4.8 Sandia National Laboratories

SNL is headquartered in Albuquerque, NM, and maintains facilities in other locations. The facilities discussed in this document refer only to the Albuquerque location, which is adjacent to the city of Albuquerque as shown in figure 4.8-1. The site shown in figure 4.8-2 is approximately 10.5 km (6.5 mi) east of downtown Albuquerque. SNL consists of 1,150 ha (2,842 acres) on Kirtland Air Force Base. An additional 6,072 ha (15,003 acres) are provided to DOE through ingrant land from Kirtland Air Force Base, the State of New Mexico, and the Isleta Pueblo to conduct operations.

4.8.1 Description of Alternatives

There are no facilities at SNL that would be phased out as a result of any of the proposed alternatives discussed in the PEIS.

No Action. SNL would continue to perform the missions described in section 3.2.8.

Stockpile Management Alternatives. The majority of the nonnuclear fabrication mission could be located at SNL. A portion of the nonnuclear fabrication mission would also be shared with LANL and possibly LLNL.

Stockpile Stewardship Alternatives. The proposed NIF could be located at SNL.

4.8.2 Affected Environment

The following sections describe the affected environment at SNL for land resources, air quality, water resources, geology and soils, biotic resources, cultural and paleontological resources, and socioeconomics. In addition, the infrastructure, radiation and hazardous chemical environment, and waste management conditions, at SNL are described.

4.8.2.1 Land Resources

SNL is located approximately 10.5 km (6.5 mi) east of downtown Albuquerque, NM (figure 4.8-1). Generalized land uses at SNL and in the vicinity are shown in figure 4.8.2.1-1. There are no prime farmlands on SNL. The affected environment consists of two technical areas at the northern end of the site, designated Technical Area I and Technical Area II (figure 4.8-2).

Technical Area I is the most intensively developed of the SNL technical areas, containing administrative and support facilities; project engineering, research, and component development activities; neutron generator production; and special laboratories and shops.

The Kirtland Air Force Base cantonment, the most heavily developed area on the base, is adjacent to Technical Area I. U.S. Air Force-accompanied base housing is located west and north of Technical Area I. Various Kirtland Air Force Base facilities and operations, including flight operations, are located west of Technical Area I. U.S. Air Force flight operations are collocated with the civilian commercial aircraft operations of Albuquerque International Airport. The runway and taxiways are owned and managed by the city of Albuquerque (SN USAF 1990a:3.6-1). The airport Accident Potential Zone 1 extends east beyond the runway clear zone to the edge of the Technical Area I boundary, with Accident Potential Zone 2 extending across Technical Area I. Flight operations of the

airport are regulated by the Federal Aviation Administration, which does not use Accident Potential Zones.

The U.S. Air Force granted an exemption for the development of an all new Air Installation Compatible Use Zone study at Kirtland Air Force Base. The base, however, monitors all development in its vicinity to ensure compatibility with base flying missions. The U.S. Air Force Air Installation Compatible Use Zone Land Use Guidelines do not recommend uses within Zone 1 and Zone 2 that are highly labor intensive; that involve explosive, fire, toxic, corrosive, or other hazardous characteristics; or that occupy high-density offices.

Except for vacant land on both sides of Tijeras Canyon east of Technical Area I and some unmanned utility facilities, the land north of SNL is part of the urbanized city of Albuquerque. The urban land use consists of a mixture of residential, commercial, industrial, institutional, and various supporting public uses. The closest residence to the Kirtland Air Force Base boundary is approximately 6 m (20 ft) to the north. An industrial park is currently being developed immediately east of the Eubank Gate and Technical Area I. Commercial uses are primarily concentrated north of the site along Central Avenue and Gibson Boulevard (SN USAF 1990a:3.6-4-3.6-6). SNL does not contain any public recreation facilities.

4.8.2.2 Site Infrastructure

The site infrastructure characteristics that exist to support the current SNL missions described in section 3.2.8 are summarized in table 4.8.2.2-1.

Table 4.8.2.2-1.--Baseline Characteristics for Sandia National Laboratories

Characteristics	Current Value
Land	
Area (ha)	1,150
Roads (km)	40
Railroads (km)	8
Electrical	
Energy consumption (MWh/yr)	186,944
Peak load (MWe)	32
Fuel	
Natural gas (m^3/yr)	15,773,761
Liquid (L/yr)	1,301,598
Coal (t/yr)	0
Steam	
Generation (kg/hr)	29,287
Water	
Usage (MLY)	1,387[1]

4.8.2.3 Air Quality

The following section describes existing air quality including a review of the meteorology and climatology in the vicinity of SNL. More detailed discussions of the air quality methodologies, input data, and atmospheric dispersion characteristics are presented in appendix section B.3.8.

Meteorology and Climatology. The climate at SNL and in the surrounding region is characteristic of a semiarid steppe. The annual average temperature in the area is 13.4 °C (56.2 °F); temperatures vary from an average daily minimum of -5.7 °C (21.7 °F) in January to an average daily maximum of 33.6 °C (92.5 °F) in July. The average annual precipitation is 22.6 cm (8.88 in). The annual average wind speed is 4.0 m/s (9.0 mph) (NOAA 1994c:3).

Ambient Air Quality . SNL is located within the Albuquerque-Mid Rio Grande New Mexico Intrastate AQCR 152. Portions of the AQCR are designated nonattainment for carbon monoxide and total suspended particulates (40 CFR 81.332). The NAAQS and the State of New Mexico ambient air quality standards are given in appendix table B.3.1-1.

The principal sources of criteria air pollutants at SNL are the steam plant and the emergency diesel generator plant (SNL 1994a:5-19,5-20). Other emissions include fugitive particulate emissions from waste-burial activities, other process emissions, vehicular emissions, and temporary emissions from various construction activities. Hazardous/toxic air pollutant emissions at SNL occur from laboratories and miscellaneous operations and consist primarily of hydrogen chloride, methyl chloroform, toluene, and xylene. The emission inventories are included in appendix table B.3.8-1.

Ambient air quality conditions at SNL are shown in table 4.8.2.3-1. Ambient air quality concentrations at SNL are in compliance with applicable guidelines and regulations.

Table 4.8.2.3-1.--Comparison of Baseline Ambient Air Concentrations with Most Stringent Applicable Regulations and Guidelines at Sandia National Laboratories, 1994

Pollutant	Averaging Time	Most Stringent Regulation or Guideline (g/m^3)	Baseline Concentration (g/m^3)
Criteria Pollutant			
Carbon monoxide	Annual	4,600 [2]	1,603
	8-hour	10,000 [3]	4,924
	1-hour	15,000 [2]	10,307
Lead	Calendar quarter	1 .5[3]	0 .0667
	30-day	3 [2]	[4]
Nitrogen dioxide	Annual	94 [5]	30
	24-hour	117 [2]	77
Ozone	1-hour	235 [3]	188

Particulate matter	Annual	50 [3]	15 .92
	24-hour	150[3]	66
Sulfur dioxide	Annual	11 [2]	0 .8
	24-hour	92 [2]	5.2
	3-hour	1,300[3]	21.7
Mandated by New Mexico and Albuquerque-Bernalillo County			
Arsenic, copper, and zinc	30-day	10[2]	0 .067
Beryllium	30-day	0 .01[2]	[4]
Hydrocarbon (non-methane)	3-hour	100[2]	[4]
Hydrogen sulfide	1-hour	4 [2]	[4]
Photochemical oxidants	1-hour	20 [2]	[4]
Total reduced sulfur	1-hour	4[2]	[4]
Total suspended particulates	Annual	60 [5]	15 .92
	30-day	90 [5]	<66
	7-day	110 [5]	<66
	24-hour	150 [5]	66
Hazardous and Other Toxic Compounds			
Acetone	8-hour	[6]	0 .25
Benzene	8-hour	[6]	< 0.01
Carbon tetrachloride	8-hour	300[5]	< 0.01
Hydrogen chloride	8-hour	[6]	3 .27
Isopropyl alcohol	8-hour	9,800 [5]	0 .11
Methanol	8-hour	[6]	0 .11
Methyl chloroform	8-hour	[6]	0.71
Methylene chloride	8-hour	[6]	0 .04
Toluene	8-hour	[6]	0 .55
Trichloroethylene	8-hour	[6]	0 .10
Trichlorotrifluoroethane	8-hour	[6]	0 .15
Xylene	8-hour	[6]	0 .59

4.8.2.4 Water Resources

This section describes the surface and groundwater resources at SNL.

Surface Water. SNL is located within Kirtland Air Force Base on the Albuquerque East Mesa. The mesa slopes gently southwest to the Rio Grande, the primary drainage channel for the area. The Rio Grande is located 10 km (6 mi) west of Kirtland Air Force Base and flows north to south. No perennial streams flow through the SNL area. The major surface water feature at SNL is the Arroyo Seco, an intermittent stream that enters the site on the eastern boundary and exits on the northwestern corner. The channel is dry at least 6 months out of the year. Two other primary surface channels at SNL are Tijeras Arroyo and the smaller Arroyo del Coyote (figure 4.8-2). The Arroyo del Coyote joins the Tijeras Arroyo to discharge into the Rio Grande approximately 8 km (5 mi) from the western edge of Kirtland Air Force Base. Both arroyos flow intermittently during spring snowmelt or following thunderstorms. Springs in the eastern mountains provide a perennial flow in the upper reaches of Tijeras Arroyo. Most of this flow evaporates or percolates into the soil before reaching Kirtland Air Force Base.

Tijeras Arroyo separates Technical Areas I, II, and IV from Technical Areas III, V, and the Coyote Test Field. Stormwater runoff is drained from the SNL Technical Areas by a combination of overland flow, natural channels, open drainage ditches, culverts, and storm sewers.

High peak flows of short duration characterize floods in the area. High-intensity summer thunderstorms produce the greatest flows, but flooding is not considered a high probability at SNL. The proposed stockpile stewardship and management activities would be located outside the 100- and 500-year floodplain zones (SNL 1995g:1-7).

SNL contains over 24 km (15 mi) of sewer lines interconnected with those of Kirtland Air Force Base. In 1994, SNL had two categorical pretreatment operations and four general wastewater streams discharging to the city of Albuquerque wastewater treatment plant. Discharges by SNL are regulated by the city of Albuquerque Public Works Department, Liquid Waste Division, under the authority of the city's Sewer Use and Wastewater Control Ordinance. The city's ordinance is approved by EPA in accordance with the Clean Water Act (CWA), as amended (SNL 1995g:6-1). Total flow from SNL is estimated to be 757 MLY (200 MGY).

To comply with EPA regulations, the city of Albuquerque has implemented an industrial wastewater pretreatment program. This program requires SNL to obtain permits for wastewater discharges to the city's wastewater treatment plant. These permits specify the required quality of discharges and the frequency of reporting the results of the monitoring (SNL 1995g:6-1). In 1994, SNL did not meet permit limits on four different occasions. Noncompliances were for excursions of lead, nickel, pH, oil, and grease (SNL 1995g:6-5).

SNL has one active permitted discharge plan from the state to discharge stormwater from oil storage tank areas and building basements to two surface impoundments (lagoons) permitted under the New Mexico Water Quality Control Commission Regulations as implemented by the New Mexico Environmental Improvement Board.

Surface Water Quality. As a part of the annual surface water monitoring program, samples are obtained from stations upstream and downstream of SNL in the Rio Grande and from Coyote Springs. The upstream station on the Rio Grande is at Corrales Bridge, and the downstream station is at the Isleta Indian Reservation, considerably downstream of the influent point of Tijeras Arroyo.

Stormwater flowing into Tijeras Arroyo is the only significant surface water flow into the Rio Grande from the site. Stormwater monitoring is conducted twice a year at SNL. Rio Grande water samples are analyzed for gross alpha, gross beta, total uranium, and tritium. Results from the 1994 annual monitoring are presented in table 4.8.2.4-1. Concentrations of radionuclides in surface waters in 1994 did not exceed applicable standards. No nonradiological monitoring is conducted in Tijeras Arroyo or in the Rio Grande.

Groundwater . SNL lies within the north-south trending Albuquerque basin. The principal aquifer of the Albuquerque basin is the Valley Fill aquifer. The Valley Fill consists of unconsolidated and semiconsolidated sands, gravels, silts, and clays that vary in thickness from a few meters adjacent to the mountain ranges to over 6,400 m (21,000 ft) at a point 8 km (5 mi) southwest of the Kirtland Air Force Base airfield. The Valley Fill aquifer is considered a Class IIa aquifer, having a current source of drinking water and waters having other beneficial uses.

The regional water table is separated by a fault complex that divides the area into a deep region on the west side of the complex and a shallower region on the east side. The depth to groundwater ranges from 15 m to 30 m (49 ft to 98 ft) on the east side of the fault complex and from 116 m (380 ft) to 153 m (500 ft) on the west side (SNL 1995g:1-5). Based on available data, the apparent direction of groundwater flow west of the fault complex is generally to the north and northwest. The direction of groundwater flow east of the fault complex typically is west toward the fault system.

Sources of recharge to the aquifer include precipitation, snowmelt along the margins of the basin, underflow from adjacent areas such as the Hagen Basin, and seepage from streams, canal drains, surface reservoirs, and applied crop irrigation water.

Table 4.8.2.4-1.--Surface Water Quality Monitoring of the Rio Grande at Sandia National Laboratories, 1994

Parameter	Unit of Measure	Water Quality Criteria[7]	Water Body Concentration Range[8]
Alpha (gross)	pCi/L	15[9]	2-3
Beta (gross)	pCi/L	50[10]	3-7
Tritium	pCi/L	80,000[11]	20-100
Uranium, total	g/L	NA	1.6-2.6

Groundwater Quality . Groundwater monitoring at SNL has been conducted since 1985. Overall, the groundwater in this region has been classified as a calcium bicarbonate chemical type with a pH ranging from 6.08 to 8.84 and an alkalinity range of 0.40 to 49 mg/L. The east side wells are characterized by lower pH than the west side wells. Currently, no monitoring wells are in the proposed project area. The closest well, located approximately 0.4 km (0.25 mi) southeast of the area, had an August 1990 depth-to-water reading of 152 m (499 ft).

The chemical waste landfill has been identified as a source of groundwater contamination. In 1994, concentrations of nickel and chromium were found above the water quality criteria established by the New Mexico Water Quality Regulations in the groundwater at the chemical waste landfill. No Target Analyte Metals or radionuclides were detected above background levels in groundwater samples collected in 1994. The groundwater contamination areas are not located near buildings that house proposed DP activities.

Groundwater Availability, Use, and Rights . SNL uses approximately 1,387 MLY (366 MGY) of water. Thirty percent of the water used at SNL is purchased from the city of Albuquerque, and the rest is pumped from Kirtland Air Force Base wells.

The city of Albuquerque has annual consumptive water rights of 27,300 MLY (7,210 MGY). The city receives a 50-percent return flow credit for sanitary wastewater discharged to the Rio Grande. In addition, the city of Albuquerque also has 56,800 MLY (15,000 MGY) consumptive water rights to the San Juan/Chama Diversion.

Kirtland Air Force Base has groundwater rights of 7,900 MLY (2,090 MGY). It also has the option of purchasing 10 percent of its water from the city of Albuquerque. Currently, it is operating at a 50-percent capacity.

Groundwater rights in New Mexico are traditionally associated with the appropriation doctrine. In this system, all water is declared to be public and subject to appropriation on the basis "first in time, first in right" principle (VDL 1990a:725). Control of well use is regulated by permits.

4.8.2.5 Geology and Soils

Geology. SNL lies on a sequence of sedimentary, igneous, and Precambrian basement rocks. The northern and western sections rest on Miocene to Quaternary gravels, sands, silts, and clays deposited in the basin formed by uplift of the mountains to the east. The eastern portion of SNL is primarily underlain by Precambrian rocks.

SNL is located in seismic Zone 2 (figure A.1-1). The eastern portion of SNL is cut by the Tijeras, Hubble Springs, Sandia, and Manzano faults. The facility is situated in a region of high seismic activity but low magnitude and intensity (SN ERDA 1977a:82). Available records indicate that more than 1,100 earthquakes have occurred during the past 127 years. Intensities have been as high as a modified Mercalli intensity of VII. However, during the past century, only three earthquakes have caused damage at Albuquerque, which is located approximately 10.5 km (6.5 mi) from SNL.

Possible geological concerns include potential ground shaking and rupturing associated with regional seismic activity and the faults intersecting on the site. Statistical studies indicate that a nondamaging earthquake of modified Mercalli intensity less than III may be expected every 2 years, with a damaging event every 100 years. The potential for damage from volcanic activity is small (DOE 1995cc:4-112).

Soils. SNL is located on soils of the Bluepoint-Kokan, Madurez-Wink, Tijeras-Embudo, Kolob-Rock outcrop, and the Seis-Orthids associations (SN USDA 1977a:31,32,41,42). The Bluepoint-Kokan soils are excessively drained, sandy, and gravelly. The Madurez-Wink soils are well-drained and loamy. The Tijeras-Embudo soils are well-drained, loamy, and gravelly. The Kolob-Rock outcrop association in the eastern portion of SNL includes deep, moderately to very steep, well-drained, loamy, and stony soils, and basalt, sandstone, and limestone rock outcrops. The Seis-Orthids association includes shallow to moderately deep soils on level to very steep slopes that are well-drained, very cobbly, stony and very stony, and loamy.

The hazard of blowing soils on the terraces and pediments is severe. Future water erosion hazards are moderate on the alluvial fans, foothills, and highlands. No soils are classified prime farmland at SNL.

The soils at SNL are acceptable for standard construction techniques.

4.8.2.6 Biotic Resources

The following section describes biotic resources at SNL including terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. A list of threatened and endangered species that may be found on or in the vicinity of SNL is presented in appendix C.

Terrestrial Resources. SNL is located at the juncture of four major North American physiographic and biotic provinces: the Great Basin, the Rocky Mountains, the Great Plains, and the Chihuahuan Desert. The biotic communities of the area exhibit influences from each of these provinces, with the Great Basin influence generally dominating. SNL occupies about 1,150 ha (2,842 acres) within the larger Kirtland Air Force Base which totals 21,319 ha (52,700 acres). Approximately 39 percent of SNL-controlled land is developed. Vegetation of the area can be classified into four major plant communities: pinyon pine-juniper, grassland, riparian woodland, and riparian scrubland. The pinyon pine-juniper and grassland communities dominate the area, while the riparian woodland and riparian scrubland are limited to the surface drainage courses of canyons and arroyos, respectively (SNL 1992c:5-1). In total, 379 species have been identified that exist or could exist within the area (SNL 1990a:27-37).

At least 10 amphibian, 46 reptile, 124 bird, and 68 mammal species exist, or could exist, in the area of SNL (SNL 1990a:14,16,17,19-22,24-26). Common species include the short-horned lizard (Phrynosoma douglassi), prairie rattlesnake (Crotalus viridis viridis), mourning dove (Zenaida macroura), horned lark (Eremophila alpestris), black-tailed jackrabbit (Lepus californicus), and black-tailed prairie dog (Cynomys ludovicianus). A number of game animals are found on SNL; however, hunting is not permitted. Raptors, such as the Cooper's hawk (Accipiter cooperii) and golden eagle (Aquila chrysaetos), and carnivores, such as the coyote (Canis latrans) and bobcat (Lynx rufus), are ecologically important groups on the site. A variety of migratory birds has been found at SNL. Migratory birds and their nests and eggs are protected by the Migratory Bird Treaty Act. Eagles are similarly protected by the Bald and Golden Eagle Protection Act.

Wetlands. National Wetland Inventory maps of SNL have not been prepared nor have site wetlands been delineated. Springs exist at Lurance Canyon, Sol se Mate, and the outlet of Coyote Canyon. Sole se Mate Spring has a small area of permanent water below it that supports wetland plants such as cattails (Typha spp.) and rushes (Juncus spp.). A swampy area exists at Coyote Springs that supports wetland vegetation (SN ERDA 1977a: 94-95). These springs can be considered an important source of water for wildlife.

Aquatic Resources. Potential aquatic resources found on SNL include Arroyo del Coyote and Tijeras Arroyo (located in the west and central portions of the site, respectively). The Rio Grande River is located about 10 km (6.2 mi) west of the site. There are no continuously flowing streams on the site. Site arroyos flow intermittently during heavy thundershowers (SNL 1994a:1-7). The arroyos do not support any permanent fish population.

Threatened and Endangered Species. The 18 Federal- and state-listed threatened, endangered, and other special status species that could be found on or in the vicinity of SNL are listed in appendix table C-6. No Federal-listed threatened or endangered species are known to exist on SNL. However, potential breeding habitat exists on SNL for the Mexican spotted owl (Strix occidentalis lucida), southwestern willow flycatcher (Empidonax traillii extimus), and the Federal-candidate mountain

plover (Charadrius montanus). The only special status species known to exist onsite is the state-threatened gray vireo (Vireo vicinior) (SNL 1992c:5-10,5-11). No critical habitat, as defined in the Endangered Species Act (50 CFR 17.11 and 17.12), exists on SNL.

4.8.2.7 Cultural and Paleontological Resources

Prehistoric Resources. The prehistoric chronology for the SNL area consists of three broad time periods: Paleo-Indian (10,000 to 5,500 B.C.), Archaic (5,500 B.C. to A.D. 1), and Anasazi (A.D. 1 to 1600) (SN NPS 1988a:132). All DOE-owned properties under SNL control have been surveyed or assessed for cultural resources (SNL 1993c:1-6). All five Technical Areas have been intensively surveyed; no prehistoric sites were recorded. However, because techniques and procedures varied greatly between projects in these areas, most surveys prior to 1985 are not considered adequate, and buried sites or archaeological remains may exist. Prehistoric site types may include pueblos, pithouse villages, rockshelters, hunting blinds, agricultural terraces, quarries, lithic and ceramic scatters, and hearths. Similar sites have been found at nearby locations. A systematic walkover survey was completed at the proposed site locations and no cultural resources were identified.

Historic Resources. Historic resources identified in the vicinity of SNL are associated with early mining, ranching and sheepherding activities, commercial ventures, or transportation routes. All five DOE Technical Areas have been intensively inventoried for resources; two historic sites were recorded. These sites were small historic trash scatters and are not eligible for the NRHP. Twenty-three historic resources have been recorded on DOE-owned or -controlled lands outside of the five Technical Areas, and about 65 percent are considered eligible or potentially eligible for the NRHP.

SNL was established in 1945 as the Z Division of the Los Alamos Scientific Laboratory. Technical Area I originally consisted of temporary World War II structures and wooden framed buildings; more permanent buildings were constructed in 1948. Construction in Technical Area II was initiated in 1948, including two buildings (Buildings 904 and 907) used to assemble the first hydrogen bomb. Test facilities were developed in Technical Area III from 1954 through 1960 (SNL 1993c:2-12,2-13). Numerous buildings and structures in Technical Areas I, II, and III were built between 1945 and 1960; most are associated with the AEC, and, as such, may be considered NRHP eligible. Buildings in Technical Areas III, IV, and V may also qualify for eligibility for the NRHP when they are 50 years old. The New Mexico SHPO has requested that buildings in these areas be evaluated at that time. Buildings 904 and 907 may be considered potentially NRHP eligible because of their association with the assembly of the first hydrogen bomb.

Native American Resources. Native Americans with concerns in this area include the Sandia Pueblo, north of Albuquerque, and the Isleta Pueblo, south of Kirtland Air Force Base (SNL 1993c:1-9). Native American resources on SNL/DOE-controlled lands may consist of prehistoric sites with ceremonial features such as kivas, village shrines, petroglyphs, or burials; all of these site types or features would be of concern to local groups. Consultation with the Isleta and Sandia Pueblos has been initiated by DOE for this project, and no Native American cultural resources have been identified within SNL, including the proposed NIF location.

Paleontological Resources. The geology at SNL consists of sedimentary and volcanic rocks. Uppermost is a sequence of gravel, sand, silt, clay, and caliche. Underneath are sedimentary rocks, and, beneath them, Precambrian rocks. Some fossils have been discovered near SNL. These fossils include vertebrate remains 5 to 8 km (3 to 5 mi) west-northwest of Technical Area III, and an ankle bone from an extinct Pleistocene camel and two teeth from a horse on the south side of Tijeras

Arroyo. A fossilized horse skull and some hare teeth were recovered near the mouth of Tijeras Arroyo. These fossils may have been transported to their site of discovery. However, it is possible fossils are present at SNL beneath the alluvial fan deposits from the Sandia Mountains.

4.8.2.8 Socioeconomics

Socioeconomic characteristics addressed at SNL include employment and local economy, population and housing, and public finance. Statistics for employment and local economy are based on the regional economic area that encompasses nine counties around SNL located in Arizona and New Mexico. Statistics for population and housing, and public finance are presented for the ROI, a three-county area in which 97 percent of all SNL employees (7,341 persons in 1993) reside: Bernalillo County (88.0 percent), Valencia County (4.5 percent), and Sandoval County (4.5 percent) in New Mexico (appendix table D.1-7). Figure 4.8.2.8-1presents a map of the counties and selected cities composing the SNL regional economic area and ROI. Supporting data is presented in appendix D.

Regional Economy Characteristics. Selected employment and regional economy statistics for the SNL regional economic area are summarized in figure 4.8.2.8-2 *(not available electronically)*. The civilian labor force in the regional economic area increased from 279,186 in 1980 to 344,309 in 1990. This is an increase of 23 percent (annual average increase of 2.3 percent). The 1994 unemployment rate in the regional economic area was 5.7, which was less than 1 percent lower than the rates in Arizona and New Mexico. The region's per capita income of $17,003 in 1993 was approximately 4 percent greater than New Mexico's per capita income of $16,346 and 6 percent lower than Arizona's per capita income of $18,085.

In 1993, as shown in figure 4.8.2.8-2 *(not available electronically*, the percentage of total employment involving the private sector activity of retail trade in the regional economic area (18 percent) was comparable to the economies of Arizona and New Mexico. Service activities in the region (31 percent of the total employment) were also comparable to Arizona and New Mexico. Manufacturing was similar in both the regional economic area (7 percent) and New Mexico, but represented a 2-percent larger share of total employment in Arizona.

Population and Housing. Between 1980 and 1992, the ROI population grew from 515,614 to 616,346. This is an increase of 19.5 percent (annual average increase of 1.6 percent). Within the ROI, Sandoval County experienced the largest increase at 97.7 percent, while Valencia County's population decreased by 21.0 percent. This decrease was due to the formation of Cibola County that was created entirely from the western portion of Valencia County shortly after the 1980 census. If the 1992 Cibola County population was added to Valencia's, the result would be an 18-percent increase from 1980 to 1992.

Between 1980 and 1990, housing units increased from 196,765 to 241,683. This is a 22.8-percent increase (annual average increase of 2.3 percent), which is similar to the percent increase for New Mexico. The total number of housing units estimated for 1992 is 244,900. The 1990 homeowner vacancy rate in the ROI was 1.8 percent. The rental vacancy rate for the ROI counties was 10.2 percent. Population and housing trends are summarized in figure 4.8.2.8-3.

Public Finance. Financial characteristics of the local jurisdictions in the SNL ROI that are most likely to be affected by the proposed action are presented in this section. The data reflect total revenues and expenditures of each jurisdiction's general fund, special revenue funds, and, as applicable, debt service, capital project, and expendable trust funds. School district boundaries may

or may not coincide with county or city boundaries, but the districts are presented under the county where they primarily provide services. Major revenue and expenditure fund categories for counties, cities, and school districts are presented in appendix tables D.2.3-12 and D.2.3-13. Figure 4.8.2.8-4 summarizes 1994 local governments' revenues and expenditures. Fund balances, which are dollars carried over from previous years, are not included in figure 4.8.2.8-4. All jurisdictions assessed had positive fund balances.

4.8.2.9 Radiation and Hazardous Chemical Environment

The following section provides a description of the radiation and hazardous chemical environment at SNL. Also included are discussions of health effects studies, emergency preparedness considerations, and a brief accident history.

Radiation Environment. Major sources of background radiation exposure to individuals in the vicinity of SNL are shown in table 4.8.2.9-1. All annual doses to individuals from background radiation are expected to remain constant over time. The incremental total dose to the population would result only from changes in the size of the population. Background radiation doses are unrelated to SNL operations.

Table 4.8.2.9-1.--Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Sandia National Laboratories Operations

Source	Committed Effective Dose Equivalent (mrem/yr)
Natural Background Radiation	
Cosmic and external terrestrial radiation[12]	95
Internal terrestrial radiation[13]	39
Radon in homes (inhaled)[13]	200
Other Background Radiation[13]	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	399

Releases of radionuclides to the environment from SNL operations provide another source of radiation exposure to people in the vicinity. The radionuclides and quantities released from operations in 1993 are listed in the *1993 Site Environmental Report Sandia National Laboratories, Albuquerque, New Mexico* (SAND94-1293). The doses to the public resulting from these releases are given in table 4.8.2.9-2. These doses fall within radiological limits (DOE Order 5400.5) and are small in comparison to background radiation. The releases listed in the 1993 report were used in the development of the reference environment (No Action) radiological releases at SNL in 2005 (section 4.8.3.9).

Based on a dose-to-risk conversion factor of 500 cancer deaths per 1 million person-rem (5x10-4 fatal cancer per person-rem) to the public (appendix E), the fatal cancer risk to the maximally exposed

member of the public due to radiological releases from SNL operations in 1993 was estimated to be approximately 8.0x10-*10* . 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 operations is less than 1 in 1 billion. (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 conversion factor, 1.4x10-*5* excess fatal cancers are projected in the population living within 80 km (50 mi) of SNL from normal operation in 1993. To place this number into perspective, it can be compared with the number of fatal cancers expected in this population from all causes. The 1990 mortality rate associated with cancer for the U.S. population was 0.2 percent per year (Almanac 1993a:839). Based on this mortality rate, the number of fatal cancers from all causes expected to occur during 1993 in the population living within 80 km (50 mi) of SNL is 1,156. This number of expected fatal cancers is much higher than the estimated 1.4x10-*5* fatal cancers that could result from SNL operations in 1993.

Table 4.8.2.9-2.--Doses to the General Public from Normal Operation at Sandia National Laboratories, 1993 (Committed Effective Dose Equivalent)

	Atmospheric Releases		Liquid Releases		Total	
Affected Environment	**Standard[14]**	**Actual**	**Standard[14]**	**Actual**	**Standard[14]**	**Actual**
Maximally exposed individual (mrem)	10	$1.6x10^{-3}$	4	0.0	100	$1.6x10^{-3}$
Population within 80 kilometers[15] (person-rem)	None	0.027	None	0.0	100	0.027
Average individual within 80 kilometers[16] (mrem)	None	$4.7x10^{-5}$	None	0.0	None	$4.7x10^{-5}$

Workers at SNL receive the same dose as the general public from background radiation, but also receive an additional dose from working in the facilities. Table 4.8.2.9-3 includes the average, maximum, and total occupational doses to workers from operations in 1992. These doses fall within radiological limits (10 CFR 835). Based on a dose-to-risk conversion factor of 400 fatal cancers per 1 million person-rem (4x10-4 fatal cancers per person-rem) among workers (appendix E), the number of excess fatal cancers to SNL workers from operations in 1992 is estimated to be $4.4x10^{-3}$.

Table 4.8.2.9-3.--Doses to the Onsite Worker from Normal Operation at Sandia National Laboratories, 1992

	Onsite Releases and Direct Radiation	
Affected Environment	**Standard[17]**	**Actual[18]**
Average worker (mrem)	None	3.2
Maximally exposed worker (mrem)	5,000	1,000
Total workers (person-rem)	None	11

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in *1993 Site Environmental Report Sandia National Laboratories, Albuquerque, New Mexico* (SAND 94-1293). In addition, the concentrations of radioactivity in various environmental media (e.g., air, water, and soil) in the onsite and offsite regions are presented in the same reference.

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 (e.g., surface waters during swimming and soil through direct contact or via the food pathway). The baseline data for assessing potential health impacts from the chemical environment are those presented in sections 4.8.2.3 and 4.8.2.4.

Adverse health impacts to the public can be minimized through administrative and design controls that decrease hazardous chemical releases to the environment and achieve compliance with permit requirements (e.g., air emissions and NPDES permit requirements). 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 operation at SNL via inhalation of air containing hazardous chemicals released to the atmosphere by operations. Risks to public health from ingestion of contaminated drinking water or by direct exposure are also potential pathways.

Baseline air emission concentrations for hazardous air pollutants and their applicable standards are presented in section 4.8.2.3. These concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. All annual concentrations are compared with applicable guidelines and regulations. Information about estimating health impacts from hazardous chemicals is presented in appendix E.

Exposure pathways to SNL workers during normal operation may include inhaling the workplace atmosphere, drinking SNL potable water, and possible other contact with hazardous materials associated with particular work assignments. The potential for health impacts 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. SNL workers are also protected by adherence to OSHA and EPA occupational standards that limit workplace atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring, which reflects the frequency and amount of chemicals utilized in the operation processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm. Therefore, worker health conditions at SNL are expected to be substantially better than required by the standards.

Health Effects Studies. There are no known epidemiological studies that have been conducted which examine the impact of SNL on the health of the surrounding communities.

Broadwell and others reported on 25 workers currently or formerly involved in the manufacture of hybrid microcircuits (AJIM 1995a:677-698). Clinical narratives and retrospective exposure assessments in the study group suggested chronic low-level exposure to solvents, with intermittent acute excursions. Solvent exposures linked to a clinical syndrome were intermittent, and symptoms

were reversible after cessation of what were reported as "high-level" exposures. Several exposed workers showed clinical evidence of an acquired toxic encephalopathy supporting an association between long-term solvent exposure and depressed mood, with increased somatic symptoms. Attention to engineering controls, chemical fume hood ventilation, work practices, safety training, and personal protective gear was markedly improved when the lab was moved in the fall of 1990. For a more detailed description of the studies and the findings, refer to appendix section E.4.8.

Accident History. A review of the recent SNL annual environmental and accident reports indicates that there have been no significant adverse impacts to workers, the public, or the environment. This review was performed to provide an indication of the site's accident history. The period of review, from 1986 to 1990, was a time during which plant operations were much higher than in previous years and also higher than what is anticipated for the future.

Emergency Preparedness. Each DOE site has established an emergency management program that would be activated in the event of an accident. This program has been developed and maintained to ensure adequate response to accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with planning, preparedness, and response.

4.8.2.10 Waste Management

This section outlines the major environmental regulatory structure and ongoing waste management activities for the Albuquerque location of SNL. A more detailed discussion of the ongoing waste management operation is provided in appendix section H.2.7.

DOE is working with Federal and state regulatory authorities to address compliance and cleanup obligations arising from its past operations at SNL. DOE is also engaged in several activities to bring its operations into full regulatory compliance. These activities are set forth in negotiated agreements that contain schedules for achieving compliance with these applicable requirements and financial penalties for nonachievement of agreed upon milestones. These agreements have been reviewed to assure the proposed actions are allowable under the terms of these agreements.

SNL is not on the NPL for sites requiring environmental restoration in accordance with CERCLA and *Superfund Amendments and Reauthorization Act* (SARA). The assessment of environmental contamination at SNL began formally in 1984, when DOE started to identify, assess, and remediate potentially hazardous waste sites in response to CERCLA. This program identified 117 sites with potential contamination. A similar investigation was conducted by EPA in 1987. These programs ultimately defined a working inventory of potential "solid waste management units." Current investigations are intended to determine the nature and extent of hazardous and radioactive contamination and to restore any sites where such materials pose a threat to human health or the environment. It is assumed that remediation at all sites will be completed by 2011.

SNL has a Waste Minimization and Pollution Awareness Plan to document projections for present and future waste generation rates. This program tracks the amount of waste generated at the site and encourages the use of waste reduction methods. In the future, it will assess opportunities for preventing pollution from priority waste streams, increasing recycling efforts, and ensuring the procurement of recycled products.

SNL manages a small quantity of spent nuclear fuel and five broad waste categories: TRU, low-level,

mixed, hazardous, and nonhazardous. Because there is no spent nuclear fuel or TRU waste associated with any of the proposed activities at SNL, there is no discussion in this PEIS of spent nuclear fuel or TRU waste generation and management at SNL. A discussion of the waste management operations associated with low-level, mixed, hazardous, and nonhazardous wastes follows.

Low-Level Waste. In 1994, SNL generated approximately 0.9 m*3* (241 gal) of liquid and 53 m*3* (70 yd^3) of solid LLW (SNL 1995f:7). SNL generates LLW in both technical and remote test areas as a result of R&D activities. Most of the LLW consists of contaminated equipment and combustible decontamination materials and cleanup debris. All generated LLW is temporarily stored at generator sites or aboveground in transportation containers at the Technical Area III disposal site. All LLW packages are currently onsite pending approval of transport by commercial carriers to NTS for disposal.

Mixed Low-Level Waste. In 1994, SNL generated approximately 0.007 m^3 (2 gal) of liquid and 1.9 m^3 (2.5 yd^3) of solid mixed LLW (SNL 1995f:7). Mixed waste includes radioactively contaminated oils and solvents and radioactively contaminated or activated lead, or other heavy metals. Other mixed waste may be generated as a result of weapons tests. The 557-m^2 (666-yd^2) Radioactive and Mixed Waste Management Facility will have a centralized packaging and storage function for LLW and mixed waste. Mixed waste will be stored at the facility until accepted for disposal at NTS once it is permitted. Processing at the Radioactive and Mixed Waste Management Facility will include activities required to comply with the waste acceptance criteria and Federal regulations. Pursuant to the *Federal Facility Compliance Act,* SNL developed a site treatment plan for mixed wastes at SNL. The site treatment plan is intended to bring SNL into compliance with Land Disposal Restrictions storage prohibitions under the New Mexico Hazardous Waste Act and RCRA. On March 31, 1995, DOE submitted its proposed site treatment plan to the New Mexico Environment Department for review, public comment, and approval. On October 6, 1995, a Compliance Order was issued by the State of New Mexico requiring SNL to comply with the site treatment plan for the treatment of mixed wastes at SNL. The Compliance Plan Volume of the site treatment plan provides overall schedules for achieving compliance with the land disposal restrictions storage and treatment requirements, a schedule for the submittal of applications for permits, construction of treatment facilities, technology development, offsite transportation for treatment, and the treatment of mixed wastes in full compliance with the New Mexico Hazardous Waste Act and RCRA. An annual update to the site treatment plan is required.

Hazardous Waste. In 1994, SNL generated approximately 342 m^3 (90,530 gal) of liquid, and 81.9 t (90.3 tons) of RCRA-regulated and 647 t (713 tons) of state-regulated solid hazardous wastes (SNL 1995f:7). Hazardous/toxic chemical waste is generated at SNL by the numerous R&D activities conducted throughout the facilities. The Hazardous Waste Management Facility can store 265 m3 (70,000 gal) of liquid and solid hazardous wastes at one time. There are no active onsite disposal facilities for hazardous/toxic wastes at SNL. All RCRA-regulated wastes are packaged, manifested, and shipped offsite by DOT-registered transporters for disposal at RCRA-permitted treatment, storage, and disposal facilities.

Nonhazardous Waste. For 1994, SNL generated approximately 75,700 m^3 (19,998,000 gal) of liquid sanitary and industrial wastewater (SNL 1995b:1). SNL contains over 24 km (15 mi) of sewer lines interconnected with those of Kirtland Air Force Base. Pretreated industrial wastewater effluent and sanitary sewage are discharged to the city of Albuquerque sewer system in compliance with NPDES permit discharge limits. In 1994, SNL generated approximately 13,600 t (14,990 tons) of solid

sanitary waste (SNL 1995f:7). Solid sanitary waste is collected and taken to the Albuquerque sanitary landfill on a regular basis.

---

1 Value based on 1990 data.
Source: SNL 1995b:1.

2 State and city/county standard.

3 Federal standard.

4 No monitoring data available, baseline concentrations assumed less than applicable standard.

5 State standard.

6 No standard.Source: 40 CFR 50; NM EIB 1995a; NM EIB 1996a; SNL 1995b:1.

7 For comparison only.

8 Samples were collected from station 11 located on the Rio Grande at the Isleta Pueblo down gradient of SNL. Samples are collected biannually: in May and August.

9 National Primary Drinking Water Regulations (40 CFR 141).

10 Proposed National Primary Drinking Water Regulations, Radionuclides (56 FR 33050).

11 DOE's Derived Concentration Guides for water (DOE Order 5400.5). Values are based on a committed effective dose equivalent of 100 mrem per year; however, because the drinking water maximum contaminant level is based on 4 mrem per year, the number listed is 4 percent of the Derived Concentration Guides.NA - not applicable.Source: SNL 1995g.

12 SNL 1994a.

13 NCRP 1987a.

14 The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10 mrem/yr limit from airborne emissions is required by the *CAA* , the 4 mrem/yr limit is required by the *SDWA* , and the total dose of 100 mrem/yr is the limit from all pathways combined. The 100 person-rem value for the population is given in proposed 10 CFR 834 (58 FR 16268).

15 In 1993, this population was approximately 578,000.

16 Obtained by dividing the population dose by the number of people living within 80 km (50 mi) of the site.
Source: SNL 1994a.

17 10 CFR 835. DOE's goal is to maintain radiological exposure as low as reasonably achievable.

18 DOE 1993n:7. The number of badged workers in 1992 was approximately 3,420.

4.8.3 Environmental Impacts

4.8.3.1 Land Resources

No Action. Under No Action, DOE would continue current and planned activities at SNL as described in section 3.2.8. No additional land-use impacts are anticipated at SNL beyond the effects of existing and future activities which are independent of the proposed action.

Management Alternatives

Nonnuclear Fabrication. The Nonnuclear Fabrication Facility at SNL would require no additional land acquisition. Modification of existing facilities and new construction at Technical Area I would be required to accommodate the new proposed activities. The new facilities at SNL would provide approximately 58,060 m^2 (625,000 ft^2) of work space and would be located within an undeveloped 9-ha (22-acre) area. The land to be developed represents approximately 6 percent of the land currently identified as available for development at SNL, but it is only a small portion of the land available for future development within SNL. An additional 5,110 m^2 (55,000 ft2) of support facility space would be located in existing buildings. The proposed nonnuclear fabrication activities would be compatible and consistent with current operations in the area and SNL land-use plans and policies. Impacts to land use or land use plans are not expected.

Sensitivity Analysis. SNL would be able to accommodate all operations and support functions for nonnuclear fabrication with modification of existing facilities. Modification of existing facilities to support base case production would be sufficient to maintain capacity for both the high and low production cases.

Stewardship Alternatives

Proposed National Ignition Facility. Impacts to land use at and around SNL from the proposed NIF project would be limited to the clearing of land, minor and temporary disruptions to contiguous land parcels south of the proposed site from construction activities, and a slight increase in vehicular traffic. The proposed site for NIF would occupy a large parcel of flat, vacant land on the southern end of Technical Area II between East Ordinance Road and "R" Boulevard, and a small plot of land for temporary construction staging on the northern edge of Technical Area IV just south of "R" Boulevard. The proposed NIF project would require the clearing of an estimated 11 ha (28 acres) of land for buildings, walkways, building access and buffer space. Such acreage would account for approximately 7 percent of the land currently identified as available for development at SNL, but it represents only a small portion of the land available for future development within SNL. The project would be located in an area dedicated to similar land uses. No impacts to land use or land-use plans and policies at SNL, in Bernalillo County, the city of Albuquerque, or nearby communities would be expected.

Potential Mitigation Measures. No mitigation measures are anticipated.

4.8.3.2 Site Infrastructure

The SNL site infrastructure resources are capable of accommodating any of the alternatives for which it is a candidate with only moderate changes in the existing electrical and fuel resources. Table

4.8.3.2-1 presents a comparison of the annual operating infrastructure resource requirements for the alternatives of No Action, nonnuclear fabrication, and the proposed NIF. The No Action alternative would continue SNL's current mission objectives in the existing facilities without modification as described in section 3.2.8. Under the No Action alternative, the required site infrastructure resources would be unchanged relative to current resource consumption.

