. This could be incremental or excess individual lifetime cancer risks.

Noncarcinogenic Effects. Health effects in this case are determined by the ratio between the calculated or measured concentration of the chemical in the air and the reference concentration or dose. This ratio is known as the Hazard Quotient. Hazard Quotients for noncarcinogens are summed to obtain the Hazard Index. If the Hazard Index is less than 1, no adverse health effects would be expected.

Effective administrative and design controls that decrease hazardous chemical releases to the environment and help achieve compliance with permit requirements, such as air emissions and NPDES permit requirements, contribute toward minimizing potential health impacts to the public. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at the accelerator(s) or reactor site via inhalation of air containing hazardous chemicals released to the atmosphere by site operations. Risks to public health from other possible pathways, such as ingestion of contaminated drinking water or direct exposure are low, relative to the inhalation pathway.

Exposure pathways for accelerator(s) or reactor site workers during normal operations may include inhaling the workplace atmosphere and direct contact with hazardous material associated with work assignments. Occupational exposure varies from facility to facility and from worker to worker, and available information is not sufficient to allow a meaningful estimation and summation of these impacts. However, workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. At the accelerator(s) or reactor site, workers are also protected by adherence to OSHA and EPA standards that limit workplace atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring that reflects the frequency and amounts of chemicals used in the operational processes, ensures that these standards are not exceeded. Worker health conditions at the generic existing accelerator(s) or reactor site are expected to be substantially better than required by the standards.

3.6.9.3 Health Effects Studies

Under Alternatives 3 and 4 of this NI PEIS, DOE would construct one or two accelerators or a research reactor at a generic DOE site for irradiation of targets to produce isotopes or for research. Once the specific sites are identified, DOE would review epidemiologic studies for the specific sites under consideration.

3.6.9.4 Accident History

Accelerators and research reactors have been operating in the United States for many years. Accident information for these accelerators and research reactors, where applicable, can be found in documentation available from DOE and NRC. Estimates of potential accidents and their consequences can also be found in safety analysis reports and probabilistic risk assessments prepared by the accelerator or reactor owners and filed with NRC.

3.6.9.5 Emergency Preparedness

The generic DOE accelerator(s) or reactor site would have a DOE-approved emergency management program that would be activated in the event of an accident. The programs are compatible with other Federal, state, and local plans and are thoroughly coordinated with all interested groups.

3.6.10 Environmental Justice

As discussed in Appendix K, Executive Order 12898 directs Federal agencies to address disproportionately high and adverse health or environmental effects of alternatives on minority and low-income populations. The Executive order does not alter prevailing statutory interpretations under NEPA or existing case law. Regulations prepared by the Council on Environmental Quality remain the foundation for preparing environmental documentation in compliance with NEPA (40 CFR Parts 1500 through 1508) and the Council's guidelines for inclusion of environmental justice under NEPA (CEQ 1997). Specific locations must be designated before detailed reviews of Environmental Justice can be conducted.

3.6.11 Waste Management

Waste management includes minimization, characterization, treatment, storage, transportation, and disposal of waste generated from ongoing DOE activities. The waste is managed using appropriate treatment, storage, and disposal technologies and in compliance with all applicable Federal and state statutes and DOE orders.

3.6.11.1 Waste Inventories and Activities

DOE facilities manage the following types of waste: high-level, transuranic, mixed transuranic, low-level radioactive, mixed low-level radioactive, hazardous, and nonhazardous. The volume of high-level radioactive waste currently stored in addition to expected generation for individual DOE sites ranges from 0 to about 213,000 cubic meters (280,000 cubic yards) (DOE 1997a:summary, 71). The volume of transuranic and mixed transuranic waste currently stored and projected through the year 2033 for individual DOE sites ranges from 0 to about 80,000 cubic meters (100,000 cubic yards). These volumes include estimates from environmental restoration, decontamination and decommisssioning, and future Departmental missions, such as the disposition of weapons-usable plutonium at SRS (DOE 1997e:3).

Based on current inventories and 20 year projections, the disposal volume for low-level radioactive waste for individual DOE sites ranges from 0 to about 3.5 million cubic meters (4.6 million cubic yards) and the disposal volume for mixed low-level radioactive waste for individual DOE sites ranges from 0 to about 320,000 cubic meters (420,000 cubic yards). These volumes include waste resulting from waste management operations and environmental restoration activities (DOE 1998k:app. A). Hazardous waste is generated or exists at most DOE facilities. The annual volume for individual DOE sites ranges from 0 to about 640,000 metric tons per year. These volumes include both wastewater and nonwastewater, RCRA-defined waste only (it does not include Toxic Substance Control Act regulated hazardous waste, state-regulated hazardous waste, and environmental restoration-generated hazardous waste) (DOE 1997a:summary, 80).

Waste management and activities specific to each category of waste are discussed in the following sections.

3.6.11.2 High-Level Radioactive Waste

High-level radioactive waste is the highly radioactive waste resulting from the reprocessing of spent nuclear, fuel including liquid waste produced directly in reprocessing and any solid material derived from the liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation (DOE Order 435.1). High-level waste is also a mixed waste because it contains hazardous constituents that are regulated under RCRA (DOE 1997a:1-27). Although the proposed plutonium-238 production, new medical and industrial isotope production, or new nuclear energy research and development activities would not generate high-level radioactive waste, some DOE facilities manage its transuranic waste as high-level waste. The high-level radioactive waste Record of Decision issued on August 12, 1999 (64 FR 46661) states that immobilized high-level radioactive waste will be stored at the DOE site of generation until transfer to a geologic repository.

