Appendix G
Methods for Assessing Environmental Impacts

This appendix briefly describes the methods used to assess the potential direct, indirect, and cumulative effects of the alternatives in this *Draft Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility* (*Nuclear Infrastructure Programmatic Environmental Impact Statement* [NI PEIS]). Included are impact assessment methods for land resources, noise, air quality, water resources, geology and soils, ecological resources, cultural and paleontological resources, socioeconomics, waste management, and cumulative impacts. Each section includes a description of the affected resource and the impact assessment method. Impact assessment methods are described separately, as appropriate, for alternatives involving existing facilities and for those involving the new accelerator(s) or a new research reactor at a generic U.S. Department of Energy (DOE) site. Descriptions of the methods for the evaluation of human health effects from normal operations, facility accidents, and transportation, and for environmental justice are presented in Appendixes H, I, J, and K, respectively.

Impact analyses vary for each resource area. For air quality, for example, estimated pollutant emissions from the candidate facilities were compared with appropriate regulatory standards or guidelines. Comparison with regulatory standards is a commonly used method for benchmarking environmental impacts and is done here to provide perspective on the magnitude of identified impacts. For waste management, waste generation ratios were compared with the capacities of waste management facilities. Impacts in all resource areas were analyzed consistently; that is, the impact values were estimated using a consistent set of input variables and computations. Moreover, efforts were made to ensure that calculations in all areas used accepted protocols and up-to-date models.

Baseline conditions at the three DOE sites assessed in this NI PEIS (Oak Ridge Reservation [ORR], Idaho National Engineering and Environment Laboratory [INEEL], and the Hanford Site [Hanford]), as well as an existing commercial light water reactor (CLWR), include present and reasonable foreseeable future actions at each site. Because baseline data for certain irradiation facilities were not available, sitewide data were used to quantify baseline conditions for the assessment of the environmental impacts of proposed actions at each site. Sitewide data set forth in the No Action Alternative define the baseline conditions used in the analysis of other action alternatives for each site, and are the data upon which incremental values were added to determine overall impacts.

G.1 LAND RESOURCES

G.1.1 Land Use

G.1.1.1 Description of Affected Resources

Land use includes the land on and adjacent to each candidate site, the physical features that influence current or proposed uses, pertinent land use plans and regulations, and land ownership and availability. The region of influence for land use varies due to the extent of land ownership, adjacent land use patterns and trends, and other geographic or safety considerations.

G.1.1.2 Description of Impact Assessment

The amount of land disturbed and conformity with existing land use were considered in order to evaluate impacts **(Table G–1)**. Conformity with existing land use was evaluated for each alternative. However, land disturbance was considered only for those alternatives involving new construction. These alternatives include

Table G–1 Impact Assessment Protocol for Land Resources

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Land area used	Site acreage	Facility acreage requirement	Acreage converted to project use
Compatibility with existing or future facility land use	Existing facility land use configurations	Location of facility on the site; expected modifications of facility activities and missions to accommodate the alternatives	Incompatibility with existing or future facility land use
Visual resources	Current Visual Resource Management classification	Location of facility on the site; facility dimensions and appearance	Change in Visual Resource Management classification

the Fuels and Materials Examination Facility (FMEF) at Hanford, which requires a new stack, and the new accelerator(s) or a research reactor at a generic DOE site. For the new stack at FMEF, the specific location and amount of land to be disturbed is known; thus, impacts to land use may be determined. Because the location of the new accelerator(s) or research reactor is unknown, however, the acreage required is only an approximation. Thus, the evaluation of impacts for these new facilities are addressed in general terms. In order to determine the range of potential effects from new facilities, the analysis considered potential impacts from construction and operation at both a disturbed and an undisturbed location at a generic DOE site.

G.1.2 Visual Resources

G.1.2.1 Description of Affected Resources

Visual resources are the 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; however, they exert varying degrees of influence. The stronger the influence exerted by these elements in a landscape, the more interesting the landscape. The more visual variety that exists with harmony, the more aesthetically pleasing the landscape. The region of influence for visual resources includes the geographic area from which the candidate facilities may be seen.

G.1.2.2 Description of Impact Assessment

Impacts to visual resources may be determined by evaluating whether or not the Bureau of Land Management Visual Resource Management classifications of the candidate sites would change as a result of the proposed action (DOI 1986) (Table G–1). Existing classifications were derived from an inventory of scenic qualities, sensitivity levels, and distance zones for particular areas. For those alternatives involving existing facilities at candidate DOE sites, alterations to visual features may be readily evaluated and the impact on the current Visual Resource Management classification determined. For those alternatives involving construction and operation of the new accelerator(s) or research reactor at a generic DOE site, the visual characteristics of the site are unknown. Thus, impacts are addressed in a general manner. In order to determine the range of potential visual effects from new facilities at a generic DOE site, the analysis considered potential impacts from construction and operation at both a disturbed and an undisturbed location at the generic site. Impacts associated with the use of an existing CLWR are also described in a general manner because its location is not known.

G.2 NOISE

G.2.1 Description of Affected Resources

Sound results from the compression and expansion of air or some other medium when an impulse is transmitted through it. Sound requires a source of energy and a medium for transmitting the sound wave. Propagation of sound is affected by various factors, including meteorology, topography, and barriers. Noise is undesirable sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities (e.g., hearing, sleep), damage hearing, or diminish the quality of the environment.

Sound-level measurements used to evaluate the effects of nonimpulsive sound on humans are compensated by an A-weighting scale that accounts for the hearing response characteristics (i.e., frequency) of the human ear. Sound levels are expressed in decibels, or in the case of A-weighted measurements, decibels A-weighted The U.S. Environmental Protection Agency (EPA) has developed noise-level guidelines for different land use classifications. Some states and localities have established noise control regulations or zoning ordinances that specify acceptable noise levels by land use category.