Table 4.8.3.2-1.-- Site Infrastructure Requirements and Changes for Stockpile Stewardship and Management Alternatives at Sandia National Laboratories

Alternative	**Electrical**		**Fuel**		
Energy (MWh/yr)	**Peak Load (MWe)**	**Liquid (L/yr)**	**Natural Gas (m3/yr)**	**Coal (t/yr)**	
Current Resources (1994)	186,944	32	1,301,598	15773,761	NA
No Action (2005)					
Total site requirements	186,944	32	1,301,598	15,773,761	NA
Change from current resources	0	0	0	0	NA
Nonnuclear Fabrication					
Total site requirement	226,644	38.2	1,301,598	19,043,761	NA
Change from No Action	39,700	6.2	0	3,270,000	NA
National Ignition Facility					
Total site requirement	228,944	42	1,304,398	16,583,761	NA
Change from No Action	42,000	20	2,800	810,000	NA
Combined Program Impacts					
Total site requirement	268,644	58.2	1,304,398	19,853,761	NA
Change from No Action	81,700	26.2	2,800	4,080,000	NA

NA - not applicable. SNL 1995b:1; SNL 1995b:4; SNL 1995b:5; SNL 1995e ; appendix I.

Management Alternatives

Nonnuclear Fabrication. SNL is being considered for the alternative of nonnuclear fabrication. Under this alternative, the majority of the ongoing nonnuclear production activities at KCP would be reconfigured and transferred to SNL, with a small portion going to LANL and possibly LLNL.

The nonnuclear fabrication alternative at SNL would result in a new stand-alone production site with four new production facilities, an office structure, and a central utilities building surrounded by a security fence. In addition, some existing buildings would require minor modifications to accept some functions associated with this action. The nonnuclear fabrication mission at SNL would increase electrical energy usage and fuel (natural gas) consumption by approximately 20 percent relative to the No Action alternative.

SNL's electrical power distribution is by underground 15 kV (nominal) feeder loops. Dual feeders, each capable of carrying the entire load, would be run in new ductbanks and manholes to new double-ended unit substations in a new central plant on the site. The required power for the nonnuclear mission is greater than is usually available from the existing site loops and would most likely require a separate, dedicated, feeder loop from the utility substation. Natural gas is supplied by Kirtland Air Force Base and would be distributed, as required, to the nonnuclear fabrication facilities from the existing underground gas main.

The effect of not including reservoirs in the nonnuclear fabrication mission would not result in any significant reduction in the site infrastructure-related impacts at SNL since this activity only involves final reservoir assembly; primarily welding, along with final inspection, testing, packaging, and shipping. The only machining to be performed would be post-weld dressing. Final certification would include volume measurement and proof testing.

Sensitivity Analysis. The site infrastructure requirements given in table 4.8.3.2-1 reflect facility operating conditions for the production of a base case, multiple-shift, stockpile size. For the reduced stockpile size associated with the low case scenario, there would be a small (10-percent) reduction in the required floorspace and operating personnel. Transition to a high case stockpile size would result in about a 30- to 50-percent increase in these requirements. These deviations in the stockpile size would result in comparable changes in site infrastructure resource requirements.

Stewardship Alternatives

Proposed National Ignition Facility. The proposed NIF alternative at SNL would result in the construction of six new buildings and ancillary facilities (i.e., access roads, parking facilities, and utility extensions). Infrastructure requirements would not exceed any utility resources available at SNL. The NIF mission would increase SNL's electrical energy consumption by approximately 22 percent, whereas the increase in fuel usage would be less than 1 percent relative to the No Action alternative.

Potential Mitigation Measures. No mitigation measures are anticipated.

4.8.3.3 Air Quality

No Action. No Action air quality utilizes estimated air emissions data from operations at SNL in 2005 assuming continuation of current site missions to calculate pollutant concentrations at or beyond the SNL site boundary. The emission rates for criteria and toxic/hazardous pollutants for No Action are presented in table B.3.8-1. Table 4.8.3.3-1 presents the No Action pollutant concentrations calculated from the 2005 emission rates. In this table, pollutant concentrations are compared with applicable Federal and state regulations and guidelines. Concentrations are expected to remain within these standards.

Management Alternatives

Nonnuclear Fabrication. No new air pollutant waste streams will be generated by the nonnuclear fabrication mission at SNL. Emissions from the additional nonnuclear fabrication missions at SNL will include exhausts from vehicles and small quantities of aromatic hydrocarbon solvents, alcohols, and related chemistry. Process gases will be vented, but these consist only of naturally occurring

atmospheric gases and vapors (i.e., nitrogen, argon, carbon dioxide, helium, hydrogen, and water) and are not considered to be pollutants. Table 4.8.3.3-1 presents the concentrations of criteria and toxic/hazardous pollutants resulting from No Action and nonnuclear fabrication. Concentrations of pollutants resulting from operation of nonnuclear fabrication added to No Action concentrations are expected to be within Federal and state regulations.

Table 4.8.3.3-1.-- Estimated Concentrations of Pollutants from No Action and Stockpile Stewardship and Management Alternatives at Sandia National Laboratories

Pollutant	Averaging Time	Most Stringent Regulations or Guidelines (g/m^3)	2005 No Action (g/m^3)	Nonnuclear Fabrication (g/m^3)	National Ignition Facility (g/m^3)
Criteria Pollutant					
Carbon monoxide	Annual	4,600[1]	1,603	1,603	1,603
	8-hour	10,000[2]	4,924	4,924	4,925
	1-hour	15,000[1]	10,307	10,307	10,311
Lead	Calendar quarter	1.5[2]	0.0667	0.0667	0.0667
	30-day	3[1]	[3]	[3]	[3]
Nitrogen dioxide	Annual	94[4]	30	30	30.12
	24-hour	117[1]	77	77	78.29
Ozone	1-hour	235[2]	188	188	188
Particulate matter	Annual	50[2]	15.92	15.92	15.93
	24-hour	150[2]	66	66	66.12
Sulfur dioxide	Annual	11[1]	0.8	0.8	0.8
	24-hour	92[1]	5.2	5.2	5.22
	3-hour	1300[2]	21.7	21.7	21.79
Mandated by New Mexico and Albuquerque-Bernalillo County					
Arsenic, copper, and zinc	30-day	10[1]	0.067	0.067	0.067
Hydrocarbons (nonmethane)	3-hour	100[1]	[3]	[3]	[3]
Hydrogen sulfide	1-hour	4[1]	[3]	[3]	[3]
Photochemical oxidants	1-hour	20[1]	[3]	[3]	[3]
Total reduced sulfur	1-hour	4[1]	[3]	[3]	[3]
Total suspended particulates	Annual	60[4]	15.92	15.92	15.92

	30-day	90[4]	<66	<66	<66
	7-day	110	<66	<66	<66
	24-hour	150[4]	66	66	66
Hazardous and Other Toxic Compounds					
Acetone	8-hour	[5]	0.25	0.25	0.25
Benzene	8-hour	[5]	<0.01	<0.01	<0.01
Carbon tetrachloride	8-hour	300[4]	<0.01	<0.01	<0.01
Hydrogen chloride	8-hour	[5]	3.27	3.27	3.27
Isopropyl alcohol	8-hour	9,800[4]	0.11	0.11	0.11
Methanol	8-hour	[5]	0.11	0.11	0.11
Methyl chloroform	8-hour	[5]	0.71	0.71	0.71
Methylene chloride	8-hour	[5]	0.04	0.04	0.04
Toluene	8-hour	[5]	0.55	0.55	0.55
Trichloroethylene	8-hour	[5]	0.10	0.10	0.10
Trichlorotrifluoroethane	8-hour	[5]	0.15	0.15	0.15
Xylene	8-hour	[5]	0.59	0.59	0.59

Sensitivity Analysis. Impacts to air quality from either the low or high case scenario of the nonnuclear fabrication alternative would result in the same concentrations of criteria and toxic/hazardous pollutants for the high and low case. The concentrations of pollutants for both cases are expected to be within applicable Federal and state regulations and guidelines.

Stewardship Alternatives

Proposed National Ignition Facility. Operation of the proposed NIF would generate criteria and toxic/hazardous pollutants resulting from the combustion of boiler fuel for heating, operation of diesel generators, and solvent cleaning processes. The emissions consist of PM10, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and VOCs. Boiler fuel is assumed to be natural gas. Emission rates of criteria and toxic/hazardous pollutants for annual operation of the proposed NIF are presented in table B.3.8-1. Table 4.8.3.3-1 presents the concentrations of criteria and toxic/hazardous pollutants resulting from No Action and those generated from operation of the proposed NIF. Concentrations of pollutants resulting from operation of the proposed NIF added to No Action concentrations are expected to be within Federal and state regulations.

Potential Mitigation Measures. No mitigation measures are anticipated for the nonnuclear fabrication and the proposed NIF at SNL.

4.8.3.4 Water Resources

Environmental impacts associated with the construction and operation of the potential stockpile stewardship and management facilities at SNL could affect surface and groundwater resources. All

water required for construction or operation would be supplied from local groundwater resources at Kirtland Air Force Base. The proposed sites for the facilities would be outside the 100- and 500-year floodplains. A description of the proposed functions to be transferred to SNL is presented in sections 3.3 and 3.4. Table 4.8.3.4-1 presents existing surface and groundwater resources and the potential changes to water resources at SNL resulting from the proposed alternatives. The total site water resource requirement for each alternative including No Action are displayed in this table.

Surface Water

No Action. Under No Action, no impacts to surface water resources are anticipated because there are no surface water withdrawals or demands. No construction would occur under No Action; therefore, no additional construction water would be used or discharged. Current operation wastewater discharges of 757 MLY (200 MGY) are expected to remain the same in 2005. Treated wastewater effluent would be monitored to comply with the city of Albuquerque's Sewer Use and Wastewater Control Ordinance. No impacts to surface or surface water quality are expected.

Management Alternatives

Nonnuclear Fabrication. No surface water would be used for construction and modification activities or operation. An additional 6.5 MLY (1.7 MGY) of wastewater would be generated by the construction and modification activities of the nonnuclear fabrication facilities. This wastewater increase represents less than 1 percent over the projected sanitary wastewater generation rate. During operation an additional 291 MLY (76.9 MGY) of wastewater would be generated. This wastewater discharge represents a 38.5-percent increase over projected sanitary wastewater generation. A stormwater pollution prevention plan would be prepared and implemented to minimize soil erosion, sedimentation, and contamination of stormwater. During construction and operation, all wastewater would be collected, treated, and discharged to the city of Albuquerque sewer systems. Treated wastewater would be monitored to meet or exceed standards of the city of Albuquerque's Sewer Use and Wastewater Control Ordinance. There would be no new wastewater streams added or special waste handling capability required. There would be no impacts to surface water quality because all wastewater would be discharged to the city of Albuquerque's sewer systems. There would be no change in stormwater runoff due to this alternative. Adverse impacts to surface water are not expected. Nonnuclear fabrication facilities would be located in portions of Technical Areas I and II that are determined to be above the 500-year floodplain.

Stewardship Alternatives

Proposed National Ignition Facility. Construction of the proposed NIF would be expected to have minor to negligible effects on water quality. A stormwater pollution prevention plan would be prepared and implemented to minimize soil erosion, sedimentation, and contamination of stormwater. During operation of NIF, wastewater discharge would be expected to increase by about 18 MLY (4.8 MGY). Wastewater discharges would have to meet all Kirtland Air Force Base and the city of Albuquerque discharge requirements. Appropriate measures would be taken to comply with stormwater discharge regulations associated with construction activities under the CWA.

Table 4.8.3.4-1.--Potential Changes to Water Resources from Stockpile Stewardship and Management Alternatives at Sandia National Laboratories

Affected Resource Indicator	No Action Single-Shift Operation 2005	Nonnuclear Fabrication Three-Shift Operation	National Ignition Facility
Construction			
Water Availability and Use			
Water source	Ground	Ground	Ground
Total site water operation requirement[6] (MLY)	0[7]	1,391	1,392.9
Percent change from No Action water use (1,390 MLY)	NA	0.05	0.2
Water Quality			
Wastewater discharge to the city of Albuquerque[8] (MLY)	0[7]	763.2	757.4
Percent change from No Action wastewater discharges to the city of Albuquerque p(757 MLY)	NA	0.86	0.05
Operation			
Water Availability and Use			
Water source	Ground	Ground	Ground
Total site operations water requirement (MLY)	1,390	2,283	1,542
Percent change from No Action water use (1390 MLY)	NA	64	11
Percent change from current use (970 MLY)	43	135	59
Water Quality			
Wastewater discharge to the city of Albuquerque (MLY)	757	1,048	775
Percent change from No Action wastewater discharge to the city of Albuquerque (757 MLY)	0	38.5	2
Percent change from current wastewater discharge (757 MLY)	0	38.5	2
Floodplain			
Actions in 100-year floodplain	NA	None	None
Actions in 500-year floodplain	NA	None	None

Groundwater

No Action. Under No Action, baseline conditions and operations, described in section 4.8.2.4, would

continue at SNL, and the current groundwater amount of *970* MLY (256 MGY) would increase to *1,390* MLY (367 MGY) by 2005. Groundwater would continue to be withdrawn from local groundwater sources, but no additional impacts to groundwater quality are anticipated because there are no direct discharges to groundwater.

Management Alternatives

Nonnuclear Fabrication. Water requirements for the modification, construction, and operation of the nonnuclear fabrication facilities would be supplied from local groundwater sources at Kirtland Air Force Base. During the modification and construction phase, approximately *0.7* MLY (0.18 MGY) of groundwater would be required. This amount is less than *0.1* percent of the projected SNL groundwater withdrawal of *1,390* MLY (367 MGY) from the Kirtland Air Force Base wells. It is anticipated that an additional *893* MLY (236 MGY) of water would be required to operate the facilities. This amount is an increase of approximately 64-percent over No Action water requirements, but only comprises 29 percent of the Kirtland Air Force Base groundwater rights of 7,900 MLY (2,090 MGY). Adverse impacts to groundwater are not expected.

Groundwater Quality. No process wastes would be discharged directly to the groundwater and all wastewater discharges would be monitored to comply with NPDES permit and other applicable discharge requirements. Given normal safeguards and precautions, no adverse impacts to groundwater quality are expected.

Sensitivity Analysis. All effluent is discharged to the city of Albuquerque; therefore, both the high and low case production scenario for nonnuclear fabrication would have no impacts to surface water quality. Groundwater or groundwater quality would not be affected by the high or low case stockpile requirement for nonnuclear fabrication at SNL.

Stewardship Alternatives

Proposed National Ignition Facility. During construction of the proposed NIF, approximately 3 MLY (0.8 MGY) of additional groundwater would be required. Approximately 152 MLY (40.2 MGY) of additional groundwater would be required during operation of NIF, increasing the water use at SNL by 11 percent over No Action.

Groundwater Quality. No process wastes would be discharged directly to the groundwater, and all wastewater discharges would be monitored to comply with NPDES permit and other applicable discharge requirements. Given normal safeguards and precautions, no adverse impacts to groundwater quality are expected.

Potential Mitigation Measures. No mitigation measures for the stockpile stewardship and management alternatives at SNL are anticipated.

4.8.3.5 Geology and Soils

The proposed alternatives for SNL would have no adverse impact on geological resources described in section 4.8.2.5. Although a moderate seismic risk exists for new facilities, this would be considered in the design of the structures. The existing seismic risk does not preclude safe construction and operation of the proposed project facilities. Control measures would be used to minimize any soil erosion. Impacts would depend on the extent of land disturbing activities and the

amount of soil disturbed. Potential changes to geology and soils associated with the proposed alternatives at SNL are discussed below.

No Action. Under No Action, DOE would continue current and planned activities at SNL. Any impacts to geology and soils would be independent of and unaffected by the proposed action.

Management Alternatives

Nonnuclear Fabrication. Construction activities would not affect geologic conditions. Designs of the new 58,060 m2 (625,000 ft2) facility would ensure that it would not be adversely affected by geologic conditions. The properties and conditions of the soils in the proposed project area place no limitations on the construction or safe operation of project facilities.

The area of land disturbance for nonnuclear fabrication at SNL is approximately 9 ha (22 acres). Part of the construction required for the new Nonnuclear Fabrication Facility includes parking spaces in the form of ground-level, uncovered, paved lots. SNL's practice is to use parking lots as construction staging areas for both material and office trailers and to pave the lots as one of the last construction activities. Further, the new buildings are proposed to be slab-on-grade for the first level, and the proposed construction site is relatively flat and unobstructed, which would minimize the amount of land required for cut-and-fill operations during construction. For modification and renovation of existing buildings, staging activities would use the same operations and staging areas that were used during previous renovations.

Disturbance could occur at building, parking, and construction laydown areas, leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil losses would depend on frequency of storms; wind velocities; size and location of the facilities with respect to drainage and wind patterns; slopes, shape, and area of the tracts of ground disturbed; and whether the soil is bare, particularly during the construction period. Appropriate erosion and sediment control measures would be used to minimize any soil loss.

Net soil disturbance during operations would be less than for construction, because areas temporarily used for laydown would be paved. Although erosion from stormwater runoff and wind action could occur occasionally during operation, it is anticipated to be minimal.

There are no known active faults that cross the area of the proposed facilities. The Tijeras and Sandia faults, located in the eastern portion of SNL, are regarded as the most probable sources for seismic activity in the vicinity of the proposed facilities. The location of active faults and the associated potential ground rupture would be considered in the design of facilities. All facilities would be designed for earthquake-generated ground acceleration in accordance with DOE O 420.1, and accompanying safety guides. Major seismic activity and associated mass movement and subsidence are unlikely to occur during the construction or operational phases, because seismic activity in the region is generally of low intensity and magnitude (see section 4.8.2.5). Hazards resulting from the return of volcanism are unlikely (see section 4.8.2.5). Potential health impacts from accidents associated with geological hazards are discussed in section 4.8.3.9.

Sensitivity Analysis. The high or low case operation scenario would not affect geology and soils.

Stewardship Alternatives

Proposed National Ignition Facility. The construction and operation of the proposed NIF at SNL would not adversely affect geological resources. NIF would require the clearing of an estimated 11 ha (28 acres) of land for buildings, walkways, building access, and buffer space (see appendix I). Soil impacts during construction would be short term and minor with appropriate standard construction erosion and sediment control measures. Net soil disturbance during operation would be less than for construction because areas temporarily used for laydown would be restored. Seismic risks would be taken into account during construction and operation of NIF.

Potential Mitigation Measures. No mitigation measures for the stockpile stewardship and management alternatives at SNL are anticipated.

4.8.3.6 Biotic Resources

The following section addresses impacts to terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. Construction and operation of nonnuclear fabrication mission facilities and the proposed NIF would result in a loss of terrestrial habitat. Nonnuclear fabrication mission facilities may also impact special status species.

No Action. Under No Action, the selected nonnuclear fabrication and stewardship R&D missions described in section 3.2.8 would continue at SNL. This would result in no changes to current biotic resource conditions at the site as described in section 4.8.2.6.

Management Alternatives

Nonnuclear Fabrication

Terrestrial Resources. While the nonnuclear fabrication mission at SNL would use some space in existing buildings, approximately 9 ha (22 acres) would be required for construction of new facilities. The area to be developed is located just east of Technical Area I and is characterized as grassland. Grassland is a common plant community type in the area. Animal species within the disturbed area would be either destroyed or displaced depending upon whether they were able to move from the area. For example, many reptiles and small mammals, as well as nests and young birds, would likely be destroyed, while larger mammals and birds would be able to leave the area. Wildlife may also be disturbed by the increased level of human activity associated with the project.

Wetlands. There are no wetlands on or near the proposed site for the location of the nonnuclear fabrication mission at SNL. Wetlands would not be affected by construction or operation of new nonnuclear fabrication facilities.

Aquatic Resources. There is no natural aquatic habitat on or near the proposed site for the location of the nonnuclear fabrication mission at SNL. Aquatic resources would not be affected by construction or operation of new nonnuclear fabrication facilities.

Threatened and Endangered Species. There would be no Federal-listed threatened or endangered species affected by construction and operation of new nonnuclear fabrication facilities at SNL. Considering that grassland habitat is the prevalent plant community type in the site area, the Federal-candidate mountain plover (Charadrius montanus) could potentially exist onsite. This bird species could lose possible nesting and foraging habitat as a result of site development. Preactivity surveys

would need to be conducted prior to construction in order to determine if any special status species are present on or near the site.

Sensitivity Analysis. While implementation of a low case workload would not alter impacts to biological resources, the high case workload would result in a slight increase in the disturbed grassland area.

Stewardship Alternatives

Proposed National Ignition Facility

Terrestrial Resources. The proposed NIF would be located within a disturbed grassland area of Technical Area II. Construction of new facilities would require 11 ha (28 acres). Proper erosion and sediment control measures would reduce the potential for disturbance of habitat adjacent to the construction area. Animal species within the disturbed area would be either destroyed or displaced, depending upon whether they were able to move from the area. For example, many reptiles and small mammals, as well as nests and young birds, would likely be destroyed, while larger mammals and birds would be able to leave the area. Wildlife may also be disturbed by the increased level of human activity associated with the project.

Wetlands. The proposed NIF site does not contain, nor is it located near, wetlands. The construction and operation of the proposed NIF is not expected to adversely impact this resource.

Aquatic Resources. The proposed NIF site does not contain, nor is it located near, aquatic resources. The construction and operation of the proposed NIF is not expected to adversely impact this resource.

Threatened and Endangered Species. Adverse impacts to special status species are not expected from the construction or operation of the proposed NIF at SNL due to the lack of suitable habitat and the disturbed nature of the proposed site. A site survey may be required to determine the presence of any special status species.

Potential Mitigation Measures. Minimization of the area to be disturbed, revegetation with native species, and implementation of a soil erosion and sediment control plan would help to lessen short- and long-term impacts to terrestrial species and habitats. Disturbance to wildlife living in areas adjacent to management and stewardship facilities may be minimized by preventing workers from entering undisturbed areas. It may be necessary to survey the site for the nests of migratory birds prior to construction and to avoid clearing operations during the breeding season. If any threatened or endangered species occur on the site, specific mitigation measures would be developed in conjunction with the USFWS.

4.8.3.7 Cultural and Paleontological Resources

For the discussion of impacts, the term cultural resources includes prehistoric, historic, and Native American resources. Cultural and paleontological resources may be affected directly through ground disturbance, building modifications, visual intrusion of the project to the historic setting, or environmental context of historic sites, visual and noise intrusions to Native American resources, reduced access to traditional use areas, and unauthorized artifact collecting and vandalism. Some NRHP-eligible historic sites may be affected by the proposed action. All of the undisturbed DOE-owned properties at SNL were surveyed for cultural resources between 1989 and 1991. No significant

resources were found. However, it is possible that buried archaeological remains are present and that some of the SNL facilities may be NRHP eligible based on their historical or architectural significance (SNL 1993c:1-6). The SNL Sitewide Hydrogeologic Characterization project reports that no important paleontological remains have been recovered from deposits on SNL (apendix I).

No Action. Under No Action, DOE would continue existing and planned missions at SNL as described in section 3.2.8. Any impacts to cultural or paleontological resources would be independent of and unaffected by the proposed action.

Management Alternatives

Nonnuclear Fabrication. This alternative would involve renovation and modification of existing facilities at SNL and the construction of a new stand alone production facility. New construction would be located on available undeveloped land directly east of Technical Area I. Although no NRHP-eligible resources were identified during a pedestrian survey of the proposed nonnuclear fabrication area, the potential for subsurface prehistoric and historic resources exists. In 1989, the Quivira Research Center identified two prehistoric lithic and ceramic scatters in a Kirtland Air Force Base management area adjacent to the proposed project area. Both of these sites are on the southern bank of the Tijeras Arroyo. It is also possible that some of the buildings involved may be NRHP eligible. NRHP-eligible resources would be identified during project-specific surveys and evaluations. Some important Native American and paleontological resources may be affected by the proposed alternative. Any project related effects would be addressed in tiered NEPA documentation.

Sensitivity Analysis. The high and low case scenarios have the same impacts to cultural and paleontological resources. The base case production facilities for the nonnuclear fabrication mission operation would accommodate the high and low case production scenarios.

Stewardship Alternatives

Proposed National Ignition Facility. If the proposed NIF were to be located at SNL, it would require the construction of six buildings on a currently undeveloped tract of 11 ha (28 acres) in Technical Area II. Pedestrian surveys indicate that no prehistoric or historic sites or standing structures exist within the proposed NIF location. The Isleta Pueblo has not identified any important Native American resources nor have important paleontological remains been recovered from deposits in the proposed NIF location. No impacts to cultural or paleontological resources are anticipated from construction and operation of the proposed NIF.

Potential Mitigation Measures. If project design or siting would result in adverse effects to NRHP-eligible sites, then a Memorandum of Agreement would need to be negotiated among DOE, the New Mexico SHPO, and the Advisory Council on Historic Preservation. The Memorandum of Agreement would formalize mitigation measures agreed to by these consulting parties. Mitigation measures could include describing and implementing intensive inventory and evaluation studies, data recovery plans, site treatments, and monitoring programs. The appropriate level of data recovery for mitigation would be determined through consultation with the New Mexico SHPO and the Advisory Council on Historic Preservation, in accordance with Section 106 of the National Historic Preservation Act. Mitigation measures for specific NRHP-eligible sites would be identified during tiered NEPA documentation.

If Native American resources cannot be avoided through project design or siting, then acceptable

mitigation measures to reduce project effects on them would be determined in consultation with the affected Native American groups. In accordance with the Native American Graves Protection and Repatriation Act and the American Indian Religious Freedom Act, such mitigations may include, but would not be limited to, appropriately relocating human remains, planting vegetation screens to reduce visual or noise intrusion, increasing access to traditional use areas during operation, or transplanting or harvesting important Native American plant resources.

Because scientifically important buried paleontological materials could be affected, paleontological monitoring of construction activities and data recovery of fossil remains would be appropriate mitigation measures.

4.8.3.8 Socioeconomics

No Action. Under No Action, the existing missions at SNL, as described in section 3.2.8, would continue. No new employment or in-migration of workers would be required. Projections of regional economy and employment rates, population and housing statistics, and public finance characteristics are presented in appendix D.

Regional Economy and Employment. Total employment in the regional economic area is projected to increase by less than 2 percent annually between 1995 and 2000, reaching approximately 420,900 in the latter year. Long-range projections show employment growth averaging slightly above 1 percent annually between 2001 and 2020, and then slowing to less than 1 percent between 2021 and 2030 when total employment reaches 563,880. Site employment for SNL is expected to be 7,341 in 2005. The unemployment rate in the regional economic area was 5.7 percent in 1994 and is expected to remain at this level into the near future. Per capita income is projected to increase from approximately $17,676 in 1995 to $25,867 in 2030.

Population and Housing. Annual ROI county and city population and housing increases are projected to average about 2 percent between 1996 and 2005. Annual increases between 2006 and 2030 are expected to average approximately 1 percent. Population in the ROI is estimated to increase from 653,100 in 1995 to 955,600 in 2030. The total number of housing units in the ROI is projected to increase from 267,700 to 391,800 during the same period.

Public Finance. Between 2000 and 2005, all ROI county, city, and school district total revenues are projected to increase at an annual average of less than 1.6 percent. Total expenditures are projected to increase at an annual average of less than 1.5 percent during the same period. These rates of increase should continue until 2030.

Management Alternatives

Nonnuclear Fabrication

Regional Economy and Employment. Construction-related activities for the Nonnuclear Fabrication Facility would require 379 direct workers during the peak construction year, and would generate 421 indirect jobs in the regional economic area. As a result of the construction and modification activities, total employment in the SNL regional economic area would increase by less than 1 percent. Regional unemployment would fall from the No Action estimate of 5.7 percent to approximately 5.5 percent. Per capita income in the SNL regional economic area would increase very slightly over No Action projections as a result of constructing the facility.

Facility operation-related employment at SNL would begin phasing in as the construction phase neared completion. Operation of the facility in the base case surge mode would require 1,160 direct jobs, and would generate 1,350 additional indirect jobs in the regional economic area. As a result of the operation of the Nonnuclear Fabrication Facility, total employment in the SNL regional economic area would increase by less than 1 percent. Regional unemployment would fall from the 5.7 percent No Action estimate to approximately 5.2 percent. Per capita income for the SNL regional economic area would increase by less than 1 percent over No Action projections. Changes in employment and per capita income resulting from the operation of the Nonnuclear Fabrication Facility are shown in figure 4.8.3.8-1.

Population and Housing. Population in the SNL ROI during peak construction would not increase over No Action projections. Enough workers would be available in the regional economic area and ROI to fill all of the direct and indirect jobs generated by the construction of the facility.

There are not enough available workers to fill all of the direct operation jobs. Approximately 145 workers would in-migrate to fill new positions at the Nonnuclear Fabrication Facility. Changes in the ROI population over No Action during full operation at SNL are shown in figure 4.8.3.8-2. Vacant housing would be sufficient to house in-migrating workers and their families.

Public Finance. Construction of the Nonnuclear Fabrication Facility would not require in-migrating workers. Therefore, changes to local finances compared to No Action projections would be attributed to income increases and would be negligible.

Changes in revenues and expenditures compared to No Action projections due to operation of the Nonnuclear Fabrication Facility with reservoirs at SNL are shown in figure 4.8.3.8-3. In 2005, the percent increase in total ROI revenues and expenditures over No Action projections would be negligible (less than 0.1 percent).

Nonnuclear Fabrication Without Reservoirs

The option of terminating the reservoir production mission at SNL would result in 56 fewer direct operations jobs. There would be less in-migration than in the nonnuclear fabrication with reservoirs alternative. This would result in slightly smaller increases in regional economy, population and housing, and public finance than occurred in the nonnuclear fabrication with reservoirs base case surge alternative.

Sensitivity Analysis. There would be no change in the number of construction workers required to complete the Nonnuclear Fabrication Facility for either the high or low case. Operation of the facility at the high case level, would require the same number of workers and would have the same socioeconomic effects as the base case surge level. For the low case, worker requirements would decrease, causing slightly lower increases in regional economy, population and housing, and public finance than occurred in the base case surge level. These changes would be negligible.

Stewardship Alternatives

Proposed National Ignition Facility. The following is a summary of the socioeconomic effects of construction of the proposed NIF at SNL. See appendix I for a more detailed, project-specific discussion.

Regional Economy and Employment. Construction of the proposed NIF would require 280 construction workers during the peak year of construction, and would generate approximately 1,490 additional indirect jobs in the regional economic area. Employment for operation would begin phasing in as the construction phase neared completion. Operation of the facility would require 330 direct workers, and would generate 340 additional indirect jobs in the regional economic area. Construction and operation of NIF would have only minimal effects on the regional economy and employment.

Population and Housing. Both construction and operation of the facility would require workers and their families to in-migrate to the ROI. This in-migration would cause a slight increase in the population of the ROI. Vacant housing in the ROI is sufficient to handle these increases.

Public Finance. Both revenues and expenditures would increase as a result of the construction and operation of the proposed NIF. Increases due to construction would peak in 1998 and then decline as construction neared completion in 2002. Increases due to operation of the facility would peak in 2003 and continue through the duration of NIF operation.

Potential Mitigation Measures. No mitigation measures are anticipated.

4.8.3.9 Radiation and Hazardous Chemical Environment

This section describes the radiological and hazardous chemical releases and their associated impacts, which could result from No Action and the proposed alternatives at SNL. Within this section, impacts resulting from the base case scenario are quantitatively discussed, and a sensitivity analysis of the high and low case scenarios is qualitatively discussed.

Summaries of the prevailing radiological impacts at SNL to the public and to workers associated with normal operation are presented in tables 4.8.3.9-1 and 4.8.3.9-2, respectively. Accident impacts are given in table 4.8.3.9-3. The impact assessment methodology is described in section 4.1.9, and further supplementary methodological information is presented in appendixes E and F.

Normal Operation. There would be no radiological releases during the construction or modification of any facilities to support the Stockpile Stewardship and Management Program. However, limited hazardous chemical releases (e.g., small spills of diesel fuel from equipment refueling) may occur due to construction activities for the base case scenario and may increase slightly for the high case scenario. The concentration of these releases is expected to be well within the regulated exposure limits and would not result in any adverse health effects.

Water from processes containing hazardous chemicals is not discharged directly into surface water or groundwater that serves as potable water. Process water that may contain hazardous chemicals is treated before discharge to the city of Albuquerque sewer system. Furthermore, state-permitted discharges of stormwater to surface impoundment (lagoons) which can be attributed to the activities associated with normal operation and operation of the stockpile stewardship and management alternatives at SNL are expected to be below New Mexico Water Quality Control Commission Regulations limits. Water quality would not be adversely affected. Thus, the primary pathway considered for the public and the onsite worker is the air pathway.

For normal operation at SNL, all possible hazardous chemicals were examined for further analysis

based on their toxicity, concentration, and frequency of use. The HI is a summation of the HQ for all chemicals. The HQ is the value used as an assessment of noncancer toxic effects of chemicals (e.g., kidney or liver dysfunction). It is independent of cancer risk, which is calculated only for those chemicals identified as carcinogens. The HI was calculated for the No Action chemicals and all alternative chemicals proposed to be added (the increment) at the site to yield cumulative levels for the site. An HI of 1.0 indicates that all noncancer exposure values meet OSHA standards; if the cancer risk is 1x10-*6* (the default value, not a regulatory standard), no further analysis is indicated. A cancer risk of 1x10-*6* is considered acceptable by EPA (40 CFR 300.430) because this incidence of cancers cannot be distinguished from the cancer risk for an individual member of the population. Information pertaining to OSHA-regulated exposure limits and toxicity profiles for all hazardous chemicals described in this PEIS may be found in the *Chemical Health Effects Technical Reference* (TTI 1996b).

No Action

Radiological Impacts. Radiological impacts to the public resulting from the No Action alternative are presented in table 4.8.3.9-1. These impacts are representative of the aggregated total which is estimated to exist from all future baseline operational contributions. Total impacts are provided to compare with applicable regulations governing total site operations. To place doses to the public from the No Action alternative into perspective, comparisons are made to natural background radiation. As shown in table 4.8.3.9-1, the total dose to the maximally exposed member of the public from annual total site operations is within radiological limits and would be 1.6x10-3 mrem for the No Action alternative. The annual population dose within 80 km (50 mi) in 2030 would be 0.027 person-rem.

Table 4.8.3.9-1.-- Potential Radiological Impacts to the Public Resulting from Normal Operation of Stockpile Stewardship Alternatives at Sandia National Laboratories

	No Action	**National Ignition Facility**
Affected Environment	**Total Site**	**Total Site**[9]
Maximally Exposed Individual (Public)		
Atmospheric Release		
Dose[10] (mrem/yr)	$1.6x10^{-3}$	$5.6x10^{-3}$
Percent of natural background[11]	$4.8x10^{-4}$	$1.7x10^{-3}$
25-year fatal cancer risk	$2.0x10^{-8}$	$7.1x10^{-8}$
Liquid Release		
Dose[10] (mrem/yr)	0	0
Percent of natural background[11]	0	0
25-year fatal cancer risk	0	0
Atmospheric and Liquid Releases		
Dose[10] (mrem/yr)	$1.6x10^{-3}$	$5.6x10^{-3}$
Percent of natural background[11]	$4.8x10^{-4}$	$1.7x10^{-3}$

25-year fatal cancer risk	$2.0x10^{-8}$	$7.1x10^{-8}$
Population Within 80 Kilometers		
Atmospheric and Liquid Releases in 2030		
Dose (person-rem)	0.027	0.23
Percent of natural background[11]	$1.0x10^{-5}$	$8.9x10^{-5}$
25-year fatal cancers	$3.3x10^{-4}$	$2.8x10^{-3}$

Total site doses to onsite workers from normal operation for the No Action alternative are presented in table 4.8.3.9-2. The estimated average annual dose to the entire facility workforce for this alternative would be 11 person-rem. The presented noninvolved worker values were not modeled due to the unavailability of certain site-specific information.

Based on the radiological impacts associated with normal operation under the No Action alternative, all resulting doses would be within radiological limits and are well below levels of natural background radiation. The associated risks of adverse health effects to the public and to workers would be small.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and onsite workers resulting from normal operation under No Action at SNL are presented below. Analyses used to support the values presented in this section are provided in appendix table E.3.4-26. This PEIS does not purport to provide the level of detail needed to go beyond a conservative screening process for hazardous chemicals. As such, the analysis in this PEIS for the No Action alternative should not be relied upon as a basis for judging the sites as having a hazardous health concern. The model used to calculate HI and cancer risk in this PEIS only establishes a baseline for comparison of alternatives among sites. The baseline is then used to determine the extent to which each alternative adds or subtracts from the No Action HI and cancer risk to the public at each site.

The HI for the maximally exposed member of the public at SNL resulting from normal operation under the No Action alternative would be 2.31x10-*3* and the cancer risk would be zero. The HI for the onsite worker would be 1.04x10-*5* and the cancer risk would be zero.

The HIs for the public and for the onsite worker are within the acceptable health levels. The cancer risks to the public and the onsite worker are within the EPA default value of 1x10-*6* .

Management Alternatives

Nonnuclear Fabrication

Radiological Impacts. There are no radiological impacts associated with this alternative.

Hazardous Chemical Impacts. Hazardous chemical impacts for the public and for the onsite worker resulting from normal operation due to the nonnuclear fabrication mission at SNL are presented below. The HI and cancer risk would remain constant over 25 years of operation, provided exposures remain the same. Analyses to support the values presented in this section are provided in appendix table E.3.4-27.

The incremental HI for the maximally exposed member of the public would be 1.02x10-*4* and the incremental cancer risk would be 1.65x10-*7* as a result of the nonnuclear fabrication mission at SNL. The incremental HI for the onsite worker would be 1.60x10-*4* and the incremental cancer risk would be 1.10x10-*5* as a result of the nonnuclear fabrication alternative.

Table 4.8.3.9-2.--Potential Radiological Impacts to Workers Resulting from Normal Operation of Stockpile Stewardship Alternatives at Sandia National Laboratories

Affected Environment	No Action	National Ignition Facility
Involved Workforce[12]		
Average worker dose[13] (mrem/yr)	NA	30
25-year fatal cancer risk	NA	3.0×10^{-4}
Total dose (person-rem/yr)	NA	8.0
Noninvolved Workforce [14]		
Average worker dose[12] (mrem/yr)	3.2	3.2
25-year fatal cancer risk	3.2×10^{-5}	3.2×10^{-5}
Total dose (person-rem/yr)	11	11
Total Site Workforce[15]		
Dose (person-rem/yr)	11	19
25-year fatal cancers	0.11	0.19

Total site operations of the nonnuclear fabrication mission would result in HIs for the public (2.41x10-3) and the onsite worker (1.70x10-4) that are within acceptable health levels. The cancer risks for the public (1.65x10-7) are within the default value. The cancer risks to the onsite worker (1.10x10-5) somewhat exceed the default value of 1x10-6 due to emissions of trichloroethylene under the nonnuclear fabrication mission at SNL.

It is likely that emissions of hazardous chemicals would not increase, and may slightly decrease, as a result of implementing the option of not including reservoirs in the nonnuclear fabrication alternative at SNL. Therefore, no effects on the existing HI and cancer risk impacts for the public and onsite workers are expected.

Sensitivity Analysis. Operations under the low case scenario for nonnuclear fabrication are expected to reduce hazardous chemical emissions by up to 50 percent at SNL and, therefore, would likely reduce the HIs and cancer risks for the public and the onsite worker.

Operations under the high case scenario for nonnuclear fabrication may result in up to a 4-fold increase in the emissions of hazardous chemicals at SNL. The HI for the public and the onsite worker

should remain within the cumulative HQ screening level of 1.0 (the HI). Cancer risks for the public are well within the default value of 1x10-6 and would not exceed this level under the high case scenario. Since cancer risk impacts for the onsite workers already exceed the EPA default value, operations under the high case scenario would further contribute to the adverse cancer risk impacts.

Stewardship Alternatives

Proposed National Ignition Facility

Radiological Impacts. Radiological impacts to the public resulting from normal operation of the proposed NIF for the enhanced option scenario are presented in table 4.8.3.9-1. These impacts are representative of the aggregate total which is estimated to exist from all future baseline operational SNL contributions and from enhanced option operations of the proposed NIF at the site. Total impacts are provided to compare with applicable regulations governing total site operations. To place doses to the public from this alternative into perspective, comparisons are made to natural background radiation. As shown in table 4.8.3.9-1, the total dose to the maximally exposed member of the public from annual total site operations is within radiological limits and would be 5.6x10-3 mrem for this alternative. The annual population dose within 80 km (50 mi) in 2030 would be 0.23 person-rem.

Total site doses to onsite workers from normal operation of the proposed NIF are presented in table 4.8.3.9-2. The average annual dose to involved workers for this alternative would be 30 mrem. The dose to the entire facility workforce (involved workforce) would be 8.0 person-rem. The presented total dose to noninvolved workers was not modeled due to the unavailability of certain site-specific information.

Based on the radiological impacts associated with normal operation of this alternative, all resulting doses would be within radiological limits and are well below levels of natural background radiation. The associated risks of adverse health effects to the public and to workers would be small.

Hazardous Chemical Impacts. No hazardous chemical impacts are expected from operation of the proposed NIF (see appendix I). Therefore, the HI and cancer risk to the public and the onsite worker were not calculated nor assessed.

Potential Mitigation Measures. Mitigation measures such as substituting less toxic solvents and chemicals or modifying processes are proposed to reduce or eliminate the emissions of trichloroethylene due to site operations. Radioactive airborne emissions to the general population and onsite exposures to workers could be reduced by implementing the latest technology for process and design improvements. For example, to reduce public exposure from emissions, improved building and work area control methods could be used to remove radioactivity from the releases to the environment. Similarly, the use of remote, automated, and robotic production methods are examples of techniques that are being developed that would reduce worker exposure (see section 3.5).

Facility Accidents. The proposed actions have the potential for accidents that may impact the health and safety of workers and the public. The potential for and associated consequences of reasonably foreseeable accidents that have been assessed are summarized in this section.

No Action. Under the No Action alternative, nonnuclear fabrication and stewardship R&D would continue to be performed at SNL with no changes to facilities and operations. Under existing

conditions, potential accidents and their consequences have been addressed in facility safety documentation according to requirements in DOE orders. In addition, there are other facilities at SNL besides those for nonnuclear fa brication and stewardship R&D. The potential for accidents at these other facilities has been similarly addressed and documented.

Management Alternatives. This section provides accident information on the nonnuclear fabrication alternative for SNL.

Nonnuclear Fabrication. The impacts of potential accidents associated with nonnuclear fabrication activities at SNL were previously addressed in Nonnuclear Consolidation Environmental Assessment (DOE/EA-0792, June 1993) where it was determined that the then current accident profile would not change as a result of the relocation of nonnuclear fabrication functions to SNL. The present proposed action to transfer the nonnuclear fabrication mission to SNL is not expected to change the accident profile that presently exists at the site.

Stewardship Alternatives

Proposed National Ignition Facility. Studies of potential accidents associated with the proposed NIF have been performed. A bounding accident was postulated based on a preliminary hazard analysis. The bounding accident assumes a severe earthquake of 1 G horizontal ground acceleration occurring during a maximum-credible-yield fusion experiment. Beamlines streaking into the target chamber and building structures other than the target area building would fail during the postulated earthquake. The collapsed beamlines and building structures would provide a pathway for acute atmospheric releases of tritium from the tritium processing system, activated gases in the air, and activated material in the target chamber.

The frequency of this severe earthquake is estimated at 1x10-4 per year. The joint frequency of the severe earthquake during the maximum-credible-yield fusion experiment would be less than 2x10-8 per year. The radiological impacts of the accident, presented in table 4.8.3.9-3, were estimated using the GENII computer code.