3.6.11.3 Transuranic and Mixed Transuranic Waste

Transuranic waste is waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years and atomic number greater than 92, except for (a) high-level radioactive waste, (b) waste that the Secretary of Energy has determined, with the concurrence of the Administrator, does not need the degree of isolation required by the disposal regulations, or (c) waste that NRC has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61. Transuranic waste is produced during reactor fuel assembly, nuclear weapons production, research and development, and spent nuclear fuel processing. The transuranic waste Record of Decision, issued on January 20, 1998 (63 FR 3629), states that DOE will develop and operate mobile and fixed facilities to characterize and prepare transuranic waste for disposal at WIPP. Each DOE site that has or will generate transuranic waste will, as needed, prepare and store its transuranic waste on site.

3.6.11.4 Low-Level Radioactive Waste

Low-level radioactive waste includes all radioactive wastes that is not classified as high-level radioactive waste, spent nuclear fuel, transuranic waste, uranium and thorium mill tailing, or waste from processed ore. Most low-level radioactive waste consists of relatively large amounts of waste materials contaminated with small amounts of radionuclides, such as contaminated equipment (e.g., gloveboxes, ventilation ducts, shielding, and laboratory equipment), protective clothing, paper, rags, packing material, and solidified sludges. Test specimens of fissionable material irradiated for research and development, only, and not for the production of power or plutonium, may be classified as low-level radioactive waste, provided the concentration of transuranics is less than 100 nanocuries per gram of waste. Low-level radioactive waste is subject to the Atomic Energy Act and is categorized as contact handled or remote handled, and as alpha or nonalpha on the basis of the types and levels of radioactivity present. However, most low-level radioactive waste contains short-lived radionuclides and generally can be handled without additional shielding or remote handling equipment (DOE 1997a:1-24). Currently, DOE sites which manage low-level radioactive waste treat and/or dispose of the waste on site or off site either at another DOE facility or commercial facility. The low-level radioactive waste and mixed low-level radioactive waste Record of Decision issued on February 18, 2000 (65 FR 10061), states that for the management of low-level radioactive waste, minimal treatment will be performed at all sites, and disposal will continue, to the extent practicable, on site at INEEL, LANL, ORR, and SRS. In addition, Hanford and the Nevada Test Site will be available to all DOE sites for low-level radioactive waste disposal.

3.6.11.5 Mixed Low-Level Radioactive Waste

Mixed low-level radioactive waste contains both hazardous and low-level radioactive components. The hazardous component in mixed low-level radioactive waste is subject to RCRA, whereas the radioactive components are subject to the Atomic Energy Act (42 U.S.C. 2011 et seq.). Mixed low-level radioactive waste is characterized as either contact handled or remote handled and as alpha or nonalpha. Mixed low-level radioactive waste results from a variety of activities, including the processing of nuclear materials used in nuclear weapons production, and energy research and development activities. Although there are some commercial and DOE treatment facilities available, commercial and DOE facilities are insufficient to treat DOE's inventory of mixed low-level radioactive waste (DOE 1997a:1-24). Most of DOE's mixed low-level radioactive waste is being stored on site awaiting the development of treatment methods. DOE is subject to the requirements mandated by the Federal Facility Compliance Act of 1992, and most DOE facilities that currently store or generate mixed low-level radioactive waste have either a state-approved or EPA region-approved Site Treatment Plan or another type of agreement. Each Site Treatment Plan or agreement requires treatment of mixed waste, including mixed low-level radioactive waste, in accordance with its provisions.

The low-level radioactive waste and mixed low-level radioactive waste Record of Decision, issued on February 18, 2000 (65 FR 10061), states that mixed low-level radioactive waste will be treated at Hanford, INEEL, ORR, and SRS and disposed of at Hanford and the Nevada Test Site.

3.6.11.6 Hazardous Waste

The quantities and types of hazardous waste generated as a result of DOE activities vary considerably and include acids, metals, industrial solvents, paints, oils, rags contaminated with hazardous cleaning compounds, and other hazardous materials that are byproducts of routine maintenance and operations. About 99 percent of DOE's hazardous waste is wastewater and is treated at DOE sites. Treatment residues and the remaining 1 percent, predominantly solvents and cleaning agents, are treated at commercial facilities. The hazardous waste Record of Decision, issued on August 5, 1998 (63 FR 41810), states that most DOE sites will continue to use offsite facilities for treatment and disposal of major portions of the nonwastewater hazardous waste, with ORR and SRS continuing to treat some of their own nonwastewater hazardous waste on site in existing facilities, where this is economically favorable.

3.6.11.7 Nonhazardous Waste

Nonhazardous and nonradioactive sanitary and industrial waste requires limited handling and can be treated or disposed of in properly designed facilities or used in energy production. DOE currently manages sanitary and industrial waste on a site-by-site basis. Some DOE sites dispose of this waste in onsite landfills that have permits issued by appropriate State agencies, while other sites use commercial landfills (DOE 1997a:1-29).

3.6.11.8 Waste Minimization

The DOE complex-wide waste reduction goals for achievement by December 31, 1999 (compared to the 1993 Baseline) are to reduce low-level radioactive waste, mixed low-level radioactive waste, and hazardous waste generation by 50 percent, and nonhazardous waste by 33 percent (DOE 1999f:1).

3.6.12 Spent Nuclear Fuel

The operation of the new reactor will generate nuclear spent fuel at a rate of about 0.31 metric tons of heavy metal per year (Appendix E of this NI PEIS). The Nuclear Waste Policy Act of 1982, as amended, assigned the Secretary of Energy the responsibility for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel. When such a repository is available, spent nuclear fuel would be transferred for disposal from the nuclear reactor site to the repository. Until a repository is available, spent nuclear fuel generated from the operation of the new reactor is expected to be stored on site in the reactor spent fuel pool, which provides the capacity for spent fuel generated from 35 years of operation.

3.7 REFERENCES

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