Noise from facility operations and associated traffic could affect human and animal populations. The region of influence for each candidate site includes the site and surrounding area, including transportation corridors, where proposed activities might increase noise levels. Transportation corridors most likely to experience increased noise levels are those roads within a few miles of the site boundary that carry most of the site's employee and shipping traffic.

Sound-level data representative of site environs were obtained from existing reports. The acoustic environment was further described in terms of existing noise sources for each candidate site. Generic sites are described in terms of existing noise characteristics at existing DOE and nuclear power plant sites.

G.2.2 Description of Impact Assessment

Noise impacts associated with the alternatives may result from modification (including construction of a new stack at FMEF) and operation of existing facilities, as well as increased traffic **(Table G–2)**. Impacts from facility modification and operation were assessed according to the types of noise sources and the locations of the candidate facilities relative to the site boundary. Potential noise impacts from traffic were based on the likely increase in traffic volume. Possible impacts to wildlife were evaluated based on the possibility of sudden loud noises occurring during facility modification and operation.

Table G–2 Impact Assessment Protocol for Noise

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Noise	Identification of sensitive offsite receptors (e.g., nearby residences); description of sound levels in the vicinity of the site	Description of major construction, modification, and operational noise sources; shipment and workforce traffic estimates	Increase in day/night average sound level at sensitive receptors

Acoustic impacts from facility construction, modification, and operation at generic sites were assessed according to the types of new noise sources and characteristics identified for a generic site. The potential for traffic noise impacts is discussed, but the change in traffic noise levels at a generic site could not be assessed without site-specific data.

G.3 AIR QUALITY

G.3.1 Description of Affected Resources

Air pollution refers to the introduction, directly or indirectly, of any substance into the air that could endanger human health and harm living resources and ecosystems, as well as material property and impair or interfere with the comfortable enjoyment of life and other legitimate uses of the environment. For the purpose of this NI PEIS, only outdoor air pollutants were addressed. They may be in the form of solid particles, liquid droplets, gases, or a combination of these forms. Generally, they can be categorized as primary pollutants (those emitted directly from identifiable sources) and secondary pollutants (those produced in the air by interaction between two or more primary pollutants, or by reaction with normal atmospheric constituents that may be influenced by sunlight). Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Thus, air quality is affected by air pollutant emission characteristics, meteorology, and topography.

Ambient air quality in a given location can be described by comparing the concentrations of various pollutants in the atmosphere with the appropriate standards. Ambient air quality standards have been established by Federal and state agencies, allowing an adequate margin of safety for the protection of public health and welfare from the adverse effects of pollutants in the ambient air. Pollutant concentrations higher than the corresponding standards are considered unhealthy; those below such standards, acceptable.

The pollutants of concern are primarily those for which Federal and state ambient air quality standards have been established, including criteria air pollutants, hazardous air pollutants, and other toxic air compounds. Criteria air pollutants are those listed in 40 CFR Part 50, "National Primary and Secondary Ambient Air Quality Standards." Hazardous air pollutants and other toxic compounds are those listed in Title I of the 1990 Clean Air Act as amended, those regulated by the National Emissions Standards for Hazardous Air Pollutants, and those that have been proposed or adopted for regulation by the respective state, or are listed in state guidelines. States may set ambient standards that are more stringent than the national ambient air quality standards. The more stringent of the state or Federal standards for each site is shown in this document. Also of concern are air pollutant emissions that may contribute to the depletion of stratospheric ozone or global warming.

Areas with air quality better than the National Ambient Air Quality Standards (NAAQS) for criteria air pollutants are designated as being in attainment, while areas with air quality worse than the NAAQS for such pollutants are designated as nonattainment. Areas may be designated as unclassified when sufficient data for attainment status designation are lacking. Attainment status designations are assigned by county, metropolitan statistical area, consolidated metropolitan statistical area, or portions thereof, or air quality control regions. Air Quality Control Regions designated by EPA are listed in 40 CFR Part 81, "Designation of Areas for Air Quality Planning Purposes." ORR, INEEL, and Hanford are all located in attainment areas (40 CFR Sections 81.313, 81.343, and 81.348).

For locations that are in an attainment area for criteria air pollutants, Prevention of Significant Deterioration regulations limit pollutant emissions from new or modified sources and establish allowable increments of pollutant concentrations. Three Prevention of Significant Deterioration classifications are specified with the criteria established in the Clean Air Act. Class I areas include national wilderness areas, memorial parks larger than 2,020 hectares (5,000 acres), national parks larger than 2,430 hectares (6,000 acres), and areas that have been redesignated as Class I. Class II areas are all areas not designated as Class I. No Class III areas have been designated (42 U.S.C. 7472, Title I, Section 162).

ORR, INEEL, and Hanford are all in Class II areas. In addition, ORR is 48.3 kilometers (30 miles) from the Great Smoky Mountains Class I area, and INEEL is 53 kilometers (33 miles) from the Craters of the Moon Wilderness Area Class I area. There are no Prevention of Significant Deterioration Class I areas within 100 kilometers (62 miles) of Hanford (DOE 1996; DOE 1999a). The recent designation of the Hanford Reach as a national monument may eventually lead to the redesignation of this area, which includes part of Hanford and adjoining areas, as a Prevention of Significant Deterioration Class I area.

The region of influence for air quality encompasses an area surrounding a candidate site that is potentially affected by air pollutant emissions caused by the alternatives. The air quality impact area normally evaluated is the area in which concentrations of criteria pollutants would increase more than a significant amount in a Class II area (i.e., on the basis of averaging period: 1 microgram per cubic meter for annual, 5 micrograms per cubic meter for 24 hours, 500 micrograms per cubic meters for 8 hours, 25 micrograms per cubic meters for 3 hours, and 2,000 micrograms for 1 hour [40 CFR Section 51.165]). Generally, this covers a few kilometers downwind from the source. Further, for sources within 100 kilometers (60 miles) of a Class I area, the air quality impact area evaluated would include the Class I area if the increase in concentration were greater than 1 microgram per cubic meter (24-hour average). The area of the region of influence depends on emission source characteristics, pollutant types, emission rates, and meteorological and topographical conditions. For the purpose of this analysis, where most of the candidate sites are large, impacts were evaluated at the site boundary and roads within the sites to which the public has access, plus any additional area in which contributions to pollutant concentrations are expected to exceed significance levels.