Table 4.8.3.9-3.--Consequences and Risk of the Bounding Proposed National Ignition Facility Accident at Sandia National Laboratories

Parameter	Conceptual Design	Enhanced Baseline Option
Workers Onsite		
Dose (person-rem)	20	33
Fatal cancers	0	0
Risk (cancer fatalities per year)	$2x10^{-10}$	$3x10^{-10}$
Maximally Exposed Individual		
Dose (rem)	0.07	0.1
Fatal cancers probability	$4x10^{-5}$	$8x10^{-5}$
Risk (cancer fatality per year)	$7x10^{-13}$	$1x10^{-12}$
Population Within 80 Kilometers		

Dose (person-rem)	1,100	1,800
Fatal cancers probability	0	1
Risk (cancer fatalities per year)	$1x10^{-8}$	$2x10^{-8}$

Source: Appendix I.

4.8.3.10 Waste Management

This section summarizes the impacts on waste management at the Albuquerque location of SNL under No Action and for each of the proposed alternatives. There is no spent nuclear fuel, HLW, or TRU waste associated with nonnuclear fabrication or the proposed NIF; therefore, there is no further discussion of these wastes at SNL. Table 4.8.3.10-1 lists the projected waste generation rates and treatment, storage, and disposal capacities under No Action. Projections for No Action were derived from 1994 environmental data, with the appropriate adjustments made for those changing operational requirements where the volume of wastes generated are identifiable. The projection does not include wastes from future, yet uncharacterized, environmental restoration activities.

Table 4.8.3.10-2 provides the total estimated operational waste volumes projected to be generated at SNL as a result of the nonnuclear fabrication alternative and the NIF alternative. The net increase over No Action is shown in the table in parentheses. The waste volumes generated from the alternatives and the resultant waste effluent used in the impact analysis can be found in table 3.4.2.5-3 for nonnuclear fabrication and table 3.3.2.2-3 for NIF. Facilities that would support the Stockpile Stewardship and Management Program would treat and package all waste generated into forms that would enable long-term storage and/or disposal in accordance with the *Atomic Energy Act,* RCRA, and other applicable statutes as outlined in appendix section H.1.2.

No Action. Under No Action, TRU, low-level, mixed, hazardous, and nonhazardous wastes would continue to be generated at SNL from the missions described in section 3.2.8. SNL would continue to treat, store, and dispose of its legacy and newly generated wastes in current and planned facilities. Liquid LLW would be neutralized and solidified. Solid LLW would be compacted, packaged, and stored at the Technical Area III storage site for shipment to NTS. Both liquid and solid mixed waste would be treated in the Technical Area III Radioactive and Mixed Waste Management Facility and disposed of according to the SNL Site Treatment Plan which was developed pursuant to the *Federal Facility Compliance Act* of 1992. The resulting waste would be stored in a RCRA-permitted facility in DOT-approved containers until shipped to an offsite DOE disposal facility. Some of this waste would be placed in interim storage until new technologies for treatment and disposal are identified and evaluated. Hazardous waste would be packaged and shipped offsite to RCRA-permitted treatment storage and disposal facilities. Liquid sanitary waste would continue to be sent to the City of Albuquerque Municipal Sanitary Sewer System. Solid nonhazardous sanitary waste would be disposed of at the Albuquerque Sanitary Landfill.

Table 4.8.3.10-1.--Projected Waste Management Under No Action at Sandia National Laboratories

Category	Annual Generation (m^3)	Treatment Method	Treatment Capacity (m^3/yr)	Storage Method	Storage Capacity (m^3)	Disposal Method	Disposa Capacit (m^3)
Low-Level							
Liquid	1	Neutralization and solidification	Included in mixed low-level	Staged at generator sites or in containers at Technical Area III aboveground storage site and other facilities	Included in mixed low-level	NA	NA
Solid	53	Compaction	Included in mixed low-level	Staged at generator sites or in containers at Technical Area III aboveground storage site and other facilities	Included in mixed low-level	None - pending offsite shipment to NTS	NA
Mixed Low-Level							
Liquid	<0.01	Neutralization and solidification; specific preferred treatment option for each treatability group as per Site Treatment Plan for Mixed Waste	Data not available at this time	Technical Area III	Included in solid	NA	NA
Solid	2	Compaction; specific preferred treatment option for each treatability group as per Site Treatment	Data not available at this time	Staged at generator sites or in containers at Technical Area III aboveground storage site	3,080	Offsite commercial facilities; some waste streams have no disposal options identified	NA

		Plan for Mixed Waste		and other facilities			
Hazardous							
Liquid	342	Neutralization or thermal treatment (open burn)	Data for neutralization not available at this time	RCRA-permitted Hazardous Waste Management Facility	Included in solid	Shipped to offsite RCRA-permitted facilities	NA
Solid	486[16]	Thermal treatment	9.1 kg/campaign	RCRA-permitted Hazardous Waste Management Facility	Data not available at this time	Shipped to offsite RCRA-permitted facilities	NA
Nonhazardous (Sanitary)							
Liquid	75,700	Offsite/Kirtland Air Force Base	NA	None	NA	Offsite-NPDES outfall to municipal facilities	NA
Solid	9,070	Segregation and recycling	NA	None	NA	Offsite sanitary landfill	NA
Nonhazardous (Other)							
Liquid	Included in sanitary	Included in sanitary	NA	None	NA	Included in sanitary	NA
Solid	Included in sanitary	Included in sanitary	NA	None	NA	Onsite classified waste landfill for classified waste; offsite for other nonhazardous wastes	NA

Table 4.8.3.10-2.--Estimated Annual Generated Waste Volumes for Stockpile Stewardship and Management Alternatives at Sandia National Laboratories

Category	No Action[17] (m^3)	Nonnuclear Fabrication[18] (m^3)	National Ignition Facility[19] (m^3)	Combined Program Impacts (m^3)
Low-Level				
Liquid	1	1	2	2

		(+0)	(+0.6)	(+0.6)
Solid	53	53	56	56
		(+0)	(+3)	(+3)
Mixed Low-Level				
Liquid	<0.01	<0.01	2	2
		(+0)	(+2)	(+2)
Solid	2	2	2	2
		(+0)	(+0.3)	(+0.3)
Hazardous				
Liquid	342	357	344	359
		(+15)	(+2)	(+17)
Solid	486	503	494	511
		(+17)	(+8)	(+25)
Nonhazardous (Sanitary)				
Liquid	75,700	367,000	93,600	385,000
		(+291,000)	(+17,900)	(+309,000)
Solid	9,070	16,900	15,100	22,900
		(+7,880)	(+6,000)	(+13,900)
Nonhazardous (Other)				
Liquid	Included in sanitary	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	Included in sanitary	Included in sanitary	Included in sanitary

Management Alternatives

Nonnuclear Fabrication. The Nonnuclear Fabrication Facility at SNL would not generate any TRU waste, LLW, or mixed LLW. Minimal impacts would result from the 15 m^3 (3,840 gal) of liquid hazardous waste and 17 m^3 (22 yd^3) of solid hazardous waste, which would be packaged and stored onsite in RCRA-permitted facilities prior to shipment offsite to commercial RCRA-permitted treatment, storage, and disposal facilities. The estimated 291,000 m^3 (77,000,000 gal) of sanitary waste would be conveyed to the City of Albuquerque Municipal Sanitary Sewer System. Additional treatment in accordance with site practice and discharge permits may be required. Following volume reduction, 3,940 m^3 (5,150 yd^3) per year of solid nonhazardous waste would be disposed of at the Albuquerque Sanitary Landfill. Minimal impacts to the remaining capacity of the landfill are expected.

Sensitivity Analysis. The waste volumes generated from the Nonnuclear Fabrication Facility required to support a larger stockpile level (high case) operating on a single-shift basis are bounded by the base case under surge operations. Thus, there are no additional waste management impacts associated with the Nonnuclear Fabrication Facility that would support a high case stockpile operating at a single shift. The volumes generated from the Nonnuclear Fabrication Facility required to support a

low case stockpile would be reduced by a factor of at least three.

Stewardship Alternatives

Proposed National Ignition Facility. The proposed NIF would not generate any TRU waste. The 0.6 m3 (159 gal) of liquid LLW would require treatment prior to disposal. Liquid LLW is currently stored at the point of generation. Treatability studies are being conducted prior to applying for a RCRA permit for treating and storing liquid LLW and mixed waste. The 3 m3 (4 yd3) of solid LLW would be packaged in approved waste containers and staged in the Technical Area III storage site pending shipment directly to NTS for management. Assuming a land usage factor of 6,000 m3 /ha (3,180 yd3 /acres), less than 0.0005 ha/yr (0.0001 acres/yr) of LLW disposal area would be required.

The SNL Site Treatment Plan for Mixed Waste was developed to comply with the *Federal Facility Compliance Act.* The mixed waste streams identified at SNL have been combined into 16 treatability groups, each with a preferred treatment option. The type of mixed wastes generated by NIF would fit into one of the established 16 treatability groups and would not require the creation of new treatability groups or new preferred treatment options. The annual generation of 2 m3 (528 gal) of liquid mixed wastes and the annual generation of 0.3 m3 (0.4 yd3) of solid mixed waste would have a negligible impact on the available storage capacity of the main areas for future mixed waste storage: the seven Manzano bunkers, the Radioactive and Mixed Waste Management Facility, and Building 6596.

Minimal impacts would result from the 2 m3 (608 gal) of liquid hazardous waste and 8 m3 (10 yd3) of solid hazardous waste, which would be staged in the onsite hazardous waste accumulation area and shipped to offsite commercial RCRA-permitted treatment, storage, and disposal facilities. There are no adverse impacts expected from the annual volume of 17,900 m3 (4.72 million gal) of liquid nonhazardous sanitary waste discharged to the City of Albuquerque Municipal Sanitary Sewer System. Additional treatment in accordance with site practice and discharge permits may be required. Minimal impacts to the Albuquerque Sanitary Landfill would result from the 6,050 m3 (7,910 yd3) of solid nonhazardous waste.

Combined Program Impacts. If all the stockpile stewardship and management alternatives listed in table 4.8.3.10-2 were located at SNL, the impacts from low-level and mixed LLW would be identical to those discussed for NIF. Minimal impacts would result from the program total of 17 m3 (4,450 gal) of liquid and 25 m3 (33 yd3) of solid hazardous wastes. Adequate facilities exist to package and stage these wastes in onsite RCRA-permitted facilities prior to shipment offsite to commercial RCRA-permitted treatment and disposal facilities. There are no adverse impacts expected from the program total of 309,000 m3 (81.7 million gal) annual volume liquid sanitary wastes discharged to the City of Albuquerque Sanitary Sewer System. Additional treatment in accordance with site practice and discharge permits may be required. After volume reduction, approximately 9,990 m3 (13,100 yd3) of solid sanitary waste would require disposal at the Albuquerque Sanitary Landfill. Minimal impacts to the landfill are expected.

Potential Mitigation Measures. Waste quantities or waste forms could undergo additional reductions by utilizing emerging technologies, thereby further reducing or mitigating impacts. Pollution prevention and waste minimization would be considered in determining the final actions of the Stockpile Stewardship and Management Program at SNL. Utilization of existing and planned treatment and storage facilities would be maximized to further reduce impacts.

4.8.3.11 Environmental Justice

As discussed in section 4.14, any impacts to surrounding communities would most likely result from toxic or hazardous air pollutants and radiological emissions. Section 4.8.3.9, which describes public and occupational health impacts from normal operation, shows that potential chemical air emissions and releases are not within the generally accepted threshold of regulatory concern. This information is based on the conservative programmatic assumptions and modeling detailed in appendix E. Any adverse human health or environmental impacts that might occur would affect people living within communities located near SNL. The analysis of the demographic data presented in appendix D for the communities surrounding SNL indicates that if there were any adverse health impacts to these communities, they would not appear to disproportionately affect minority or low-income populations.

---

1 State and city/county standard.

2 Federal standard.

3 No monitoring data available; concentration assumed less than applicable standard.

4 State standard or guideline.

5 No standard. Source: 40 CFR 50; NM EIB 1995a; NM EIB 1996a; SNL 1995b:1; SNL 1995e; appendix I.

6 Total water requirements for construction at SNL are based on a 3-year period for nonnuclear fabrication and a 5-year period for NIF.

7 No construction water would be used or construction wastewater generated. Total site water use and wastewater discharged would be the same as No Action operation.

8 All discharges to natural drainages require NPDES permits. NA - not applicable; MLY - million liters per year. SNL 1995b:l; SNL 1995e; appendix I.

9 Includes impacts from No Action.

10 The applicable radiological limits for an individual member of the public from total site operations are 10 mrem/yr from the air pathways, 4 mrem/yr from the drinking water pathway, and 100 mrem/yr from all pathways combined (DOE Order 5400.5).

11 Natural background radiation levels to an average individual are 334 mrem/yr and to the population within 80 km (50 mi) in 2030 are 259,500 person-rem. Source: SNL 1994a; appendix I.

12 The involved worker is a worker associated with operation of NIF. The estimated number of involved workers is 267 for NIF.

13 The radiological limit for an individual worker is 5,000 mrem/yr (10 CFR 835).

14 The noninvolved worker is an onsite worker not associated with operation of NIF. The estimated

number of noninvolved workers is 3,400 for NIF.

15 The total site workforce is the sum of the number of involved and noninvolved workers. The estimated number of workers in the total site workforce is 3,400 for No Action and 3,667 for NIF. NA - not applicable. Source: DOE 1993n:7; appendix I.

16 Includes RCRA-regulated, state-regulated, and TSCA-regulated wastes. NA - not applicable. Source: SNL 1995d.

17 No Action volumes are from table 4.8.3.10-1.

18 Volumes for nonnuclear fabrication are from table 3.4.2.5-3 and are based on surge operations (three shifts).

19 Volumes for NIF are from table 3.3.2.2-3 and are based on the conceptual design. Waste generation volumes were rounded to three significant figures. Waste effluent volumes are found in sections 3.3 and 3.4

4.9 Nevada Test Site

NTS was established in 1950 and currently occupies approximately 351,000 ha (867,000 acres) located 105 km (65 mi) northwest of Las Vegas, NV. The site has conducted underground testing of nuclear weapons and evaluation of the effects of nuclear weapons on military communications systems, electronics, satellites, sensors, and other materials. In October 1992, underground nuclear testing was halted, yet the site maintains the capability to resume testing if authorized by the President. Section 3.2.9 provides a description of all DOE missions and support facilities at NTS. The location of NTS within the state of Nevada is illustrated in figure 4.9-1, and the principal facilities at NTS are shown in figure 4.9-2.

4.9.1 Description of Alternatives

There are no facilities at NTS that would be phased out as a result of any of the proposed alternatives discussed in this PEIS.

No Action. NTS would continue to perform the mission described in section 3.2.9.

Stockpile Management Alternatives. The A/D mission, including the nonintrusive modification pit reuse mission (hereafter referred to as A/D), and the option of storage of strategic reserves of plutonium and uranium could be located at NTS.

Stockpile Stewardship Alternatives. NIF could be located at NTS (at the main site or at NLVF).

4.9.2 Affected Environment

The following sections describe the affected environment at NTS and NLVF for land resources, air quality, water resources, geology and soils, biotic resources, cultural and paleontological resources, and socioeconomics. In addition, the infrastructure, radiation and hazardous chemical environment, and waste management conditions are described.

4.9.2.1 Land Resources

Land Use. NTS occupies approximately 351,000 ha (867,000 acres) in southern Nye County in southern Nevada, with the southwestern boundary located approximately 16 km (10 mi) from California. The town of Indian Springs and the Indian Springs Air Force Auxiliary Field, in northeast Clark County, NV, are 39 km (24.2 mi) southeast of the closest NTS boundary. All of the land within NTS is owned by the Federal Government and is administered, managed, and controlled by DOE. NTS is also entirely bordered by Federal land: the land to the west, north, and east consists of the Nellis Air Force Range; the land to the south is administered by the Bureau of Land Management.

Generalized land uses at NTS and its vicinity are shown in figure 4.9.2.1-1. NTS is divided into 3 major regions consisting of 26 areas. The northern region of NTS is the underground nuclear weapons test area. Nuclear test ranges are located at Yucca Flats, Pahute Mesa, Rainier Mesa, and Buckboard Mesa. The southwest region of NTS (Area 25) provides support for nonweapons and nonnuclear weapons programs, such as the proposed HLW repository at the Yucca Mountain Project Site. Area 25 also provides support for short-term activities such as the nuclear weapons accident exercises conducted by the Nuclear Emergency Search Team. The southeastern region is the

nonnuclear test area and primary administrative and support area of NTS.

Land areas not used for missions or other purposes have been designated in the Nevada Site Development Plan as reserve areas, available for future development (NT DOE 1994d:7-8). Approximately 4,050 ha (10,000 acres) of reserve areas are present within Areas 5 and 6, which are located in Frenchman and Yucca Flats. Figure 4.9.2.1-2 identifies the primary facilities, A/D area, and testing areas at NTS.

The Device Assembly Facility, undergoing final construction, is designed to conduct all nuclear assembly operations at NTS in support of the Nuclear Weapons Test Program. Other nearby facilities include the DOD test area, explosives disposal area, radioactive waste management site, and the Spill Test Facility.

In 1992, DOE designated the entire NTS as a National Environmental Research Park. The park is used by the national scientific community as an outdoor laboratory for research on the effects of human activities on the desert ecosystem. There is no prime farmland present on NTS. Offsite agricultural activity occurs on the south side of U.S. Route 95, consisting of a cattle allotment granted by the Bureau of Land Management.

The Timber Mountain Caldera National Natural Landmark is located approximately 11 km (6.8 mi) north-northwest of the Device Assembly Facility, separated by mountains to the west. A wilderness study area located within the Desert National Wildlife Refuge, which has been recommended for inclusion in the National Wilderness System, is approximately 12 km (7.5 mi) to the east. This part of the refuge is also a part of the Nellis Air Force Range; it is jointly managed by the U.S. Air Force and USFWS. Public entry to this portion of the refuge is generally prohibited by the Air Force. The closest offsite residence to the NTS boundary is approximately 2 km (1.2 mi) south, at the unincorporated town of Amargosa Valley.

North Las Vegas Facility

Land Use. NLVF occupies 32 ha (80 acres) in the city of North Las Vegas, NV, as shown in figure 4.9.2.1-3. NLVF is zoned for general industrial use and is bordered on the north, south, and east by general industrial zoning. The western border of the site is adjacent to Commerce Street, which separates the property from fully developed, single-family residential-zoned property (figure 4.9.2.1-4).

NLVF is divided into three distinct areas: the A, B, and C Complexes. Complex A covers 8 ha (20 acres) and houses support for the LLNL nuclear test program. Complex B covers 8 ha (20 acres) just south of Complex A and houses support for the LANL test program. Complex C, located west of A and B Complexes, covers 15.5 ha (38.3 acres) and houses a computer center and administrative and engineering support functions (appendix I).

4.9.2.2 Site Infrastructure

As shown in figure 4.9.2.1-1, activities at NTS are concentrated in facilities in several general areas. Section 3.2.9 describes the current NTS missions. To support these missions an infrastructure exists as shown in table 4.9.2.2-1.

Table 4.9.2.2-1.--Baseline Characteristics for Nevada Test Site

Characteristics	Current Value
Land	
Area (ha)	351,000
Roads (km)	640
Railroads (km)	0
Electrical	
Energy consumption (MWh/yr)	121,460
Peak load (MWe)	27.4
Fuel	
Natural gas (m^3/yr)	0
Liquid (L/yr)	5,716,000
Coal (t/yr)	0

NTS 1993a:4; NTS 1995a:1; NTS 1995a:2.

4.9.2.3 Air Quality

The following section describes the existing air quality at NTS and NLVF and includes a review of meteorology and climatology in the vicinity. More detailed discussions of air quality methodologies, input data, and atmospheric dispersion characteristics are presented in appendix section B.3.9 and appendix I.

Meteorology and Climatology. The climate at NTS and in the surrounding region is characterized by limited precipitation, low humidity, and large diurnal temperature ranges. The lower elevations are characterized by hot summers and mild winters, which are typical of other Great Basin desert areas. As elevation increases, precipitation amounts increase and temperatures decrease (NT DOE 1986b:3-46).

The annual average temperature is 19.5 °C (67.1°F); the average daily minimum temperature is 0.9 ° C (33.6°F) in January; and the average daily maximum temperature is 41.1 C (105.9°F) in July. The average annual precipitation at NTS is 10.5 cm (4.13 in) (NOAA 1994d:3). Prevailing winds at NTS vary by location. The annual average wind speed is 4.2 m/s (9.3 mph).

Ambient Air Quality. NTS is located within the Nevada AQCR 147. The region is designated as an attainment or unclassified area (40 CFR 81.329) with respect to the NAAQS. Applicable NAAQS and Nevada State ambient air quality standards are presented in appendix table B.3.1-1.

Two Prevention of Significant Deterioration Class I areas in the vicinity of NTS are Grand Canyon National Park, approximately 193 km (120 mi) to the southeast, and Sequoia National Park, California, approximately 169 km (105 mi) to the west-southwest of the site. Since the promulgation of Prevention of Significant Deterioration regulations (40 CFR 52.21) in 1977, no permits have been required for any emissions source at NTS.

The primary emission sources of criteria air pollutants at NTS include particulates from construction

and other surface disturbances, fugitive dust from unpaved roads, various pollutants from fuel burning equipment, incineration, open burning, and volatile organics from fuel storage facilities. A summary of emission estimates for sources at NTS is presented in appendix table B.3.9-1.

Table 4.9.2.3-1 shows the site baseline ambient air concentrations for criteria pollutants and other pollutants of concern at NTS. No hazardous air pollutant or other toxic compound sources are indicated. Baseline concentrations are in compliance with applicable guidelines and regulations. Elevated levels of ozone or particulate matter may occur occasionally because of pollutants transported into the area by wind or because of local sources of fugitive particulates (NT DOE 1983a:30). Concentrations of other criteria pollutants (sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead) are low because there are no large emission sources nearby. The nearest significant emission source for criteria pollutants is the Las Vegas area, which is about 105 km (65 mi) southeast of NTS.

Table 4.9.2.3-1.--Comparison of Baseline Ambient Air Concentrations with Most Stringent Applicable Regulations and Guidelines at Nevada Test Site, 1990 to 1992

Pollutant	Averaging Time	Most Stringent Regulation or Guideline (mg/m3)	Baseline Concentration (mg/m3)
Criteria Pollutant			
Carbon monoxide	8-hour	10,000[1]	2,290
	1-hour	40,000[1]	2,748
Lead	Calendar quarter	1.5[1]	2
Nitrogen dioxide	Annual	100[1]	2
Ozone	1-hour	235[1]	2
Particulate matter3	Annual	50[1]	9.4
	24-hour	150[1]	106
Sulfur dioxide	Annual	80[1]	8.4
	24-hour	365[1]	94.6
	3-hour	1,300[1]	725
Mandated by Nevada			
Hydrogen sulfide	1-hour	112[4]	2

Source: 40 CFR 50; NT REEC O 1990a; NV DCNR 1995a

North Las Vegas Facility

Meteorology and Climatology. The climate at NLVF and the surrounding region has four well-

defined seasons. Summers display desert conditions, with maximum temperatures usually in the 38 °C (100 °F) range. Winter daytime temperatures average near 15.5 °C (60 °F). Rainy days average less than one in June to three per month in the winter. The annual average temperature at NLVF is 19.1 °C (66.3 °F); average daily temperatures range from 6.9°C (44.5 °F) in January to 32.1 °C (89.8 °F) in July. The average annual precipitation is 106 millimeters (4.19 in). The prevailing winds are from the southwest at an annual average wind speed of 4.2 m/s (9.3 mph) (GRI 1992a). Additional information related to meteorology and climatology at NLVF is presented in appendix I.

Ambient Air Quality. NLVF is located within the Las Vegas Intrastate AQCR 13, which only includes Clark County. Portions of Clark County, including the NLVF site, are in nonattainment with the NAAQS for carbon monoxide, particulate matter, and TSPs (40 CFR 81.329). The Clark County Health District is responsible for air pollution control and attainment of air quality standards in Clark County. Applicable NAAQS and Clark County ambient air quality standards are presented in table 4.9.2.3-1. In addition to NAAQS for criteria pollutants, NLVF is subject to ambient air quality standards adopted by the Clark County Health District.

The Clark County Health District operates a network of ambient air monitoring stations in Clark County. The county monitor closest to NLVF is at the McDaniel Post Office at 1414 East Lake Mead Drive, approximately 1.9 km (1.2 mi) east of the proposed NIF location. Data for this and other monitors near NLVF are provided in appendix I. Table 4.9.2.3-1 presents the 1994 baseline ambient air concentrations for criteria pollutants and other pollutants at NLVF. As the table shows, all of the baseline concentrations are in compliance with the NAAQS.

Table 4.9.2.3-2.--Comparison of Baseline Ambient Air Concentrations with Most Stringent Applicable Regulations and Guidelines at North Las Vegas Facility, 1994

Pollutant	Averaging Time	Most Stringent Regulation or Guideline (mg/m3)	Baseline Concentration[5] (mg/m3)
Criteria Pollutant			
Carbon monoxide	8-hour	10,000[6]	8,635
	1-hour	40,000[6]	13,456
Lead	Calendar quarter	1.5[6]	[7]
Nitrogen dioxide	Annual	100[6]	53
Ozone	1-hour	235[6]	192
Particulate matter	Annual	50[6]	47
	24-hour	150[6]	117
Sulfur dioxide	Annual	60[8]	[7]
	24-hour	260[8]	[7]
	3-hour	1,300[6]	[7]

Mandated by Nevada			
Hydrogen sulfide	1-hour	112[g]	[7]

4.9.2.4 Water Resources

This section describes the surface and groundwater resources at NTS and NLVF.

Surface Water. Surface water is not used at NTS. There are no perennial streams on NTS. The most noticeable natural hydrologic features are the playas (lake beds) that collect stormwater runoff. Runoff in the eastern half of the site ultimately collects in the playas of Yucca Flat and Frenchman Flat. In the northeastern portion, the runoff drains outside the test site and onto the Nellis Air Force Range Complex. In the western half and southernmost part, runoff is carried offsite towards the Amargosa Desert. Figure 4.9.2.4-1shows the locations of the playas and flats. A few natural springs can be found at NTS.

Because there are no continuously flowing surface waters, there are no studies to assess 500-year floodplain boundaries. Two 100-year flood analyses have been conducted. These analyses show no runoff from a 100-year storm adversely affecting the proposed project areas. However, the proposed project areas are in a region where flash flooding occurs due to locally isolated intense convection storms. These floods normally last less than 6 hours.

Surface Water Quality. There are no NPDES permits for the site because there are no wastewater discharges to onsite or offsite surface waters. However, the state has issued sewage discharge permits for sewage lagoons and ponds for NTS facilities. Because there are no surface waters at or near the proposed project areas, and because there will be no withdrawal or discharge to natural surface waters at NTS, the assessment of surface water quality is not applicable.

Surface Water Rights and Permits. Surface water rights are not an issue because NTS facilities do not withdraw surface water for use, nor do they discharge effluents directly to natural surface waters.

Groundwater. NTS is located within three groundwater subbasins of the Death Valley Groundwater Basin (NT DOE 1994b:9-2). Groundwater beneath the eastern portion of NTS is located in the Ash Meadows Subbasin; the western portion is located in the Alkali Flat Furnace Creek Ranch Subbasin; and a small part of the northwestern corner is located in the Oasis Valley Subbasin (figure 4.9.2.4-1). The proposed project area is situated over the Ash Meadows Subbasin. Three primary aquifers are present within the Ash Meadows Subbasin: the Lower Carbonate (the deepest), the Volcanic, and the Valley-Fill (the shallowest) (NT DOE 1994b:2-13). Other aquifers are present to a limited extent under the area, but their water bearing potential has not been thoroughly investigated. Limited aquifers may occur in other volcanic units, including lava flows and bedded tuffs.

The Lower Carbonate is the regional aquifer and comprises carbonate rocks of Middle Cambrian through Devonian age. The saturated thickness ranges from 100 to over 1,000 m (328 to over 3,280 ft). This aquifer drains in a south-southwest direction, under Yucca and Frenchman Flat, toward Ash Meadows (NT USGS 1975a:C1). The Volcanic and Valley-Fill aquifers range in thickness from zero to about 610 m (2,000 ft) and are confined to their respective drainage basin (such as Frenchman and Yucca Flats) (NT DOE 1992d).

Depth to groundwater at NTS ranges from 160 m (515 ft) beneath Frenchman Flat to over 700 m (2,300 ft) at Pahute Mesa. There are, however, areas of perched water that lie at considerably shallower depths.

Estimates of the perennial yield of the NTS aquifers (i.e., the total amount that can be removed on an annual basis without depleting the groundwater reservoir) include 57,000 MLY (15,058 MGY) (NT USGS 1988a) and 38,000 MLY (10,039 MGY) (NT DOE 1992b:41-43). Groundwater recharge occurs from infiltration of precipitation in the northern and eastern mountain ranges and from underflow from upgradient areas. Natural discharge from the aquifers primarily occurs from evaporation and transpiration in the Amargosa Valley (including Ash Meadows) and Death Valley areas (figure 4.9.2.4-1).

Groundwater pumping at Ash Meadows was curtailed by order of the U.S. Supreme Court to protect the endangered pupfish *Cyprinodon* by maintaining water levels at Devils Hole. Devils Hole is a water-filled cavern near Ash Meadows, approximately 48 km (29.8 mi) southwest of NTS (latitude 36°25'40", longitude 116°18'13"). Studies show that historical pumping on NTS at rates that exceed current rates was probably unrelated to observed declines at Devils Hole (NT LVVWD 1994a). Springs at Ash Meadows nearby contain a large concentration of rare, endangered, and threatened indigenous species which depend upon adequate spring flow for their survival. Substantially increased pumping at NTS is unlikely to lower spring levels but might reduce spring discharge rates (NTS 1995a:1).

Groundwater Quality. Currently, aquifers beneath NTS have not been classified by EPA. However, during an independent study (NT DOE 1989a:ii-v) the aquifers beneath NTS were classified as Class IIa and Class IIb (groundwater currently used for drinking water). In 1972, the Nevada Operations Office instituted a long-term hydrological monitoring program to be operated by EPA under an Interagency Agreement. Groundwater is monitored at and in the vicinity of NTS to detect any radioactivity that may be related to previous nuclear testing activities. Only wells drilled previously for water supply or exploratory purposes are being used in the existing monitoring program. In compliance with the *SDWA* and a State of Nevada DrinkingWater Supply System Permit, drinking water wells and industrial use distribution systems are sampled and analyzed on a monthly basis. Groundwater samples collected are analyzed for a standard suite of parameters and constituents, including radioactive materials, nonradioactive materials, and other field parameters (pH and total dissolved solids).

Groundwater at portions of NTS has been affected by nuclear testing activities conducted during the last 43 years. Approximately 20 percent of the total underground nuclear tests have been conducted below the water table or have been close enough that effects have extended below it. Table 4.9.2.4-1 shows the 1993 groundwater quality in the vicinity of the proposed project site. In general, tritium is the only radionuclide that appears at significant levels in sampled groundwater. Samples collected in 1993 show tritium concentrations ranging from 120 pCi/L in a nonpotable supply well located in the northwestern part of NTS to 0.93 pCi/L in a potable supply well located in the southeastern part of NTS. It is speculated that the Lower and Upper Carbonate aquifers would most likely be the aquifers in which tritium might migrate to offsite areas.

Table 4.9.2.4-1.--Groundwater Quality Monitoring at Nevada Test Site, 1993

Parameter	Unit of Measure	Water Quality Criteria and Standards[10]	Potable Water Distribution System	
			High	Low
Radiological				
Alpha (gross)	pCi/L	15[11]	11	0.62
Beta (gross)	pCi/L	50[12]	13	3.2
Tritium	pCi/L	80,000[12]	120	0.93
Nonradiological				
Alkalinity	mg/L	NA	270	64
Arsenic	mg/L	0.05[11]	0.012	0.003
Barium	mg/L	2.0[11]	0.15	0.00
Chromium	mg/L	0.1[11]	<0.005[12]	<0.005[12]
Lead	mg/L	0.015[11]	<0.005[12]	<0.005[12]
Nitrate	mg/L	10 [11]	6.8	1.2
pH	pH units	6.5-8.5[12]	8.66	7.70
Sodium	mg/L	NA	103	30
Total dissolved solids	mg/L	500[12]	639	283

Groundwater Availability, Use, and Rights. Groundwater is the only local source of industrial and drinking water supplies in the NTS area. Numerous production wells are located on NTS and distributed among various areas of the site. Figure 4.9.2.4-1 shows how the NTS water system has been divided into four water service areas (A, B, C, and D) based on the location of the water supply system and support facilities. Water usage on NTS is largely for potable, construction, and dust control purposes. Water supply wells at NTS draw water from the Lower and Upper Carbonate, the Volcanic, and the Valley Fill aquifers. The total water usage in 1994 was 2,400 MLY (634 MGY), of which 1,300 MLY (343 MGY) were withdrawn from the Ash Meadows Subbasin, and 1,100 MLY (290 MGY) were withdrawn from the Alkali Flat Furnace Creek Ranch Subbasin (figure 4.9.2.4-1). The pumping capacity for all the water supply wells at NTS is estimated at 14,800 MLY (3,910 MGY).

The State of Nevada strictly controls all surface and groundwater withdrawals. The Appropriation Doctrine governs the acquisition and use of water rights. NTS has been withdrawn from public use and thus possesses an unquantified water right sufficient to meet the purposes of NTS land withdrawal, subject to water rights that existed at the time land for NTS was withdrawn.

North Las Vegas Facility

NLVF is located in the Las Vegas Valley, which is a desert between sharp, rugged mountain ranges

on a gently sloping alluvial fan piedmont. At the lowest point of the alluvial fan is the Las Vegas Wash, which drains an area of 2,280 km2 (880 mi2) toward Lake Mead. Stormwater from NLVF is discharged into local flood control systems (appendix I).

The water supply for NLVF is provided by the city of North Las Vegas. Current water usage by NLVF is about 69 MLY (18.2 MGY) (appendix I). Industrial wastewater and sanitary sewage from NLVF are discharged into the city of North Las Vegas sewer system, which is connected to the city of Las Vegas treatment plant. The treated wastewater is discharged into Lake Mead under an NPDES permit issued by the Nevada Division of Environmental Protection (appendix I). NLVF discharges an average of 55 MLY (14.5 MGY) of wastewater. Wastewater quality has historically met the permit requirement established by the city to protect the treatment processes and ultimately the water quality of Lake Mead (appendix I).

4.9.2.5 Geology and Soils

Geology. NTS is located in the southern part of the Great Basin section of the Basin and Range Province in an intermediate position between the high, topographically closed basins in central Nevada and the low, connected basins of the Amargosa Desert-Death Valley region to the southwest. NTS consists of three flats (Yucca, Jackass, and Frenchman) surrounded by mountains (NT DOE 1988a:3-116). The general geology of the test site comprises three major rock units: complexly folded and faulted sedimentary rocks of Paleozoic age overlain at many places by volcanic tuffs and lavas of Tertiary age, which in the valleys are covered by an alluvium of late Tertiary and Quaternary age that was derived from erosion of the nearby hills of Tertiary and Paleozoic rocks (NT ERDA 1977a:2-40).

The general region has been tectonically active in the near past and has numerous faults (figure 4.9.2.5-1). NTS lies in an area of moderate historic seismicity on the southern margin of the Southern Nevada East-West Seismic Belt in seismic Zones 2 and 3 (figure A.1-1). Since about 1848, more than 4,000 earthquakes have been recorded within a 241-km (150-mi) radius of NTS. Most of these earthquakes were minor events with Richter magnitudes of less than 5.5. The largest event on record, which took place 161 km (100 mi) west in Owens Valley, CA, had an estimated magnitude of 8.3. In 1992, an earthquake of 5.6 magnitude occurred in the southwest corner of the site under Little Skull Mountain. The maximum acceleration from this earthquake was approximately 0.21 G (G is the acceleration due to gravity) at Amargosa Valley (DOE 1995i:4-117).

The Yucca and Carpetbag faults were active during the late Quaternary. The Yucca fault has undergone surface rupture within the past few thousand to tens of thousands of years. Some earthquakes can be directly associated with the fault trace and the area beyond the southern end of the mapped section in the Yucca Pass, suggesting that the fault may continue in that direction. No significant vertical surface displacement has occurred on the Carpetbag fault system during the past 150,000 years, but there is evidence of episodes of fracturing and possible minor faulting from 30,000 to 240,000 years ago, with average recurrence intervals at about 25,000 years for the last 125,000 years (NT DOE 1988e:30-31). The Carpetbag fault has been mapped in the subsurface beyond the southern end of Yucca Basin and may project to the northeast of the proposed project area. Possible magnitude, intensity, and acceleration of earthquakes along the Yucca and Carpetbag faults have not been estimated (DOE 1995i:4-117).

The Cane Spring fault, which lies approximately 8 km (5 mi) south of the proposed project area, does not show Holocene displacement but is thought to have been the source of a magnitude 4.3 earthquake in 1971. The maximum credible earthquake associated with the Cane Spring fault is

expected to produce a peak acceleration of 0.67 G with a 6.7 magnitude (DOE 1995i:4-117). The recurrence interval is estimated at 10,000 to 30,000 years.

The most recent volcanic activity in the immediate area was 3.7 million years ago, and the likelihood for renewed activity in the next 10,000 years is slight (DOE 1995i:4-117). NTS lies approximately 241 km (150 mi) southeast of the Long Valley area of California, an area with potential volcanic eruption of the Mount St. Helens type.

Soils. Limited soil studies have been performed at NTS. Soil studies (borings) were done for the Device Assembly Facility. Studies in adjacent areas have divided soils into three major types: shallow soils developed in the uplands and mountains; soils on valley fill and nearly level to moderately sloping outwash plains, alluvial fans, and fan aprons; and playas and soils on nearly level flats and basins. Possible erosion hazards range from slight to severe, while the shrink-swell potential ranges from low to high for these soils. The potential for wind erosion and shrink-swell increases into the playas and basins. The potential for water erosion increases with increasing slope. The soils at NTS are considered acceptable for standard construction techniques. There is no prime farmland at NTS.

North Las Vegas Facility

NLVF is located within the Las Vegas Valley. Rugged mountain ranges surround the low lying alluvial filled valley. The valley consists primarily of fine grained Miocene and Pliocene sedimentary rocks. NLVF is located within seismic Zone 2 (figure A.1-1). The soils on NLVF range from stiff to very stiff silty and sandy clay and clay with interbedded medium-dense to dense clayey and silty sand. The soils at NLVF are considered acceptable for standard construction techniques.

4.9.2.6 Biotic Resources

The following section describes biotic resources at NTS and NLVF including terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. Also presented in appendix C is a list of the threatened and endangered species that may be found onsite or in the vicinity of NTS.

Terrestrial Resources . NTS lies in a transition area between the Mojave and Great Basin deserts. As a result, flora and fauna characteristic of both deserts are found within the site boundaries (NT ERDA 1976a:34). Approximately 33 km2 (12.7 mi2) of NTS have been developed, which represent less than 1 percent of the site; thus, natural plant communities are found across most of NTS (NT DOE 1988d:3,4,6,7). The site has been divided into nine major communities as shown in figure 4.9.2.6-1. Of the communities present onsite, the mountains, hills and mesas, sagebrush, creosote bush, and hopsage-desert thorn communities are the most extensive. Saltbush and desert thorn communities occupy more limited areas adjacent to the playas in Frenchman and Yucca Flats. Introduced plants such as red brome (*Bromus rubens*), cheatgrass (*Bromus tectorum*), and Russian thistle (*Salsola kali*) have become important species in some areas. These plants rapidly invade disturbed areas and delay revegetation of areas by native species (NT ERDA 1976a:40; NT Hunter 1991a:1). A total of 711 taxa of vascular plants has been identified on or near NTS (NT ERDA 1976a:34).

Terrestrial wildlife found on NTS includes 33 species of reptiles, 222 species of birds, and 49 species of mammals (NT Greger 1992a; NTS 1990a:1; NTS 1990a:2). Species common to NTS include the side-blotched lizard (*Uta stansburiana*), western shovel-nosed snake (*Chionactis occipitalis*), blackthroated sparrow (*Amphispiza bilineata*), red-tailed hawk (*Buteo jamaicensis*), Merriam's

kangaroo rat (*Dipodomys merriami*), and Great Basin pocket mouse (*Perognathus parvus*). Water holes, both natural and manmade, are important to many species of wildlife, including game animals such as pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) (NT Greger nda). Hunting is not permitted anywhere on NTS. Raptors and carnivores are two ecologically important groups on NTS and are represented by species such as the turkey vulture (*Cathartes aura*) and rough-legged hawk (*Buteo lagopus*), and long-tailed weasel (*Mustela frenata*) and bobcat (*Lynx rufus*), respectively. A variety of migratory birds has been found at NTS. Migratory birds and their nests and eggs are protected by the *Migratory Bird Treaty Act* . Eagles are similarly protected by the *Bald and Golden Eagle Protection Act* .

The proposed NIF site would be located in an area of creosote bush habitat to the west of the Mercury Base Camp (figure 4.9.2.6-1). Wildlife present in the site area would include that associated with the Mojave desert and could include Merriam's kangaroo rat, Le Conte's thrasher (*Toxostoma lecontei*), and desert iguana (*Dipsosaurus dorsalis*).

Wetlands . National Wetland Inventory maps of NTS have not been prepared nor have wetlands been delineated on the site. However, small riparian areas (less than 0.4 ha [1.0 acres]) may be associated with site springs. There are no wetlands on or near the proposed NIF site (appendix I).

Aquatic Resources . Potential aquatic habitat on NTS includes surface drainages, playas, springs, and manmade reservoirs. There are no continuously flowing streams on the site, and permanent surface water sources are limited to a few small springs. These surface drainages, playas, and springs are unable to support permanent fish populations (DOE 1995w:2.4-61). Manmade construction water reservoirs located throughout the site support three introduced species of fish: bluegill (*Lepomis macrochirus)* , goldfish (*Carassius auratus*), and golden shiners (*Notemigonus crysoleucas*) (NTS 1992a:6). There are no aquatic resources on or near the proposed NIF site (appendix I).

Threatened and Endangered Species . *Nine* Federal- and state-listed threatened, endangered, and other special status species may be found in the vicinity of NTS (appendix table C-7). Eight of these species have been observed on NTS, seven of which are listed as either Federal- or state-threatened or endangered species. No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act* (50 CFR 17.11; 50 CFR 17.12), exists on NTS.

The Federal-listed bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*) have been recorded as rare migrants on NTS, but the desert tortoise (Gopherus agassizii) is the only resident Federal-listed species known to inhabit NTS. The range of the desert tortoise lies in the southern third of NTS. Tortoises on NTS are most commonly found in the areas shown in figure 4.9.2.6-1. Further surveys may reveal other areas of concentration. The abundance of tortoises on NTS is considered low to very low relative to other areas within this species' geographic range. Densities of tortoises on NTS range from 0 to 17 individuals per square km (0 to 45 individuals per square mile), with most habitats probably having densities of 0 to 8 individuals per square km (0 to 20 individuals per square mile) (NT DOE 1991b:3-23).

The only known population of the Devils Hole pupfish (*Cyprinodon diabolis*) lives in a single, spring-fed sinkhole pool in Ash Meadows, approximately 48 km (29.8 mi) southwest of the proposed project area. There is concern over the survival of the pupfish and other sensitive species found in the Ash Meadows area due to the threat of declining water levels (NT DOI 1991a:*1,4-6*). Several additional state-listed species have been recorded on NTS. These species include the spotted bat (*Euderma maculatum*), Beatley milkvetch (*Astragalus beatleyae*), and Mojave fishhook cactus

(*Sclerocactus polyancistrus*). The Federal-candidate mountain plover has also been observed on NTS (appendix table C-7).

The proposed NIF location contains habitat suitable for several special status species. The desert tortoise is the only Federal-listed species known to inhabit the area. A site-specific survey may be required to verify the existence of special status species.