Baseline air quality is typically described in terms of pollutant concentrations modeled for existing sources at each candidate site and background air pollutant concentrations measured near the sites. For this analysis, concentrations for existing sources were obtained from existing source documents such as the *Surplus Plutonium Disposition Final Environmental Impact Statement (Surplus Plutonium Disposition EIS)* (DOE 1999a), the *Storage and Disposition of Weapons-Usable Fissile Material Final Programmatic Environmental Impact Statement (Storage and Disposition PEIS)* (DOE 1996), and the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (*Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management EIS*) (DOE 1995). These concentrations were compared with Federal and state standards or guidelines (**Table G–3**). To determine human health risk, modeling outputs on chemical concentrations in air were weighed against chemical-specific toxicity values.

G.3.2 Description of Impact Assessment

Potential air quality impacts of pollutant emissions from facility modification and normal operations were evaluated for those alternatives associated with the Fast Flux Test Facility (FFTF) restart and the use of existing facilities. This assessment included a comparison of pollutant concentrations from each alternative with applicable Federal and state ambient air quality standards. If both Federal and state standards exist for a given pollutant and averaging period, compliance was evaluated using the more stringent standard. Operational air pollutant emissions data for each alternative were based on conservative engineering analyses.

Table G–3 Impact Assessment Protocol for Air Quality

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Criteria air pollutants and other regulated pollutants[a]	Measured and modeled ambient concentrations (micrograms per cubic meter) from existing sources at site	Emission (kilograms per year) of air pollutants from facility; source characteristics (e.g., stack height and diameter, exit temperature and velocity)	Concentration of alternative and total site concentration of each pollutant at or beyond site boundary, or within boundary on public road compared to applicable standard
Toxic and hazardous air pollutants[b]	Measured and modeled ambient concentrations (micrograms per cubic meter) from existing sources at site	Emission rate (kilograms per year) of pollutants from facility; source characteristics (e.g., stack height and diameter, exit temperature and velocity)	Concentration of alternative and total site concentration of each pollutant at or beyond site boundary, or within boundary on public road compared to applicable standard

a. Carbon monoxide; hydrogen fluoride; lead; nitrogen oxides; ozone; particulate matter with an aerodynamic diameter less than or equal to 10 microns; particulate matter with an aerodynamic diameter less than 2.5 microns; sulfur dioxide; total suspended particulates.
b. Clean Air Act Title III pollutants, pollutants regulated under the National Emissions Standard for Hazardous Air Pollutants, and other state-regulated pollutants.

For each alternative, contributions to offsite air pollutant concentrations were modeled on the basis of guidance presented in EPA's "Guidelines on Air Quality Models" (40 CFR Part 51, Appendix W). The EPA-recommended screening model SCREEN 3 (EPA 1995), was selected as an appropriate model to perform the air dispersion modeling because it is designed to support the EPA regulatory modeling program and predicts conservative worst-case impacts. The SCREEN 3 model was used to estimate maximum 1-hour concentrations. Appropriate regulatory scaling factors were used to estimate concentrations for other averaging periods based on the maximum 1-hour concentration (3 hours, 0.9; 8 hours, 0.7; 24 hours, 0.4; annual, 0.05) (Brode 1988). Concentrations for the No Action Alternative were taken from the baseline air quality discussed previously.

The modeling analysis incorporated conservative assumptions, which tend to overestimate pollutant concentrations. The maximum modeled concentration for each pollutant and averaging time was selected for comparison with the applicable standard. The concentrations evaluated were the maximum occurring at or beyond the site boundary and a public access road, or other publicly accessible area within the site. Available monitoring data, which reflect both onsite and offsite sources, were also taken into consideration. Concentrations of the criteria air pollutants, hazardous air pollutants, and toxic air compounds were presented for each alternative. A set of worst-case meteorological conditions were used in the air quality modeling.

Ozone is typically formed as a secondary pollutant in the ambient air (troposphere). It is formed in the presence of sunlight from the mixing of primary pollutants, such as nitrogen oxides, and volatile organic compounds that emanate from vehicular (mobile), natural, and other stationary sources. Ozone is not emitted directly as a pollutant from the candidate sites. Although ozone may be regarded as a regional issue, specific ozone precursors, notably nitrogen dioxide and volatile organic compounds, were analyzed as applicable to the alternatives under consideration.

The Clean Air Act, as amended, required that Federal actions conform to the host state's "state implementation plan." A state implementation plan provides for the implementation, maintenance, and enforcement of NAAQS for the six criteria pollutants: sulfur dioxide, particulate matter with an aerodynamic diameter less than or equal to 10 microns, carbon monoxide, ozone, nitrogen dioxide, and lead. Its purpose is to eliminate or reduce the severity and number of violations of NAAQS and to expedite the attainment of these standards.

No department, agency, or instrumentality of the Federal Government shall engage in or support in any way (i.e., provide financial assistance for, license or permit, or approve) any activity that does not conform to an applicable implementation plan. The final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (58 FR 63214) took effect on January 31, 1994. ORR, INEEL, and Hanford are within areas currently designated as attainment for criteria air pollutants. Therefore, the alternatives being considered at these sites are not affected by the provisions of the conformity rule.

Continued operation of a CLWR at an unknown site would result in a small amount of nonradiological air pollutants being released to the atmosphere, mainly due to the requirement of periodical testing of the emergency diesel generators. Air quality impacts associated with a CLWR were addressed as a contribution from the facility operation.

Air quality impacts from the new accelerator(s) or a research reactor are discussed for construction and operation at a generic DOE site. The potential for an increase in nonradiological air emissions is attributed to the supporting facility equipment and construction activities, such as increased employee vehicles, truck traffic, and diesel generator use.

Emissions of potential stratospheric ozone-depleting compounds such as chlorofluorocarbons were not evaluated, as no emissions of these pollutants were identified in the engineering design reports.

G.4 WATER RESOURCES

G.4.1 Description of Affected Resources

Water resources are the surface and subsurface waters that are suitable for human consumption, aquatic or wildlife propagation, agricultural purposes, irrigation or industrial/commercial purposes. The region of influence used for water resources encompasses those surface water and groundwater systems which could be impacted by water withdrawals, effluent discharges, and spills or stormwater runoff associated with construction and operation of the candidate facilities.

G.4.2 Description of Impact Assessment

G.4.2.1 Water Use

This analysis involved the review of engineering estimates of expected water use and effluent discharges associated with each alternative, and the impacts on local water availability and quality, including surface water and groundwater. Impacts on water use were assessed by determining changes in the volume of current water usage and effluent discharges as a result of the proposed activities. The determination of the impacts on water usage and effluent discharge are summarized in **Table G–4**.

If the determination reflected an increase in water use or effluent discharge, then an evaluation of the design capacity of the water and effluent treatment facilities was made to determine whether the design capacity would be exceeded by the additional flow. If the combined flow (i.e., the existing flow plus those from the proposed activities), was less than the design capacity of the water supply systems and effluent treatment plants, then it was assumed that there would be no impact on water availability for local users, nor on the receiving stream from effluent discharges. Because flows from the candidate facilities were generally found not to exceed the design capacity of existing water supply systems or effluent treatment facilities, no additional analyses were performed.

Table G–4 Impact Assessment Protocol for Water Use and Effluent Discharge

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Surface water availability	Surface waters near the facilities, including average flow and current usage	Volume of withdrawals from, and discharges to, surface waters	Changes in availability to downstream users of water for drinking, irrigation, or animal feeding
Groundwater availability	Groundwater near the facilities, including existing water rights for major water users and current usage	Volume of withdrawals from, and discharges to, groundwater	Changes in availability of groundwater for human consumption, irrigation, or animal feeding

G.4.2.2 Water Quality

The water quality impact assessment for this NI PEIS analyzed how effluent discharges to surface water, as well as discharges reaching groundwater, from the candidate facilities would affect current water quality. The determination of the impacts of the alternatives is summarized in **Table G–5** and consisted of a comparison of the projected water quality with relevant regulatory standards such as the Clean Water Act, Safe Drinking Water Act, state regulations, and existing permit conditions. Separate analyses were conducted for surface water and groundwater impacts.

Table G–5 Impact Assessment Protocol for Water Quality

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Surface water quality	Surface waters near the facilities in terms of stream classifications and changes in water quality	Expected contaminants and contaminant concentrations in discharges to surface water	Compliance of discharge to surface water with relevant standards of Clean Water Act or with state regulations and existing National Pollutant Discharge Elimination System permits
Groundwater quality	Groundwater near the facilities in terms of classification, presence of designated sole source aquifers, and changes in quality of groundwater	Expected contaminants and contaminant concentrations in discharges that could reach groundwater	Concentrations of contaminants in groundwater exceeding standards established in accordance with Safe Drinking Water Act or state regulations

Surface Water Quality. The evaluation of the surface water quality impacts focused on the quality and quantity of the effluent to be discharged and the quality of the receiving stream upstream and downstream from the discharge. The evaluation of effluent quality featured review of the expected parameters, such as the design average and maximum flows, as well as the effluent parameters reflected in the existing or expected National Pollutant Discharge Elimination System (NPDES) permit. Those parameters include total suspended solids, metals, organic and inorganic chemicals, radionuclides, and any other parameters that affect the local environment. Water quality management practices were reviewed to ensure that NPDES permit limitations would be met. Factors that currently degrade water quality were also identified.

Groundwater Quality. Potential groundwater quality impacts associated with effluent discharges were examined. Engineering estimates of contaminant concentrations were weighed against Federal and state groundwater quality standards, effluent limitations, and drinking water standards to determine the impacts of each alternative. Also evaluated were the consequences for groundwater use in the area.

The water resources impact assessment for activities involving generic DOE or CLWR sites was generally conducted in the same manner as described above. However, as the exact nature of the sites is not known, it was necessary to make bounding assumptions regarding the range of potential resource conditions that could be present and potentially affected (e.g., surface or groundwater) coupled with using highly conservative estimates of expected impacts (e.g., water withdrawals). This was done to better ensure that the resulting analysis would be applicable to any site and to provide a comparative basis for the impacts assessment.

G.5 GEOLOGY AND SOILS

G.5.1 Description of Affected Resources

Geologic resources include consolidated and unconsolidated earth materials, including mineral assets such as ore and aggregate materials, and fossil fuels such as coal, oil, and natural gas. Geologic conditions include hazards such as earthquakes, faults, volcanoes, landslides, and land subsidence. Soil resources include the loose surface materials of the earth in which plants grow, usually consisting of mineral particles from disintegrating rock, organic matter, and soluble salts. Prime farmland, as defined in 7 CFR Part 657, is land that contains the best combination of physical and chemical characteristics for producing crops. It includes cropland, pasture land, rangeland, and forest land.

The region of influence for geology and soils includes all areas subject to disturbance by construction and operation or decontamination and decommissioning of the candidate facilities, as applicable, and those areas beneath existing or new facilities that would remain inaccessible for the life of the facilities.

Geology and soil conditions that could affect the integrity and safety of the candidate facilities include large-scale geologic hazards (e.g., earthquakes) and attributes of the soil and bedrock beneath the new facilities. The area within which these conditions exist, and which could impact existing or new facilities, constitute the region of influence for this resource area.