North Las Vegas Facility

Terrestrial Resources. NLVF is in the Southern Basin and Range Ecoregion (see appendix I). NLVF was built on cleared, previously disturbed land that is now mostly covered by buildings, pavement, or landscaping. Exceptions include about 4.5 ha (11 acres) of undeveloped land at the western end of the facility (designated area for proposed new construction associated with NIF), the open area west of the Building C-3, and the stormwater detention basin south of the Building C-1. No original undisturbed native vegetation remains on the site (see appendix I).

Because NLVF is located in an urbanized area and contains little vegetation, few wildlife species exist. The only species that exist are those adapted to urban habitats which may include small mammals such as house mouse (*Mus musculus*) and Norway rat (*Rattus norvegicus*); and ubiquitous bird species such as American robin (*Turdus migratorius*), European starling (*Sturnus vulgaris*), house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), and rock dove (*Columba livia*) (see appendix I).

Threatened and Endangered Species. Because NLVF is located within urban Las Vegas, and on previously disturbed land within a fenced site, it is not expected that any threatened, endangered, or rare species exist. No designated critical habitats for Federal-listed species exist at NLVF. The facility is within the range of the Federal-listed desert tortoise; however, urbanized areas of Clark County are not considered tortoise habitat. No desert tortoises were found during an offsite survey of undeveloped land located near the western boundary of NLVF (see appendix I).

4.9.2.7 Cultural and Paleontological Resources

Prehistoric Resources. *Approximately 6 percent of NTS has been inventoried for cultural resources including all lands managed through a Memorandum of Agreement with Nellis Air Force Base. Excluding sites in the Yucca Mountain project area, over 1,600 prehistoric sites have been recorded at NTS. Prehistoric site types identified on NTS include habitation sites with wood and brush structures, windbreaks, rock rings, and cleared areas; rockshelters; petroglyphs (rock art); hunting blinds; rock alignments; quarries; temporary camps; milling stations; roasting ovens or pits; water caches; and limited activity locations. Milling stations are especially prevalent near the Yucca Lake playa margins. Several prehistoric rockshelters have been identified on Hogback Ridge.*

At Frenchman Flat, in which the proposed A/D site would be located, 99 archaeological sites have been identified to date, including 2 historic sites and 2 sites related to nuclear testing (NT DOE 1996c:4-190). Forty-nine of these sites have been determined to be NRHP eligible, and a historic district composed of structures related to the development of nuclear weapons has also been proposed. Cultural resources surveys were conducted around the A/D site in 1984. No significant archaeological sites were found.

The proposed NIF would be located in Area 22. Only three prehistoric sites have been identified in

Area 22, or Mercury Valley, and none are NRHP eligible. An archaeological survey was conducted at the proposed location and several scatters of debris were identified on the surface. These are not considered eligible for the NRHP.

Historic Resources. *Historic site types on NTS include mines and prospects, trash dumps, settlements, campsites, ranches, homesteads, developed spring heads, trails, and roads. Nuclear test site structures and associated debris, including instrumentation stands and temporary storage bunkers, are also located within NTS. The test site area at Frenchman Flat, which includes the remains of many of these structures, has been recommended to the SHPO as a Historic District. Excluding the Yucca Mountain project area, 63 historic sites, including 7 associated with nuclear testing, have been recorded. One historic site was identified in Mercury Valley, but is not NRHP eligible. The only site currently listed on the NRHP is Sedan Crater. The Crater, located in Yucca Flat, was created in 1962 as part of the Plowshare Program, whose aim was to identify peaceful uses for nuclear explosions. The Emigrant Trail used by the "49ers" that traverses the southwestern corner of NTS is considered NRHP eligible. Additional historic sites may occur on unsurveyed portions of NTS.*

Native American Resources. *At the time of European American contact, southern Nevada was inhabited by the Western Shoshone, the Southern Paiute, and the Owens Valley Paiute. Families lived in small groups from the spring through the fall. During winter, relatively stable villages of several families were established in relatively warm places, close to reserves of pine nuts, seeds, and dried meats.*

Native American resources include burials, ceremonial sites, musical stones, medicine rocks, petroglyphs, and traditional use areas. Local plants important in traditional and religious activities include jimsonweed, juniper, greasewood, creosote, Indian tobacco, piñon pine, buckbush, and scrub oak. Concern has been expressed about the availability and accessibility of such resources. It is worth noting that many natural resources at NTS are viewed as cultural resources by Native Americans. As an example, sagebrush is used as a tool and for clothing and medicinal purposes. Both Mercury Valley and Frenchman Flat contain a wide variety of plants and animals significant to Native Americans.

Consultation with Native American cultural and religious leaders has been conducted for other projects at or near NTS to identify traditional cultural resources that may be affected by Federal actions, and to obtain Native American recommendations for mitigating potential adverse impacts on traditional cultural resources. DOE has established ongoing consultation with 17 Native American tribal organizations with cultural ties to NTS. According to these groups, no Native American resources have been identified in the proposed NIF location.

Paleontological Resources. *The surface geology of NTS is characterized by alluvium-filled valleys surrounded by ranges composed of Paleozoic sedimentary rocks and Tertiary volcanic tuffs and lavas. The Pre-Cambrian and Paleozoic rocks at NTS represent relict deposits made in shallow water at the submerged edge of a continental platform which ran from Mexico to Alaska and existed throughout most of the Paleozoic. Although the Pre-Cambrian sedimentary deposits contain no fossils or only a few poorly preserved fossils, the Paleozoic marine limestones are moderately to abundantly fossiliferous. Marine fossils found in the same Paleozoic formations on Nellis Air Force Range, adjacent to NTS to the north, include trilobites, conodonts, ostracods, solitary and colonial corals, brachiopods, algae, gastropods, and archaic fish. These fossils, however, are relatively common and have low research potential.*

Tertiary volcanic deposits are not expected to contain fossils; however the Late Pleistocene terrestrial vertebrate fossils of the Rancholabrean Land Mammal Age could be expected in the Quaternary deposits. The possibility of finding mammoth, horse, camel, and bison remains might be expected because such fossils have been found at Tule Springs, 56 km (34.8 mi) from the southern edge of NTS and in Nye Canyon. Fossils found at Tule Springs include bison, deer, a small donkey-like horse, camel, Columbia mammoth, ground sloth, giant jaguar, bobcat, coyote, muskrat, and a variety of rabbits, rodents, and birds. This paleontological assemblage has high research potential. Although Quaternary deposits with paleontological materials may occur on NTS, no known fossil localities have been recorded to date.

Other Pleistocene resources include pack rat middens, which are studied by scientists at the University of Nevada, Reno, the Desert Research Institute, and New Mexico Tech, to investigate paleoclimatic regimes. No paleontological resources are expected to exist within the area proposed for the NIF, as the geology in that area does not contain fossiliferous deposits.

North Las Vegas Facility

Although a historic site (Kyle Ranch) is located less than 1.6 km (1 mi) southwest of the proposed NIF location, no archaeological remains (prehistoric or historic) are likely to be present because of the heavy past disturbance of the surface and near-surface sediment (NT DOE 1996c:4-746). Lower lying deposits that are relatively undisturbed are too ancient to contain archaeological remains. No historic structures exist in the proposed NIF location. No Native American cultural resources have been identified at NLVF in the course of past consultation with potentially affected tribal organizations.

4.9.2.8 Socioeconomics

Socioeconomic characteristics addressed at NTS and NLVF include employment and regional economy, population, housing, and public finance. Statistics for employment and regional economy are presented for the regional economic area that encompasses 11 counties around NTS and NLVF in Arizona, Nevada, and Utah. Statistics for population, housing, and public finance are presented for the ROI, a two-county area in which 97 percent of all NTS employees reside: Clark County (82 percent) and Nye County (15 percent). The residential distribution of NLVF employees follows a similar pattern, with the vast majority of employees residing in these two counties. As a result, both DOE facilities occupy the same ROI and regional economic area. Figure 4.9.2.8-1 presents a map of the counties and selected cities that comprise the NTS and NLVF regional economic area and ROI. Supporting data are presented in appendix D.

Regional Economy Characteristics. *Selected employment and economic statistics for the NTS and NLVF regional economic area are summarized in figure 4.9.2.8-2. The civilian labor force grew 64 percent between 1980 and 1990, an annual average of 6.4 percent. Total employment in the region was 587,533 in 1994. During 1994, unemployment in the regional economic area was 6.1 percent, comparable to state unemployment in Arizona (6.4 percent) and Nevada (6.2 percent), but higher than in Utah (3.7 percent). The 1993 regional economic area per capita income of $20,561 was almost 9 percent lower than Nevada's per capita income of $22,727, but significantly higher than the per capita income in Arizona ($18,085) and Utah ($16,354).*

As shown in figure 4.9.2.8-2, the NTS regional economic area and Nevada have similar employment

patterns. In both the region and the state, the service sector accounts for over 40 percent of the total employment. In Utah and Arizona, services account for about a third of employment, with manufacturing providing a greater source of employment in these states than in Nevada.

Population and Housing *. The ROI population, which totalled 865,144 in 1992, increased by about 83 percent (6.9 percent annually) from the 1980 level, a rate of increase that exceeded the state annual population growth rate of about 5 percent during the same period. Some cities within the ROI grew at even faster rates; the city of Henderson, for example, increased at an average annual rate of over 20 percent between 1980 and 1992.*

Increases in housing units averaged approximately 7 percent annually in the ROI between 1980 and 1990, greater than the approximately 3-percent annual increase for Nevada. The homeowner vacancy rate in the ROI averaged 3 percent in 1990, while the vacancy rate for rental units averaged 10 percent. Both rates were comparable to Nevada's vacancy rates. Population and housing statistics for the ROI are summarized in figure 4.9.2.8-3.

Public Finance. *Financial characteristics of the local jurisdictions in the NTS ROI that are most likely to be affected by the proposed action are presented in this section. The data reflect total revenues and expenditures of each jurisdiction's general fund, special revenue funds, and, as applicable, debt service, capital project, and expendable trust funds. School district boundaries may or may not coincide with county or city boundaries, but the districts are presented under the county where they primarily provide services. Major revenue and expenditure fund categories for counties, cities, and school districts are presented in appendix tables D.2.3-14 and D.2.3-15. Figure 4.9.2.8-4 summarizes 1994 local government revenues and expenditures. Fund balances, which are dollars carried over from previous years, are not included in figure 4.9.2.8-4. All jurisdictions assessed had positive fund balances.*

4.9.2.9 Radiation and Hazardous Chemical Environment

The following section provides a description of the radiation and hazardous chemical environments at NTS and NLVF. Also included are discussions of health effects studies, emergency preparedness considerations, and an accident history.

Radiation Environment. Major sources of background radiation exposure to individuals in the vicinity of NTS are shown in table 4.9.2.9-1. All annual doses to individuals from background radiation are expected to remain constant over time. The total dose to the population changes as population size changes. Background radiation doses are unrelated to NTS operations.

Table 4.9.2.9-1.-- Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Nevada Test Site Operations

Source	Committed Effective Dose Equivalent (mrem/yr)
Natural Background Radiation	
Cosmic and cosmogenic radiation[13]	74
Internal terrestrial radiation[14]	39
Radon in homes (inhaled)[14]	200

Other Background Radiation[14]	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	378

Releases of radionuclides to the environment from NTS operations provide another source of radiation exposure to individuals in the vicinity of NTS. The radionuclides and quantities released from NTS operations in 1993 are listed in the U.S. Department of Energy Nevada Operations Office Annual Site Environment Report-1993 (DOE/NV/11432-123). The doses to the public resulting from these releases are presented in table 4.9.2.9-2. These doses fall within radiological limits (DOE Order 5400.5) and are small in comparison to background radiation. The releases listed in the 1993 report were used in the development of the reference environment's (No Action) radiological releases at NTS in 2005 (section 4.9.3.9).

Table 4.9.2.9-2.--Doses to the General Public from Normal Operation at Nevada Test Site, 1993 (Committed Effective Dose Equivalent)

	Atmospheric Releases		**Liquid Releases**		**Total**	
Affected Environment	**Standard**[15]	**Actual**	**Standard**[15]	**Actual**	**Standard**[15]	**Actual**
Maximally exposed individual (mrem)	10	0.0048	4	0.0	100	0.0048
Population within 80 kilometers[16](person-rem)	None	0.012	None	0.0	100	0.012
Average individual within 80 kilometers[17] (mrem)	None	$5.5x10^{-4}$	None	0.0	None	$5.5x10^{-4}$

Based on a dose-to-risk conversion factor of 500 cancer deaths per 1 million person-rem (5x10-4 fatal cancers per person-rem) to the public (appendix E), the fatal cancer risk to the maximally exposed member of the public due to radiological releases from NTS operations in 1993 is estimated to be 2.4x10-9. 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 NTS operations is about 2 chances in 1 billion. (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 conversion factor, 6.0x10-6 excess fatal cancers are projected in the population living within 80 km (50 mi) of NTS from normal operation in 1993. To place this number into perspective, it can be compared with the number of fatal cancers expected in this population from all causes. The 1990 mortality rate associated with cancer for the entire U.S. population was 0.2 percent per year (Almanac 1993a:839). Based on this national rate, the number of fatal cancers from all causes expected during 1993 in the population living within 80 km (50 mi) of NTS was 44. This

number of expected fatal cancers is much higher than the estimated 6.0x10-6 fatal cancers that could have resulted from NTS operations in 1993.

Workers at NTS receive the same dose as the general public from background radiation, but also receive an additional dose from working in the facilities. Table 4.9.2.9-3 includes the average, maximum, and total occupational doses to NTS workers from operations in 1992. These doses fall within radiological limits (10 CFR 835). Based on a dose-to-risk conversion factor of 400 fatal cancers per 1 million person-rem (4x10-4 fatal cancers per person-rem) among workers (appendix E), the number of excess fatal cancers to NTS workers from operations in 1992 is estimated to be 0.0008.

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in the U.S. Department of Energy Nevada Operations Office Annual Site Environment Report-1993 (DOE/NV/11432-123). The concentrations of radioactivity in various environmental media (e.g., air and water) and in animal tissue in the site region (onsite and offsite) are also presented in the same reference.

Table 4.9.2.9-3.--Doses to the Onsite Worker from Normal Operation at Nevada Test Site, 1992

Affected Environment	**Onsite Releases and Direct Radiation**	
	Standard[18]	**Actual**[19]
Average worker (mrem)	None	2.6
Maximally exposed worker (mrem)	5,000	750
Total workers (person-rem)	None	2.0

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 (e.g., soil through direct contact or via the food pathway). The baseline data for assessing potential health impacts from the chemical environment are those presented in sections 4.9.2.3 and 4.9.2.4.*

Adverse health impacts to the public can be minimized through administrative and design controls to decrease hazardous chemical releases to the environment and to achieve compliance with permit requirements. 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 NTS via inhalation of air containing hazardous chemicals released to the atmosphere by NTS operations. Risks to public health from ingestion of contaminated drinking water or direct exposure are also potential pathways.

Baseline air emission concentrations for hazardous air pollutants and their applicable standards are presented in section 4.9.2.3. These concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. These concentrations are compared with applicable guidelines and regulations. Information about estimating health impacts from hazardous chemicals is presented in appendix E.

Exposure pathways to NTS workers during normal operation may include inhaling the workplace

atmosphere, drinking NTS potable water, and possible other contact with hazardous materials associated with work assignments. The potential for health impacts 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. NTS workers are also protected by adherence to OSHA and EPA occupational standards that limit atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring, which reflects the frequency and amounts of chemicals utilized in the operation processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm. Therefore, worker health conditions at NTS are expected to be substantially better than required by standards.

Health Effects Studies*. Several epidemiological studies have been conducted to investigate possible adverse health effects of low-level radioactive fallout on residents of Nevada and Utah. A mortality study of Utah children conducted by Lyon et al. investigated the relationship between childhood leukemia and radioactive fallout and found a significant excess of leukemia among children who died during the high fallout period (between 1951 and 1958) compared to those who died during the low fallout periods (between 1944 and 1950 and between 1959 and 1975). A followup to the Lyon et al. study conducted by Beck and Krey found that bone doses of southern Utah residents were too low to account for the excess leukemia deaths.*

A nonstatistically significant excess of thyroid neoplasm was reported among children living near the nuclear testing sites (Utah/Nevada) when compared to a group living in Arizona (HP 1990c:739-746).

An excess number of leukemia cases were observed among men who participated in military maneuvers in August 1957. No excess in "total cancers" was observed but four cases of polycythemia vera were reported where 0.2 were expected (JAMA 1984a:662-664). For a more detailed description of the studies and the findings, refer to appendix section E.4.7.

Accident History*. Nuclear testing began at NTS in 1951. There were some 100 atmospheric nuclear explosions before the Limited Test Ban Treaty was implemented in 1973. Since then, all nuclear tests have been conducted underground.*

Since 1970, there have been 126 nuclear tests that released approximately 54,000 Ci (2,000 TBq) of radioactivity to the atmosphere. Of this amount, 11,500 Ci (430 TBq) were accidental due to containment failure (massive releases or seeps) and late-time seeps. (Seeps are small releases after a test when gases diffuse through pore spaces of the overlying rock.) The remaining 42,500 Ci (1,600 TBq) were operational releases. From the perspective of human health risk, if the same person had been standing at the boundary of NTS in the area of maximum concentration of radioactivity for every test since 1970, that person's total exposure would be equivalent to 32 extra minutes of normal background exposure, or the equivalent of one-thousandth of a single chest x ray (OTA 1989a).

Emergency Preparedness*. Each DOE site has established an emergency management program that would be activated in the event of an accident. This program has been developed and maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response. The NTS Emergency Preparedness Plan is*

designed to minimize or mitigate the impact of any emergency upon the health and safety of employees and the public. The plan integrates all emergency planning into a single entity to minimize overlap and duplication and to ensure proper responses to emergencies not covered by a plan or directive. The manager of the Nevada Operations Office has the responsibility to manage, counter, and recover from an emergency occurring at NTS.

The plan provides for identification and notification of personnel for any emergency that may develop during operational and nonoperational hours. The Nevada Operations Office receives warnings, weather advisories, and any other communications that provide advance warning of a possible emergency. The plan is based upon current Nevada Operations Office vulnerability assessments, resources, and capabilities regarding emergency preparedness.

North Las Vegas Facility

NLVF provides calibration services using specialized radiation fields for a variety of instrument test packages in support of DOE Nevada operations. A detailed discussion of the radiation environment, including background, radiological releases, and doses to members of the public are presented in the U.S. Department of Energy Nevada Field Office Annual Site Environmental Report-1993 (DOE/NV/11432-123, September 1994). The concentrations of radioactivity in various environmental media (i.e., air, water, and soil) in the site region and the dose to onsite workers at NLVF are also presented in that reference.

Table 4.9.2.9-4.--Annual Doses to the General Public and Onsite Workers from Normal Operation at North Las Vegas Facility, 1993

Receptor	Atmospheric Releases		Liquid Releases		Total		
	Regulatory Limit[20]	Calculated	Regulatory Limit[20]	Calculated	Regulatory Limit[20]	Calculated	Risk[21]
Individual Dose							
Average exposed individual (mrem)	10	0.0[22]	4	0.0	100	0.0	0.0
Maximally exposed individual (mrem)	10	0.0[23]	4	0.0	100	0.0	0.0
Population Dose							
Population within80 kilometers (person rem)	[23]	0 .0[22]	[23]	0.0	[23]	0.0	0.0
Worker Dose							
Average worker (mrem)	NA[24]	0 .0	NA[24]	0.0	5,000	82	$3.3x10^{-5}$

Maximally exposed worker (mrem)	NA[24]	0 .0	NA[24]	0.0	5,000	440	$1.8x10^{-4}$
Total workers[25] (person-rem)	NA[24]	0 .0	NA[24]	0.0	None	0.57	$2.3x10^{-4}$

Calculated radiological doses are used to estimate the potential health impacts to the public and onsite workers at NLVF from any releases of radioactivity. Small atmospheric releases occurred on July 12 and August 14, 1995. The dose to a maximally exposed individual and to the surrounding population from these releases is expected to be negligible. The actual dose to these receptors will be quantified upon receipt of monitoring data. The annual doses to workers and the public are summarized in table 4.9.2.9-4; corresponding health risks are also presented in the table. These doses are in addition to those from natural background radiation, consumer products, and medical sources, which total about 360 mrem/yr. The onsite worker doses are within regulatory limits. Background radiation doses are unrelated to NLVF operations.

Chemical Environment. Exposure pathways to NLVF workers during normal operation may include inhaling the workplace atmosphere, drinking NLVF potable water, and possible other contact with hazardous materials associated with work assignments. The potential for health impacts 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. NLVF workers are also protected by adherence to OSHA and EPA occupational standards that limit atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring, which reflects the frequency and amounts of chemicals utilized in the operation processes, ensures that these standards are not exceeded. The maximum daily quantities of NIF-related hazardous materials stored at NLVF are presented in appendix table I.4.4.1.7.2-1. NLVF stores and uses few hazardous materials in amounts greater than the threshold planning quantities that require reporting under 40 CFR 370 (NT DOE 1995g).

4.9.2.10 Waste Management

This section outlines the major environmental regulatory structure and ongoing waste management activities for NTS, including NLVF. A more detailed discussion of the ongoing waste management operations is provided in appendix section H.2.8.

DOE is working with Federal and state regulatory authorities to address compliance and cleanup obligations arising from its past operations at NTS. DOE is engaged in several activities to bring its operations into full regulatory compliance. These activities are set forth in negotiated agreements that contain schedules for achieving compliance with applicable requirements and financial penalties for nonachievement of agreed upon milestones. These agreements have been reviewed to assure the proposed actions are allowable under the terms of these agreements.

DOE has decided that underground testing areas should be governed pursuant to the provisions of CERCLA. Preliminary assessment/site investigation reports and a hazardous ranking system package were provided to EPA for their use in determining whether NTS should be included on the NPL. In May 1993, the state of Nevada issued a letter to DOE indicating it did not appear that EPA would make a decision on the NPL status of NTS in the near future.

DOE has published the Nevada Test Site Treatment Plan and Federal Facility Compliance Act consent order addressing environmental restoration and waste management on NTS. A mutual consent agreement between the state of Nevada and DOE, updated in June 1995, permits NTS to use the available capacity of the TRU waste storage pad for the storage of onsite generated mixed LLW that does not meet the land disposal provisions of RCRA.

The Nevada Operations Office completed a waste minimization plan for NTS in 1991 and created an organization whose mission is to promote waste minimization and pollution prevention and to ensure compliance with DOE requirements. NTS currently generates waste from ongoing operations and remediation associated with past activities and receives waste from other DOE facilities. NTS manages the following waste categories: TRU, LLW, mixed, hazardous, and nonhazardous. A discussion of the waste management operations associated with each of these categories follows.

Transuranic Waste. *Although NTS does not currently generate any TRU wastes, from 1974 to 1990, < 612 m3 (800 yd3) of mixed TRU waste was received from LLNL and is stored on a 8,300-m2 (89,300-ft2) asphalt storage pad at Area 5 of NTS (NT REECO 1995a:21). DOE and the State of Nevada signed a Settlement Agreement on July 23, 1992, allowing the Nevada Operations Office to retain this inventory of mixed TRU waste subject to an appropriate permitting process. None of these waste packages is WIPP certified. They will have to be certified before shipment to WIPP. These wastes have been moved to a 1,995-m2 (21,470-ft2) polyvinyl chloride-coated polyester fabric covered building for storage until WIPP is determined to be a suitable disposal facility, pursuant to the requirements of 40 CFR 191 and 40 CFR 268, or until another suitable repository is found (NT DOE 1996b:30-38). NTS has areas of plutonium-contaminated soil, for which treatment technology is being developed. This activity may produce additional volumes of TRU or mixed TRU waste. Limited quantities of TRU waste were also disposed of in trench 4C and in greater confinement units in Area 5.*

Low-Level Waste. *In 1993, NTS generated approximately 178m 3 (233 yd3) of solid LLW onsite (NT DOE 1994f:4). LLW has been generated and disposed of in eight areas at NTS, but currently only Areas 3 and 5 are active for disposal. Bulk waste is disposed of in Area 3, and packaged classified and unclassified waste is disposed of in Area 5. Disposal of onsite waste began in 1971, and in 1978 operations expanded to receive wastes generated offsite. In 1995, 15 generators shipped LLW to NTS for disposal. An additional nine generators are applying for or awaiting approval (NT DOE 1996c:4-61, 4-62). As of October 1994, approximately 301,667 m3 (394,600 yd3) of LLW in Area 3 (NT DOE 1996c:4-43) and as of December 1993 approximately 167,400 m3 (218,900 yd3) of LLW in Area 5 (NT REECO 1994a:12) have been disposed of. Standard shallow land burial techniques have been employed.*

Mixed Low-Level Waste. *In 1993, NTS did not generate any mixed waste. Disposal of mixed waste received from the Rocky Flats Environmental Technology Site has taken place at NTS. Mixed waste disposal at NTS ceased, pending issuance by the state of Nevada of a RCRA Part B Permit for NTS. environmental restoration at NTS could generate additional volumes of mixed waste which would require some form of treatment. A liquid waste treatment system is being designed to process these mixed wastes. Mixed waste generated in the state of Nevada that meets land disposal restrictions of RCRA can be disposed of in the Area 5 mixed waste disposal unit, Pit 3. Pit 3 currently has an inventory of 8,024 m3 (10,500 yd3) (NT DOE 1996c:4-46). Other units in Areas 3 and 5 where mixed waste was previously disposed of will be closed in conformance with RCRA. The Nevada Division of Environmental Protection provides RCRA oversight for NTS. The 1992 revised RCRA Part B Permit*

application to include a separate mixed waste storage and disposal unit at NTS, in accordance with the provisions of the Federal Facility Compliance Act of 1992, has been submitted to the state of Nevada. A mutual consent agreement between the state of Nevada and DOE permits the storage of mixed LLW that do not meet RCRA land disposal restrictions on the TRU waste storage pads. DOE has published the NTS Site Treatment Plan and Federal Facility Compliance Act Consent Order that establishes the basis for treatment, storage and disposal of mixed LLW at NTS.

Hazardous Waste. *For 1993, NTS generated approximately 34.6 m3 (45 yd3) of hazardous wastes (NT DOE 1994f:4). Hazardous wastes result from ongoing operations that utilize solvents, lubricants, fuel, lead, metals, motor oil, and acids. Hazardous wastes are accumulated at satellite areas, stored at the Area 5 RCRA-permitted hazardous waste storage unit, and shipped offsite by truck to a commercial RCRA-permitted facility using DOT-approved transporters. Additional accumulation areas and new equipment are planned to prevent the possibility of cross contamination with radioactive wastes (creating mixed wastes) in handling these materials. PCB-contaminated waste is accumulated and stored in the Area 6 TSCA waste accumulation unit. Accumulated PCB waste is shipped offsite to a commercial TSCA-permitted treatment, storage, and disposal facility. Hazardous waste generation is decreasing as the result of an aggressive waste minimization program, and will substantially decrease in the future due to the present moratorium on nuclear testing.*

NLVF generated about 8.2 m3 (2,180 gal) of liquid and 3.5 m3 (4.6 yd3) of solid hazardous wastes in 1994. All hazardous wastes are treated, stored, or disposed of offsite at RCRA-permitted facilities. Spills or releases of hazardous materials have historically been minor in nature and have been promptly cleaned up upon discovery.

A Waste Minimization and Pollution Prevention Awareness Implementation Plan submitted to DOE on December 20, 1991, is in place for NLVF. A formalized system of waste minimization was developed through the implementation of EG&G/EM Policy No. 31-70, Waste Minimization and Pollution Prevention, and Standard Operating Procedure 31-006.A, Hazardous Waste Minimization Plan. Hazardous waste generation from various processes has already been reduced through product substitution or by permanently discontinuing the hazardous waste generating process.

There are no underground storage tanks for hazardous or petroleum substances at NLVF. All aboveground tanks employ either secondary containment or a double-walled tank with continuous leak detection. There are no hazardous waste treatment, storage, or disposal facilities requiring state or Federal permits at NLVF (NT DOE 1995g).

Nonhazardous Waste. *Nonhazardous sanitary wastes are expected to be generated at the current rates for several years, then decline assuming the present moratorium on underground weapons testing continues. Liquid nonhazardous wastes are disposed of in septic tanks, sumps, or in ponds. Solid wastes are disposed of in landfills at various locations on the site. Recycling of paper, metals, glass, plastics, and cardboard has already resulted in some decreases in waste quantities. NTS generated 7,170 t (7,900 tons) of solid sanitary wastes in 1993 (NT DOE 1994f:4). Solid waste landfills located in Areas 6, 9, and 23 are in use for the disposal of solid nonhazardous wastes.*

The Area 6 landfill is a Class III landfill that accepts hydrocarbon-burdened soil and debris. The Area 9 landfill is a Class II landfill because it accepts less than 18 t (20 tons) of solid waste per day. The Area 9 landfill is allowed to receive all types of nonhazardous solid waste, excluding radioactive waste, free liquids, and asbestos. Its current capacity is approximately 993,883 m3 (1.3 million yd3).

Due to changes in state regulatory requirements, the Area 9 landfill will undergo partial closure and reopen as a Class III construction and demolition landfill. The Area 23 landfill receives all types of nonhazardous solid waste with nonpathogenic hospital waste, dead animals, and asbestos-containing materials being buried in separate cells that are identified by concrete markers. The current capacity is approximately 449,541 m3 (588,000 yd3). The Area 23 landfill is scheduled to remain in operation as a Class II landfill after modification to comply with the new state regulations (NT DOE 1996c:4-47).

Policies and procedures are in place at NLVF that promote recycling and resource recovery. Physical and administrative measures implemented at NLVF minimize or prevent the introduction of pollutants into stormwater. Stormwater from the NLVF site is discharged by concentrated conveyance or sheet flow onto Losee Road. Industrial wastewater and sanitary sewage from NLVF are discharged into city of North Las Vegas sewer lines, which are connected to the city of Las Vegas publicly owned treatment works. The publicly owned treatment works discharges treated wastewater directly into Lake Mead under a NPDES permit issued by the Nevada Division of Environmental Protection. NLVF discharges an average of 147,303 L (38,888 gal) of wastewater per day into the publicly owned treatment works, with a peak maximum of 369,318 L (97,000 gal) of wastewater per day. Approximately 32 to 35 percent of the total wastewater originates from industrial processes, while the remaining 65 percent is predominantly sanitary wastes. Wastewater quality historically has been in compliance with permit conditions established by the city of North Las Vegas to protect the publicly owned treatment works treatment processes and ultimately the water quality in Lake Mead (NT DOE 1995g).

---

1 Federal and state standard.

2 No monitoring data available; baseline concentration assumed less than applicable standard.

3 It is assumed that particulate matter data are TSP data.

4 State standard. Source: 40 CFR 50; NT REECO 1990a; NV DCNR 1995a.

5 For short-term standards, baseline concentration is highest second highest concentration for year.

6 Federal standard (40 CFR 50).

7 No monitoring data available; baseline concentration assumed less than applicable standard.

8 County standard.

9 State standard. Source: ANL 1995b; NT County 1993a; NT County 1995c:1.

10 For comparison only.

11 National Primary DrinkingWater Regulations (40 CFR 141).

12 Proposed National Primary Drinking Water Regulations; Radionuclides (56 FR 33050). [d] DOE's Derived Concentration Guides for water (DOE Order 5400.5). Values are based on a committed

effective dose equivalent of 100 mrem per year; however, because the drinking water maximum contaminant level is based on 4 mrem per year, the number listed is 4 percent of the Derived Concentration Guides. [e] Below laboratory detection limit. [f] National Secondary Drinking Water Regulations (40 CFR 143). Note: NA - not applicable. Source: NT DOE 1994b.

13 Derived from information given in EPA 1981b.

14 NCRP 1987a.

15 The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10 mrem/yr limit from airborne emissions is required by the CAA, the 4 mrem/yr limit is required by the SDWA, and the total dose of 100 mrem/yr is the limit from all pathways combined. The 100 person-rem value for the population is given in proposed 10 CFR 834 (58 FR 16268).

16 In 1993, this population was approximately 21,750.

17 Obtained by dividing the population dose by the number of people living within 80 km (50 mi) of the site.

18 10 CFR 835. DOE's goal is to maintain radiological exposure as low as reasonably achievable. NT DOE 1994b.

19 DOE 1993n:7. The number of badged workers in 1992 was approximately 780.

20 The regulatory limits for individuals are given in DOE Order 5400.5. The 10 mrem/yr limit from airborne emissions is required by the CAA. The 4 mrem/yr limit is required by the SDWA, and the total dose of 100 mrem/yr is the limit from all pathways combined. The regulatory limit for workers is 5,000 mrem (10 CFR 835).

21 Based on latent fatal cancer risk factors of $5x10^{-4}$ /mrem for individuals, 5x10-4 /person-rem for population, and $4x10^{-4}$ /mrem for workers (ICRP 1991a).

22 Two very small atmospheric releases occurred on July 12 and August 14, 1995. Dose to any offsite individual is expected to be a fraction of a mrem (monitoring data is not yet available from all stations).

23 No regulatory limits exist for population doses.

24 NA - not applicable; worker doses were estimated on the basis of readings from monitoring devices called thermoluminescent dosimeters.

25 The number of badged workers in 1994 was approximately seven. Source: NTS 1995a:5.

4.10 Intersite Transportation

4.10.1 Methodology

This PEIS evaluates the potential impacts from transporting special nuclear materials, hazardous wastes, and other weapons-related materials associated with the activities under consideration by the Stockpile Stewardship and Management Program. All materials shipped by DOE are first stabilized, then packed and shipped in accordance with all applicable Federal and state transportation regulatory requirements. In most cases, DOE requirements exceed DOT and NRC standards for commercial transport. Baseline information, the existing transportation patterns for each site, and the types of containers required to ship the materials have been included for this analysis, as appropriate.

Actual and projected inventories were used for the transportation analysis. Data already collected were used to the extent possible. Environmental impacts of transporting materials between facilities were estimated using a homogeneous population (i.e., urban, suburban, and rural), an average container or truckload of material, and a unit of measure (i.e., risk per kilometer) for each of the material forms. The assessment provides an overview comparison of transportation impacts for the alternatives being considered.

The estimated health risks in terms of potential total fatalities from transporting special nuclear material and radioactive material between the sites were quantitatively analyzed with the RADTRAN 4 computer code. Unit risk factors were developed for each type of special nuclear material and radioactive material to estimate the potential risk of transporting truckload shipments by DOE safe secure trailer over intersite routes or transporting shipments by air. These unit risk factors were used in conjunction with the quantity of material, form, distance, and number of shipments to estimate potential radiological and nonradiological impacts to the transport crew and public. The potential fatality impacts are presented for each alternative considered. The transportation of HE was evaluated qualitatively based on past shipping experience.

4.10.2 Affected Environment

The volume of DOE's hazardous material (radioactive and nonradioactive) shipments is extremely small in comparison to the volume of non-DOE hazardous materials shipments. DOT estimates that approximately 3.6 billion t (4 billion tons) of regulated hazardous materials are transported each year and that approximately 500,000 shipments of hazardous materials occur each day (PL 101-615, Section 2[1]). There are approximately 2 million shipments of radioactive materials, involving about 2.8 million packages, annually. This is about 2 percent of the Nation's total annual hazardous materials shipments. Most radioactive shipments involve small or intermediate quantities of material in relatively small packages. By comparison, the Complex ships about 6,200 radioactive packages (commercial and classified) between its sites, annually. This represents less than 0.3 percent of all radioactive shipments in the United States.

DOE's unclassified radioactive, HE, and other hazardous materials are transported by commercial carrier (truck, rail, or air). The hazardous and nonhazardous cargo shipped by commercial carriers to and from each of the alternative sites is described in appendix tables G.2-1, G.2-2, and G.2-3. Special nuclear materials, such as plutonium and HEU in the form of pits and secondaries included in this assessment, are transported by DOE-owned and -operated safe secure trailers. The safe secure trailers are vehicles designed specifically for the cargo's safety and security, and the special nuclear materials

receive continual surveillance and accountability from DOE's Transportation Safeguards Division at Albuquerque, NM. Shipments by safe secure trailer are accompanied by armed guards and are monitored by a tracking system. Tritium components are transported by DOE's air cargo contractor.

HE is a nonradioactive, hazardous material. HE shipments must meet the standard shipping criteria established by DOT (49 CFR Subchapter C) and supplemented by state, local, and DOE regulations. These standards require the shipper to comply with selecting the proper, authorized packaging for the material; properly certifying what is being shipped; properly marking, labeling, loading, blocking, and bracing the material; and meeting safety requirements. HE is usually transported by commercial or Government truck (although DOE contract air shipments are allowed by DOT exemption).

4.10.2.1 Materials Transported Between Existing Sites (No Action)

Kansas City Plant. KCP produces nonnuclear components for nuclear weapons. These nonnuclear components are primarily transported from KCP to Pantex and SRS. A limited number of nonnuclear components are also shipped from KCP to LLNL and LANL for reliability testing. Nonnuclear components are transported by commercial truck.

Lawrence Livermore National Laboratory. LLNL performs nuclear weapons research, development, and testing (RD&T). LLNL also maintains a limited capability to fabricate plutonium components (pits), which are transported between sites by safe secure trailer. Presently, LLNL does not manufacture components for nuclear weapons. A limited amount of intersite transportation by commercial carriers, to or from LLNL, and the other DOE facilities is currently conducted to allow for research and testing needs. This transportation activity is unrelated to the direct weapons production activities.

Los Alamos National Laboratory. LANL performs nuclear weapons RD&T. Similar to LLNL, LANL also maintains a limited plutonium component (pit) fabrication capability. LANL currently produces and ships some nonnuclear components for nuclear weapons. Like LLNL, it does send and receive a limited number of weapons components to and from other DOE facilities by commercial carriers.

Nevada Test Site. NTS maintains the capability to conduct underground nuclear weapons testing and nonnuclear experiments. Nuclear weapons and fissile components to conduct such tests are transported by safe secure trailer from LLNL, LANL, and Pantex. Currently, there is no underground nuclear weapons testing. NTS has historically received LLW by truck from other DOE nuclear weapons sites, such as Pantex, for disposal. LLW is routinely transported to NTS from other DOE facilities by certified commercial truck carriers for disposal. NTS does not currently ship or receive nuclear weapon components for production, disposition, or testing.

Oak Ridge Reservation. The Y-12 Plant at ORR processes depleted uranium and HEU, and fabricates uranium components. Y-12 also produces lithium compounds and parts, provides precision machining and specialty subassembly of structural components, and provides storage for HEU. Y-12 ships secondaries to and receives secondaries from Pantex. A small number of secondaries are sometimes supplied to and from LLNL and LANL. HEU and secondaries and cases are transported by safe secure trailer. Other nonfissile components required by Y-12 are typically transported by commercial truck.

Pantex Plant. Pantex assembles and disassembles nuclear weapon components; performs weapons

repair, modification, and disposal; conducts stockpile evaluation and testing; fabricates HE and nonnuclear components; and provides storage for plutonium in the form of pits. Fissile components such as pits, secondaries, or nuclear weapons are transported by safe secure trailer. Tritium reservoirs are transported between Pantex and SRS by air. HE and nonnuclear components are transported by commercial or Government truck. Pantex receives weapons from the stockpile for disassembly, uranium components from Y-12, tritium reservoirs from SRS, and nonnuclear components from KCP. Pantex ships nuclear weapons to the stockpile, uranium components to Y-12, tritium limited-life components to SRS, and LLW to NTS.

Sandia National Laboratories. Nonnuclear components for nuclear weapons systems are designed and engineered at SNL. SNL currently ships a limited number of nonnuclear weapons components to Pantex, LLNL, and LANL by commercial truck.

Savannah River Site. SRS recovers tritium from returned reservoirs, purifies the recovered tritium, and fills and surveys new and refurbished tritium reservoirs. SRS also stores a limited amount of weapons-grade plutonium. Under its current tritium recycling mission, SRS ships and receives tritium reservoirs to and from Pantex and DOD sites. Tritium reservoirs are transported almost exclusively by air. Plutonium is transported by safe secure trailer.

4.10.2.2 Site Transportation Interfaces for the Transport of Special Nuclear Materials

The existing transportation modes that serve each candidate site and the links to those modes for the intersite transport of special nuclear materials, weapon components, radioactive waste, and other hazardous materials are summarized in table 4.10.2.2-1.

Although hazardous materials could be transported by rail, truck, air, and barge, the materials discussed in this PEIS would normally be transported by truck or aircraft. Plutonium and HEU would be transported exclusively by DOE safe secure trailer. Tritium reservoirs would be transported by DOE contract air carrier. TRU waste and LLW would be transported by certified commercial truck carriers to licensed or permitted disposal facilities. It is unlikely that there would be any barge or rail shipments.

Table 4.10.2.2-1 also depicts the relative transportation ratings of the Stockpile Stewardship and Management Program alternative sites. This table was established using the rating methodology and evaluation procedures established by the Nuclear Weapons Complex Reconfiguration Site Panel and has been adapted for the stockpile stewardship and management alternatives.

Table 4.10.2.2-1.-- Transportation Modes and Comparison Ratings for the Candidate Sites

Site	Nearest Interstate Highway (km)	Distance to Airport for Cargo Shipments (km)	Possible Weather Delays--TSS Shipments	Overall Level of Transport Service
KCP	5	68[1]	Minimal	Good
LLNL	3	61	No	Good
LANL	66	177	Yes	Satisfactory
NTS	97	105[1]	No	Good

ORR	6	50	Minimal	Good
Pantex	11	32	Minimal	Outstanding
SNL	88	11	Minimal	Good
SRS	48	32	Minimal	Good

4.10.2.3 Packaging

Plutonium, HEU, and components containing tritium would always be transported in Type B packaging that meets stringent Nuclear Regulatory Commission (10 CFR) and DOT (49 CFR) requirements. Type B packaging is designed and tested to retain its containment and shielding properties in an accident. Thus, during normal operation, plutonium, HEU, or tritium-related transportation poses no significant risk to transportation workers or the public. Typical types of packagings used for stewardship and management materials are shown in table 4.10.2.3-1. Packaging is discussed further in appendix G.

Table 4.10.2.3-1.-- Types of Packaging for Stewardship and Management Materials

Material	DOE-Approved Type B Packaging (NRC Performance Criteria)	DOT/NRC-Approved Type B Packaging	DOT-Approved Type A Wood or Metal Box	DOT-Approved Type A Drum	Strong Industrial; Packaging
Pits	X				
Secondaries	X				
Tritium components	X	X			
Nonnuclear components					X
Transurancic waste		X			
Low-level waste			X	X	
Plutonium		X			
Highly enriched uranium		X			
HIgh explosives			X		

NRC - Nuclear Regulatory Commission.
49 CFR Subchapter C; NRC 1992a.

4.10.3 Environmental Consequences

Two kinds of intersite transportation of special nuclear materials are analyzed in this PEIS: the one-time relocation of strategic reserve materials and the transport of plutonium pits, canned subassemblies, and tritium reservoirs to support normal operation.

Under No Action, key weapons functions would continue to be performed at existing locations. These functions include pit storage and weapons A/D at Pantex, HEU storage and secondary and case fabrication at ORR, pit fabrication at LANL (in limited quantities), and production of tritium components at SRS. The combined annual radiological and nonradiological impacts from transporting pits, secondaries, and tritium components for normal operation (100 weapons per year) under No Action is estimated to be 3.33x10-*3* fatalities per year (see table 4.10.3-2).

For the stockpile stewardship and management alternatives, the one-time relocation of the plutonium strategic reserve (pits) from storage at Pantex to storage at NTS and/or the relocation of the HEU strategic reserve secondaries from ORR to either NTS or Pantex could be required. The impact from transporting these materials was calculated using the RADTRAN computer code for standardized truckloads of material. The assumed truckloads consisted of 117 kg (256 lbs) of plutonium per truckload or 54 kg (119 lbs) of uranium per truckload. The annual impacts from transporting these materials are shown in table 4.10.3-1.