G.5.2 Description of Impact Assessment

The geology and soils impact analysis (**Table G–6**) considered the risks to the existing and new facilities of large-scale geologic hazards such as faulting and earthquakes, lava extrusions and other volcanic activity, landslides, and sinkholes, (i.e., conditions that tend to affect broad expanses of land). While evidence of impacts in facility-specific areas was developed, as appropriate, there was no attempt to revisit the basic conclusions of the *Storage and Disposition PEIS* (DOE 1996) as reviewed in the *Surplus Plutonium Disposition EIS* (DOE 1999a) for INEEL and Hanford in this regard: that the risks of such hazards to storage and disposition facilities at the candidate sites are acceptable. The findings of those analyses, which focused on the presence of the hazard and the distance of the facilities from it, were accepted as generally applicable to the candidate facilities. Because no major construction is associated with any of the alternatives (which involve only existing facilities), geologic resources and soils (including prime farmland) would not be affected.

Table G–6 Impact Assessment Protocol for Geology and Soils

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Geologic hazards	Presence of geologic hazards within the region of influence	Location of facility on the site	Potential for damage to facilities
Prime farmland soils	Presence of prime farmland within the region of influence	Location of facility on the site	Loss of prime farmland

The geology and soils impact assessment for activities involving generic DOE or CLWR sites was generally conducted in the same manner as described above. However, as the exact nature of the sites is not known, it was necessary to make bounding assumptions regarding the range of potential geologic and soils conditions that could be present (e.g., subsurface composition, proximity of faults) coupled with using highly conservative estimates of expected impacts (e.g., land disturbance). This was done to better ensure that the resulting analysis would be applicable to any site and to provide a more comparative basis for the impacts assessment. Once candidate sites have been identified, subsequent National Environmental Policy Act (NEPA) actions would be required.

G.6 ECOLOGICAL RESOURCES

G.6.1 Description of Affected Resources

Ecological resources include terrestrial and aquatic resources (plants and animals), wetlands, and threatened and endangered species. The region of influence used for the ecological resource analysis encompassed the area potentially disturbed by construction and operation of the candidate facilities.

Terrestrial resources are defined as those plant and animal species and communities that are most closely associated with the land; for aquatic resources, a water environment. Wetlands are defined by the U.S. Army Corps of Engineers and EPA as ". . . those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR Section 328.3).

Endangered species are defined under the Endangered Species Act of 1973 as those in danger of extinction throughout all or a large portion of their range. Threatened species are defined as those species likely to become endangered within the foreseeable future. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service propose species to be added to the lists of threatened and endangered species. They also maintain a list of "candidate" species for which they have evidence that listing may be warranted but for which listing is currently precluded by the need to list species more in need of Endangered Species Act protection. Candidate species do not receive legal protection under the Endangered Species Act, but should be considered in project planning in case they are listed in the future. Critical habitat for threatened and endangered species is designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service. Critical habitat is defined as specific areas that contain physical and biological features essential to the conservation of species and that may require special management consideration or protection. States may also designate species as endangered, threatened, sensitive protected, in need of management, of concern, monitored, or species of special concern.

G.6.2 Description of Impact Assessment

Impacts to ecological resources may occur as a result of land disturbance, water use, air and water emissions, human activity, and noise associated with project implementation **(Table G–7)**. Each of these factors was considered when evaluating potential impacts from the proposed action. All alternatives, except those involving construction and operation of the new accelerator(s) or research reactor, involve only internal facility modification or limited new construction (a new stack for FMEF). Thus, direct impacts to ecological resources from land disturbance and human activity would be minimal. For alternatives involving construction and operation of the new accelerator(s) or research reactor at a generic DOE site, potential impacts to terrestrial resources were determined based on the approximate acreage of land disturbed. Because a specific facility location is not known, the analysis generally considered impacts at both a disturbed and an undisturbed location at a generic DOE site. Impacts to terrestrial and aquatic ecosystems and wetlands from water use and

Table G–7 Impact Assessment Protocol for Ecological Resources

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Terrestrial resources	Vegetation and wildlife within vicinity of facilities	Facility location, air and water emissions, and noise	Loss or disturbance to terrestrial habitat; emissions and noise values above levels shown to cause impacts to terrestrial resources
Aquatic resources	Aquatic resources within vicinity of facilities	Facility air and water emissions, water source and quantity, and wastewater discharge location and quantity	Discharges above levels shown to cause impacts to aquatic resources; changes in water withdrawals and discharges
Wetlands	Wetlands within vicinity of facilities	Facility location, air and water emissions, and wastewater discharge quantity and location	Loss or disturbance to wetlands; discharge to wetlands
Threatened and endangered species	Threatened and endangered species within vicinity of facilities	Facility location, air and water emissions, noise, water source and quantity, and wastewater discharge location and quantity	Measures similar to those noted above for terrestrial and aquatic resources

air and water emissions were evaluated based on the results of the analysis conducted for air quality and water resources. Consultations have been initiated with the U.S. Fish and Wildlife Service and National Marine Fisheries Service to comply with Section 7 of the Endangered Species Act. Consultations have also been initiated with appropriate state agencies. The determination of impacts to these species were based on similar factors as noted above for terrestrial resources, wetlands, and aquatic resources.

G.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

G.7.1 Description of Affected Resources

Cultural resources are the indications of human occupation and use of the landscape as defined and protected by a series of Federal laws, regulations, and guidelines. For this NI PEIS, potential impacts were assessed separately for each of the three general categories of cultural resources: prehistoric, historic, and Native American. Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geological age, and may be sources of information on paleoenvironments and the evolutionary development of plants and animals. Although not governed by the same historic preservation laws as cultural resources, they could be affected by the proposed action in much the same manner.

Prehistoric resources are physical remains of human activities that predate written records; they generally consist of artifacts that may alone or collectively yield otherwise inaccessible information about the past. Historic resources consist of physical remains that postdate the emergence of written records; in the United States, they are architectural structures or districts, archaeological objects, and archaeological features dating from 1492 and later. Ordinarily, sites less than 50 years old are not considered historic, but exceptions can be made for such properties if they are of particular importance, such as structures associated with Cold War themes. Native American resources are sites, areas, and materials important to Native Americans for religious or heritage reasons. Such resources may include geographical features, plants, animals, cemeteries, battlefields, trails, and environmental features. The region of influence for the cultural and paleontological

resource analysis encompassed the area potentially disturbed by construction and operation of the candidate facilities.

G.7.2 Description of Impact Assessment

The analysis of impacts to cultural and paleontological resources addressed potential direct and indirect impacts at each candidate site, including an unspecified CLWR site and a generic DOE site (**Table G–8**).

Table G–8 Impact Assessment Protocol for Cultural and Paleontological

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Prehistoric resources	Prehistoric resources within the vicinity of facilities	Location of facility on the site	Potential for loss, isolation, or alteration of the character of prehistoric resources; introduction of visual, audible, or atmospheric elements out of character; neglect of resources listed or eligible for listing on the National Register of Historic Places
Historic resources	Historic resources within the vicinity of facilities	Location of facility on the site	Potential for loss, isolation, or alteration of the character of historic resources; introduction of visual, audible, or atmospheric elements out of character; neglect of resources listed or eligible for listing on the National Register of Historic Places
Native American resources	Native American resources within the vicinity of facilities	Location of facility on the site	Potential for loss, isolation, or alteration of the character of Native American resources; introduction of visual, audible or atmospheric elements out of character
Paleontological resources	Paleontological resources within the vicinity of facilities	Location of facility on the site	Potential for loss, isolation or alteration of paleontological resources

Potential indirect impacts include those associated with reduced access to a resource site, as well as impacts associated with increased traffic and visitation to sensitive areas. Direct impacts include those resulting from groundbreaking activities associated with new construction. Direct impacts would be associated with construction of the new accelerator(s) or research reactor at a generic DOE site. Because the specific location is unknown, however, impacts from new construction were addressed in a general manner. In order to determine the range of potential impacts, the analysis considered potential effects at both a disturbed and an undisturbed location at a generic DOE site. Impacts associated with the use of an existing CLWR at an unknown location were also addressed in a general manner. Consultations to comply with Section 106 of the National Historic Preservation Act have been initiated with the various State Historic Preservation Officers. Consultations have also been initiated with interested Native American tribes.

G.8 SOCIOECONOMICS

G.8.1 Description of Affected Resources

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics of a region. The number of jobs created by the proposed action would affect regional employment, income, and expenditures. Job creation is characterized by two types: (1) construction-related jobs, transient in nature and short in duration, and thus less likely to impact public services; and (2) jobs related to plant operations, required for a decade or more, and thus possibly creating additional service requirements in the region of influence.

The socioeconomic environment is made up of two geographic regions, the regional economic area and region of influence. Regional economic areas are made up of regional economies and include descriptions of industrial and service sector characteristics and their linkages to the communities within a region. These linkages determine the nature and magnitude of any effect associated with a change in regional economic activity. For example, as work expands within a region, the money spent on accomplishing this work flows into the local economy; it is spent on additional jobs, goods, and services within the regional economic area.

Similarly, potential demographic impacts were assessed for the region of influence. The region of influence could represent a smaller geographic area, one in which only the housing market and local community services would be significantly affected by a given alternative. Site-specific regions of influence were identified as those counties in which at least 90 percent of the site's workforce reside. This distribution reflects an existing residential preference for people currently employed at the sites and was used to estimate the distribution of new workers supporting the alternatives.

G.8.2 Description of Impact Assessment

For each regional economic area, data were compiled on the current socioeconomic conditions, including unemployment rates, economic industrial and service sector activities, and the civilian labor force. The workforce and cost requirements of each alternative were determined in order to measure their possible effect on these socioeconomic conditions. Although workforce requirements may be able to be filled by employees already working at DOE sites, it was assumed these requirements would be filled by new employees to ensure that the maximum impact was assessed. For each region of influence, census statistics were also compiled on population, housing demand, and community services. U.S. Bureau of the Census population forecasts for the regions of influence were combined with overall projected workforce requirements for each of the alternatives being considered at each candidate site to determine the extent of impacts on housing demand and levels of community services (**Table G–9**).

For those alternatives involving construction and operation of the new accelerator(s) or research reactor at a generic DOE site, the socioeconomic characteristics of the site are unknown. Impacts cannot be measured until candidate sites are identified. Therefore, if one of these alternatives were selected, additional NEPA documentation would be required, which would address the socioeconomic impacts.

Impacts associated with the use of an existing CLWR were addressed in a general manner as the location is unknown.

Table G–9 Impact Assessment Protocol for Socioeconomics

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Regional Economic Characteristics			
Workforce requirements	Site workforce projections from DOE sites	Estimated construction and operating staff requirements and timeframes	Workforce requirements added to sites' workforce projections
Regional economic area civilian labor force	Labor force projections based on state population projections	Estimated construction and operating staff requirements and timeframes	Workforce requirements as a percentage of the civilian labor force
Unemployment rate	1996 unemployment rates in counties surrounding sites and in host states	Estimated construction and operating staff requirements	Projected change in unemployment rates
Population and Housing			
Population	Latest available population projection estimates from the U.S. Bureau of the Census	Estimated contribution to projected population	Projected change in population projection
Housing—Percent of occupied housing units	Latest available rates from the U.S. Bureau of the Census	Assess potential need for new housing units to meet workforce requirements	Projected change in workforce
Community Services			
Education			
Percent operating capacity for school districts in the region of influence	Latest available rates from the U.S. Bureau of the Census	Assess potential need for new schools	Projected change in student population
Teacher-to-student ratio	Latest available rates from the U.S. Bureau of the Census	Assess potential need for additional teachers	Projected change to maintain current teacher-to-student ratio
Public safety—Ratio of police and firefighters to 100,000 residents	Latest available rates from the U.S. Bureau of the Census	Assess potential need for additional officers and firefighters	Projected change to maintain the current police officer/firefighter to population ratio
Health care—Number of hospital beds and physicians per 100,000 residents	Latest available rates from the U.S. Bureau of the Census	Assess potential need for additional hospitals and physicians	Projected change in the availability of hospital beds/physicians to population ratio