The transportation in support of normal operation would affect the individual sites as indicated below:

- The nonnuclear fabrication mission could remain at KCP with transportation requirements the same as No Action. Alternative sites to perform KCP's nonnuclear functions are LLNL, LANL, and SNL (many sites would absorb the mission).

Table 4.10.3-1.-- Annual Health Impacts from the One-Time Transportation of Strategic Reserve Materials

Option	Existing Storage Location	Potential Storage Location	Total Health Effect[2]
Relocate pits	Pantex	NTS	2.66×10^{-3}
Relocate secondaries	ORR	NTS	0.0170
Relocate secondaries	ORR	Pantex	9.06×10^{-3}

- Functions that could be relocated to LLNL are manufacturing secondary and case assemblies, nonnuclear components, and HE components. These functions would require the transport of nuclear components between LLNL and the A/D and/or the consolidated storage site and nonnuclear and HE components between LLNL and the A/D site.

- Functions that could be located at LANL would be fabricating pits, secondary and case assemblies, HE components, and nonnuclear components. These functions would require the transport of nuclear components between LANL and the A/D and/or the consolidated storage site and nonnuclear and HE components from LANL to the A/D site.
- NTS could be an alternative site to perform weapons A/D, which includes modifying existing plutonium pits, and could include storing the strategic reserve of plutonium and HEU. Placing the A/D function at NTS would require the shipment of weapon components (nuclear, nonnuclear, limited-life, and HE) between NTS and the pit and secondary and case fabrication, nonnuclear fabrication, HE fabrication, and the tritium recycling locations. It would also require the shipment of weapons to and from DOD facilities.
- The secondary and case fabrication mission could remain at ORR with transportation requirements the same as No Action. The alternative sites to fabricate ORR's fabrication of secondary and case assemblies are LLNL and LANL.
- The A/D and HE functions or the A/D function alone could remain at Pantex. If the A/D and HE functions remained, the transportation requirements would be the same as No Action except that the locations might change for primaries, secondaries, and nonnuclear components. Moving only the HE mission from Pantex would require shipping HE components and HE waste between Pantex and the new HE site or sites.
- SNL could be an alternative site for location of the majority of nonnuclear fabrication. This function would require shipping more nonnuclear weapon components to the A/D site.
- The function to fabricate pits could be reestablished at SRS. This would require the transportation of plutonium components between SRS and the A/D site and/or the plutonium storage site.

The Storage and Disposition PEIS is evaluating alternatives that could possibly move the plutonium strategic reserve from existing storage at Pantex to either Hanford, Idaho National Engineering Facility (INEL), NTS, ORR, or SRS, and the HEU strategic reserve from ORR to either Hanford, INEL, NTS, Pantex, or SRS. The one-time transport of materials to these potential consolidated storage locations is not addressed in this Stockpile Stewardship and Management PEIS. The impacts from the relocation of the strategic reserve pits from Pantex to NTS and the relocation of the strategic reserve secondaries from ORR to either NTS or Pantex under stockpile stewardship and management are presented in table 4.10.3-1. This section evaluates the potential impacts associated with the operational transportation requirements necessary to support the proposed management alternatives with storage at one of these storage and disposition sites.

Tritium reservoirs would continue to be recycled at SRS; thus, in the future these components would be transported between the A/D site (NTS or Pantex) and SRS. Tritium reservoirs would be transported by DOE contract air carrier.

If the A/D and HE missions remain collocated at Pantex (No Action), there would be no intersite transportation of HE, except for small quantities being shipped to LANL and LLNL for testing. If the HE mission is relocated, or if NTS is selected as the A/D site, an estimated 150 classified HE component shapes would be transported from either LLNL or LANL to Pantex, or from LLNL, LANL, or Pantex to NTS. In addition, HE waste material generated from the disassembly of weapons would be transported from the A/D Facility to the HE fabrication site.

Most of Pantex's shipments of HE material have been surplus material sold to commercial buyers. It is assumed surplus shipments would continue from a relocated HE mission (see appendix G for a description of HE shipments in 1994). Transporting HE component shapes is estimated to require

approximately 12 round-trip shipments per year (the return leg would transport HE waste). There would be no impacts from normal (accident-free) transportation. The accident risk from transporting this material would be no greater than that encountered by the public from industry's transport of similar explosives. The HE accident impacts from transportation are bounded by the risk analyzed and presented in the facility accident sections.

For the alternatives under consideration, there are eight potential sites which could fabricate nuclear components, store strategic reserves of plutonium and uranium, recycle tritium, or perform A/D. All possible route combinations between these sites were evaluated to determine the potential impacts from transporting pits, secondaries, and tritium components for normal operation. The annual health risk for each potential combination of routes is described in appendix table G.1-1. Radiological and nonradiological and accident and accident-free risks are included.

There are 12 possible combinations of the stockpile stewardship and management alternatives for A/D, pit fabrication, and secondary and case fabrication. For each of these combinations, table 4.10.3-2 gives the annual health impact for the situation where strategic storage is collocated with the A/D function. In addition, taking into account the other possible consolidated storage locations considered in the Storage and Disposition Draft PEIS, table 4.10.3-3 gives the highest and lowest risk determined by the storage location for each possible combination of stockpile stewardship and management functions. Specific risks for all possible routes, including a breakout of accident and accident-free risks, are presented in appendix G.

In summary, annual transportation risk to support the activities required by the alternatives considered in this PEIS could range from 0.0154 to 2.85×10^{-3} fatalities. More detailed information is presented in appendix G. The route combinations required to support the alternatives considered in this PEIS are expected to increase upper and lower bound limits as follows:

- The maximum annual transportation health impact would be 0.0154, or approximately one additional fatality in 65 years. It is projected that this potential upper bound impact would result from the alternative which would require transporting pits from consolidated storage at Hanford to pit fabrication at SRS, then transporting them to weapons assembly at NTS; transporting secondaries from Hanford to secondary and case fabrication at ORR, then transporting them to weapons assembly at NTS; and transporting tritium reservoirs from SRS to weapons assembly at NTS.
- It is projected that the potential minimum annual transportation health impact would be 2.85×10^{-3} , or approximately one additional fatality in 351 years. This projected impact would result from selecting the alternative that would require transporting pits from storage at Pantex to pit fabrication at LANL, then transporting them to weapons assembly at Pantex; transporting secondaries from Pantex to secondary and case fabrication at LANL, then transporting them to weapons assembly at Pantex; and transporting tritium reservoirs from SRS to weapons assembly at Pantex.

Table 4.10.3-2.-- Summary of Annual Transportation Health Risk for Proposed Stockpile Stewardship and Management Alternatives

Alternative	Pit/Secondary and Case Storage Site	Health Effects[3]		
		Accident	**Accident-Free**	**Total**
No Action	Pantex/ORR	$2.57x10^{-3}$	$7.64x10^{-4}$	$3.33x10^{-3}$
Assembly/Disassembly at NTS				
Pit Fabrication at LANL				
Secondary and case fabrication at ORR	NTS/ORR	$4.78x10^{-3}$	$1.34x10^{-3}$	$6.12x10^{-3}$
Secondary and case fabrication at LANL	NTS/NTS	$3.87x10^{-3}$	$1.02x10^{-3}$	$4.89x10^{-3}$
Secondary and case fabrication at LLNL	NTS/NTS	$3.58x10^{-3}$	$1.08x10^{-3}$	$4.66x10^{-3}$
Pit Fabrication at SRS				
Secondary and case fabrication at ORR	NTS/ORR	$7.03x10^{-3}$	$2.03x10^{-3}$	$9.06x10^{-3}$
Secondary and case fabrication at LANL	NTS/NTS	$6.13x10^{-3}$	$1.70x10^{-3}$	$7.83x10^{-3}$
Secondary and case fabrication at LLNL	NTS/NTS	$5.83x10^{-3}$	$1.77x10^{-3}$	$7.60x10^{-3}$
Assembly/Disassembly at Pantex				
Pit Fabrication at LANL				
Secondary and case fabrication at ORR	Pantex/ORR	$2.57x10^{-3}$	7.64x10-4	$3.33x10^{-3}$ [4]
Secondary and case fabrication at LANL	Pantex/Pantex	$2.25x10^{-3}$	$5.96x10^{-4}$	$2.85x10^{-3}$ [5]
Secondary and case fabrication at LLNL	Pantex/Pantex	$5.92x10^{-3}$	$1.71x10^{-3}$	$7.63x10^{-3}$
Pit Fabrication at SRS				
Secondary and case fabrication at OR	Pantex/ORR	$3.89x10^{-3}$	$1.20x10^{-3}$	$5.09x10^{-3}$

Secondary and case fabrication at LAN	Pantex/Pantex	3.57×10^{-3}	1.03×10^{-3}	4.60×10^{-3}
Secondary and case fabrication at LLNL	Pantex/Pantex	7.24×10^{-3}	2.15×10^{-3}	9.39×10^{-3} 6

Table 4.10.3-3.-- High and Low Range of Annual Transportation Health Risk for All Possible Site Combinations (Strategic Storage Located at Any Site)

	Highest Risk				Lowest Risk		
		Health Effects7				Health	
Alternative	Pit/Secondary and Case Storage Site	Accident	Accident-Free	Total	Pit/Secondary and Case Storage Site	Accident	Acc Fre
Assembly/Diassembly at NTS							
Pit Fabrication at LANL							
Secondary and case fabrication at ORR	Hanford/Hanford	9.88×10^{-3}	2.84×10^{-3}	0.0127	NTS/ORR	4.78×10^{-3}	1.3
Secondary and case fabrication at LANL	SRS/SRS	6.39×10^{-3}	1.85×10^{-3}	8.24x10	Pantex/Pantex	3.06×10^{-3}	8.0
Secondary and case fabrication at LLNL	SRS/SRS	8.16×10^{-3}	2.44×10^{-3}	0.0106	NTS/NTS	3.58×10^{-3}	1.0
Pit Fabrication at SRS							
Secondary and case fabrication at ORR	Hanford/Hanford	1.19×10^{-2}	3.49×10^{-3}	0.0154[8]	ORR/ORR	5.55×10^{-3}	1.6

Secondary and case fabrication at LANL	Hanford/Hanford	7.92×10^{-3}	2.23×10^{-3}	0.0102	Pantex/Pantex	4.84×10^{-3}	1.3
Secondary and case fabrication at LLNL	SRS/SRS	8.00×10^{-3}	2.39×10^{-3}	0.0104	NTS/NTS	5.83×10^{-3}	1.7
Assembly/Diassembly at Pentax							
Pit Fabrication at LANL							
Secondary and case fabrication at ORR	Hanford/Hanford	7.90×10^{-3}	2.28×10^{-3}	0.0102	Pantex/ORR	2.57×10^{-3}	7.6
Secondary and case fabrication at LANL	SRS/SRS	5.58×10^{-3}	1.64×10^{-3}	7.22×10^{-3}	Pantex/Pantex	2.25×10^{-3}	5.9
Secondary and case fabrication at LLNL	SRS/SRS	9.33×10^{-3}	2.74×10^{-3}	0.0121	NTS/NTS	4.76×10^{-3}	1.3
Pit Fabrication at SRS							
Secondary and case fabrication at ORR	Hanford/Hanford	9.44×10^{-3}	2.85×10^{-3}	0.0123	ORR/ORR	3.10×10^{-3}	9.6
Secondary and case fabrication at LANL	Hanford/Hanford	6.64×10^{-3}	1.90×10^{-3}	8.54×10^{-3}	Pantex/Pantex	3.57×10^{-3}	1.0
Secondary and case fabrication at LLNL	SRS/SRS	8.71×10^{-3}	2.59×10^{-3}	0.0113	NTS/NTS	6.54×10^{-3}	1.9

4.11 Next Generation Stockpile Stewardship Facilities

DOE recognizes that to be viable, its Stockpile Stewardship and Management Program must change over time to be responsive to national needs and the results of current research and evaluation

activities. Accordingly, all facilities needed to fully implement the stockpile stewardship program over time cannot be fully identified at present. DOE has done some preliminary conceptual planning and research associated with the next generation of stockpile stewardship facilities, but is not yet able to define the facilities and/or their requirements sufficiently for decisionmaking. However, these next generation facilities can be defined in general terms at this time based on existing operating or proposed facilities such that broad environmental impacts can be discussed. These general impacts from construction and operation of such facilities are presented so that any significant cumulative environmental impacts that might be related to the ultimate science-based stockpile stewardship program can be identified in this PEIS and considered in the PEIS Record of Decision (ROD). At this time DOE has identified four potential facilities as next generation facilities for science-based stockpile stewardship: Advanced Hydrotest Facility (AHF), Advanced Radiation Source (ARS [X-1]), the Jupiter Facility, and High Explosive Pulsed Power Facility (HEPPF). The following section provides a broad description of what these proposed future facilities might look like and the types of environmental impacts associated with their construction and operation. In the future, DOE may choose to drop these concepts, expand upon them, or add to them. Any proposals would be subject to NEPA review prior to any decision to implement them.

Advanced Hydrotest Facility. AHF would be the next generation hydrodynamic test facility following the DARHT Facility at LANL. The AHF would be an improved radiographic facility that would provide for imaging on more than two axes, each with multiple time frames, though the number of axes and time frames is still subject to requirements definition and design evolution. The facility would be used to better reveal the evolution of weapon primaries implosion symmetry and boost-cavity shape under normal conditions and in accident scenarios. Due to the nature of the dynamic experiments and hydrodynamic testing to be conducted with the facility, AHF would probably be considered for location at NTS and LANL only.

At this point, the feasibility and definition of an AHF is still insufficiently determined for DOE to propose such a facility or adequately analyze it for the purposes of NEPA. For example, performance requirements and specifications for such a facility (i.e., determination of what capabilities should be required of an AHF for assessment of stockpile aging and related effects, beyond those of DARHT) have not been fully established. In addition, the type of technology to provide the basis for the facility has not been determined, and concepts for the resultant physical plant accordingly would vary significantly. Three basic technology approaches are currently being examined. These include linear induction accelerators of a type similar to that in the baseline DARHT Facility design (DOE/EIS-0228), an inductive-adder pulsed-power technology based on technology now in use for other purposes at SNL and elsewhere, and high-energy proton accelerators similar to technology in use at LANSCE and a number of facilities in the U.S. and internationally. The first two are different approaches to accelerating a high-current burst of electrons, which when stopped in a dense target produce x-rays for radiography. This is the approach used in the existing PHERMEX (LANL) and FXR (LLNL) facilities, and which will be used in DARHT. The third approach would use bursts of very energetic (approximately 20 billion-electron-volt) protons, magnetic lenses, and particle detectors to produce the radiographic image. These technologies still require development and validation.

It is likely that an AHF would require new building construction and considerable infrastructure (i.e., facilities, equipment, and personnel) in support of test events. Existing infrastructure at LANL or NTS might be used to the extent practical. The construction and operational requirements for AHF might be greater than that of the DARHT Facility. The impacts associated with construction and operation of facilities based on the different technology approaches could be significantly different.

For example, the acreage required could be comparable to or somewhat larger than the 3.1 ha (9 acres) of land resources required for DARHT, but use of proton radiography could require an accelerator comparable in scale to the kilometer-long LANSCE or to other large accelerators operated by DOE. Based on information on the DARHT Facility, it is estimated that over 250 additional workers would be required for construction and operation of AHF. Construction and operation of AHF is not anticipated to use large quantities of water. New construction activities would be expected to result in an increase in short-term air emissions. Operation of AHF would be expected to have a minimal impact on the air quality considering the impacts projected for DARHT operations. AHF would not be expected to impact existing community infrastructure or services in the area; however, depending on the specific design, a proton accelerator could require significant electrical power resources. Waste volumes would not be expected to increase substantially over existing operations at LANL. Waste management associated with dynamic experiments with plutonium at NTS could require additional infrastructure.

To the extent the potential environmental impacts of an AHF can be forecast at this time, a significant part of the public and worker exposures and impacts due to normal operation of AHF would be those related to the conduct of hydrodynamic tests and dynamic experiments at the facility. While the impacts are inherently site-dependent, the hydrodynamic tests and dynamic experiments themselves can be anticipated to be similar to such activities as analyzed at DARHT in the DARHT Facility EIS (DOE/EIS-0228); therefore the DARHT Facility impacts are summarized here for reference. Population-based impacts may be expected to be lower at NTS. The normal radiological impacts of the DARHT Facility to the annual collective dose to the population residing within 80 km (50 mi) would be expected to be 0.57 person-rem. Latent cancer fatalities at this dose would not be expected. The maximum annual dose to any nearby resident would be about $2x10^{-5}$rem with a corresponding latent cancer fatality of $1x10^{-8}$. The average annual dose to individual workers would probably not exceed 0.02 rem with a corresponding maximum probability of latent cancer fatality of 8x10-6 . Routine exposure to chemicals is expected to be low. The likelihood of a severe facility accident occurring would be very small. The population dose resulting from acute accidental release in the bounding facility accident, accidental uncontained detonation of a plutonium-containing assembly, evaluated on a what-if basis (related DOE safety studies indicate a probability of less than 10-6 per year), would be expected to range from 9,000 to 24,000 person-rem in the maximally exposed sector, based on 50th or 95th percentile atmospheric dispersion factors, respectively. Five to twelve latent cancer fatalities would [not] be expected from this dose. Population dose from acute accidental plutonium release from a containment breach was estimated to range from 210 to 560 person-rem, for which no latent cancer fatalities would be expected. For workers, the likelihood of a severe accident occurring and resulting in death would be minimized by a comprehensive training program and an explosives safety program.

Advanced Radiation Source (X-1) and Jupiter Facility. ARS (X-1) would be an advanced pulsed-power x-ray source that would provide enhanced capabilities in the areas of weapons physics, radiation science effects, and pulsed-power technology. SNL would be a principal candidate site because of its extensive expertise in this weapon physics and radiation effects technology and because the ARS (X-1) could probably utilize existing infrastructure associated with the Saturn Facility and Technical Area IV. The ARS (X-1) would likely require new building construction. The Saturn Facility accelerator is used as a nuclear weapon effects and weapon physics simulator with a large area and intense source of radiation. The Saturn Facility accelerator is designed to generate bremsstrahlung, x rays, and other electromagnetic radiation.

New construction activities for ARS (X-1) would be expected to result in an increase in short-term air

emissions. The construction and operational requirements for the ARS (X-1) would be similar to those of the existing Saturn Facility. Operation of ARS (X-1) would be expected to have a minimal impact on the air quality of Albuquerque and the surrounding region considering the impacts resulting from operating the Saturn Facility. Based on Saturn Facility information, it is estimated that additional workers would be required for construction and operation of ARS (X-1). However, they would not be expected to impact existing community infrastructure or services in the area. Waste volumes would not increase substantially over existing operations. No radioactive materials would be expected to be produced or released from ARS (X-1). Materials handling and disposal of other wastes would serve to minimize the pollution and/or contamination risks.

Based on operation of the Saturn Facility, no significant risk to the public health and safety or to the environment would be expected from operation of ARS (X-1). Offsite impacts to the environment would be expected to be negligible or nonexistent. Onsite personnel exposures would be expected to be below 0.1 rem/yr and site boundary annual exposure would most likely be undetectable. Employee risk from industrial accidents during operation of ARS (X-1) would be identified and reduced to a level that is as low as reasonably achievable for the facility.

The Jupiter Facility would be a next generation facility well beyond ARS (X-1). It is not expected to have any significant or unusual environmental impacts based on the similar types of experiments and technology involved.

High Explosives Pulsed Power Facility. HEPPF, a potential next-generation facility, would be a possible follow-on HE firing site, configured specially for HE-driven pulsed power experiments, beyond the existing capabilities in the Complex to support such experiments. These experiments would, for example, study physics related to weapons secondary at shock pressures and velocities approaching those of actual weapon conditions.

DOE has pursued the application of electrical pulsed power on the microsecond time scale to weapons research since the 1960s. This R&D program has involved HE pulsed-power generators of various types, which have been used at existing HE firing sites in the Complex, in addition to fixed-facility capacitor banks such as Pegasus II at LANL and the proposed Atlas Facility. HE generators are used to explore higher energy (higher current) frontiers than may be available in existing fixed facilities without major capital investment, albeit at a relatively low data rate, and capacitor banks provide repeatable (and indoor) experimental facilities with higher data rates, for broad experimental use. These activities are programmatically complementary aspects of R&D (appendix K considers reliance on explosive-driven pulsed-power experiments and discusses why this is not a reasonable alternative to Atlas). Ongoing HE pulsed-power experiments are conducted for pulsed-power technology R&D, for weapons stockpile stewardship applications, and for unclassified scientific collaborations including those with Russian and other foreign scientists.

A variety of HE pulsed-power generator types are used in experiments. These generators are one-time-use assemblies of HE and metal and other components (commonly copper, structural materials such as aluminum, steel, and plastic, and possibly other materials depending on the experiment). When detonated, the explosive motion of the assemblies acts as an electrical generator to produce a large current, which is delivered to an experimental configuration. High magnetic fields result from the current pulse. In principle, such experiments can be performed at any appropriately equipped firing location, of which there are many in routine use at the DOE stockpile stewardship sites, within environmental limits and the structural design limits of the individual firing site. However, some HE firing sites (e.g., at TA-39 at LANL) have been specially configured to support these HE pulsed-

power experiments; a principal firing site at TA-39 has within its bunker a capacitor bank to provide the seed electrical current for the HE pulsed-power generators. Currently, most of the largest-scale HE pulsed-power experiments in the United States are conducted at this LANL location. The highest-current generator design presently in routine use in the United States is called Procyon, and is about 3 m (10 ft) in length. Impacts of these ongoing R&D activities are included in the cumulative impacts for the No Action alternative in this PEIS.

HEPPF, as conceptualized, would be specially designed to support HE pulsed-power experiments of larger scale and of greater complexity in support of the stockpile stewardship mission: for example, to support generators using much larger explosive charges, which though not yet fully demonstrated for experiments, could produce higher pressures in larger masses and volumes than can be accessed at the LANL site. HEPPF would probably be sited at NTS because of the amount of HE and because an existing infrastructure is already available. Since the idea of a new HEPPF was first conceived some years ago, Big Explosives Experimental Facility (BEEF) has been separately developed as a firing site at NTS, based on refurbished bunkers originally developed for atmospheric nuclear tests. Although BEEF does not have specially configured HE pulsed power like the principal LANL firing site, in its current configuration BEEF is suitable for a variety of HE experiments, including many pulsed-power technology experiments. Experiments related to such purposes have been part of recent qualification tests. Therefore it may be possible to make modifications to BEEF when the need for and definition of such modifications is clear, to satisfy any future need for a new HEPPF.

BEEF is located in north-central Area 4 of Yucca Flat. BEEF comprises Bunkers 4-300 and 4-480, which house modern test equipment for use during detonations of very large, conventional HE charges and devices. Bunker 4-300 contains the control room, the laser room, and the utility room. The control and utility rooms were modified to house the diagnostic and firing control electronics, digitizers, electronic recording equipment, and other electronic equipment necessary for hydrodynamic and pulsed power experiments. The laser room was modified to accommodate a pulsed Ruby laser for image-converter camera illumination and a laser for multibeam Fabry-Perot velocimetry. Bunker 4-480 is designed to contain up to five helium or nitrogen-gas-driven rotating-mirror framing cameras and five optical ports with access to the gravel firing pad. The area surrounding the bunkers is graded with new earthen berms which provide blast protection, shield from radiation, and serve as a downrange projectile stop.

BEEF contains a firing table approximately 20x20 m (66x66 ft), consisting of pea gravel 1.8 m (6 ft) to 2.4 m (8 ft) deep, within the graded area west of the bunkers. Three large steel cylinders (3 m [10 ft] in diameter and 6 m [20 ft] long) are placed outside the bunkers near the firing pad to house 2.3-million-electron volt Febetron x-ray sources for high-energy x-ray radiography. As at other firing sites, among the HE experiments that can be performed at BEEF are pulsed-power-generating experiments. The facility has the capability to support many of the sophisticated diagnostic techniques needed for the evaluation of hydrodynamic and pulsed-power experiments containing large amounts of HE. Analysis of the impacts of operating the existing BEEF for explosive experiments, including those that involve pulsed-power technology, is incorporated in the NTS EIS (DOE/EIS 0243). These impacts are also included in cumulative impacts for the No Action alternative in this PEIS.

Should a need for HEPPF be determined, existing infrastructure at NTS would be used, to the extent practical, to develop the facility. Definition of the required modifications and additions is not yet mature enough to support environmental analysis in this PEIS. However, modifications to BEEF could include construction of additional bunker/shelter space near the firing location. The additional

bunker space could be reinforced concrete construction, buried or earth covered in a manner virtually identical to Bunkers 4-300 and 4-480. In addition, future experiments conducted at HEPPF may require recording of a large number (several hundred) of channels of electronic and optical data. An expanded, suitably sheltered recording station also may be required. Additional shelters and blast-shields may be temporary or permanent and constructed of native soil to form earth berms or steel and sandbags to form structures. Upgrading construction activities would be expected to result in an increase in short-term air emissions.

Additional workers would be required for construction; however, for operation, the number of workers would be expected to be similar to that of BEEF. Operation of HEPPF would be expected to have minimal impact on the air quality of Clark County and the surrounding region considering the impacts projected for BEEF operations. HEPPF would not be expected to impact existing community infrastructure or services in the area.

Based on the operation of BEEF as analyzed in the NTS EIS, no significant risk to workers, to the public health and safety, or to the environment would be expected for HEPPF. Offsite impacts to the environment would be expected to be negligible or nonexistent.

4.12 Environmental Impacts of Underground Nuclear Testing

The last underground nuclear test was conducted in the United States in 1992. Since then, the Nation has been observing a moratorium on underground nuclear testing while pursuing a Comprehensive Test Ban Treaty (CTBT). On August 11, 1995, the President announced that, "one of my Administration's highest priorities is to negotiate a Comprehensive Test Ban Treaty to reduce the danger posed by nuclear weapons proliferation." In this announcement, the President also stated that he would seek a "zero-yield" CTBT, which would "ban any nuclear weapon test explosion or any other nuclear explosion immediately upon entry into force." The President declared his commitment "to do everything possible to conclude the Comprehensive Test Ban Treaty negotiations as soon as possible so that a treaty can be signed next year."

As part of this announcement, the President also stated that he had been assured "that we can meet the challenge of maintaining our nuclear deterrent under a Comprehensive Test Ban Treaty through a science-based Stockpile Stewardship Program without nuclear testing." However, the President cautioned that, "while I am optimistic that the Stockpile Stewardship Program will be successful, as President I cannot dismiss the possibility, however unlikely, that the program will fall short of its objectives." The President went on further to say that, "In the event that I were informed by the Secretary of Defense and Secretary of Energy...that a high level of confidence in the safety or reliability of a nuclear weapons type which the two Secretaries consider to be critical to our nuclear deterrent could no longer be certified, I would be prepared, in consultation with Congress, to exercise our `supreme national interests' rights under the Comprehensive Test Ban Treaty in order to conduct whatever testing might be required."

One of the primary purposes of the Stockpile Stewardship and Management PEIS is to evaluate ways of maintaining a continued safe and reliable nuclear deterrent in the absence of nuclear testing. Thus, the proposal described in chapter 3 of this PEIS does not include nuclear testing. However, because it is possible--although not probable--that under the CTBT the United States might one day exercise its "supreme national interests" rights to conduct underground nuclear testing to certify the safety and reliability of its nuclear weapons, the following programmatic evaluation of the environmental impacts of underground nuclear testing at NTS is provided. More detailed information on the

environmental impacts of underground nuclear testing is contained in the *Environmental Impact Statement for the Nevada Test Site and Off-site Locations in the State of Nevada (DOE/EIS 0243, 1996).*

The various steps involved in conducting an underground nuclear test are summarized below to provide an overview to the reader, and to aid in understanding the potential environmental impacts associated with underground nuclear testing. (For other descriptions of the testing process, see NT USGS 1994a; OTA 1989a). Variations to this general description will occur based on which national laboratories performs the weapon emplacement and testing.

- In recent years, emplacement holes were drilled using mud or detergent and water and a dual-string reverse-circulation method. This method replaced the conventional circulation method that used bentonite or sepiolite mud. Steel casing is installed and extends 9 to 30 m (30 to 98 ft) from the surface. If the test point is below the static water level, a liner is also installed in the bottom of the emplacement hole, and the emplacement hole is dewatered. Otherwise, no liner is installed. Cement grout is placed around the casing and liner.
- Each test includes a test rack made of steel that is used to support the nuclear device and the various instruments and detectors used to measure test results. Typically, racks are more than 30 m (98 ft) in height and include from 2 to as many as 20 line-of-sight pipes, each with a window of a composition compatible with the desired measurement. The rack sits on top of a steel canister that contains the nuclear device.
- The canister is often lined with a mixture of boron and polyethylene. Large quantities of polyethylene are used on the racks. Other organic materials used include polyvinyl chloride, TeflonTM, polystyrene, phenolic, and neoprene. Complex fluorescing compounds and laser dyes are used as part of some detectors. Typically, tens of tons of lead are used to shield both the canister and the rack. Copper is used for wiring and other purposes. Beryllium, nickel, and zinc may be present in small quantities in detector packages. Arsenic, chromium, cadmium, osmium, and thallium have been used in rare instances. Other commonly used metals include tungsten, tantalum, stainless steel (iron, chromium, and nickel), and aluminum.
- Each test device contains nuclear materials, such as uranium, plutonium, tritium, lithium, and structural materials, such as steel, aluminum, beryllium, and gold. Radiochemical detectors (for example, yttrium, zirconium, thulium, and lutetium) and tracers (isotopes of uranium, plutonium, americium, or curium) are also used. The detectors and tracers are generally less than 100-g (3.5-oz) quantities.
- Magnetite powder is poured downhole to cover the sides and top of the rack. This naturally occurring mineral contains thorium and a variety of other impurities. Stemming materials are used to prevent the escape of radioactivity from the device upwards in the emplacement hole. Stemming materials consist of layers of coarse gravel with layers of fine gravel, sand, or bentonite. The gravel and sand are native materials. Two or more plugs made of two-part epoxy, coal-tar epoxy, sanded gypsum concrete, or sanded gypsum aggregate are placed in the hole, well above the cavity formed by the detonation, and remain intact after the test.
- As shown in figure 4.12-1, Stage I, the explosion initially creates a nearly spherical cavity filled with gases that are formed by atomization and vaporization of materials from the explosive device and its immediate surroundings. The molten cavity walls subsequently flow down to form a puddle that is vitrified as a result of quenching during condensation of the cavity gases as the cavity cools (Stage II). As gas pressure decreases, the rock above the cavity generally falls into the cavity with rubble (Stage III); this chimney-forming process may proceed upward all the way to the surface to form a crater, or it may stop at some intermediate point (Stage IV). Vaporized material is condensed and incorporated into molten rock or escapes into the chimney

rubble where it may condense on solid rock. Volatile elements or materials tend to be enriched in the rubble zone, whereas refractory materials tend to remain in the puddle glass.

- The melt zone created by the nuclear test incorporates a mass (expressed in tons) of the same order of magnitude as the device yield (expressed in tons); the zone would extend well beyond the top of a 30-m (98-ft) rack if the yield was about 100 kt or more. In every test with a significant nuclear-energy release, the entire device is atomized and mixed with a relatively large quantity of rock.
- Reentry holes are typically drilled at an angle directed to intercept the test debris and puddle glass near its center. A profile of the radioactive material along the hole is measured with a downhole Geiger counter, and then samples of the puddle glass are collected using a sidewall sampler. The drilling procedure uses drilling mud with various additives, and a significant fraction of the mud is generally lost downhole into the highly permeable structure of the rubble created by the test. LLNL uses air foam for the upper part of the drill-back hole and drilling mud for the lower part of the hole.

The consequences of underground testing on the environment of the NTS can be evaluated on the basis of past testing actions. Through 1992, there have been 928 announced nuclear detonations on the NTS; 828 of these tests were underground tests. In general, the effects of underground testing that have occurred in the past, and those to be anticipated in the future, include impacts to land, geology, water resources, biotic, air quality, radiological and human health, and transportation. Each of these resource areas is discussed below.

Land. As shown in figure 4.12-2, underground nuclear testing would likely be conducted in the Yucca Flats, Painted Mesa, or Rainer Mesa Areas that are designated as the Nuclear Test Zone. Including a buffer zone, each underground nuclear test requires approximately 16 ha (40 acres). Approximately 5 ha (12 acres) of surface geologic media are disturbed in each underground nuclear test in Yucca Flat (Data Sheets, 1995). Radii of cavities at NTS range up to about 50 m (160 ft), and rubble chimneys range from up to about 50 m (160 ft) to about 350 m (1,150 ft) high (NT LLNL 1976a).

Because the land designated as the Nuclear Test Zone encompasses several hundred thousand hectares, the amount of potentially affected land would be a relatively small percentage (less than 1 percent). Additionally, underground testing would be a compatible use of the land; therefore, a change in land-use designation would not be required.

The formation of underground cavities and subsidence craters, as a result of underground testing, represent an unavoidable impact on the land in the vicinity of the planned tests. However, there are already hundreds of such cavities and craters on NTS.

Geology. Potential impacts on geological resources include fault reactivation and associated seismicity induced by underground testing of nuclear devices, offsite disturbances, and onsite radiological contamination of geological media. Fault reactivation from testing of nuclear devices disturbs subsurface and surface geologic media, which is potentially significant in terms of resultant limitations on land use or resultant changes in surface and subsurface water movement. Ground-motion studies have played a large role in the weapons testing program. SNL has developed a program for recording surface and subsurface motions resulting from underground nuclear explosions (SNL 1979a; SNL 1982b). There are several factors that influence the level and duration of ground motion from underground explosions, including yield of the device; ground-coupling at the source of

explosion, which is a function of depth of the device, local geology, and stratigraphy; geological complexity along the transmission path; and the topography and geology at the location receiving ground motion. There is always some variation or unknown associated with estimating these factors; but, because of the long history of conducting weapon tests, the effects are reasonably predictable.

The yield or size of underground nuclear explosions is limited by the Limited Test Ban Treaty to a maximum HE equivalent of 150 kt. For the purposes of this evaluation, all future weapons testing is assumed to occur under this limitation. Historically, most underground nuclear testing has been conducted in the Paihute Mesa and Yucca Flat areas. Because geologic structure may differ considerably among the testing areas, effects of tests in the unused areas are uncertain. Nevertheless, the geographic areas for testing and the yield limits can be used to estimate ground-motion effects from future weapons tests.

Ground-motion hazards can result from the underground nuclear explosion and secondary seismic effects. Because of the rather complete recording of ground motions emanating from NTS activities, the effects of the weapons testing program are predictable, and damage effects have been documented. Communities within about 48 km (30 mi) of testing areas that could be most affected by ground motion from underground nuclear explosions are Beatty, Amargosa Valley, and Indian Springs. The closest potential testing areas for these communities are 31 to 40 km (19 to 25 mi) away. Table 4.12-1 is a tabulation of peak horizontal ground-motions for 150-kiloton tests at 31 km (19 mi) away, using regressions developed by Long (NT SNL 1986a). Peak ground acceleration, velocity, and displacement were computed at the 50th and 84th percentiles of the log-normal distributions given by Long (NT SNL 1986a) for rock and alluvium recording geology at 31 km (19 mi) for 150 kt tests. Expected peak ground accelerations are well below 0.05, which is the acceleration where slight damage might occur in typical buildings less than several stories in height.

Table 4.12-1.-- Predicted (50th and 84th Percentiles) Peak Ground Motions at Localities 31 Kilometers (19 Miles) from Underground Testing Areas

		Acceleration (g's)[10]		Velocity (m/sec)[11]		Displacement (cm)[12]	
Distance (km)	**Yield (kt)** [13]	**50 Percent**	**84 Percent**	**50 Percent**	**84 Percent**	**50 Percent**	**84 Percent**
Rock 31	150	0.012	0.029	0.009	0.021	0.23	0.5
Alluvium 31	150	0.009	0.016	0.009	0.018	0.28	0.61

Data pertaining to offsite damage support conclusions based on expected motion. Since the Threshold Test Ban Treaty, only a few reports of damage to local communities occur each year, and these are of a very minor nature. Beyond about 48 km (30 mi), structures would have to be higher than several stories tall before they would be affected. The closest location where structures of that height are located is in Las Vegas. A smaller number of similar complaints have been recorded from people in Las Vegas high-rise structures.

Several Nye County mines are located in the testing vicinity, but all are at a distance greater than 40 km (25 mi) from the closest potential testing area. Because the distances from these mines to the underground nuclear explosions are approximately the same as, or greater than, the distances for communities, damage to structures in the mines is not expected. In investigations of earthquake

effects to mines (Owen 1981a), there are very few reports of damage. Surveys of mines in the vicinity of NTS by Owen and Scholl further support these findings (NT ERDA 1977a).

In addition to direct ground motion effects of underground nuclear explosions, there is also a potential hazard from secondary seismic effects. Secondary effects are associated with co-seismic strain release attributed to release of tectonic strain, aftershocks that can be associated with tectonic strain release, and events associated with the collapse of cavities created by the underground nuclear explosions. Beyond 5 to 10 km (3 to 6 mi) of even the largest, pre-Limited Test Ban Treaty underground nuclear explosion (greater than 1 megaton), there was no evidence of significant secondary seismic effects associated with testing, and in no case has the magnitude of an aftershock been larger than the magnitude of the underground nuclear explosion (NT SNL 1986b).

Underground conventional HE, hydrodynamic, and hydronuclear experiments would produce some of the physical effects on geologic media and processes associated with underground tests of nuclear devices (e.g., compression and fracturing). These effects are anticipated to be significant and irrevocable although small in relation to the effects of detonation of nuclear devices.

In addition to the direct effect on geologic media and processes of detonating nuclear and other devices, preparation for such tests also disturbs geologic media. Disturbances include any associated infrastructure, excavated tunnels, and an inventory of deep boreholes up to 3.6 m (11.8 ft) in diameter for detonation of nuclear devices. Geologic media excavated in tunnels, boreholes, and borrow pits are considered to be permanently lost. Excavation of tunnels and any testing conducted in those tunnels potentially could impact slope stability.

During an underground detonation, large quantities of neutrons are released. Naturally occurring materials in the host rock, such as iron, lead, and zinc, capture some of these neutrons. The result is the formation of unstable radioactive nuclei. The majority of atoms in the host rock occur in a stable form; the activation products that are generated are considered part of the total release from a test. Radioisotope contamination might extend up to five cavity radii from the point of detonation where radioactivity has been released into the geologic media. However, most of the radioactive materials that are created during an underground nuclear explosion are expected to be trapped within a pocket of resolidified rock melt in the explosion cavity. Radioactive noble gases and tritium may be released to the surface by gradual seepage from the cavities and by escape of gases during sampling operations. The effects of subsidence and the confined radioactivity on the environment will persist for many years.

Water Resources. Because underground nuclear testing does not utilize any significant amount of groundwater, it is unlikely that there would be any potential to impact groundwater availability. However, as an unavoidable consequence of underground nuclear testing, the quality of the groundwater under some portions of NTS has been affected. If any underground tests were to be detonated under or near the water table, additional impacts to water quality could be expected.

The effects of underground testing have been well documented (NT LLNL 1976a), and the hazardous materials associated with testing have been detailed by Bryant (NT DOE 1996c). The potential for a given test event to result in groundwater contamination is a function of the yield of the test device and its location relative to the water table.

The types of contaminants related to active testing include four major categories of radionuclides and hazardous substances: source term and fission products, activation products, stemming material, and

ancillary operations that use radioactive or hazardous substances. The exact quantity of substances that are released during a given test is unknown, but can be approximated based upon the similarity in materials used and in the overall testing procedures.

Information concerning releases from a test is summarized in Borg et. al. (NT LLNL 1976a) and Glasstone (DOD 1962a). The source term that is released during a test includes the original nuclear material that did not undergo reaction during detonation. The fission products are those direct products generated as a consequence of the detonation. About 80 different fission products result from the fission of a given nuclear detonation, and about 200 different isotopes of 36 elements can be formed through their decay into a complex mixture of daughter products. There are also 3 specific source-term radionuclides (tritium, plutonium, and uranium) and 24 specific fission products that result from a typical nuclear test. The estimated total release of fission and source-term radionuclides and activation products is 804,500 curies per kiloton.

Another source of contamination from underground testing is from the use of stemming materials. For most tests, significant quantities of nonradioactive materials are emplaced underground, along with the nuclear device, and are collectively termed stemming materials. For a typical test, at least 59,000 kg (130,000 lb) of rack and stemming materials are placed underground (NT DOE 1996c). Lead is by far the major hazardous constituent at about 450 kg (1,000 lb) per test. Small quantities (less than 0.5 kg [1 lb] each) of arsenic, beryllium, naphthalene, and zinc are also commonly present in the stemming materials.

Because test yields and the location and proximity to the water table of any tests that might be conducted have not been defined, it is not possible to estimate the total potential releases to the groundwater. If any tests are conducted in or near the water table, then significant releases to the groundwater are to be expected. If any tests are conducted in or near the water table, then significant releases of radionuclides and hazardous materials into the near test environment are to be expected. Tests conducted well above the water table would release significant quantities of radionuclides and hazardous materials into the unsaturated zone. Some downward migration of these contaminants might occur and might have the potential to contaminate the underlying groundwater.

The ancillary operations related to testing are primarily surface based and have little potential for groundwater contamination. Minor quantities of drilling fluids or lost circulation materials might be introduced into the near-water-table environment during test hole drilling and postshot drill-back operations. Any contamination that results from these activities would be considered inconsequential compared to the releases from the actual test.

It is difficult to predict the significance of the releases from underground testing on the water resources of NTS. Perhaps the best gauge can be made based upon the results of past testing activities. There have been 111 tests conducted under the water table and 124 tests where the lower shot cavity was under, or within 75 m (250 ft) of the water table. The combined yield of the tests conducted under the water table and tests with cavities that extended below the water table was 28 megatons.

The results of the Long Term Hydrology Monitoring Program and research into tritium migration have found that the migration of radionuclides beyond the near test environment is rare. Instances have been found where radionuclides have moved through fracture injection at the time of the test (NT DOE 1996c). Tritium migration via groundwater flow has been confirmed, but in the more than 30 years that underground testing has been done, no offsite releases of tritium in the groundwater

have been detected.

Underground testing would be expected to have a significant impact on groundwater quality only if the testing is conducted in, or near, the water table. In this event, large scale contamination of the near-test groundwater resources could occur. However, because of the conditions at NTS (low hydraulic conductivities, high absorption geologic media, and slight hydraulic gradients), it is not considered likely that any significant impacts would occur in areas downgradient of the underground testing locations.

Biotic Resources. Because DOE has already prepared sufficient sites to handle numerous underground tests, no new impacts on biological resources would arise from preparation for these tests. A subsidence crater would be created by the underground test of the nuclear device. Because this crater would form in the area disturbed during site preparation for the test, no new loss of habitat would occur. Underground testing might impact individuals of recreational important species, such as waterfowl and doves, and candidate species of bats and birds, as they would be exposed to drilling fluid in drilling sumps constructed during postshot operations. Exposure to drilling fluid additives might increase these organisms' probability of drowning (NT DOE 1996c). The impact would not be large enough to decrease offsite recreational opportunities.

Hazardous or radioactive material releases could cause the mortality of plants and animals over tens or hundreds of hectares (NT DOE 1996c). This could have a significant impact on the viability of rare plants found in the northern half of NTS. However, because past aboveground tests and vented underground tests have not caused the expiration of any species from NTS, it is unlikely that future accidental venting would have that effect.

Because nuclear tests are conducted north of the range of the desert tortoise and because these tests normally are conducted when the wind is blowing to the north or northeast, accidental venting should not impact this threatened species (DOD 1977a; NT DOE 1995i). Additional releases of tritium into the aquifer from the underground nuclear test would not likely increase the impact to threatened and endangered species located at Devils Hole National Monument or Ash Meadows National Wildlife Refuge, given the short half-life of tritium and the slow rate of water exchange between the nuclear test sites and those springs (GTI 1995a; NT LLNL 1976a). Transportation to study sites would be infrequent enough as to not significantly increase the impact of this program on biological resources.

Air Quality. The average, annual fugitive dust emission rate (PM_{10}), including various drilling and construction activities, is about 1,290 t (1,422 tons). These emissions represent 0.16 percent of the total Nye County fugitive emissions. Fugitive dust calculations assume a 50-percent reduction as a result of watering the sites. As construction activities are only expected to occur on a short-term basis, long-term air quality impacts are not expected. Nevada Administrative Code 445B.365 regulates fugitive dust from surface disturbance of 2 ha (5 acres) or more. DOE has current Operating Permit 2743, which expires March 1998, for variable disturbance of land at NTS. If any radioactive noble gases and tritium were released to the surface by gradual seepage from the cavities or by escape during sampling operations, such releases are expected to be so small that impacts would be negligible.

Radiological and Human Health. Potential exposures of workers are possible during the tests conducted as part of the underground nuclear testing. The human health effects due to these exposures are based on an average annual dose reported in the NTS Site-Wide EIS (DOE/EIS 0243), with the results included in table 4.12-2.

Potential accidental releases from underground nuclear weapons testing were determined based on historical information from past testing at the site. These effects are also included in table 4.12-2.

Should DOE be directed by the President to conduct underground nuclear-yield testing under Alternative 1 of the NTS Site-Wide EIS, the probability of a single latent cancer fatality in the offsite population being caused as a result of radiological accidents over the 10 years evaluated by the EIS would be about 0.0055 (about one in 180). The probability of any other detrimental health effect occurring in the offsite population would be about 0.0025 (about one in 400).

Device delivery and assembly, as part of the underground nuclear weapons testing, are conducted at the Device Assembly Facility. Accident analyses performed as part of the Device Assembly Facility SAR show that for various design basis and operational accident scenarios considered, the impacts in terms of latent cancer fatalities fall well below the nuclear safety goal. All device assembly facility risk estimates are based on the SAR for the Device Assembly Facility. Section 4.9.3.9 of this PEIS discusses potential impacts associated with accidents at the Device Assembly Facility.

Transportation. DOE evaluated and reported the risks (consequences and probabilities) associated with transporting DP materials in SNL's Defense Programs Transportation Risk Assessment: Probabilities and Consequences of Accidental Dispersal of Radioactive Material Arising from Off-Site Transportation of Defense Programs Material (U) (SAND93-1617, September 1994). In that study, the annual risk of shipments of various cargos was evaluated based on many factors, including, but not limited to the transportation mode, how often and how far each cargo must be shipped, the specific route, and the population density along specific routes.

Table 4.12-2.-- Human Health Risks and Safety Impacts from Underground Nuclear Testing

	Routine Operation		**Construction**	
Project	**Cancer**	**Detriment**	**Injury**	**Fatality**
Underground nuclear weapons testing	0.034	0.013	6.8	0.012

Source: NT DOE 1996c.

Detailed information relating to methods and assumptions used for the risk analysis of DP materials is provided in appendix B of the transportation study. The results of the risk analysis indicate a very low potential for accidents; data analyzed from fiscal year 1984 through 1993 yielded an estimated 6.6 accidents per 161 million km (100 million mi). The risk of latent cancer fatalities (total to members of the public) and radiation detriment are significantly lower than the risk of fatalities and injuries from accidents (e.g., collision with a truck). Relating to onsite (within NTS) risk, the only potential hazard is on the 32 to 40 km (20 to 25 mi) of roadway that the safe secure trailer would travel. A group of flammable-liquid storage tanks located near the Mercury Facility is located about 30 m (100 ft) off the roadway and are protected by dikes. Based on accepted transportation accident rates, a transportation accident having serious consequences along this route would have a probability of less than or equal to 1 in 1 million.

---

[1] A closer onsite or nearby airfield could be used for DOE Transportation Safeguards System air

cargo shipments only.
Note: TSS - Transportation Safeguards System. Source: DOE 1991j.

[2] Fatalities.
Source: RADTRAN model results.

[3] Estimated fatalities per year.

[4] Same as No Action risk.

[5] Lowest potential impact of all site combinations.

[6] Highest potential impact of all site combinations.
Source: RADTRAN model results.

[7] Estimated fatalities per year. Specific risk for these different cases is presented in appendix table G.1-1.

[8] Highest potential impact of all site combinations.

[9] Lowest potential impact of all site combinations.
Source: RADTRAN model results.

"Lime"

[10] Local acceleration due to gravity.

[11] Meters per second.

[12] Centimeters.

[13] Kilotons. All peak values reported are the largest of the radial and transverse components.
Source: NT DOE 1996c.

4.14 Operating Conditions Common to All Sites

Current operations at each Complex site result in the emission of pollutants to the atmosphere, discharge of pollutants in wastewater, and the generation of wastes. DOE orders require that site operations be conducted in accordance with all regulatory standards and provide for protection of the public and the environment. Monitoring is conducted at each site to determine compliance with these standards. When monitoring indicates noncompliance, DOE orders require that appropriate corrective actions and followups be performed. Monitoring activities conducted at DOE sites are reported in accordance with permit, regulatory, and DOE operational requirements. Additionally, monitoring results and analyses are included in the site's annual environmental surveillance reports, which are available to the public as required by DOE Order 5400.1, General Environmental Protection Program.

All sites are subject to state environmental requirements for solid mixed and hazardous waste under RCRA and regulated wastes under TSCA. Nonhazardous (sanitary) solid wastes are governed by RCRA subtitle D standards. All radioactive and mixed waste management activities at the sites are conducted primarily under DOE Order 5820.2A and RCRA. All mixed waste storage areas must meet RCRA containment system requirements. The recent Federal Facility Compliance Act (October 6, 1992) required DOE to submit site-specific plans to EPA and the states containing schedules for providing treatment capacity for mixed waste streams at DOE sites. DOE has developed proposed treatment plans that are being negotiated with EPA and the states.

In accordance with RCRA, as amended, the Pollution Prevention Act of 1990, and DOE Order 5400.1, all sites have an active pollution prevention and waste minimization program to reduce the volume and toxicity of waste generated, to the extent that is economically practical. The site programs are an organized and continual effort to systematically reduce waste generation. The overall focus of these programs is on pollution prevention, which involves the elimination/minimization of pollutant releases to all environmental media from all aspects of site operations. This includes air emissions and water discharges to sewer systems, as well as the offsite disposal of solid waste.

Some of the solvents used in the Complex and used in the nonnuclear facilities have been identified as ozone-depleting pollutants. Attempts are being made, both internationally and nationally, to reduce ozone-depleting gases. In September 1987, 27 nations, including the United States, signed the Montreal Protocol, which limits the production of chlorofluorocarbons and halogens. Schedules contained in Title VI of the CAA Amendments (November 1990) call for the phaseout of all chlorofluorocarbons and halogens between 2015 and 2030. A second meeting regarding the Montreal Protocol extended the phasing out of ozone-depleting gases into the early 21st century because of the slow development of chlorofluorocarbon alternatives. All DOE sites have, or are developing, site-specific plans to meet the CAA-mandated phaseout schedule. Potential ozone-depleting chemicals identified in 40 CFR 82 and discussed in this PEIS include 1,1,1-trichloroethane, CCI4, chlorodifluoromethane, dichlorodifluoromethane, and trichlorotrifluoroethane.

Workplace Safety and Accidents. Operations at all DOE sites expose workers to occupational hazards during the normal conduct of their work activities. Occupational safety and health training is provided for all employees at DOE facilities and includes specialized job safety and health training appropriate to the work performed. Such training also includes informing employees of their rights and responsibilities under OSHA Executive Order 12196, which established OSHA Federal agency standards; 29 CFR 1960, *OSHA Standards for Federal Agencies* , which describes the safety and health programs that Federal agencies must establish and implement under Executive Order 12196;

and DOE O 440.1, Worker Protection Management for DOE Federal and Contractor Employees. DOE provides implementation guidance in DOE O 440.1, including the requirements and guidelines for the DOE *Federal Employee Industrial Hygiene Program* . The following is DOE policy:

- Provide places and conditions of employment that are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm
- Assure that employees and employee representatives shall have the opportunity to participate in the *Federal Employees Occupational Safety and Health Program*
- Establish programs in safety and health training for all levels of Federal employees
- Consider 29 CFR 1960 requirements to be the minimum standards for DOE employees

DOE contractor operations at each site expose workers to hazardous constituents. DOE orders require that site operations have programs for the protection of workers. DOE O 441.1, Radiological Protection for DOE Activities, and DOE O 440.1, Worker Protection Management for DOE Federal and Contractor Employees, establish procedures for protection of workers against radiological and hazardous materials, respectively. DOE M 232.1-1, Occurrence Reporting and Processing of Operations Information, provides for reporting and guides appropriate corrective action and followup should exposure occur.

DOE O 451.1, National Environmental Policy Act Compliance Program; DOE O 5480.23, Nuclear Safety Analysis Reports; and DOE O 430.1, Lifecycle Asset Management, provide the basis for review of all planned and existing construction and operation for potential accidents and the assessment of the associated human health and environmental consequences of an accident. These reviews are required before authorization of construction or start of operation. These reviews also involve the identification of hazards and an analysis of normal, abnormal, and accident conditions. This analysis includes consideration of natural and manmade external events, including fires, floods, tornadoes, earthquakes, other severe weather events, human errors, and explosions. The sites associated with the Stockpile Stewardship and Management Program have complied with applicable DOE orders.

In accordance with DOE O 151.1, *Comprehensive Emergency Management System* , emergency response planning and training are provided to mitigate the consequences of potential accidents. Additionally, should an accident occur, the incident would be reported in accordance with DOE M 232.1-1, Occurrence Reporting and Processing of Operations Information. The reports would also include appropriate corrective actions and followup.

Operation Consequences Common to All Sites. Consolidating or relocating stockpile stewardship and management functions to a site could increase the emissions of pollutants to the atmosphere, discharge of pollutants in wastewater, and generation of wastes. Members of the public could be exposed to pollutants that are released to the environment. Additionally, these functions, as with all industrial processes, would have the potential for exposing workers to hazardous constituents and accidents.

The monitoring currently conducted at each Complex site would be reviewed to ensure that monitoring activities are adequate to assess whether new operations and site conditions are adversely affecting members of the public, workers, or the environment. At each site, modifications to monitoring activities would be made, as appropriate. Any modifications, as well as the bases for the modification, would be documented in the sites' Environmental Protection Program. The results of these monitoring activities and the potential for exposures to the public and workers would be

reviewed, processed, and reported, as discussed earlier.

In many cases, the functions proposed for relocation are similar to or the same as activities currently being performed at the receiver site. In addition, the processes and materials associated with relocated functions are similar to or the same as those currently performed and used at the receiver sites. These processes and materials have been previously reviewed and analyzed in accordance with applicable regulatory and DOE order requirements and have been documented in various forms, including memoranda, safety assessments, and various NEPA documents. In all cases, current activities at these sites have received the appropriate authorization to operate.

The human health impacts of relocating a stockpile stewardship and management function to a receiver site were assessed in the following manner for each site: from an operational perspective, the additional impacts associated with the activity and the cumulative impacts after relocation were determined and presented; from an accident perspective, the processes to be transferred and the potential hazards they present were assessed. This assessment included the review of NEPA documents, SAR, and other applicable documents. Additionally, all proposed stockpile stewardship and management functions to be consolidated or relocated are currently being performed at existing DOE sites and do not constitute new activities within the Complex.

Potential Consequences of the Stockpile Stewardship and Management Program on Workplace Safety and Accidents. Downsizing and consolidating Complex missions could potentially result in increased exposure of site workers to industrial-type work hazards and accidents. In addition, levels of risk to workers in new construction increases in relation to the amount of new construction required for stockpile stewardship and management facilities. Based on the length of construction periods for new facilities, the new A/D Facility at NTS (2,768 worker years) would have the largest construction accident risk and the new Nonnuclear Fabrication Facility at SNL (781 worker years) would have the lowest construction accident risk. Table 4.14-1 shows the relative risk of fatalities due to construction (both new building and existing building modification) by alternative. Before implementing the Stockpile Stewardship and Management Program alternatives at any site, the site's environment, safety, and health staff would be notified that a new process or facility was being considered for change or modification to allow them to evaluate the impact of the anticipated change on the work environment.

Table 4.14-1.-- Estimated Number of Construction Worker Fatalities by Alternatives

Alternatives	Worker Years	Construction Period (years)	Potential Accidental Workers Deaths[1]
Stewardship			
National Ignition Facility	1,627	5	0.358
Contained Firing Facility	60	2	0.013
Atlas Facility>/td>	53	4	0.012
Management			
Assembly/Disassembly			

Pantex Plant	99	3	0.022
Nevada Test Site	2,768	6	0.609
Nonnuclear Fabrication			
Kansas City Plant	459	4	0.101
Los Alamos National Laboratory	12	2	0.003
Lawrence Livermore National Laboratory	19	5	0.004
Sandia National Laboratories	781	3	0.172
Pit Fabrication			
Los Alamos National Laboratory	216	3	0.048
Savannah River Site	801	5	0.176
Secondary and Case Fabrication			
Oak Ridge Reservation	72	6	0.016
Los Alamos National Laboratory	205	4	0.045
Lawrence Livermore National Laboratory	330	3	0.073
High Explosives Fabrication			
Pantex Plant	46	3	0.01
Los Alamos National Laboratory	77	2	0.017
Lawrence Livermore National Laboratory	19	1	0.004

Appropriate measures would be implemented to minimize work hazards and accidents based on this early evaluation. Once operational, as part of the Occupational Safety and Health Program at each site, ongoing surveillance of the new or modified processes or activities would be performed to identify potential health hazards. If potential health hazards are identified, a hazard evaluation would be conducted to determine the extent of the hazard and, if required, the recommended control measures. Where feasible, engineering controls would be used to protect worker health and safety. Administrative controls and personal protective equipment would supplement engineering controls, as appropriate.

4.15 Unavoidable Adverse Environmental Impacts

Siting, construction, modification, and operation of stockpile stewardship and management facilities at ORR, SRS, KCP, Pantex, LANL, LLNL, SNL, or NTS would result in adverse environmental impacts. The impact assessment conducted in this PEIS has identified these potential adverse impacts along with mitigative measures that could be implemented to either avoid or minimize these impacts. The residual adverse impacts remaining after mitigation are unavoidable and the bounding case impacts of all stockpile stewardship and management alternatives at all alternative sites are discussed below.

At NTS 18.2 ha (45 acres) of land would be disturbed to construct and operate the proposed NIF and provide additional supporting infrastructure and access roads. Loss of habitat in the disturbed area would be unavoidable. Land requirements for the proposed NIF would represent less than 11 percent of the uncommitted land at each alternative site except for the NLVF alternative at NTS where 56 percent would be required. Soil erosion in the disturbed area due to wind and stormwater runoff would be minor with appropriate sediment control measures. Small areas of potential wetlands could be unavoidably impacted, but mitigation measures approved by the U.S. Corps of Engineers would be implemented.

Construction, modification, and operation of stockpile stewardship and management facilities would generate criteria and toxic/hazardous pollutants that have the potential to exceed Federal and state ambient air quality standards and guidelines. Concentrations of PM *10* and TSP are expected to be close to or exceed the *24-hour ambient* PM *10 and TSP* standards during peak construction periods under dry and windy conditions. Such exceedances are not uncommon for large construction projects. Air pollutant concentrations during operation are expected to remain within Federal and state ambient air quality standards, except for 1-hour ozone concentrations at KCP, 1-hour nitrogen dioxide concentrations at LLNL, 24-hour nitrogen dioxide concentrations at LANL, and annual PM *10* concentrations at KCP.

For each of the alternatives considered, use of water is unavoidable and could represent an adverse impact depending on the site. The maximum amount of surface water required for stockpile stewardship and management facilities operation would be about *1,510 MLY (400 MGY)* at ORR, and the maximum groundwater requirement would be 893 MLY (236 MGY) at SNL. Increased turbidity during construction activities could impact some fish spawning and feeding habitat. It is expected that this loss would be small in comparison with resident fish populations and reproductive capabilities.

Federal-listed threatened or endangered species, such as the desert tortoise, could be affected directly or by disruptions to benthic and foraging habitats during construction and operation of stockpile stewardship and management facilities. Several candidate or state-listed animal species and special status plant species may also be affected at different sites. Preactivity surveys for such species would be conducted prior to the start of projects and any mitigation measures would be developed in consultation with the USFWS. It may be necessary to survey the sites for the nests of migratory birds prior to construction and to avoid clearing operations during the breeding season. While such disruptions may be unavoidable, appropriate measures would be implemented and monitored to ensure that any impacts are not irreversible. Construction of new facilities would have some adverse unavoidable effects on animal populations. Larger mammals and birds would move to similar habitats nearby, while less mobile animals within the project areas, such as amphibians, reptiles, and small mammals, would be destroyed during land-clearing activities.

Some NRHP-eligible prehistoric and historic resources may occur within the disturbed area at each

candidate site. The appropriate SHPO would be consulted to minimize unavoidable adverse impacts. Monitoring of construction activities by a paleontologist may be an appropriate mitigative measure in areas where scientifically important paleontological materials may be affected. Native American resources may be unavoidably affected by land disturbance and audio or visual intrusions on Native American sacred sites or due to reduced access to traditional use areas. DOE would consult with the affected tribes to minimize any impacts.

During construction of stockpile stewardship and management facilities, there would be no in-migration at any site. However, for operation of these facilities, there would be in-migration at some of the sites. The site and regional population would increase by as much as 1,950 (0.1 percent) during A/D operation at NTS. In most cases, vacancies in the existing housing stock would be sufficient for the in-migrating population. Some additional housing construction would be needed during operation of pit fabrication at SRS. Effects on the public finances of local governments in the ROI would be for the most part positive. An increase in vehicle traffic associated with construction and operation of stockpile stewardship and management facilities would affect the roads and transportation network surrounding some of the alternative sites. The resulting impacts in traffic, congestion, and road accidents resulting from socioeconomic growth is unavoidable, but can be reversed. For example, site access roads which are degraded during construction can be upgraded beyond their original condition to accommodate increased worker traffic.

Some amount of radiation would be released unavoidably by normal stockpile stewardship and management operations. The largest annual radiation dose to the maximally exposed member of the public would be 6.7 mrem from atmospheric and liquid releases at LANL. The associated risk of fatal cancers from 25 years of operations with these doses is 8.4×10^{-5}. The greatest annual population dose from total site operations through 2030 would be 40.8 person-rem at ORR; such a total dose would result in 0.52 fatal cancers over the entire 25 years of operation. The largest average annual dose to a site worker would be 380 mrem at SRS and LANL and would result in an associated risk of fatal cancer of 3.8×10^{-3} from 25 years of operation. The greatest annual dose to the total site workforce would be 505 person-rem occurring at SRS and would result in 5.0 fatal cancers over 25 years of operation.

Since hazardous and toxic chemicals are present during construction and operation of stockpile stewardship and management facilities, worker exposure to these chemicals is unavoidable. The maximum hazard to site workers, based solely on emissions of hazardous chemicals, is represented by an HI of 2.39 at LLNL for the No Action alternative. The incremental effects of the stockpile stewardship and management alternative at SRS would not appreciably change this No Action value. The incremental cancer risks to the public and site workers are essentially zero.

Although each site would implement waste minimization techniques, generation of additional low-level, hazardous and nonhazardous wastes is unavoidable. Any introduction of new waste types could be an adverse impact since treatment, storage, and disposal facilities may have to be developed and permitted to deal with certain new types of wastes. In addition, the generation of additional LLW at Pantex would require one additional shipment to NTS every 2 years. Generation of additional hazardous or mixed wastes could require expansion of existing or planned treatment, storage, and disposal facilities for these wastes at some sites. Generation of additional nonhazardous wastes may also require expansion of existing, or construction of new, liquid and solid waste treatment facilities, or reduce the lifetimes of current solid waste landfills.

4.16 Relationship Between Local Short-Term Uses of the Environment and the

Maintenance and Enhancement of Long-Term Productivity

The use of land on any of the eight alternative sites being considered for stockpile stewardship and management facilities would enhance the long-term productivity on each site in two ways. First, stockpile stewardship and management missions represent long-term R&D and production functions compatible with historic nuclear weapons support and require a technically competent, skilled and stable workforce. Second, in light of current reductions in the nuclear weapons stockpile, the lack of new weapons development or production, the moratorium on nuclear testing, and concerns about safety and reliability in the aging stockpile, DOE plans to downsize or consolidate existing facilities. In addition, DOE plans to provide upgraded or new experimental and computational capabilities that will enhance the long-term productivity of the selected sites.

Each alternative requires the use of additional land for increased disposal of radiological and hazardous materials. Such short-term usage would remove this land from other beneficial uses indefinitely because of the presence of long-lived hazards. Disposal of solid nonhazardous waste generated from facilities construction and operations would require additional land at onsite sanitary landfills. Solid nonhazardous waste generated from these facilities would continuously require additional land at a sanitary landfill site that would be unavailable for other uses in the long term. LLW would require additional space for onsite storage and waste processing and would involve the commitment of associated land, transportation, processing facilities, and other disposal resources. Creation of land disposal facilities allows the site to be productive for the long term by protecting the overall environment and complying with Federal and state environmental requirements.

One specific activity has been identified that requires short-term resource use that could compromise long-term productivity. The range of the endangered desert tortoise lies in the southern third of NTS. Construction and operation of new facilities associated with the A/D mission have the potential to impact the Federal-listed threatened desert tortoise. Measures designed to avoid impacts to the desert tortoise from previous projects at NTS have been implemented with mitigation measures developed in consultation with USFWS.

Losses of other terrestrial and aquatic habitats from natural productivity to accommodate new facilities and temporary disturbances required during construction are possible. Land clearing and construction activities resulting in large numbers of personnel and equipment moving about an area would disperse wildlife and temporarily eliminate habitats. Although some destruction would be inevitable during and after construction, these losses would be minimized by site selection and through environmental reviews at the site-specific level. In addition, short-term disturbances of previously undisturbed biological habitats from the construction of new facilities could cause long-term reductions in the biological productivity of an area. These long-term effects could occur, for example, at facilities located in arid areas of the western United States such as SNL, LANL, LLNL, and NTS, where biological communities recover very slowly from disturbances.

Potential termination of DP activities at ORR, KCP, and Pantex offers the possibility of restoring existing facilities at these sites to other purposes. Environmental restoration activities could have minor or short-term impacts similar to those normally associated with construction activities such as habitat disturbance and soil erosion. If contaminated structures were removed and site areas restored to a natural state, these areas could provide improved conditions for the long term.

4.17 Irreversible and Irretrievable Commitments of Resources

This section describes the major irreversible and irretrievable commitments of resources that can be identified at this programmatic level of analysis. A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource. An irretrievable commitment refers to the use or consumption of resources neither renewable nor recoverable for later use by future generations.

The Stockpile Stewardship and Management Program was initiated to ensure the safety and reliability of the Nation's nuclear weapons stockpile. As such, the programmatic decisions resulting from this PEIS will ensure the commitment of resources to the new construction or modification of facilities that are essential to the efficacy and efficiency of the Complex. This section discusses three major resource categories that are committed irreversibly or irretrievably to the proposed action: land, materials, and energy. Values for irreversible or irretrievable commitments of resources are shown in tables 4.17-1 through 4.17-4.

Land Use . The land that is currently occupied by, or designated for, future stockpile stewardship and management facilities, could ultimately be returned to open space uses if buildings, roads, and other structures were removed, areas cleaned up, and the land revegetated. Alternatively, the facilities could be modified for use in other nuclear programs. Therefore, the commitment of this land is not necessarily irreversible.

However, land rendered unfit for other purposes, such as that set aside for radiological and hazardous chemical waste disposal facilities, represents an irreversible commitment because wastes in below-ground disposal areas may not be completely removed at the end of the project. The land could not be restored to its original condition or to minimum cleanup standards, nor could the site feasibly be used for any other purposes following closure of the disposal facility. This land would be perpetually unusable because the substrata would not be available for other potential intrusive uses such as mining, utilities, or foundations for other buildings. However, the surface area appearance and biological habitat lost during construction and operation of the facilities could be restored to a large extent.

Material . The irreversible and irretrievable commitment of material resources during the entire lifecycle of stockpile stewardship and management existing or proposed facilities includes construction materials that cannot be recovered or recycled, materials that are rendered radioactive but cannot be decontaminated, and materials consumed or reduced to unrecoverable forms of waste. Where construction is necessary, materials required include wood, concrete, sand, gravel, plastics, steel, aluminum, and other metals. At this time, no unusual construction material requirements have been identified either as to type or quantity. The construction resources, except for those that can be recovered and recycled with present technology, would be irretrievably lost. However, none of these identified construction resources is in short supply and all are readily available in the vicinity of locations being considered for new functions. The commitment of materials to be manufactured into new equipment that cannot be recycled at the end of the project's useful lifetime is irretrievable. Consumption of operating supplies, miscellaneous chemicals, and gases, while irretrievable, would not constitute a permanent drain on local sources or involve any material in critically short supply in the United States as a whole. Materials consumed or reduced to unrecoverable forms of waste, such as uranium, are also irretrievably lost. However, strategic and critical materials, or resources having small natural reserves, are of such value that economics promotes recycling. Plans to recover and recycle as much of these valuable, depletable resources as is practical would depend on need. Each item would be considered individually at the time a recovery decision is required.

Energy. The irretrievable commitment of resources during construction and operation of the facilities would include the consumption of fossil fuels used to generate heat and electricity for the sites. Energy would also be expended in the form of diesel fuel, gasoline, and oil for construction equipment and transportation vehicles. The amounts of irretrievable energy required to construct and operate new or modified facilities are estimated in chapter 3. These estimates are roughly comparable to past energy requirements for the Complex.

Table 4.17-1.-- Irreversible and Irretrievable Commitments of Construction Resources for Assembly/Disassembly, Nonnuclear Fabrication, and Stockpile Stewardship Facilities

Construction	Contained Firing Facility	National Ignition Facility [2]	Atlas Facility	Assembly/Disassembly		Nonnuclear Fabricatio			
				Pantex	NTS[3]	KCP	LANL[4]	LLNL[3]	SN
Resource Requirements									
Electrical energy (MWh)	64	24	520	609	38,000	0	0.105	21	46.8
Liquid fuel (L)	56,800	1,500,000	<1,000	28,800	3,030,000	0	0	19,900	2,60(
Concrete (m^3)	3,000	60,000	<100	840	75,000	286	0	7.6	12,8(
Carbon and stainless steel (t)	1,500	10,000	<10	15	16,300	220	0	7.3	5,44(
Industrial gases (m^3)	4,300	9,000	0	600	65,100	0	0	7.5	0
Water (L)	3,790,000	1.43x107	<10,000	1,400,000	9.84x1077	0	9,500	79,500	2,20(
Employment									
Total employment (worker years)	60	1,627	53	99	2,768	459	12	19	781
Construction period (years)	2	5	4	3	6	4	2	5	3

Table 4.17-2.-- Irreversible and Irretrievable Commitments of Construction Resources for Stockpile Management Alternatives

	Pit Fabrication and Modification		Secondary and Case Fabrication			High Explosives Fabrication		
Construction	**SRS[5]**	**LANL[6]**	**ORR**	**LANL[7]**	**LLNL[7]**	**Pantex**	**LANL[8]**	**LLNL[8]**
Resource Requirements								
Electrical energy (MWh)	15	Minimal	2.7	4,130	3,500	257	Minimal	15
Liquid fuel (L)	175,000	Minimal	10,000	22,700	908,000	12,200	Minimal	9,500
Concrete (m3)	1,600	Minimal	100	245	612	356	Minimal	190
Carbon and stainless steel (t)	249	Minimal	20	54	73	6	Minimal	15
Industrial gases (m3)	3,780	Minimal	300	11,500	142	258	Minimal	3
Water (L)	30,000,000	Minimal	2,000,000	4,160,000	8,710,000	644,000	Minimal	1,230,000
Employment								
Total employment (worker years)	801	216	72	205	330	46	77	19
Construction period (years)	5	3	6	4	3	3	2	1

Table 4.17-3.-- Irreversible and Irretrievable Commitments of Operation Resources for Asse Nonnuclear Fabrication, and Stockpile Stewardship Facilities

				Assembly/Disassembly		Nonnuclear	
Operations	**Contained Firing Facility**	**National Ignition Facility[9]**	**Atlas Facility**	**Pantex**	**NTS[10]**	**KCP**	**LANL[11]**
Resource Requirements							
Electrical energy (MWh/yr)	1,600	58,000	5,360	43,000	45,000	225,000	525
Fuel, gas (m3/yr)	0	1,100,000	0	7,150,000	3,680,000	18,900,000	340

Liquid fuel (L/yr)	2,650	5,820	0	740,000	432,000	0	0
Coal (t/yr)	0	NA	0	NA	NA	NA	NA
Total water (L/yr)	2.3x106	1.52x108	10,000	1.96x108	9.84x107	1.34x109	4.83x107
Liquid chemicals (kg/yr)	0	0	90	49,216	18,979	15,259,650	8,343
Solid chemicals (kg/yr)	0	0	0	70,068	11,027	0	124,860
Gaseous chemicals (kg/yr)	0	0	0	65,772	65,772	9,305	0
Plant Footprint (ha)[12]	0.4	20	0.3	13	4.3	13	13
Employment							
Total workforce	26	267	15	1,266	1,093	2,257	315

Table 4.17-4.-- Irreversible and Irretrievable Commitments of Operation Resources for Stoc Management Alternatives

	Pit Fabrication and Modification		Secondary and Case Fabrication			High Explosives Fab	
Operations	**SRS [14]**	**LANL [15]**	**ORR**	**LANL [16]**	**LLNL [16]**	**Pantex**	**LANL [17]**
Resource Requirements							
Electrical energy (MWh/yr)	9,700	5,480	118,000	36,000	15,000	3,250	5,600
Fuel, gas (m3/yr)	0	30,900	1.7x107	0	566,000	500,000	3,650,000
Liquid fuel (L)	28,400	0	250,000	100,000	85,200	55,600	94,600
Coal (t/yr)	1,090	0	500	0	NA	NA	NA

Total water (L/yr)	4.62x107	3.02x107	1.51x109	5.5x107	1.94x108	1.25x107	1.3x107
Liquid chemicals (kg/yr)	9,191	57,772	199,466	153,728	58,107	8,050	9,049
Solid chemicals (kg/yr)	7,138	99,278	54,223	56,340	15,845	51,480	49,669
Gaseous chemicals (kg/yr)	52,521	1,533,089	6,488,333	1,568,333	1,883,037	1,810	1,361
Plant Footprint [18]	[18]	[19]	[18]	[18]	[18]	[18]	[18]
Employment							
Total Workforce	813	628	1,376	523	760	37	200

4.18 Facility Transition

The final disposition of all Complex facilities is the responsibility of DOE. DOE is committed to remediate these sites, to comply with all applicable environmental requirements, and to protect public and worker health and safety. DOE is currently considering many technologies for the treatment of contaminated materials and equipment, and for the long-term management of sites. DOE is preparing a PEIS to identify configurations for selected waste management facilities. The term "configurations" as used in this context means the arrangement of facilities and related activities at one or more DOE sites for a specific waste type. The selected waste management facilities for each of these waste types are: interim storage facilities for treated HLW; treatment and storage facilities for TRU waste in the event that treatment is required before disposal; treatment and disposal facilities for LLW; interim storage facilities for commercial Greater-Than-Class C LLW; treatment and disposal facilities for mixed LLW; and treatment facilities for hazardous waste.

4.19 Use of Plutonium-242 for Research and Development

Interim Management of Nuclear Materials Environmental Impact Statement (DOE/EIS-0220) dated October 20, 1995, categorized certain isotopes of plutonium, neptunium, americium, and curium as programmatic, leaving the issue of long-term use of these materials to various Program offices within DOE. The ROD for the Interim Management of Nuclear Materials EIS dated December 12, 1995, left programmatic decisions for the plutonium-242 material to DP. DP has determined that the plutonium-242 from SRS would be useful for future R&D activities. The issue for this PEIS concerns where to store the plutonium-242 material for such use. This section provides an analysis of the alternatives for storing SRS plutonium material for future R&D use. Further information regarding use of this material is contained in a classified appendix to this PEIS.

As discussed in the ROD for the Interim Management of Nuclear Materials EIS, existing plutonium-242 in nitrate solutions at H-Canyon will be stabilized by conversion to plutonium oxide in the HB-line. The portion of the HB-line where the conversion to oxide will occur is called Phase III. Phase III is being used to produce plutonium-238 for National Aeronautic and Space Administration for use as a thermal power source. The plutonium-242 in solution will be converted to oxide form (stabilized) between July and December 1996. The oxide will then be stored at existing facilities at either FB-Line or Building 235F at SRS.

A new DOE standard entitled *DOE Criteria for Safe Storage of Plutonium Metals and Oxides (DOE-STD-3013-94)* requires the handling and packaging of plutonium without the use of plastic and other organic materials (e.g., rubber or elastomeric seals). The ROD for the Interim Management of Nuclear Materials EIS determined that a new Actinide Packaging and Storage Facility will be constructed in the F-Area at SRS to allow for packaging this oxide as specified in the above-mentioned standard. The Actinide Packaging and Storage Facility is planned to be a fiscal year 1997 construction line item and construction completion is expected by May 2001. If the plutonium oxide were to remain at SRS, the material would be transferred from its storage location at FB-Line or Building 235F to the Actinide Packaging and Storage Facility once construction is completed.

The alternatives being evaluated in this Stockpile Stewardship and Management PEIS for the plutonium-242 oxide are to leave the material in place at SRS (the No Action alternative) or transport the material to LANL or LLNL for use in R&D. Both LANL and LLNL have a history of working with plutonium (including plutonium oxide) for research purposes. LANL currently performs most of the plutonium research for the Complex and has the necessary analytical facilities for plutonium. LLNL, although a reasonable alternative, is currently reducing its inventory of plutonium.

Environmental Impacts. The plutonium-bearing nitrate solutions in the F- and H- Canyons at SRS are being converted to plutonium oxide to stabilize the material in accordance with the Interim Management of Nuclear Materials and the F-Canyons Plutonium Solutions RODs. As stated above, the plutonium oxide will be stored at existing SRS facilities.

Under the No Action alternative, the material would be stored at FB-Line or Building 235F until it could be treated and then stored in the new Actinide Packaging and Storage Facility at SRS in accordance with newly developed standards. At LANL, TA-55 is the expected location for storing the material. The potential storage location at LLNL is Building 332 within the high security Superblock Complex. Regardless of the storage location for this material, there would be negligible environmental impacts. At SRS, LANL, or LLNL, this small quantity of plutonium oxide is within the historical quantities stored at these sites. Previous environmental analyses (LLNL and SNL Final EIS [DOE/EIS-0157, August 1992], Final EIS Interim Management of Nuclear Materials [DOE/EIS-0220, October 1995], and *the Environmental Assessment for Nuclear Material Storage for TA-55* [DOE/EA-0273, November 1985]) provide the NEPA documentation for continued storage of radioactive materials. No new additional risks to workers or the public would result from storage of this material at any of the three sites. No wastes are generated from storing the material. No additional site infrastructure or workers are required. No additional air or liquid releases would occur from normal operation. Therefore, this Stockpile Stewardship and Management PEIS analyzes the transportation from SRS to LANL or LLNL, against the No Action alternative of not transporting the plutonium oxide.

Transportation. The No Action alternative is to leave the plutonium oxide stored at SRS in the

Actinide Packaging and Storage Facility. Under No Action, there would be no transportation impacts, and thus, no further environmental impacts associated with this storage.

Transportation of this plutonium oxide from SRS to either LANL or LLNL would only require a fraction of one safe secure trailer shipment. Although the material could be packaged in a small number of containers, for the purposes of this analysis, a safe secure trailer loaded with 26 containers was assumed. The actual quantity of plutonium-242 is much less than is assumed for this analysis. Thus, these stated risks conservatively bound the true risk of transportation. The potential total health impacts of transportation of one such safe secure trailer shipment from either SRS to LANL, or SRS to LLNL, are shown in table 4.19-1. There could be a total health impact of 6.63x10-4 deaths from a one-time shipment of 26 canisters of plutonium-242 from SRS to LLNL. A one-time shipment of the same material from SRS to LANL could result in a total health impact of 4.14x10-4 deaths. The risks from transportation to LLNL are slightly higher only because of the greater distance traveled from SRS to LLNL. This table indicates that there are essentially no impacts from either alternative.

Table 4.19-1.---Total Potential Fatalities from the One-Time Transportation of Plutonium-242 (Oxide) from Savannah River Site to Lawrence Livermore National Laboratory or Los Alamos National Laboratory

Route	Health Effects [20]		
	Accident	Accident-Free	Total
SRS to LLNL	5.10×10^{-4}	1.53×10^{-4}	6.63×10^{-4}
SRS to LANL	3.17×10^{-4}	9.70×10^{-5}	4.14×10^{-4}

1 Results are based on the death rates experienced for construction workers in 1993. For the construction industry in general in 1993, the death rate was 22 deaths per 100,000 worker-years. Source: NSC 1994a.

2 NIF values reflect nonsite-specific requirements. See appendix I for site-specific information.

3 Values reflect requirements if Pantex is phased out.

4 Values reflect requirements if KCP is phased out. Derived from text.

5 Values reflect requirements if SRS receives this mission.

6 Values reflect requirements if LANL receives this mission.

7 Values reflect requirements if ORR is phased out.

8 Values reflect requirements if Pantex is phased out. Derived from text.

9 NIF values reflect nonsite-specific requirements. See appendix I for site-specific information.

10 Values reflect requirements if Pantex is phased out.

11 Values reflect requirements if KCP is phased out.

12 In addition to existing facilities.

13 Existing facilities would be used. NA - not applicable. Derived from text.

14 Values reflect requirements if SRS receives this mission.

15 Values reflect requirements if LANL receives this mission.

16 Values reflect requirements if ORR is phased out.

17 Values reflect requirements if Pantex is phased out.

18 In addition to existing facilities.

19 Existing facilities would be used.
NA - not applicable. Derived from text.

20 Assumes all plutonium-242 would be transported in one truckload.
RADTRAN model results.

CHAPTER 5.0 ENVIRONMENTAL, OCCUPATIONAL SAFETY & HEALTH PERMITS, AND COMPLIANCE REQUIREMENTS

Chapter 5 identifies the environmental, occupational safety and health permits, and compliance requirements associated with the proposed action as specified by the major Federal and state statues, regulations, orders, and agreements.

5.1 Introduction and Purpose

Chapter 5 provides information concerning the environmental standards and statutory requirements that impact the various stockpile stewardship and management facilities to the extent necessary to assist in making programmatic-level decisions. It presents some of the more important regulatory requirements associated with the proposed action by identifying the applicable environmental statutes, regulations, and approval requirements. These requirements are found in Federal and state statutes, regulations, permits, approvals, and consultations, as well as in Executive and Department of Energy (DOE) Orders, Consent Orders, Federal Facility Agreements, Federal Facility Compliance Agreements, and Agreements In Principle. These documents provide the standard for evaluating the ability of alternative sites to meet the environment, safety, and health (ES&H) requirements and for obtaining required Federal and state permits and licenses necessary to implement programmatic decisions. The remainder of the chapter provides historical background on environmental protection at nuclear weaons production facilities, explains the concept of shared Federal and state enforcment, and sumarizes compliance with occupational safety and health requirements.

Compliance with the applicable requirements of each of the major environmental statutes, regulations, or orders in the tables would allow DOE to construct and operate the stockpile stewardship and management facilities to meet existing ES&H requirements. To be environmentally sound, programmatic decisions must also plan for future ES&H considerations and requirements described in section 3.3 of the Nuclear Weapons Complex Reconfiguration Study (DOE/DP-0083) in order for the stockpile stewardship and management facilities to accomplish their mission in a timely and cost-effective manner.

5.2 Background

Since the majority of the Nuclear Weapons Complex (Complex) facilities were constructed in the 1940s and 1950s before the advent of today's environmental and worker health requirements, safety and the ability to satisfy national security requirements played dominant roles in the design and operation of these major industrial plants; however, with the emerging awareness of environmental and health-related issues and the enactment of environmental and worker health programs, DOE shifted a great deal of its resources into programs designed to achieve compliance with all applicable Federal, state, and local ES&H requirements. Today, many government agencies at the Federal, state, and local levels have regulatory authority over DOE facility operations. DOE has entered into enforceable compliance agreements with the regulators at most of its facilities. These agreements detail specific programs, funding levels, and schedules for achieving compliance with applicable ES&H statutory and regulatory requirements.

All newly constructed and modified facilities must comply with the increasing number and

complexity of environmental regulations. The application of constantly changing requirements to facilities that are more than 40 years old makes it difficult to achieve compliance quickly. These older facilities generally do not meet all current standards for seismic design, fire protection, and environmental protection (air emissions, liquid effluents, and the management of solid and hazardous wastes). However, modernization of facilities to meet all applicable ES&H requirements now and into the 21st century and the development of a system to adequately manage the wastes generated by these facilities would take place regardless of the proposed action addressed in this programmatic environmental impact statement (PEIS).

5.3 Environmental Statutes, Orders, and Agreements

The *Atomic Energy Act* of 1954, as amended, directs DOE to protect public health and minimize dangers to life or property with respect to activities under its jurisdiction. The Environmental Protection Agency (EPA), under authority of the Atomic Energy Act, has set radiation protection standards for workers and the public. EPA has also promulgated Federal environmental regulations and implemented statutes to protect the environment and to control the generation, handling, treatment, storage, and disposal of hazardous materials and waste substances.

Because of their length, and for ease of reading, all tables in this chapter are presented consecutively at the end of the text. Table 5.3-1 lists the applicable Federal environmental statutes, regulations, and Executive Orders, and also identifies the associated permits, approvals, and consultations generally required to site, construct, or operate stockpile stewardship and management facilities. Except for limited Presidential exemptions, Federal agencies must comply with all applicable provisions of Federal environmental statutes and regulations, in addition to all applicable state and local requirements. DOE is committed to fully complying with all applicable environmental statutes, regulatory requirements, and Executive and internal orders. Table 5.3-2 lists selected DOE ES&H orders that apply to all sites, but which may affect each site differently.

Table 5.3-1. Federal Environmental Statutes, Regulations, and Orders

Resource Category	Statute/Regulation/Order	Citation	Responsible Agency	PEIS-Level Potential Applicability: Permits, Approvals, Consultations, and Notifications
Air resources	Clean Air Act (CAA), as amended	42 USC §§7401 et seq.	EPA	Requires sources to meet standards and obtain permits to satisfy: National Ambient Air Quality Standards (NAAQS), State Implementation Plans, Standards of Performance for New Stationary Sources, National Emission Standards for Hazardous Air Pollutants (NESHAP), and Prevention of Significant Deterioration.

National Ambient Air Quality Standards/State Implementation Plans	42 USC §§7409 et seq.	EPA	Requires compliance with primary and secondary ambient air quality standards governing *sulfur dioxide* , *nitrogen oxide* , carbon monoxide, *ozone* , lead, and *particulate matter* and emission limits/reduction measures as designated in each state's implementation plan.
Standards of Performance for New Stationary Sources	42 USC §7411	EPA	Establishes control/emission standards and recordkeeping requirements for new or modified sources specifically addressed by a standard.
National Emission Standards for Hazardous Air Pollutants	42 USC §7412	EPA	Requires sources to comply with emission levels of carcinogenic or mutagenic pollutants; may require a preconstruction approval, depending on the process being considered and the level of emissions that will result from the new or modified source.
Prevention of Significant Deterioration	42 USC §§7470 et seq.	EPA	Applies to areas that are in compliance with NAAQS. Requires comprehensive preconstruction review and the application of Best Available Control Technology to major stationary sources (emissions of 100 t/year) and major modifications; requires a preconstruction review of air quality impacts and the issuance of a construction permit from the responsible state agency setting forth emission limitations to protect the Prevention of Significant Deterioration increment.