G.9 WASTE MANAGEMENT

G.9.1 Description of Affected Resources

Depending on the alternative, construction and operation of the candidate facilities, as well as the permanent deactivation of FFTF and decontamination and decommissioning of the new accelerator(s), research reactor, and support facility, would generate several types of waste. Such wastes include the following:

- **Transuranic:** Waste containing more than 100 nanocuries per gram of alpha-emitting transuranic isotopes, with half-lives greater than 20 years, except for (1) high-level radioactive waste; (2) waste that DOE has determined, with the concurrence of EPA, does not need the degree of isolation required by 40 CFR Part 191; and (3) waste that the U.S. Nuclear Regulatory Commission has approved for disposal, case-by-case in accordance with 10 CFR Part 61. Contact-handled transuranic waste is packaged transuranic waste whose external surface dose rate does not exceed 200 millirem per hour. Remote-handled transuranic waste is packaged transuranic waste whose external surface dose rate exceeds 200 millirem per hour. Mixed transuranic waste contains hazardous components regulated under the Resource Conservation and Recovery Act (RCRA).

- **Low-level radioactive:** Waste that contains radioactivity and is not classified as high-level radioactive waste, transuranic waste, or spent nuclear fuel, or the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material. 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 transuranic concentration is less than 100 nanocuries per gram of waste.

- **Mixed low-level radioactive:** Low-level radioactive waste that also contains hazardous components regulated under RCRA.

- **Hazardous:** Under RCRA, a waste that, because of its characteristics, may (1) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness, or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous wastes appear on special EPA lists or possess at least one of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. This category does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act.

- **Nonhazardous:** Discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. This category does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act.

The alternatives could have an impact on existing site facilities devoted to the treatment, storage, and disposal of these categories of waste. Waste management activities in support of the proposed action would be contingent on Records of Decision issued for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (Waste Management PEIS)* (DOE 1997). The Record of Decision for transuranic waste, issued on January 20, 1998 (63 FR 3629), states that transuranic and transuranic mixed waste would be certified on site and shipped to a suitable geologic repository. According to the Record of Decision for hazardous waste, released on August 5, 1998 (63 FR 41810), DOE sites evaluated in this NI PEIS will continue to use offsite facilities for the treatment and disposal of major portions of their nonwastewater hazardous waste, with ORR

continuing to treat some of its nonwastewater hazardous waste in existing facilities where economically feasible. Based on the Record of Decision for low-level radioactive waste and mixed low-level radioactive waste issued on February 18, 2000 (65 FR 10061), minimal treatment of low-level radioactive waste will be performed at all sites, and to the extent practical, onsite disposal of low-level radioactive waste will continue. Hanford and the Nevada Test Site will be made available to all DOE sites for the disposal of low-level radioactive waste. Mixed low-level radioactive waste analyzed in the *Waste Management PEIS* (DOE 1997) will be treated at Hanford, INEEL, ORR, and the Savannah River Site (SRS) and will be disposed of at Hanford and the Nevada Test Site.

G.9.2 Description of Impact Assessment

As shown in **Table G–10**, impacts were assessed by comparing the projected waste stream volumes generated from the proposed activities at each candidate site with that site's waste management capacities and generation rates. Only the impacts relative to the capacities of waste management facilities were considered; other environmental impacts of waste management facility operations (e.g., human health effects) are evaluated in other sections of this NI PEIS, or in other facility-specific or sitewide NEPA documents. Projected waste generation rates for the proposed activities were compared with site processing rates and capacities of those treatment, storage, and disposal facilities likely to be involved in managing the additional waste. The waste generation rates were provided by the sites' technical personnel.

Table G–10 Impact Assessment Protocol for Waste Management

Resource	Required Data		Measure of Impact
	Affected Environment	Alternative	
Waste management capacity Transuranic waste Low-level radioactive waste Mixed low-level radioactive waste Hazardous waste Nonhazardous waste	Site generation rates (cubic meters per year) for each waste type Site management capacities (cubic meters) or rates (cubic meters per year) for potentially affected treatment, storage, and disposal facilities for each waste type	Generation rates (cubic meters per year) from facility operations for each waste type	Combination of facility waste generation volumes and other site generation volumes in comparison to the capacities of applicable waste management facilities

For the generic DOE site or CLWR site, projected waste stream volumes could not be compared to site waste management capacities and generation rates because a specific location was not identified.

G.10 CUMULATIVE IMPACTS

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR Section 1508.7). The cumulative impact analysis for this NI PEIS involved combining the impacts of the alternatives (including No Action) with the impacts of other present and reasonably foreseeable activities in the region of influence. The regions of influence for different resources can vary widely in extent. For example, the region of influence for waste management would generally be confined to the areal extent of each site, whereas the region of influence for human health would include the areas extending out to 80 kilometers (50 miles) from each site.

In general, cumulative impacts were calculated by adding the values for the baseline affected environment (i.e., conditions attributable to present actions by DOE and other public and private entities), the proposed action, and other future actions. This cumulative value was then weighed against the appropriate impact

indicators (e.g., standards or number of fatalities) to determine the potential for impact. For this cumulative impact assessment, it was conservatively assumed that all facilities would operate concurrently at the candidate DOE sites. The selected indicators of cumulative impacts evaluated in this NI PEIS are shown in **Table G–11**.

Table G–11 Selected Indicators of Cumulative Impact

Category	Indicator
Resource use	Electricity use compared with site capacity Water use compared with site capacity Workers required compared with existing workforce
Air quality	Criteria pollutant concentrations and comparisons with standards or guidelines
Human health	Public Offsite population dose Maximally exposed individual dose Fatalities Comparison with DOE dose limits Workers Total dose Average worker dose Fatalities Comparison with DOE dose limits
Waste	Transuranic waste generation rate compared with existing generation rate Low-level radioactive generation rate compared with existing generation rate Mixed low-level radioactive generation rate compared with existing generation rate Hazardous waste generation rate compared with existing generation rate Nonhazardous generation rate compared with existing generation rate
Spent nuclear fuel	Spent nuclear fuel generation rate and storage capacity
Transportation	Radiation exposures Public Transportation workers Fatalities Traffic fatalities

Public documents prepared by agencies of Federal, state, and local governments were the primary sources of information for non-DOE actions.