	Noise Control Act of 1972	42 USC §§4901 et seq.	EPA	Requires facilities to maintain noise levels that do not jeopardize the health and safety of the public.
Water resources	Clean Water Act (CWA)	33 USC §§1251 et seq.	EPA	Requires EPA or state-issued permits and compliance with provisions of permits regarding discharge of effluents to surface waters.
	National Pollutant Discharge Elimination System (NPDES) (section 402 of CWA)	33 USC §1342	EPA	Requires permit to discharge effluents (pollutants) and stormwaters to surface waters; permit modifications are required if discharge effluents are altered.
	Dredged or Fill Material - (section 404 of CWA)/ *Rivers and Harbors Appropriations Act* of 1899	33 USC §1344/ 33 USC §§401 et seq.	U.S. Army Corps of Engineers	Requires permits to authorize the discharge of dredged or fill material into navigable waters or wetlands and to authorize certain work in or structures affecting navigable waters.
Water resources (continued)	Wild and Scenic Rivers Act	16 USC §§1271 et seq.	Fish and Wildlife Service (USFWS), Bureau of Land Management, Forest Service, National Park Service	Consultation required before construction of any new Federal project associated with a river designated as wild and scenic or under study in order to minimize and mitigate any adverse effects on the physical and biological properties of the river.
	Safe Drinking Water Act (SDWA)	42 USC §§300f et seq.	EPA	Requires permits for construction/operation of underground injection wells and subsequent discharging of effluents to ground aquifers.

	Executive Order 11988: Floodplain Management	3 CFR, 1977 Comp., p. 117	Water Resources Council, Federal Emergency Management Agency, Council on Environmental Quality (CEQ)	Requires consultation if project impacts a floodplain.
	Executive Order 11990: Protection of Wetlands	3 CFR, 1977 Comp., p. 121	U.S. Army Corps of Engineers/USFWS	Requires Federal agencies to avoid the long- and short-term adverse impacts associated with the destruction or modification of wetlands.
	Compliance with Floodplain/Wetlands Environmental Review Requirements	10 CFR 1022	DOE	Requires DOE to comply with all applicable floodplain/wetlands environmental review requirements.
Hazardous wastes and soil resources	Resource Conservation and Recovery Act (RCRA)/Hazardous and Solid Waste Amendments of 1984	42 USC §§6901 et seq./PL 98-616	EPA	Requires notification and permits for operations involving hazardous waste treatment, storage, or disposal facilities; changes to site hazardous waste operations could require amendments to RCRA hazardous waste permits involving public hearings.
	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)/Superfund Amendments and Reauthorization Act of 1986 (SARA)	42 USC §§9601 et seq./PL 99-499	EPA	Requires cleanup and notification if there is a release or threatened release of a hazardous substance; requires DOE to enter into Interagency Agreements with EPA and state to control the cleanup of each DOE site on the National Priorities List (NPL).
	Executive Order 12580: Superfund Implementation	3 CFR, 1987 Comp., p. 193	EPA	DOE shall comply with the National Contingency Plan (NCP) in addition to the other requirements of the order, as amended.

Hazardous wastes and soil resources (continued)	Community Environmental Response Facilitation Act	PL 102-426	EPA	Amends CERCLA (40 CFR 300) to establish a process for identifying, prior to the termination of Federal activities, property that does not contain contamination. Requires prompt identification of parcels that will not require remediation to facilitate the transfer of such property for economic redevelopment purposes.
	Farmland Protection Policy Act of 1981	7 USC §§4201 et seq.	Soil Conservation Service	DOE shall avoid any adverse effects to prime and unique farmlands.
	Federal Facility Compliance Act of 1992	42 USC §6961	States	Waives sovereign immunity for Federal facilities under RCRA and requires DOE to develop plans and enter into agreements with states as to specific management actions for specific mixed waste streams.
Biotic resources	Fish and Wildlife Coordination Act	16 USC §§661 et seq.	USFWS	Requires consultation on the possible effects on wildlife if there is construction, modification, or control of bodies of water in excess of 10 acres (4 ha) in surface area.
	Bald and Golden Eagle Protection Act	16 USC §§668 et seq.	USFWS	Consultations should be conducted to determine if any protected birds are found to inhabit the area. If so, DOE must obtain a permit prior to moving any nests due to construction or operation of project facilities.

	Migratory Bird Treaty Act	16 USC §§703 et seq.	USFWS	Requires consultation to determine if there are any impacts on migrating bird populations due to construction or operation of project facilities. If so, DOE will develop mitigation measures to avoid adverse effects.
	Wilderness Act of 1964	16 USC §§1131 et seq.	Department of Commerce and Department of the Interior	DOE shall consult with the Department of Commerce and Department of the Interior and minimize impact.
	Wild Free-Roaming Horses and Burros Act of 1971	16 USC §§1331 et seq.	Department of the Interior	DOE shall consult with Department of the Interior and minimize impact.
	Endangered Species Act of 1973	16 USC §§1531 et seq.	USFWS/National Marine Fisheries Service	Requires consultation to identify endangered or threatened species and their habitats, assess DOE impacts thereon, obtain necessary biological opinions, and, if necessary, develop mitigation measures to reduce or eliminate adverse effects of construction or operations.
Cultural resources	National Historic Preservation Act of 1966, as amended	16 USC §§470 et seq.	President's Advisory Council on Historic Preservation	DOE shall consult with the State Historic Preservation Office (SHPO) prior to construction to ensure that no historical properties will be affected.
	Archaeological and Historical Preservation Act of 1974	16 USC §§469 et seq.	Department of the Interior	DOE shall obtain authorization for any disturbance of archaeological resources.
Cultural resources (continued)	Archaeological Resources Protection Act of 1979	16 USC §§470aa et seq.	Department of the Interior	DOE shall obtain authorization for any excavation or removal of archaeological resources.
	Antiquities Act	16 USC §§431-33	Department of the Interior	DOE shall comply with all applicable sections of the act.

	American Indian Religious Freedom Act of 1978	42 USC §1996	Department of the Interior	DOE shall consult with local Native American Indian tribes prior to construction to ensure that their religious customs, traditions, and freedoms are preserved.
	Native American Graves Protection and Repatriation Act of 1990	25 USC §3001	Department of the Interior	DOE shall consult with local Native American Indian tribes prior to construction to guarantee that no Native American graves are disturbed.
	Executive Order 11593: Protection and Enhancement of the Cultural Environment	3 CFR 154, 1971-1975 Comp., p. 559	Department of the Interior	DOE shall aid in the preservation of historic and archaeological data that may be lost during construction activities.
Worker safety and health	Occupational Safety and Health Act (OSHA)	5 USC §5108	OSHA	Agencies shall comply with all applicable worker safety and health legislation (including guidelines of 29 CFR 1960) and prepare, or have available, Material Safety Data Sheets.
	Hazard Communication Standard	29 CFR 1910.1200	OSHA	DOE shall ensure that workers are informed of, and trained to handle, all chemical hazards in the DOE workplace.
Other	Atomic Energy Act of 1954	42 USC §2011	DOE	DOE shall follow its own standards and procedures to ensure the safe operation of its facilities.
	National Environmental Policy Act (NEPA)	42 USC §§4321 et seq.	Council on Environmental Quality (CEQ)	DOE shall comply with NEPA implementing procedures in accordance with 10 CFR 1021.
	Uranium Mill Tailings Radiation Control Act of 1978	42 USC §§7901 et seq.	EPA	DOE shall enforce and implement health and environmental standards and acquire licenses when required.

	Toxic Substances Control Act (TSCA)	15 USC §§2601 et seq.	EPA	DOE shall comply with inventory reporting requirements and chemical control provisions of TSCA to protect the public from the risks of exposure to chemicals; TSCA imposes strict limitations on use and disposal of polychlorinated biphenyl-contaminated equipment.
	Hazardous Materials Transportation Act	49 USC §§1801 et seq.	Department of Transportation (DOT)	DOE shall comply with the requirements governing hazardous materials and waste transportation.
	Hazardous Materials Transportation Uniform Safety Act of 1990	49 USC §1801	DOT	Restricts shippers of highway route-controlled quantities of radioactive materials to use only permitted carriers.
Other (continued)	Emergency Planning and Community Right-To-Know Act of 1986	42 USC §§11001 et seq.	EPA	Requires the development of emergency response plans and reporting requirements for chemical spills and other emergency releases, and imposes right-to-know reporting requirements covering storage and use of chemicals which are reported in toxic chemical release forms.
	Pollution Prevention Act of 1990	42 USC 11001-11050	EPA	Establishes a national policy that pollution should be reduced at the source and requires a toxic chemical source reduction and recycling report for an owner or operator of a facility required to file an annual toxic chemical release form under section 313 of SARA.

Executive Order 12843: Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances	April 21, 1993	EPA	Requires Federal agencies to minimize procurement of ozone depleting substances and conform their practices to comply with Title VI of CAA Amendments referencing stratospheric ozone protection and to recognize the increasingly limited availability of Class I substances until final phaseout.
Executive Order 12856: Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements	August 3, 1993	EPA	Requires Federal agencies to achieve 50-percent reduction of agency's total releases of toxic chemicals to the environment and offsite transfers, to prepare a written facility pollution prevention plan not later than 1995, to publicly report toxic chemicals entering any waste stream from Federal facilities, including any releases to the environment, and to improve local emergency planning, response, and accident notification.
Executive Order 12873: Federal Acquisition, Recycling, and Waste Prevention	October 20, 1993	EPA	Requires Federal agencies to develop affirmative procurement policies and establishes a shared responsibility between the system program manager and the recycling community to effect use of recycled items for procurement.
Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	February 11, 1994	EPA	Requires Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-

				income populations.
	Executive Order 12088: Federal Compliance with Pollution Control Standards	3 CFR, 1978 Comp., p. 243	Office of Management and Budget	Requires Federal agency landlords to submit to Office of Management and Budget an annual plan for the control of environmental pollution and to consult with EPA and state agencies regarding the best techniques and methods.
	Executive Order 11514: Protection and Enhancement of Environmental Quality	3 CFR, 1966-1970 Comp., p. 902	CEQ	Requires Federal agencies to demonstrate leadership in achieving the environmental quality goals of NEPA; provides for DOE consultation with appropriate Federal, state, and local agencies in carrying out their activities as they affect the environment.
Other (continued)	Nuclear Waste Policy Act of 1982	42 USC §§10101 et seq.	EPA	DOE shall dispose of radioactive waste in accordance with 40 CFR 191.
	Low-Level Radioactive Waste Policy Act	42 USC §§2021b-2021d	Nuclear Regulatory Commission	DOE shall dispose of low-level wastes (LLW) in accordance with the states in which it operates.

Table 5.3-2. Selected Department of Energy Environment, Safety, and Health Orders

DOE Order	Order Title
5400.1	General Environmental Protection Program
5400.5	Radiation Protection of the Public and the Environment
5480.4	Environmental Protection, Safety, and Health Protection Standards
5480.19	Conduct of Operations Requirements for DOE Facilities
5480.21	Unreviewed Safety Questions
5480.22	Technical Safety Requirements
5480.23	Nuclear Safety Analysis Reports
5482.1B	Environment, Safety, and Health Appraisal Program
5484.1	Environmental Protection, Safety, and Health Protection Information Reporting Requirements

5530.1A	Accident Response Group
5530.4	Aerial Measuring System
5630.12A	Safeguards and Security Inspection and Assessment Program
5632.1C	Protection and Control of Safeguards and Security Interests
5700.6C	Quality Assurance
5820.2A	Radioactive Waste Management
M 231.1	Environment, Safety, and Health Reporting
N 441.1	Radiological Protection for DOE Activities
O 151.1	Comprehensive Emergency Management System
O 232.1-1	Occurrence Reporting and Processing of Operations Information
O 420.1	Facility Safety
O 430.1	Life Cycle Asset Management
O 440.1	Worker Protection Management for DOE Federal and Contractor Employees
O 451.1	National Environmental Policy Act Compliance Program
O 460.1	Packaging and Transportation Safety
O 460.2	Departmental Materials Transportation and Packaging Management
O 470.1	Safeguards and Security Program

DOE has entered into agreements with regulatory agencies on behalf of all of the DOE facilities being considered in this PEIS. These agreements normally establish a schedule for achieving full compliance at these DOE facilities. Table 5.3-3 lists those DOE environmental agreements with Federal and state regulatory agencies that have substantive provisions in effect. Appendix section A.1 summarizes the applicability of and provides more detail on the environmental regulatory compliance agreements and consent orders still in effect at each of the nuclear facilities. These agreements and consent orders are generally available from the regulatory agency that is a party to the agreement, normally the state environmental department or EPA region, and also from the local DOE information resource center or reading room. Table 5.3-4 lists the potential requirements imposed by the major state environmental statutes and regulations applicable to this PEIS. These requirements apply to Federal activities within the jurisdiction of the enforcing authority. Just as table 5.3-1 identifies requirements based on Federal laws, table 5.3-4 identifies the permits, approvals, and consultations generally required to site, construct, or operate stockpile stewardship and management facilities in accordance with state statutes and regulations.

Table 5.3-3. Department of Energy Agreements with Federal and State Environmental Regulatory Agencies

Facility	Resource Category	Parties (Agency/State)	Scope of Agreement	Effective Date

Kansas City Plant	Soil	DOE/EPA	RCRA Section 3008 (h) Administrative Order on Consent. Groundwater cleanup primarily for volatile organic compounds (VOCs) and PCBs (agreement between DOE and EPA but Missouri Department of Natural Resources maintains RCRA authority over the KCP groundwater monitoring program)	06/23/89
Lawrence Livermore National Laboratory	Water	DOE/EPA/CA-RWQCB, CA-Dept. Health Svcs	Federal Facility Agreement-Regulates groundwater cleanup activities at LLNL under CERCLA/SARA Section 120	11/02/88
	Water/Soil	DOE/EPA/CAEPA Department of Toxic Substances Control/RWQCB	CERCLA-Federal Facility Agreement describes the groundwater and soil investigations to be conducted at Site 300 and specifies reporting dates.	9/92
	Air/Soil	DOE/EPA/CAEPA Department of Toxic Substances Control	Hazardous Waste Compliance Agreement 92/93-031 governing open burning of explosives wastes at Site 300.	
Los Alamos National Laboratory	Water	DOE/EPA	CWA-NPDES compliance agreement	08/29/91
Nevada Test Site	Air/Water	DOE/NV	Agreement in Principle for DOE to provide funding to Nevada for oversight of environmental, safety and health activities	10/90
	Soil	DOE/NV	RCRA-Settlement Agreement-TRU mixed waste	07/23/92
	Cultural	DOE/NV	Programmatic Agreement-Archaeological and Historic Preservation activities	05/08/93
Oak Ridge Reservation	Air	DOE/EPA	CAA-Federal Facility Compliance Agreement, Radionuclide NESHAP	05/26/92
	Soil	DOE/EPA/TN	CERCLA-Federal Facility Agreement	01/01/92

	Soil	DOE/EPA	RCRA-Federal Facility Compliance Agreement for storage of mixed waste subject to land disposal restrictions	06/12/92
	Soil	DOE/EPA/TN	Federal Facility Compliance Act Commissioners Order ORR Site-Specific Treatment Plan for Mixed Waste	9/26/95
	All except Radiological	DOE/TN Dept. of Environment and Conservation	Oversight of environmental monitoring programs	5/13/91
	Cultural	DOE/TN	DOE commitment to prepare a cultural resource management plan for ORR and to conduct a survey to identify significant historical properties located within the ORR; interim programmatic exclusions from Section 106 review	5/24/94
Pantex Plant	Soil	DOE/EPA	RCRA-Section 3008 (h) Administrative Order on Consent	12/10/90
Sandia National Laboratories/NM	Soil	DOE/NM	RCRA-Groundwater monitoring at chemical waste landfill	12/29/89
Savannah River Site	Air	DOE/EPA	CAA-Federal Facility Compliance Agreement, Radionuclide NESHAP	10/31/91
	Soil	DOE/SC	RCRA-Settlement Agreement 87-52-SW with amendment, Part B application deficiencies; groundwater monitoring	11/12/87, 05/10/91
	Soil	DOE/EPA	RCRA-Federal Facility Compliance Agreement for land disposal restrictions, with amendment 1, Docket No. 91-01-FFR	03/13/91, 04/24/92
	Soil	DOE/EPA/SC	CERCLA/RCRA-Federal Facility Agreement	01/15/93
	Cultural	DOE/SHPO ACHP	Programmatic Memorandum of Agreement-Management of Archaeological Sites	08/90

Table 5.3-4. State Environmental Statutes, Regulations, and Orders

Resource Category	Legislation	Citation	Responsible Agency	Potential Applicability/Permits
Kansas City Plant, MO				
Air resources	Missouri Air Conservation Law	MO Stat., Title 40, Chapter 643	MO Department of Natural Resources	Permit required prior to the construction or modification of an air contaminant source.
	Missouri Air Quality Standards	MO Code 10-6.060	MO Department of Natural Resources	Permit required prior to the construction or modification of an air contaminant source.
Water resources	Missouri Clean Water Law	MO Stat., Title 40, Chapter 644	MO Department of Natural Resources	Permit required prior to the construction or modification of a water discharge source.
Hazardous wastes and soil resources	Missouri Solid Waste Law	MO Code, Title 10, Division 80	MO Department of Natural Resources	Permit required prior to the construction or modification of a solid waste disposal facility.
	Missouri Hazardous Waste Management Law	MO Code, Title 10, Division 25	MO Department of Natural Resources	Permit required prior to the construction or modification of a hazardous waste disposal facility.
	Missouri Underground Storage Tank Act	MO Code, Title 10	MO Department of Natural Resources	Permit required prior to the construction or modification of an underground storage tank.
Biotic resources	Missouri Wildlife Code	Rule 3 CSR10-4.111	MO Department of Conservation	Prohibits transactions involving endangered plants and animal species. Lists species endangered in Missouri.
Kansas City Plant, MO (continued)				
Biotic resources (continued)	Missouri Wildlife Code	Revised Statutes of Missouri Rule (RSMO) 252.240	MO Department of Natural Resources	Prohibits transactions involving endangered species as listed by the U.S Department of the Interior and prohibits collecting, digging, or picking of any rare or endangered plants without the owner's permission.

Cultural resources	State Historic Preservation Act	RSMO Sections 253.408 to 253.412	MO Department of Natural Resources Historic Preservation Program	Establishes State Historic Preservation Officer, and a state historic preservation office with duties including conducting comprehensive survey of cultural resources, assisting Federal and state agencies to carry out historic preservation responsibilities, and coordinating with state and Federal agencies to ensure that historic properties are taken into consideration at all levels of planning and development.
	Historic Preservation Revolving Fund Act	RSMO Sections 253.400 to 253.407	MO Department of Natural Resources Historic Preservation Program	Establishes a fund to protect and preserve the historic properties of Missouri, to be administered throughout the State Department of Natural Resources.
	Unmarked Human Burial Sites	RSMO Sections 194.400 to 194.410	MO Department of Natural Resources Historic Preservation Program	Requires notification of local law enforcement or SHPO if an unmarked human burial or human skeletal remains are encountered during construction or any ground disturbing activities on state land or waters.
	Private Cemeteries	RSMO Section 214.131	MO Department of Natural Resources Historic Preservation Program	Makes desecration or destruction of abandoned family or private cemeteries a misdemeanor.
	Historic Shipwrecks, Salvage, or Excavation Regulations	RSMO Section 253.420	MO Department of Natural Resources Historic Preservation Program	The State Department of Natural Resources shall monitor and grant permits for salvage excavations of submerged or embedded abandoned shipwrecks in the state.

Kansas City Plant, MO (continued)

Cultural resources (continued)	Missouri Indian Affairs Commission Act	March 24, 1994	MO Department of Natural Resources Historic Preservation Program	Creates the Missouri Indian Affairs Commission within the Department of Natural Resources. The Commission will act as a liaison between the Indian people and various Indian agencies, including Federal and state agencies.

Worker safety and health	No state-level legislation identified	NA	MO Department of Natural Resources	NA
Lawrence Livermore National Laboratory, CA				
Air resources	California Clean Air Act	CA Health and Safety Code, Sections 39000 et seq.	CA Environmental Protection Agency, Air Resources Board and local districts	Permit required prior to construction or modification of an air contaminant source.
	Air Toxics "Hot Spots" Information and Assessments Act	CA Health and Safety Code, Sections 44300 et seq.	CA Environmental Protection Agency, Air Resources Board and local districts	Screening Risk Assessment required to estimate human health impacts to a resident living near the boundary of the site.
Water resources	California Porter-Cologne Water Quality Act	Water Code, Sections 13000 et seq.	CA Environmental Protection Agency, Water Resources Control Board and Regional Water Quality Control Boards	Permit required prior to construction or modification of water discharges sources.
Hazardous wastes and soil resources	California Hazardous Waste Control Act	CA Health and Safety Code, Sections 25100 et seq.	CA Environmental Protection Agency, Department of Toxic Substances Control	Permit required prior to construction or modification of hazardous waste management facility.
	The Hazardous Waste Source Reduction and Management Review Act of 1989	CA Health and Safety Code, Sections 25244.12 et seq.	CA Environmental Protection Agency, Department of Toxic Substances Control	Requires reports and plans describing how mandatory percentage reductions in waste streams will be achieved.
	"Hazardous Materials" Department of the California Highway Patrol	13 C.C.R, Chapter 6	CA Highway Patrol	Defines routes, stopping places, and rules of the road for transportation of hazardous materials.

	California Environmental Quality Act	CA Public Resources Code, Section 21081.6	CA Environmental Protection Agency	Requires evaluation of environmental impacts associated with Department of Toxic Substances Control permitting decisions.
Lawrence Livermore National Laboratory, CA (continued)				
Biotic resources	California Endangered Species Act	CA Fish and Game Code, Sections 2050-2098	CA Department of Fish and Game	States that agencies should not approve projects that would jeopardize the continued existence of threatened or endangered species or result in destruction or adverse modification of habitat essential to the continued existence of those species if conservation alternatives are reasonable and prudent.
Cultural resources	California Environmental Quality Act	CA Public Resources Code, Section 21083.2	CA Office of Planning and Research	Requires consideration of the effects of a project on prehistoric and historic cultural resources.
Worker safety and health	California Occupational Safety and Health Act does not directly apply to LLNL			
Los Alamos National Laboratory, NM and Sandia National Laboratories/NM				
Air resources	New Mexico Air Quality Control Act	NM Stat., Title 74, Article 2	NM Environment Department	Permit required prior to the construction or modification of an air contaminant source.
	New Mexico Air Quality Standards and Regulations	NM Air Quality Control Regs., §100	NM Environment Department	Permit required prior to the construction or modification of an air contaminant source.
Water resources	New Mexico Water Quality Act	NM Stat., Title 74, Article 6	NM Water Quality Control Com.	Permit required prior to the construction or modification of a water discharge source.
	New Mexico Water Quality Regulations	NM Water Regulations	NM Water Quality Control Com.	Permit required prior to the construction or modification of a water discharge source.
Hazardous wastes and soil resources	New Mexico Solid Waste Act	NM Stat., Chap. 74, Article 8	NM Environment Department	Permit required prior to the construction or modification of a solid waste disposal facility.

	New Mexico Solid Waste Management Regulations	NM Solid Waste Mgmt. Regs.	NM Environment Department	Permit required prior to the construction or modification of a solid waste disposal facility.
	New Mexico Hazardous Waste Management Regulations	NM Hazardous Waste Mgmt. Regs.	NM Environment Department	Permit required prior to the construction or modification of a hazardous waste disposal facility.
Los Alamos National Laboratory, NM and Sandia National Laboratories/NM (continued)				
Hazardous wastes and soil resources (continued)	New Mexico Underground Storage Tank Regulations	NM Underground Storage Tank Regulations	NM Environment Department	Permit required to comply with tank requirements prior to the construction or modification of an underground storage tank.
Biotic resources	New Mexico Wildlife Conservation Act	NM State Act 1978, Sections 17-2-37 through 17-2-46	NM Department of Game and Fish	Permit and coordination required if a project may disturb habitat or otherwise affect threatened or endangered species.
	New Mexico Endangered Plant Species Act	NM State Act 1978, Sections 75-6-1	NM State Forestry Department	Coordination with the department required.
Cultural resources	New Mexico Cultural Properties Act	NM State Act 1978, Sections 18-6-1 through 18-6-23	NM State Historic Preservation Office	Established State Historic Preservation Office and requirements to prepare an archaeological and historic survey and consult with the State Historic Preservation Office.
Worker safety and health	No state-level legislation identified	NA	NA	NA.
Nevada Test Site, NV				
Air resources	Nevada Air Pollution Control Law	NV Statutes, Title 40	NV State Environmental Commission	Permit required prior to construction or modification of an air contaminant source.
	Nevada Air Quality Regulations	NV Admin. Code, Chapter 445	NV State Environmental Commission	Permit required prior to construction or modification of an air contaminant source.
Water resources	Nevada Water Pollution Control Law	NV Statutes, Title 40, Chapter 445	NV Department of Environmental Protection	Permit required prior to construction or modification of a water discharge source.
	Nevada Water Pollution Control Regulations	NV Admin. Code, Chapter 445	NV Department of Environmental Protection	Permit required prior to construction or modification of a water discharge source.
Nevada Test Site, NV (continued)				

Hazardous wastes and soil resources	Nevada Underground Storage Tank Rules	NV Admin. Code, Chapter 459	NV Department of Environmental Protection	Permit required prior to construction or modification of an underground storage tank.
	Nevada Solid Waste Disposal Law	NV Statutes, Title 40, Chapter 444	NV Department of Environmental Protection	Permit required prior to construction or modification of a solid waste disposal facility.
	Nevada Solid Waste Disposal Regulations	NV Admin. Code, Chapter 44	NV Department of Environmental Protection	Permit required prior to construction or modification of a solid waste disposal facility; permit for septage hauling may be required.
	Nevada Hazardous Waste Disposal Law	NV Statutes, Title 40, Chapter 459	NV Department of Environmental Protection	Permit required prior to construction or modification of a hazardous waste disposal facility.
	Nevada Hazardous Waste Facility Regulations	NV Admin. Code, Chapter 444	NV Department of Environmental Protection	Permit required prior to construction or modification of a hazardous waste disposal facility.
Biotic resources	Nevada Non-Game Species Act	NV Admin. Code, Title 45, Chapter 503	NV Department of Wildlife	Consult with NV Department of Wildlife and minimize impact.
Cultural resources	Historic Preservation and Archaeology Regulations	NV Statutes, Title 26, Chapter 381-383	NV Advisory Board for Historic Preservation and Archaeology	Permit required prior to the investigation, exploration, or excavation of a historic or prehistoric site.
Worker safety and health	No state-level legislation identified	NA	NA	NA.
Oak Ridge Reservation, TN				
Air resources	Tennessee Air Pollution Control Regulations	TN Rules, Division of Air Pollution	TN Air Pollution Control Board	Permit required to construct, modify, or operate an air contaminant source; sets fugitive dust requirements.
Water resources	Tennessee Water Quality Control Act	TN Code, Title 69, Chapter 3	TN Water Quality Control Board	Authority to issue new or modify existing NPDES permits required for a water discharge source.

Oak Ridge Reservation, TN (continued)

Hazardous wastes and soil resources	Tennessee Underground Storage Tank Program Regulations	TN Rules, Chapter 1200-1-15	TN Division of UST Programs	Permit required prior to construction or modification of an underground storage tank.
	Tennessee Hazardous Waste Management Act	TN Code, Title 68, Chapter 46	TN Division of Solid Waste Management	Permit required to construct, modify, or operate a hazardous waste treatment, storage, or disposal facility.
	Tennessee Solid Waste Processing and Disposal Regulations	TN Rules, Chapter 1200-1-7	TN Division of Solid Waste Management	Permit required to construct or operate a solid waste processing or disposal facility.
Biotic resources	Tennessee State Executive Order on Wetlands	TN State Executive Order	TN Division of Water Quality Control	Consultation with responsible agency.
	Tennessee Threatened Wildlife Species Conservation Act of 1974	TN Code, Title 70, Chapter 8	TN Wildlife Resources Agency	Consultation with responsible agency.
	Tennessee Rare Plant Protection and Conservation Act of 1985	TN Code, Title 70, Chapter 8-301 et seq.	TN Wildlife Resources Agency	Consultation with responsible agency.
	Tennessee Water Quality Control Act	TN Code, Title 69, Chapter 3	TN Division of Water Quality Control	Permit required prior to alteration of a wetland.
Cultural resources	Tennessee Desecration of Venerated Objects	TN Code, Title 39, Chapter 17-311	TN Historical Commission	Forbids a person to offend or intentionally desecrate venerated objects including a place of worship or burial.
	Tennessee Abuse of Corpse	TN Code, Title 39, Chapter 17-312	TN Historical Commission	Forbids a person from disinterring a corpse that has been buried or otherwise interred.
	Native American Indian Cemetery Removal and Reburial	TN Comp. Rules and Regulations, Chapter 400-9-1	TN Historical Commission	Requires notification if Native American Indian remains are uncovered.
	Tennessee Protective Easements	TN Code, Title 11, Chapter 15-101	TN State Government	Grants power to the state to restrict construction on land deemed as a "protective" easement.

Worker safety and health	No state-level legislation identified	NA	NA	NA.
Pantex Plant, TX				
Air resources	Texas Air Pollution Control Regulations	TX Admin. Code, Title 30, Chapter 101-125, 305	TX Natural Resource Conservation Commission (effective 9/1/93)	Permit required prior to construction or modification of an air contaminant source.
Pantex Plant, TX (continued)				
Water resources	Texas Water Quality Standards	TX Admin. Code, Title 30, Chapter 305, 308-325	TX Natural Resource Conservation Commission (effective 9/1/93)	Permit may be required prior to any modification of waters of the state including stream alteration for the construction of intakes, discharges, bridges, submarine utility crossings, etc.
	Texas Consolidated Permit Rules	TX Admin. Code, Title 30	TX Natural Resource Conservation Commission (effective 9/1/93)	Permit may be required prior to any modification of waters of the state including stream alteration for the construction of intakes, discharges, bridges, submarine utility crossings, etc.
	Texas Water Quality Acts	TX Code, Title 30, Chapter 290	TX Natural Resource Conservation Commission (effective 9/1/93)	Permit may be required prior to any modification of waters of the state including stream alteration for the construction of intakes, discharges, bridges, submarine utility crossings, etc.
Hazardous wastes and soil resources	Texas Underground Storage Tanks Rules	TX Admin. Code, Title 30, Chapter 334	TX Natural Resource Conservation Commission (effective 9/1/93)	Permit required prior to construction or modification of an underground storage tank.
	Texas Solid Waste Management Regulations	TX Admin. Code, Title 30, Chapter 305, 335	TX Natural Resource Conservation Commission (effective 9/1/93)	Permit required prior to construction or modification of a solid waste disposal facility.
	Texas Solid Waste Disposal Act	TX Admin. Code, Title 30, Chapter 305, 334, and 335	TX Natural Resource Conservation Commission (effective 9/1/93)	Permit required prior to construction or modification of a solid waste disposal facility.

Biotic resources	Texas Parks and Wildlife Regulations	TX Parks and Wildlife Code, Chapter 67, 68, and 88	TX Parks and Wildlife Department	Permit required by anyone who possesses, takes, or transports endangered, threatened, or protected plants or animals.
Cultural resources	Antiquities Code of Texas	TX Statutes, Volume 17, Article 6145	TX State Historical Survey Committee	Permit required for the examination or excavation of sites and the collection or removal of objects of antiquity.
Worker safety and health	No state-level legislation identified			
Savannah River Site, SC				
Air resources	South Carolina Pollution Control Act/South Carolina Air Pollution Control Regulations and Standards	SC Code, Title 48, Chapter 1	SC Dept. of Health and Environmental Control (SCDHEC)	Permit required prior to construction or modification of an air contaminant source.
	Augusta-Aiken Air Quality Control Region	40 CFR 81.114	SC and GA	Requires SRS and surrounding communities in the 2-state region to attain National Ambient Air Quality Standards (NAAQS).
	South Carolina Atomic Energy & Radiation Control Act	SC Code, Title 13, Chapter 7	SCDHEC	Establishes standards for radioactive air emissions.
Water resources	South Carolina Pollution Control Act	SC Code, Title 48, Chapter 1	SCDHEC	Permit required prior to construction or modification of a water discharge source.
	South Carolina Water Quality Standards	SC Code, Title 61, Chapter 68	SCDHEC	Permit required prior to construction or modification of a water discharge source.
	South Carolina Safe Drinking Water Act	SC Code, Title 44, Chapter 55	SCDHEC	Establishes drinking water standards.
Hazardous wastes and soil resources	South Carolina Underground Storage Tanks Act	SC Code, Title 44, Chapter 2	SCDHEC	Permit required prior to construction or modification of an underground storage tank.
	South Carolina Solid Waste Regulations	SC Code, Title 61, Chapter 60	SCDHEC	Permit required to store, collect, dispose, or transport solid wastes.

	South Carolina Industrial Solid Waste Disposal Site Regulations	SC Code, Title 61, Chapter 66	SC Pollution Control Authority	Permit required for industrial solid waste disposal systems.
	South Carolina Hazardous Waste Management Act	SC Code, Title 44, Chapter 56	SCDHEC	Permit required to operate, construct, or modify a hazardous waste treatment, storage, or disposal facility.
	South Carolina Solid Waste Management Act	SC Code, Title 44, Chapter 96	SCDHEC	Establishes standards to treat, store, or dispose of solid waste.
Biotic resources	South Carolina Nongame and Endangered Species Conservation Act	SC Code, Title 50, Chapter 15	SC Wildlife and Marine Resources Department	Consult with SC Wildlife and Marine Resources Department and minimize impact.
Cultural resources	South Carolina Institute of Archaeology and Anthropology	SC Code, Title 60, Chapter 13-210	SC State Historic Preservation Office	Consult with SC State Historic Preservation Office and minimize impact.
Worker safety and health	No state-level legislation identified	NA	NA	NA

5.4 Federal and State Environmental Enforcement

Under various Federal environmental statutes (table 5.3-1), EPA may delegate the implementation and execution of the laws' various provisions to states with approved programs that are at least as stringent as the minimum Federal requirements contained in the laws and EPA regulations. Table 5.3-4 lists many of the states' laws and regulations, including provisions that are more stringent than the minimum requirements. In addition, the *Federal Facility Compliance Act* of 1992 waives sovereign immunity from enforcement of the *Resource Conservation and Recovery Act* (RCRA) at Federal facilities and thereby gives states the authority to assess fines and penalties under certain conditions. It further requires DOE to develop plans and enter into agreements with states as to specific management actions for particular mixed waste streams. Such agreements could have a direct effect on the wastes generated as a result of the implementation of the proposed action, yet such an effect cannot be determined until such time as these agreements are approved according to the terms of the *Federal Facility Compliance Act* .

Some environmental regulatory programs are enforced through review, approval, and permitting requirements that attempt to minimize the negative impacts from releases to the environment from potential pollution sources by limiting activities to established standards. Federal and state agencies share environmental regulatory authority over DOE facility operations when Federal legislation delegates permitting or review authority to qualifying states. Some examples are the following: National Emission Standards for Hazardous Air Pollutants and the Prevention of Significant Deterioration under the *Clean Air Act* ; the Water Quality Standards and the National Pollutant Discharge Elimination System under the *Clean Water Act* ; the Hazardous Waste Programs under RCRA; and the Drinking Water and Underground Injection Control Programs under the *Safe*

Drinking Water Act . When Federal legislation allows delegation of enforcement authority, states must set standards equal to or more stringent than those required by Federal law to obtain such authority. Where the Federal regulatory agency has delegated its authority, the state or local regulations set the governing standards; however, when Federal legislation does not provide for delegation of enforcement authority to the states (e.g., the *Toxic Substances Control Act*), the standards are administered and enforced solely by the Federal Government.

5.5 Compliance with Occupational Safety and Health Requirements

The health and safety of all workers associated with the stockpile stewardship and management facilities is a primary consideration in the programmatic decision resulting from this PEIS. A comprehensive nuclear and occupational safety and health initiative was announced by the Secretary on May 5, 1993, entailing closer consultation with the Occupational Safety and Health Administration (OSHA) regarding regulation of worker safety and health at DOE contractor-operated facilities. Regulation of worker health and safety at DOE contractor-operated facilities will gradually shift from DOE to OSHA. The Occupational Safety and Health Act of 1970 (Public Law 91-596) establishes Federal requirements for ensuring occupational safety and health protection for employees. DOE facilities also comply with the Emergency Planning and Community Right-To-Know Act (42 USC §11001), which requires facilities to report the release of extremely hazardous substances and other specified chemicals; to provide material safety data sheets or lists thereof; and to provide estimates of the amounts of hazardous chemicals onsite. The reporting and emergency preparedness requirements are designed to protect both individuals and communities.

CHAPTER 6: REFERENCES

ORDERS AND REGULATIONS

10 CFR 20 Nuclear Regulatory Commission (NRC), "Energy: Standards for Protection Against Radiation," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, January 1, 1995.

10 CFR 61 NRC, "Energy: Licensing Requirements for Land Disposal of Radioactive Waste," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, January 1, 1995.

10 CFR 835 U.S. Department of Energy, (DOE), "Energy: Occupational Radiation Protection," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, January 1, 1995.

10 CFR 1021 DOE, "Energy: Compliance with the National Environmental Policy Act," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, January 1, 1995.

36 CFR 60 National Park Service, "National Register of Historic Places," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 50 Environmental Protection Agency (EPA), "Protection of the Environment: National Primary and Secondary Ambient Air Quality Standards," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 52 EPA, "Protection of the Environment: Approval and Promulgation of Implementation Plans," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 61 EPA, "Protection of the Environment: National Emission Standards for Hazardous Air Pollutants," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 81 EPA, "Protection of the Environment: Designation of Areas for Air Quality Planning Purposes," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 141 EPA, "Protection of the Environment: National Primary Drinking Water Regulations," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 143 EPA, "Protection of the Environment: National Secondary Drinking Water Regulations," Code of Federal Regulations, Office of the Federal Register, National Archives and

Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 190 EPA, "Protection of the Environment: Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 268 EPA, "Protection of the Environment: Land Disposal Restrictions," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 300 EPA, "Protection of the Environment: National Oil and Hazardous Substances Pollution Contingency Plan," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 433 EPA, "Protection of Environment--Effluent Guidelines and Standards: Metal Finishing Point Source Category," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 503 EPA, "Protection of Environment: Standards for the Use or Disposal of Sewage Sludge," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1500 Council on Environmental Quality (CEQ), "Protection of the Environment: Purpose, Policy and Mandate," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1501 CEQ, "Protection of the Environment: NEPA and Agency Planning," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1502 CEQ, "Protection of the Environment: Environmental Impact Statement," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1503 CEQ, "Protection of the Environment: Commenting," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1504 CEQ, "Protection of the Environment: Predecision Referrals to the Council of Proposed Federal Actions Determined to be Environmentally Unsatisfactory," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1505 CEQ, "Protection of the Environment: NEPA and Agency Decision Making," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration,

U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1506 CEQ, "Protection of the Environment: Other Requirements of NEPA," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1507 CEQ, "Protection of the Environment: Agency Compliance," Code of Federal Regulations,Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

40 CFR 1508 CEQ, "Protection of the Environment: Terminology and Index," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, Revised July 1, 1995.

49 CFR Subchapter C Department of Transportation, "Transportation--Hazardous Materials Regulations," Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, October 1, 1994.

50 CFR 17.11 U.S. Fish and Wildlife Service (FWS), "Endangered and Threatened Wildlife and Plants--Endangered and Threatened Wildlife," Code of Federal Regulations, Fish and Wildlife Service, U.S. Department of the Interior, Washington, DC, October 31, 1995.

50 CFR 17.12 FWS, "Endangered and Threatened Wildlife and Plants--Endangered and Threatened Plants," Code of Federal Regulations, Fish and Wildlife Service, U.S. Department of the Interior, Washington, DC, October 31, 1995.

56 FR 33050 EPA, "National Primary Drinking Water Regulations; Radionuclides," Federal Register, Vol. 56, No. 138, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, July 18, 1991.

58 FR 16268 DOE, "Radiation Protection of the Public and the Environment," Federal Register, Vol. 58, No. 56, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, March 25, 1993.

60 FR 28680 DOE, "Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs," Federal Register, Vol. 60, No. 105, June 1, 1995.

60 FR 29914 FWS, "Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Mexican Spotted Owl," Federal Register, Vol, 60, No. 108, June 6, 1995.

60 FR 31291 DOE, "Notice of Intent to Prepare a Stockpile Stewardship and Management Programmatic Environmental Impact Statement," Federal Register, Vol. 60, No. 114, June 14, 1995.

61 FR 7596 FWS, "Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates for Listing as Endangered or Threatened Species," Federal Register, Vol. 61, No. 40, February 28, 1996.

61 FR 9441 DOE, "Programmatic Spent Nuclear Fuel Management and Idaho National Engineering

Laboratory Environmental Restoration and Waste Management Programs," Federal Register, Vol. 61, No. 47, March 8, 1996.

DOE Order 5400.5 DOE, "Radiation Protection of the Public and the Environment, Office of Environment, Safety and Health, Washington, DC, January 7, 1993.

PL 101-615 Public Law 101-615--101st Cong. 2d sess., "Hazardous Materials Transportation Uniform Safety Act of 1990," Amended November 16, 1990.

PL 102-484 Public Law 102-484--102d Cong. 2d sess., "National Defense Authorization Act for Fiscal Year 1993," October 23, 1992.

PL 103-160 Public Law 103-160--103d Cong. 1st sess., "National Defense Authorization Act of 1994," November 3, 1993.

GENERAL

AD 1990a Schneider, J.S., D.H. Moore, and R.W. Sagebiel, "Early Diagnosis of Cutaneous Malignant Melanoma at Lawrence Livermore National Laboratory," Arch Dermatol, 967-969, 1990.

AEC 1968a Casarett, A.P., Radiation Biology, prepared under the direction of the American Institute of Biological Science for the Division of Technical Information United States Atomic Energy Commission, Prentice Hall, Inc., Englewood Cliffs, NJ, 1968.

AEH 1981a Polednak, A.P., "Mortality Among Welders, Including a Group Exposed to Nickel Oxides," Archives of Environmental Health, Vol. 36, pp 235-241, 1981.

AEH 1987a Archer, V. E., "Association of Nuclear Fallout with Leukemia in the United States," Archives of Environ Health, Vol. 42, No. 5, pp 263-271, 1987.

AJE 1987c *Machado, S.G., C.E. Land, and F.W. McKay , "Cancer Mortality and Radioactive Fallout in Southwestern Utah," American Journal of Epidemiology* , Vol. 125, No. 1, pp 44-61, The Johns Hopkins University School of Hygiene and Public Health, Baltimore, MD, 1987.

AJE 1988a Checkoway, H., N. Pearce, D.J. Crawford-Brown, and D.L. Cragle, "Radiation Doses and Cause-Specific Mortality Among Workers at a Nuclear Materials Fabrication Plant," American Journal of Epidemiology, Vol. 127, No. 2, pp 255-266, The Johns Hopkins University School of Hygiene and Public Health, Baltimore, MD, 1988.

AJE 1990a Gilbert, E.S., S.A. Fry, L.D. Wiggs, G.L. Voelz, D.L. Cragle, and G.R. Petersen, "Methods for Analyzing Combined Data from Studies of Workers Exposed to Low Doses of Radiation," American Journal of Epidemiology, Vol. 131, pp 917-927, 1990.