The analysis focused on the potential for cumulative impacts at each candidate site from DOE actions under detailed consideration at the time of this NI PEIS, as well as cumulative impacts associated with transportation between the sites, between SRS and other sites, and between the processing sites and Los Alamos National Laboratory (**Table G–12**). Non-DOE actions were also considered where information was readily available.

It is assumed that construction impacts would not be cumulative because construction is typically short in duration, and construction impacts are generally temporary. Further, except for a stack required for FMEF, construction is limited to internal modifications to existing DOE facilities. Decontamination and decommissioning of the candidate facilities was not addressed in the cumulative impact estimates. Given the uncertainty regarding the timing of decontamination and decommissioning, any impact estimate at this time would be highly speculative. A detailed evaluation of decontamination and decommissioning would be provided in follow-on NEPA documentation closer to the actual time of those actions.

Table G–12 Other Present and Reasonably Foreseeable Actions Considered in the Cumulative Impact Assessment

Activities	ORR	INEEL	Hanford
Disposition of Surplus Plutonium		X	X
Storage and Disposition of Weapons-Usable Fissile Materials	X	X	X
Disposition of Surplus Highly Enriched Uranium	X		
Waste Management PEIS	X	X	X
Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management	X	X	X
Foreign Research Reactor Spent Nuclear Fuel Management		X	X
Stockpile Stewardship and Management	X		
Tank Waste Remediation			X
Radioactive Releases from WNP Nuclear Power Plant			X
Hanford Reach of the Columbia River Comprehensive River Conservation Study			X
Hanford Comprehensive Land Use Plan			X
Advanced Mixed Waste Treatment Project		X	
Treatment and Management of Sodium-Bonded Spent Nuclear Fuel		X	
Construction and Operation of the Spallation Neutron Source	X		
Long-Term Management and Use of Depleted Uranium Hexafluoride	X		
Treatment and Shipment of Transuranic Waste	X		
Management of Liquid Low-Level Radioactive Waste	X		
Management of Spent Nuclear Fuel	X		
Transportation of Low-Level Radioactive Waste to Offsite Treatment or Disposal	X		
Transportation of Mixed Low-Level Radioactive Waste to Offsite Treatment or Disposal	X		
Natural and Accelerated Bioremediation Field Research Center Assessment	X		
High-Level Waste and Facilities Disposition		X	

The *Surplus Plutonium Disposition EIS* (DOE 1999a), *Final Environmental Impact Statement, Construction and Operation of the Spallation Neutron Source* (DOE 1999b), the *Storage and Disposition PEIS* (DOE 1996), and the *Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management EIS* (DOE 1995) provide a comprehensive evaluation of cumulative impacts for the DOE sites.

G.11 REFERENCES

Code of Federal Regulations

7 CFR Part 657, "Prime and Unique Farmland," U.S. Department of Agriculture.

10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," U.S. Nuclear Regulatory Commission.

33 CFR Section 328.3, "Definitions of Waters of the United States," Corps of Engineers, Department of the Army.

40 CFR Part 50, "National Primary and Secondary Ambient Air Quality Standards," U.S. Environmental Protection Agency.

40 CFR Part 51, Appendix W, "Guidelines on Air Quality Models," U.S. Environmental Protection Agency.

40 CFR Section 51.165, " Permit Requirements," U.S. Environmental Protection Agency.

40 CFR Section 81.313, "Designation of Areas for Air Quality Planning Purposes, Idaho," U.S. Environmental Protection Agency.

40 CFR Section 81.343, "Designation of Areas for Air Quality Planning Purposes, Tennessee," U.S. Environmental Protection Agency.

40 CFR Section 81.348, "Designation of Areas for Air Quality Planning Purposes, Washington," U.S. Environmental Protection Agency.

40 CFR Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," U.S. Environmental Protection Agency.

40 CFR Section 1508.7, "Cumulative Impact," Council on Environmental Quality.

Federal Register

58 FR 63214, U.S. Environmental Protection Agency, 1993, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans," November 30.

63 FR 3629, U.S. Department of Energy, 1998, "Record of Decision for the Department of Energy's Waste Management Program: Treatment and Storage of Transuranic Waste," January 20.

63 FR 41810, U.S. Department of Energy, 1998, "Record of Decision for the Department of Energy Waste Management Programs: Treatment of Nonwastewater Hazardous Waste," August 5.

65 FR 10061, U.S. Department of Energy, 2000, "Record of Decision for the Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste; Amendment of the Record of Decision for the Nevada Test Site," February 25.

United States Code

42 U.S.C. 7472, Title I, Section 162, "Initial Classifications."

Other References

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DOE (U.S. Department of Energy), 1996, *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement,* DOE/EIS-0229, Office of Fissile Materials Disposition, Washington, DC, December.

DOE (U.S. Department of Energy), 1997, *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste,* DOE/EIS-0200-F, Office of Environmental Management, Washington, DC, May.

DOE (U.S. Department of Energy), 1999a, *Surplus Plutonium Disposition Final Environmental Impact Statement,* DOE/EIS-0283, Office of Fissile Materials Disposition, Washington, DC, November.

DOE (U.S. Department of Energy), 1999b, *Final Environmental Impact Statement, Construction and Operation of the Spallation Neutron Source,* DOE/EIS-0247, Office of Science, Germantown, MD, April.

DOI (U.S. Department of Interior), 1986, *Visual Resource Contrast Rating,* BLM Manual Handbook H-8431-1, Bureau of Land Management, Washington, DC, January 17.

EPA (U.S. Environmental Protection Agency), 1995, *SCREEN 3 Model User's Guide,* EPA-454/B-95-004, Office of Air Quality Planning and Standards Emissions, Monitoring, and Analysis Division, Research Triangle Park, NC, September.