AJIM 1988a Carpenter, A.V., W.D. Flanders, E.L. Frome, W.G. Tankersley, and S.A. Fry, "Chemical Exposures and Central Nervous System Cancers: A Case-Control Study Among Workers at Two Nuclear Facilities," American Journal of Industrial Medicine, Vol. 13, pp. 351-362, Alan R. Liss, Inc., 1988.

AJIM 1988b Cragle, D.L., R.W. McLain, J.R. Qualters, J.L.S. Hickey, G.S. Wilkinson, W.G.

Tankersley, and C.C. Lushbaugh, "Mortality Among Workers at a Nuclear Fuels Production Facility," American Journal of Industrial Medicine, Vol. 14, pp 379-401, Alan R. Liss, Inc., 1988.

AJIM 1993a Wing, S., C.M. Shy, J.L. Wood, S. Wolf, D.L. Cragle, W. Tankersley, and E.L. Frome, "Job Factors, Radiation and Cancer Mortality at Oak Ridge National Laboratory: Follow-Up Through 1984," American Journal of Industrial Medicine, Vol 23, pp 265-279, Wiley-Liss, Inc., 1993.

AJIM 1995a Broadwell, D.K., D.J. Darcey, H.K. Hudnell, D.A. Otto, and W.K. Boyes, "Work-Site Clinical and Neurobehavioral Assessment of Solvent-Exposed Microelectronics Workers," American Journal of Industrial Medicine, Vol. 27, pp. 677-698, 1995.

AJIM 1996a Loomis, D.P. and S.H. Wolf, "Mortality of Workers at a Nuclear Materials Production Plant at Oak Ridge, Tennessee, 1947-1990," American Journal of Industrial Medicine, Vol. 29, pp 131-141, 1996.

AJM 1974a Rallison, M.L., B.M. Dobyns, F.R.eating, J.E. Rall, and F.H. Tyler, "Thyroid Disease in Children," American Journal of Medicine, Vol. 56, pp 457-463, 1974.

AJPH 1971a Weiss, E.S., M.L. Rallison, W.T. London, G.D.C. Thompson, "Thyroid Nodularity in Southwestern Utah School Children Exposed to Fallout Radiation," American Journal Public Health, pp 241-249, 1971.

AJPH 1987a Carpenter, A.V., W.D. Flanders, E.L. Frome, P.Cole, and S.A. Fry, "Brain Cancer and Nonoccupational Risk Factors: A Case-Control Study Among Workers at Two Nuclear Facilities," American Journal of Public Health, Vol. 77, No. 9, pp. 1180-1182, September 1987.

Almanac 1993a The 1993 Information Please Almanac Atlas and Yearbook, Houghton Mifflin Company, 46th Edition, Boston, MA, 1993.

AN 1988a Albers, J.W., et al, "Neurological Abnormalities Associated with Remote Occupational Elemental Mercury Exposure," Annals of Neurology, Vol. 24, pp 651-659, 1988.

ANL 1993b Yuan, Y.C., et al., RISKIND--A Computer Program for Calculating Radiological Consequences and Health Risks from Transportation of Spent Nuclear Fuel, ANL/EAIS-6, Argonne National Laboratory, Argonne, IL, 1993.

ANL 1995a:1 Argonne National Laboratory (ANL), "Comments of the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," (Version 3 and later), Argonne, IL, 1995.

ANL 1995b ANL, Preliminary Draft Technical Support Material for the National Ignition Facility Project Specific analysis -- Formally the NIF PSA Appendices, Ver. 1, Environmental Assessment Division, Argonne, IL, 1995.

AOEH 1992a Cragle, D.L., S.M. Wells, and W.G. Tankersley, "An Occupational Morbidity Study of a Population Potentially Exposed to Epoxy Resins, Hardeners and Solvents," Applied Occupational and Environmental Hygiene, Vol. 7, pp 826-834, 1992.

APCA 1986a Schulman, L.L., and S.R. Hanna, "Evaluation of Downwash Modifications to the

Industrial Source Complex Model," Journal of the Air Pollution Control Association, prepared by Environmental Research and Technology, Inc., Concord, MA for Air Pollution Control Association, 1986.

APHA 1988a Wiggs, L.D., C.A. Weber, and E.T. Lee, "Suicide Mortality Among Female Nuclear Industry Workers," 116th Annual Meeting of the American Public Health Association and Related Organizations Technology and Health Problems and Promise, prepared by Los Alamos National Laboratory and University of Oklahoma, Health Sciences Center for the American Public Health Association, Washington, DC, November 13-17, 1988.

BJIM 1985a Checkoway, H., R.M. Mathew, C.M. Shy, J.E. Watson, Jr., W.G. Tankersley, S.H. Wolf, J.C. Smith, and S. A. Fry, "Radiation, Work Experience, and Cause Specific Mortality Among Workers at an Energy Research Laboratory," British Journal of Industrial Medicine, Vol. 42, pp 525-533, 1985.

CA DFG 1994a California Department of Fish and Game, Special Animals, State of California, The Resources Agency, Natural Heritage Division, Natural Diversity Data Base, Sacramento, CA, August 1994.

CA DFG 1995a California Department of Fish and Game, Endangered and Threatened, Animals of California, State of California, The Resources Agency, Natural Heritage Division, Natural Diversity Data Base, Sacramento, CA, October 1995.

CA DFG 1995b California Department of Fish and Game, Endangered, Threatened, and Rare Plants of California, State of California, The Resources Agency, Natural Heritage Division, Plant Conservation Program, Sacramento, CA, September 1995.

CA DFG 1995c California Department of Fish and Game, Special Plants List, State of California, The Resources Agency, Natural Heritage Division, Natural Diversity Data Base, Sacramento, CA, October 1995.

CA DHS 1995a California Department of Health Services, Cancer Incidence Among Children and Young Adults in Livermore, California 1960-1991, Environmental Health Investigations Branch, September 6, 1995.

CA EPA 1993a California Environmental Protection Agency Air Resources Board, California Air Quality Data, Summary of 1993 Air Quality Data, Gaseous and Particulate Pollutants, Vol. XXV, Sacramento, CA, 1993.

Census 1982c Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--South Carolina, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1982.

Census 1982d Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--Tennessee, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1982.

Census 1982f Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--Missouri, U.S. Department of Commerce, Economics and

Statistical Administration, Washington, DC, August 1982.

Census 1982j Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--Georgia, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1982.

Census 1982o Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--New Mexico, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1982.

Census 1982u Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--Kansas, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1982.

Census 1982v Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--Texas, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1982.

Census 1982w Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--Nevada, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1982.

Census 1982y Bureau of the Census, 1980 Census of Population and Housing Summary of Population and Housing Characteristics--California, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1982.

Census 1983b Bureau of the Census, 1980 Census of Population Characteristics of the Population General Social and Economic Characteristics--South Carolina, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1983.

Census 1983c Bureau of the Census, 1980 Census of Population Characteristics of the Population General Social and Economic Characteristics--Georgia, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1983.

Census 1983g Bureau of the Census, 1980 Census of Population Characteristics of the Population General Social and Economic Characteristics--New Mexico, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1983.

Census 1983q Bureau of the Census, 1980 Census of Population Characteristics of the Population General Social and Economic Characteristics--Tennessee, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1983.

Census 1990a Bureau of the Census, County and City Data Book, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, 1990.

Census 1991a Bureau of the Census, 1990 Census of Population and Housing Summary Population and Housing Characteristics--Georgia, 1990 CPH-1-12, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1991b Bureau of the Census, 1990 Census of Population and Housing Summary Population and Housing Characteristics--South Carolina, 1990 CPH-1-42, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1991c Bureau of the Census, 1990 Census of Population and Housing Summary Population and Housing Characteristics--Tennessee, 1990 CPH-1-44, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1991f Bureau of the Census, 1990 Census of Population and Housing Summary Population and Housing Characteristics--Missouri, 1990 CPH-1-27, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1991g Bureau of the Census, 1990 Census of Population and Housing Summary Population and Housing Characteristics--Nevada, 1990 CPH-1-30, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1991h Bureau of the Census, *1990 Census of Population and Housing Summary Population and Housing Characteristics--New Mexico,* 1990 CPH-1-33, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1991j Bureau of the Census, *1990 Census of Population and Housing Summary Population and Housing Characteristics--California,* 1990 CPH-1-6, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1991m Bureau of the Census, 1990 Census of Population and Housing Summary Population and Housing Characteristics--Texas, 1990 CPH-1-45, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1991ff Bureau of the Census, 1990 Census of Population and Housing Summary Population and Housing Characteristics--Kansas, 1990 CPH-1-18, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1991.

Census 1993a Bureau of the Census, "1992 Population Estimates for States, Counties, MCD's and Incorporated Places," (Database), U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, 1993.

Census 1993b Bureau of the Census, 1990 Census of Population Social and Economic Characteristics--Tennessee, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1993c Bureau of the Census, 1990 Census of Population Social and Economic Characteristics--South Carolina, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1993e Bureau of the Census, 1990 Census of Population Social and Economic Characteristics--Georgia, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1993f Bureau of the Census, 1990 Census of Population Social and Economic Characteristics--Arizona, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1993m Bureau of the Census, 1990 Census of Population Social and Economic Characteristics--New Mexico, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1993q Bureau of the Census, 1990 Census of Population Social and Economic Characteristics--Missouri, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1993s Bureau of the Census, 1990, Census of Population and Housing Summary Tape File, Database (A3), Department of Commerce, Washington, DC, 1993.

Census 1993t Bureau of the Census, *1990 Census of Population Social and Economic Characteristics--Kansas,* U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1993.

Census 1993w Bureau of the Census, *1990 Census of Population Social and Economic Characteristics--Texas,* U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, August 1993.

Census 1993x Bureau of the Census, *1990 Census of Population Social and Economic Characteristics--California,* U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1993y Bureau of the Census, *1990 Census of Population Social and Economic Characteristics--Nevada,* U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1993z Bureau of the Census, *1990 Census of Population Social and Economic Characteristics--Utah,* U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, September 1993.

Census 1994o Bureau of the Census, County and City Data Book 1994, U.S. Department of Commerce, Economics and Statistical Administration, Washington, DC, 12th Edition, August 1994.

DOC 1982a Cottman, J.L., C.A. von Hake (Editors), Earthquake History of the United States, prepared by U.S. Department of Commerce, National Oceanic and Atmospheric Administration and U.S. Department of the Interior, Geological Survey, Boulder, CO, 1982.

DOC 1990c U.S. Department of Commerce, *BEA Regional Projections to 2040, Volume 3: BEA Economic Areas,* Projections Branch, Regional Economic Analysis Division, Bureau of Economic Analysis, October 1990.

DOC 1990d U.S. Department of Commerce, *BEA Regional Projections to 2040, Volume 1: States,* Projections Branch, Regional Economic Analysis Division, Bureau of Economic Analysis, June

1990.

DOC 1994j Campbell, P. R., Population Projections for States, by Age, Sex, Race and Hispanic Origin: 1993-2020, P2S-1111, U.S. Department of Commerce, Economics and Statistics Administration, Washington, DC, 1994.

DOC 1995a Bureau of Economic Analysis, REIS - Regional Economic Information System 1969 - 1993 (CD-ROM), U.S. Department of Commerce, Economics and Statistics Administration, Bureau of Economic Analysis, Regional Economic Measurement Division, Washington, DC, May 1995.

DOD 1962a Glasstone, S. (Editor), The Effects of Nuclear Weapons, U.S. Department of Defense and U.S. Atomic Energy Commission, Washington, DC, Revised Edition, 1962.

DOD 1977a Glasstone, S. and P.J. Dolan (Editors), The Effects of Nuclear Weapons, U.S. Department of Defense and U.S. Department of Energy, Washington, DC, Third Edition, 1977.

DOE 1985a DOE, Department of Energy National Environmental Research Parks, DOE/ER-0246, Office of Energy Research, Office of Health & Environmental Research, Washington, DC, August 1985.

DOE 1985b Robinette, C. D., S. Jablon, and T. L. Preston, Studies of Participants in Nuclear Tests, September 1, 1978 through October 31, 1984, Final Report, DOE/EV/01577, work performed under Contract DE-AI08-78EV01577 by Medical Follow-up Agency, National Research Council, for the U.S. Department of Energy, Washington, DC, 1985.

DOE 1991h Martin Marietta Energy Systems (MMES), Integrated Data Base for 1991: U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, DOE/RW-0006, Revision 7, prepared under Contract DE-AC05-84OR 21400 by Oak Ridge National Laboratory for the U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Office of Environmental Restoration and Waste Management, Washington, DC, October 1991.

DOE 1991j DOE, Nuclear Weapons Complex Reconfiguration Site Evaluations, A Report by the Nuclear Weapons Complex Reconfiguration Site Evaluation Panel, Predecisional, U.S. Department of Energy Field Office, San Francisco, CA, October 1991.

DOE 1992c DOE, Implementation Plan Nuclear Weapons Complex Reconfiguration Programmatic Environmental Impact Statement, DOE/EIS-0161IP, prepared by Office of Defense Programs, Deputy Assistant Secretary for Weapons Complex Reconfiguration, Washington, DC, February 1992.

DOE 1992e DOE, Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, Volume 1: Section 1-10, DOE/NP-0014, U.S. Department of Energy, Office of New Production Reactors, Washington, DC, September 1992.

DOE 1992f ORNL, Integrated Data Base for 1992: U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, DOE/RW-0006, Revision 8, prepared under Contract DE-AC05-84OR 21400 by Oak Ridge National Laboratory for the U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Office of Environmental Restoration and Waste Management, Washington, DC, October 1992.

DOE 1992o:3 DOE, "Hazardous Materials Shipments for Selected Sites--Times and Distance," computer printout, information provided from U.S. Department of Energy Albuquerque Field Office, Transportation Safeguards Division, Transportation Management Branch, Oak Ridge, TN, March 23, 1992.

DOE 1993e DOE, Environmental Restoration and Waste Management Five-Year Plan, Fiscal Years 1994-1998, DOE/S-00097PVol.1, Volume 1, U.S. Department of Energy, Washington, DC, January 1993.

DOE 1993h DOE, U.S. Department of Energy Interim Mixed Waste Inventory Report: Waste Streams, Treatment Capacities and Technologies, DOE/NBM-1100, Volume V: Site Specific--Tennessee through Washington, U.S. Department of Energy, Washington, DC, April 1993.

DOE 1993j DOE, Nonnuclear Consolidation Environmental Assessment Nuclear Weapons Complex Reconfiguration Program, DOE/EA-0792, Volume 1, U.S. Department of Energy, Washington, DC, June 1993.

DOE 1993n:7 DOE, "Compilation of Doses to Workers at DOE Facilities in 1992," U.S. Department of Energy, Washington, DC, 1993.

DOE 1994c ORNL, Integrated Data Base for 1993: U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, DOE/RW-0006, Revision 9, prepared under Contract DE-AC05-84OR 21400 by Oak Ridge National Laboratory, Managed by Martin Marietta Energy Systems, Inc., for the U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Office of Environmental Restoration and Waste Management, Washington, DC, March 1994.

DOE 1994d ORNL, Integrated Data Base for 1993: U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, DOE/RW-0006, Revision 10, prepared under Contract DE-AC05-84OR 21400 by Martin Marietta Energy Systems, Inc., for the U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Office of Environmental Management, Washington, DC, December 4, 1994.

DOE 1994k ICF Incorporated, "Final Phase II Mixed Waste Inventory Report (Database)," prepared by ICF Incorporated, Arlington, VA, U. S. Department of Energy, Patricia Bubar, Director, EM-25, Federal Facility Compliance, Task Force, Office of Waste Management, Environmental Management, Washington, DC, May 14, 1994.

DOE 1994n Martin Marietta Energy Systems (MMES), "Waste Management Information System (Database)," Version 2.0, prepared under Contract DE-AC05-84OR214 Hazardous Waste Remedial Action Program for the U.S. Department of Energy, Oak Ridge Reservation, Oak Ridge, TN, March 1994.

DOE 1994s Kelly, D.L., User's Guide for Shipping Type B Quantities of Radioactive and Fissile Material, Including Plutonium, in DOT-6M Specification Packaging Configurations, DOE/RL-94-68, prepared by Westinghouse Hanford Company, Richland, WA, for the U.S. Department of Energy, Transportation Management Division, Office of Environmental Management, September 1994.

DOE 1994v DOE, Comparative Study of Waste Isolation Pilot Plant (WIPP) Transportation

Alternatives, DOE/WIPP 93-058, U.S. Department of Energy, Washington, DC, February 1994.

DOE 1995h Dixson, A.L., "Shipment Mobility/Accountability Collection System (Database)," request for information provided by Andrew L. Dixson, Science Applications International Corporation, Oak Ridge, TN for the U.S. Department of Energy (EM-561), Washington, DC, 1995.

DOE 1995i DOE, Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling, DOE/EIS-0161, Volume 1, Office of Reconfiguration, U.S. Department of Energy, Washington, DC, October 1995.

DOE 1995p DOE, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, DOE/EIS-0203-F, Volume 1, Appendix C, Office of Environmental Management, Idaho Operations Office, U.S. Department of Energy, Idaho Falls, ID, April 1995.

DOE 1995q DOE, Estimating the Cold War Mortgage, the 1995 Baseline Environmental Management Report, DOE/EM-0232, Volume II: Site Summaries, March 1995.

DOE 1995w DOE, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, DOE/EIS-0203-F, Volume 1, Appendix F, Office of Environmental Management, Idaho Operations Office, U.S. Department of Energy, Idaho Falls, ID, April 1995.

DOE 1995cc DOE, *Waste Management Draft Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste,* DOE/EIS-0200-D, *Volume I of IV, U.S. Department of Energy, Office of Environmental Management, Washington, DC,* August 1995.

DOE 1995gg DOE, *1995 National Mixed Waste Inventory Report (Database),* Office of Waste Management and Office of Environmental Restoration, U.S. Department of Energy, Washington, DC, November 8, 1995.

DOE 1995hh DOE, *Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement,* DOE/EIS-0228, U.S. Department of Energy, Albuquerque Operations Office, Los Alamos Area Office, Albuquerque, NM, August 1995.

DOE 1995kk ORNL, Integrated Data Base for 1994: U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, DOE/RW-0006, prepared under Contract DE-AC05-84OR 21400 by Martin Marietta Energy Systems, Inc., for the U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Office of Environmental Management, Washington, DC, Revision 11, November 29, 1995.

DOE 1996a DOE, Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement, DOE/EIS-0229-D, Volume I, U.S. Department of Energy, Office of Fissile Materials Disposition, Washington, DC, February 1996.

DOE 1996h DOE, Medical Isotopes Production Project: Molybdenum-99 and Related Isotopes Environmental Impact Statement, DOE/EIS-0249F, Volume I, U.S. Department of Energy, Office of

Nuclear Energy, Science and Technology, Washington, DC, April 1996.

DOE 1996j DOE, Analysis of Stockpile Management Alternatives in Support of the Stockpile Stewardship and Management Programmatic Environmental Impact Statement, U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, NM, July 1996.

DOE 1996k DOE, Analysis of Stockpile Management Preferred Alternatives Report in support of the Stockpile Stewardship and Management Programmatic Environmental Impact Statement, U.S. Department of Energy, Washington, DC, July 1996.

DOE 1996m DOE, Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement, DOE/EIS-0240, U.S. Department of Energy, Office of Fissile Materials Disposition, Washington, DC, June 1996.

DOL 1991a DOL, Local Area Unemployment Statistics Annual Averages for 1990, Bureau of Labor Statistics, Washington, DC, 1991.

DOL 1995a DOL, Local Area Unemployment Statistics Annual Averages for 1994, Bureau of Labor Statistics, Washington, DC, May 18, 1995.

ED 1982a Johnson, C.J., "Environmental and Health Effects of the Nuclear Industry and Nuclear Weapons: A Current Evaluation," *Ecology of Disease,* prepared by Carl J. Johnson, Department of Preventative Medicine and Biometrics, University of Colorado School of Medicine, Denver, Co, Pergamon Press Ltd., Great Britain, 1982.

EPA 1977a EPA, User's Manual For Single Source (CRSTER) Model, EPA-450/2-77-013, Office of Air and Waste Management, Office of Air Quality Planning and Standards, Research Triangle Park, NC, July 1977.

EPA 1981a Bowers, J. F., and A. J. Anderson, An Evaluation Study for the Industrial Source Complex (ISC) Dispersion Model, EPA-450/4-81-002, prepared under Contract 68-02-3323 Work No. 5 by H. E. Cramer Company, Inc., Salt Lake City, UT, for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Source Receptor Analysis Branch, Research Triangle Park, NC, January 1981.

EPA 1981b Bogen and Goldin, Population Exposure to External Natural Radiation Background in the United States, PB81-233082, Office of Radiation Programs, Environmental Protection Agency, Washington, DC, April 1981.

EPA 1982a Bowers, J.F., A. J. Anderson, and W. R. Hargraves, Tests of the Industrial Source Complex (ISC) Dispersion Model at the Armco Middletown, Ohio, Steel Mill, EPA-450/4-82-006, prepared under Contract 68-02-3323 by H. E. Cramer Company, Inc., University of Utah Research Park, Salt Lake City, UT for U.S. Environmental Protection Agency, Source Receptor Analysis Branch, Research Triangle Park, NC, February 1982.

EPA 1992f EPA, User's Guide for the Industrial Source Complex (ISC2) Dispersion Models, EPA-450/4-92-008a, Volume I - User Instructions, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Technical Support Division, Research Triangle Park, NC, March 1992.

Epidemiology 1993a Hiatt, R.A., N. Krieger, R.W. Sagebiel, W.H. Clark, and M.C. Mihm, "Surveillance Bias and the Excess Risk of Malignant Melanoma Among Employees of the Lawrence Livermore National Laboratory," Epidemiology, pp 43-47, 1993.

Epidemiology 1995a Dupree, E.A., J.P. Watkins, J.N. Ingle, P.W. Wallace, C.M. West, and W.G. Tankersley, "Lung Cancer Risk and Uranium Dust Exposure in Four Uranium Processing Operations," Epidemiology, Vol. 6, pp 370-375, 1995.

EPRI 1983a TRC Environmental Consultants, Inc., Overview, Results, and Conclusion for the EPRI Plume Model Validation and Development Project: Plains Site, Research Project 1616-1, EPRI-EA-3074, prepared for Electric Power Research Institute, Palo Alto, CA, May 1983.

EPRI 1985a TRC Environmental Consultants, Inc., Summary of Results and Conclusions for the EPRI Plume Model Validation and Development Project: Moderately Complex Terrain Site, Research Project 1616-1, EPRI-EA-3755, prepared for Electric Power Research Institute, Palo Alto, CA, May 1985.

EPRI 1988a TRC Environmental Consultants, Inc., Urban Power Plant Plume Studies, Research Project 2736-1, EPRI-EA-5463, prepared for Electric Power Research Institute, Palo Alto, CA, January 1988.

ER 1980a Polednak, A.P., "Mortality Among Men Occupationally Exposed to Phosgene in 1943-1945," Environmental Research, Vol. 22, pp 357-367, Medical and Health Sciences Division, Oak Ridge Associated Universities, Oak Ridge, TN, Academic Press, Inc., 1980.

ER 1981a Stebbings, Jr., J.H. and G.L. Voelz, "Morbidity and Mortality in Los Alamos County, New Mexico," *Environ Research, Vol. 25, pp 86-105, Academic Press, Inc.,* 1981.

ESRI 1995a Environmental Systems Research Institute, "ArcView Version 2.1," Socioeconomic regional economic area and region of influence maps, 1995.

FEMA 1983a Federal Emergency Management Agency, "Flood Insurance Rate Map City of North Las Vegas, Nevada," Washington, DC, 1983.

GRI 1992a Gale Research, Inc., Weather of U.S. Cities, Detroit, MI, 4th Edition, 1992.

GTI 1995a Geo Trans, Inc., A Fracture/Porous Media of Tritium Transport in the Underground Weapons Testing Areas: Nevada Test Site, Boulder, CO, 1995.

HNUS 1995a Halliburton NUS Corporation, Health Risk Data for Tritium Supply and Recycling Programmatic EIS, prepared for the U. S. Department of Energy, DP-43, Washington, DC, February 1995.

HNUS 1996a *Maltese, J.G., W.E. Joyce, A.L. Toblin, and S.R. Tammara, Supporting Documentation for the Accident Impacts Presented in the Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management, Topical Report, HNUS Report No. ARP-96-042, Halliburton NUS Corporation, Gaithersburg, MD, July 1996.*

HP 1983c Acquavella, J.F., G. Wilkinson, G. Tietjen, C. Key, J. Stebbings, and G. Voelz, "A Melanoma Case Control Study at the Los Alamos National Laboratory," Health Physics, Vol. 45, No. 3. pp 587-592, September 1983.

HP 1985a Acquavella, J.F., L.D. Wiggs, R.J. Waxweiler, D.G. MacDonell, G.L. Tietjan, and G.S. Wilkinson, "Mortality Among Workers at the Pantex Weapons Facility," Health Physics, Vol. 48. No. 6, pp 735-746, 1985.

HP 1990c Rallison, M.L., T.M. Lotz, M. Bishop, W. Divine, K. Haywood, J.L. Lyon, and W. Stevens, "Cohort Study of Thyroid Disease Near the Nevada Test Site: A Preliminary Report," Health Physics, Vol. 59, No. 5, pp 739-746, Health Physics Society, Pergamon Press, November 1990.

HP 1991a Voelz, G.L. and J.N.P. Lawrence, "A 42-y Medical Follow-Up of Manhattan Project Plutonium Workers," Health Physics, Vol. 61, No. 2, pp. 181-190, August 1991.

HP 1994a Wiggs, L.D., E.R. Johnson, C.A. Cox-DeVore, and G.L. Voelz, "Mortality Through 1990 Among White Male Workers at the Los Alamos National Laboratory. Considering Exposures to Plutonium and External Ionizing Radiation," Health Physics, Vol. 67, pp 577-588, 1994.

HP 1995a Till, J.E., S.L. Simon, R. Kerber, et al., "The Utah Thyroid Cohort Study: Analysis of the Dosimetry Results," Health Physics, Vol. 68, pp 472-483, 1995.

IARC 1984a Cragle, D.L., D.R. Hollis, T.H Newport, and C.M. Shy, "A Retrospective Cohort Mortality Study Among Workers Occupationally Exposed to Metallic Nickel Powder at the Oak Ridge Gaseous Diffusion Plant," Nickel in the Human Environment, IARC Scientific Publications No. 53, Editorial Board: F.W. Sunderman, Jr. Editor-in-Chief, A. Aitio, A. Berlin, C. Bishop, E. Buringh, W. Davis, M. Gounar, P.C. Jacquignon, E. Mastromatteo, J.P. Rigaut, C. Rosenfeld, R. Saracci, and A. Sors. International Agency for Research on Cancer, Lyon, Oxford University Press, New York, 1984.

ICBO 1994a 1994 Uniform Building Code© *1994. Reproduced with the permission of the publisher, the International Conference of Building Officials.*

ICRP 1991a *Smith, H. (Editor), 1990 Recommendations of the International Commission on Radiological Protection, Annals of the ICRP, ICRP Publication 60, published for The International Commission on Radiological Protection by Pergamon Press, NY, 1991.*

JAMA 1975a *Rallison, M.L., B.M. Dobyns, F.R. Keating, J.E. Rall, and F.H. Tyler, "Thyroid Nodularity in Children," Journal of the American Medical Association, Vol. 233, pp 1069-1072, 1975.*

JAMA 1980a *Caldwell, G.G., D.B. Kelley, C.W. Heath, Jr., Journal of the American Medical Association, Vol. 244, No. 14, pp 1575-1578, October 3, 1980.*

JAMA 1983a *Caldwell, G.G., D. Kelley, M. Zack, H. Falk, C.W. Heath, Jr., "Mortality and Cancer Frequency Among Military Nuclear Test (Smoky) Participants, 1957 through 1979," Journal of the American Medical Association , Vol. 250, No. 5, pp 620-624, August 5, 1983.*

JAMA 1984a *Caldwell, G.G., D.B. Kelley, C.W. Heath, Jr., and M. Zack, "Polycythemia Vera Among Participants of a Nuclear Weapons Test," Journal of the American Medical Association, Vol. 252, No. 5, pp 662-664, August 3, 1984.*

JAMA 1984b *Johnson, C.J., "Cancer Incidence in an Area of Radioactive Fallout Downwind from the Nevada Test Site," Journal of the American Medical Association, Vol. 251, No. 2, pp 230-236, January 13, 1984.*

JAMA 1991a *Journal of American Medical Association, Vol. 265, No. 11, pp 1397-1402, 1403-1408, March 20, 1991.*

JAMA 1993a *Kerber, R.A., J.E. Till, S.L. Simon, J.L. Lyon, D.C. Thomas, S. Preston-Martin, M.L. Rallison, R.D. Lloyd, and W.Stevens, "A Cohort Study of Thyroid Disease in Relation to Fallout From Nuclear Weapons Testing," Journal of American Medical Association, Vol. 271, No. 17, pp 2076-2082, November 3, 1993.*

JAMA 1994a *Dworkin, H.J., "Nuclear Weapons Testing Fallout and Thyroid Disease," Journal of American Medical Association, Vol. 271, No. 11, pp 825-826, March 16, 1994.*

JAMA 1994b *Lapp, R.E., "Nuclear Weapons Testing Fallout and Thyroid Disease," Journal of the American Medical Association, Vol. 271, No. 11, p. 826, March 16, 1994.*

JOM 1979a *Hadjimichael, C.C., A.M. Ostfeld, D.A. D'Atri, et al., "A Long-Term Mortality Study of Workers Occupationally Exposed to Metallic Nickel at the Oak Ridge Gaseous Diffusion Plant," Journal of Occupational Medicine, Vol. 21, pp 799-806, 1979.*

JOM 1981a *Polednak, A.P. and E.L. Frome, "Mortality Among Men Employed Between 1943 and 1947 at a Uranium-Processing Plant," Journal of Occupational Medicine, Vol. 23, No. 3, pp 169-178, March 1981.*

JOM 1984a *Cragle, D.L., D.R. Hollis, J.R. Qualters, W.G. Tankersley, and S.A. Fry, "A Mortality Study of Men Exposed to Elemental Mercury," Journal of Occupational Medicine, Vol. 26, No. 11, pp 817-821, November 1984.*

JOM 1987a *Carpenter, A.V., W.D. Flanders, E.L. Frome, D.J. Crawford-Brown, and S.A. Fry, "CNS Cancers and Radiation Exposure: A Case-Control Study Among Workers at Two Nuclear Facilities," Journal of Occupational Medicine, Vol. 29, No. 7, 601-604, July 1987.*

JRSS 1989a *Gardner, M.J., "Review of Reported Increase of Childhood Cancer in the Vicinity of Nuclear Installations in the United Kingdom," JR Stat Sec A, Vol. 152, No. pp 307-325, 1989.*

KC ABA 1986a *Allied Bendix Aerospace, Kansas City Plant Site Development Plan, BDX-613-2976R, Technical Communications, Bendix Kansas City Division, U.S. Department of Energy, Kansas City, MO, Revised December 1986.*

KC ASAC 1991a *Allied Signal Aerospace Company (ASAC), Annual Site Environmental Report for Calendar Year 1990, KCP-613-4578, U.S. Department of Energy, Kansas City, MO, May 1991.*

KC ASI 1995a *Allied Signal Inc., (ASI), KCP II, Complex 2010 Stockpile Stewardship and Management Programmatic Environmental Impact Statement Nonnuclear Alternative Data Report, Kansas City Division, August 4, 1995.*

KC City 1995a *"Statistical City Data for Regional Economic Area/Region of Influence, Kansas City Plant," Kansas City, MO, 1995.*

KC County 1995a *"Statistical County Data for Regional Economic Area/Region of Influence, Kansas City Plant," Kansas City, MO, 1995.*

KC DOE 1989a *DOE, Environmental Assessment Environmental Restoration Program Kansas City Plant, Kansas City, Missouri, DOE/AL, March 1989.*

KC DOE 1990a *DOE, Environmental Assessment Completion of Flood Protection Works Bannister Road Federal Complex Kansas City, Missouri, prepared by Planning Division, Environmental Resources Branch, U.S. Department of Energy, Kansas City Plant, Kansas City, MO, September 1990.*

KC DOE 1995a *ASI., 1994 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1 , prepared for the U.S. Department of Energy, Kansas City Area Office, October 23, 1995.*

KC School 1995a *"Statistical Data for Regional Economic Area/Region of Influence, Kansas City Plant," Kansas City, MO, 1995.*

KC USGS 1975a *USGS, "Geological Survey Grandview Quadrangle--Missouri," 1:24 000, Revised 1975.*

KCP 1991a:1 *ASAC, "No Action Alternative Datacall," PEIS request for information provided by Kansas City Plant, Kansas City, MO, November 1991.*

KCP 1991a:2 *ASAC, "No Action Alternative--Water Resources," PEIS request for information provided by Kansas City Plant, Kansas City, MO, November 1991.*

KCP 1991a:3 *ASAC, "No Action Alternative--Biological Resources," PEIS request for information provided by Kansas City Plant, Kansas City, MO, November 1991.*

KCP 1993a:1 *Jeffries, J.E. (Site Contact), "Comments--Nonnuclear Consolidation Environmental Assessment," PEIS request for information provided by Allied Signal Aerospace Company, U.S. Department of Energy, Kansas City Division, Kansas City, MO, to T.Uko, Reconfiguration Manager, Kansas City Area Office, Kansas City, MO, February 26, 1993.*

KCP 1995a:1 *KCP, "Affected Environment: No Action Data Call Response," Kansas City Plant response to the draft Affected Environment section provided to site representatives by the U.S. Department of Energy, April 1995.*

KCP 1995a:2 *KCP, "Data Resolution Comments," compilation of correspondence with Kansas City Plant clarifying in the Nonnuclear Alternative Data Package (KC ASI 1995a), 1995.*

KCP 1995a:3 *KCP and Albuquerque Operations Office, "Comments on Draft Versions of the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," (Version 3 and later), 1995.*

KCP 1995a:4 *Gentile, C., "Kansas City Plant RCRA Part B Permit Application," PEIS request for information provided by Allied Signal, Inc., Kansas City Plant, Kansas City, MO, October 9, 1995.*

LA BLM 1990a *USGS, "Surface Management Status Los Alamos, New Mexico, 1:100 000-Scale Metric Topographic Map," 10x60 quadrangle, edited and published by the Bureau of Land Management, 1990.*

LA City 1995a *"Statistical City Data for Regional Economic Area/Region of Influence, Los Alamos National Laboratory," Los Alamos, NM, 1995.*

LA County 1995a *"Statistical County Data for Regional Economic Area/Region of Influence, Los Alamos National Laboratory," Los Alamos, NM, 1995.*

LA DOE 1979a *DOE, Final Environmental Impact Statement, Los Alamos Scientific Laboratory Site, Los Alamos, New Mexico, DOE/EIS-0018, Washington, DC, December 1979.*

LA NERP 1981a *White, G.C., Biotelemetry Studies on Elk, LA-8529-NERP, Los Alamos National Laboratory, Los Alamos, NM, 1981.*

LA School 1995b *"Statistical School Data for Regional Economic Area/Region of Influence, Los Alamos National Laboratory," Los Alamos, NM, 1995.*

LA USDA 1987c *USDA, Santa Fe National Forest Plan, Forest Service, South Western Region, Santa Fe National Forest, Santa Fe, NM, July 1987.*

LA USDA 1990a *USDA, "New Mexico State and Federal Natural Resource Recreation Map," Forest Service, Army Corps of Engineers; Interior Bureau of Land Management, Fish and Wildlife Service, National Park Service and State of New Mexico Departments of Game and Fish; Parks and Recreation; and Tourism and Travel Division, 1990.*

LA Wiggs 1987a *Wiggs, L.D., "Mortality Among Females Employed by the Los Alamos National Laboratory: An Epidemiologic Investigation," Doctoral dissertation, University of Oklahoma, 1987.*

Lancet 1981a *Austin, D.F., P.J. Reynolds, M.A. Snyder, M.W. Biggs, and H.A. Stubbs, "Malignant Melanoma Among Employees of Lawrence Livermore National Laboratory," Lancet, Vol. 2, pp. 712-716, 1981.*

Lancet 1982a *Acquavella, J.F., G.S. Wilkinson, G.L. Tietjen, Key, C.R., and G.L. Voelz, "Malignant Melanoma Incidence at the Los Alamos National Laboratory," The Lancet, pp 883-884, April 17, 1982.*

Lancet 1987a *Schneider, J.S., R.W. Sagebiel, D.H. Moore, and G.M. Lawton, "Melanoma Surveillance and Earlier Diagnosis," The Lancet, p 1435, 1987.*

LANL 1984a *Purtymun, W. D., Hydrologic Characteristics of the Main Aquifer in the Los Alamos Area: Development of Ground Water Supplies, LA-9957-MS, UC-11, prepared under Contract W-7405-ENG-38 by Los Alamos National Laboratory, Los Alamos, NM, January 1984.*

LANL 1985a *Voelz, G.L., G.S. Wilkinson, J.W. Healy, J.F. McInroy, G.L. Tietjen, "Mortality Study of Los Alamos Workers with Higher Exposures to Plutonium," Report No. LA-UR-83-85, Los Alamos National Laboratory, 1985.*

LANL 1987a *LANL, "Maps Area 3, Technical Sites, Los Alamos and White Rock, Los Alamos,", Visitor's Guide, Los Alamos National Laboratory, NM, 1987.*

LANL 1987b *LANL, Environmental Surveillance at Los Alamos During 1986, LA-10992-ENV, Environmental Surveillance Group, Las Alamos National Laboratory, Los Alamos, NM, April 1987.*

LANL 1987c *Gardner, J.N., and L. House, Seismic Hazards Investigations at Los Alamos National Laboratory, 1984 to 1985, LA-11072-MS, prepared by Los Alamos National Laboratory, Los Alamos, NM, October 1987.*

LANL 1990a *LANL, 1989 Waste Management Site Plan, Los Alamos National Laboratory, Los Alamos, NM, March 1990.*

LANL 1990b *LANL, 1990 Site Development Plan Technical Site Information, LA-CP-90-405, Facility Engineering Division Planning Group, ICF Kaiser Engineers, Inc., Los Alamos, NM and Royston Hanamoto Alley and Abey, Mt. Valley, CA, September 1990.*

LANL 1991a *LANL, "Structural Location Maps," Facility Engineering Division, Los Alamos National Laboratory, Los Alamos, NM, 1991.*

LANL 1991b:6 *LANL, "Employee Residential Distribution," PEIS request for information provided by S. L. Coonley, Site Contact, U. S. Department of Energy, Los Alamos National Laboratory, Los Alamos, NM, November 1991.*

LANL 1992a:6 *Seay, G., LANL Site Contact, unpublished material, 1992.*

LANL 1992c *Travis, J.R., Atlas of the Breeding Birds of Los Alamos County, New Mexico, LA-12206, Los Alamos National Laboratory, Los Alamos, NM, October 1992.*

LANL 1993b *LANL, Environmental Surveillance at Los Alamos During 1991, LA-12572-ENV, UC-902, prepared by Los Alamos National Laboratory, Los Alamos, NM, August 1993.*

LANL 1994a *LANL, Environmental Surveillance at Los Alamos During 1992, LA-12764-ENV, prepared by Los Alamos National Laboratory, Los Alamos, NM, July 1994.*

LANL 1994b *LANL, Standard Data Report 1993 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1, prepared by Los Alamos National Laboratory for the U. S. Department of Energy, Office of Environmental Management, Waste Minimization Division, EM-334, November 4, 1994.*

LANL 1995a *LANL, Proposed Site Treatment Plan for Mixed Waste, Los Alamos National Laboratory, Los Alamos, NM, March 24, 1995.*

LANL 1995b:1 *LANL, "Affected Environment: No Action Data Call Response," LANL response to the draft Affected Environment section provided to site representatives by the U.S. Department of Energy, April 1995.*

LANL 1995b:3 *LANL, "Data Resolution Comments," compilation of correspondence with LANL clarifying data in the Nonnuclear, High Explosives, Secondary Manufacturing, and Pit Manufacturing Alternative Data Packages. (LANL 1995c; LANL 1995d LANL 1995e; LANL 1995g), 1995.*

LANL 1995b:4 *LANL and Albuquerque Operations Office, "Comments on Draft Versions of the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," (Version 3 and later), 1995.*

LANL 1995b:6 *Neal, T. (Program Manager), "Worker Dose for Pit Fabrication," PEIS request for information provided by Tim Neal, Materials and Process Technologies, Los Alamos National Laboratory, Los Alamos, NM, December 20, 1995.*

LANL 1995c *LANL, Stockpile Stewardship and Management Programmatic Environmental Impact Statement Alternative Report Nonnuclear Production at Los Alamos National Laboratory, LA-CP-95-184, compiled by the Los Alamos SSM PEIS Team, Los Alamos National Laboratory, Los Alamos, August 4, 1995.*

LANL 1995d *LANL, Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSM PEIS) Alternative Report High Explosives Production at Los Alamos National Laboratory, LA-CP-95-181, compiled by the Los Alamos SSM PEIS Team, Los Alamos National Laboratory, Los Alamos, August 4, 1995.*

LANL 1995e *Tubesing, P.K., R. A. Patterson, P.S. Dunn, S.R. Bingert, D.K. Korzekwa, Stockpile Stewardship and Management Programmatic Environmental Impact Statement Expanded Data Call Addendum to the Los Alamos Alternative for Secondary Manufacturing (LA-CP-95-108), LA-UR-95-2113, August 4, 1995.*

LANL 1995g *LANL, Stockpile Stewardship & Management Programmatic Environmental Impact Statement Expanded Data Call Addendum to the Alternative Report for Pit Manufacturing at Los Alamos National Laboratory, LA-UR-95-2670, prepared by members of the Los Alamos National Laboratory SSM PEIS Pit Working Team, September 12, 1995.*

LANL 1995i *Risberg, D., Draft Biological and Floodplain/Wetland Assessment for the Dual-Axis Radiographic Hydrodynamics Test Facility (DARHT), LAUR-95-649, Los Alamos National Laboratory, Los Alamos, NM, February 1995.*

LANL 1995j *Keller, D.C. and D. Risberg, Draft Biological and Floodplain/Wetland Assessment for the Dual-Axis Radiographic Hydrodynamics Test Facility (DARHT) , LAUR-95-647, Los Alamos National Laboratory, Los Alamos, NM, July 1995.*

LANL 1995r *LANL, Water Supply at Los Alamos During 1993, LA-12951-RP, Progress Report, prepared under contract W-7405-ENG-36 for the U.S. Department of Energy, October 1995.*

LANL 1995s *LANL, Environmental Surveillance at Los Alamos During 1993 , LA-12973-ENV, prepared by Los Alamos National Laboratory, Los Alamos, NM, October 1995.*

LANL 1995t *LANL, Los Alamos National Laboratory Institutional Plan FY 1996-2001, Los Alamos National Laboratory, Los Alamos, NM, October 1995.*

LANL 1996e:1 *LANL, "Comments on the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," DOE/EIS-0236, February 1996.*

LANL 1996e:2 *LANL, "Species of Interest Table 4.6-1 to the LANL Site Wide EIS Special Status Species Potentially Occurring on Los Alamos National Laboratory," 1996.*

LL City 1995a *"Statistical City Data for Regional Economic Area/Region of Influence, Lawrence Livermore National Laboratory," Livermore, CA, 1995.*

LL County 1995a *"Statistical County Data for Regional Economic Area/Region of Influence, Lawrence Livermore National Laboratory," Livermore, CA, 1995.*

LL DOE 1981a *Busby, C. I., D. M. Garaventa, and L. S. Kobori, A Cultural Resource Inventory of Lawrence Livermore National Laboratory's Site 300, Alameda and San Joaquin Counties, California, EPD-01055, prepared by Basin Research Associates, Inc., Hayward, CA for the University of California under Contract W-7405-ENG 48 with the Department of Energy, May 1981.*

LL DOE 1992c *DOE and University of California, Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore, DOE/EIS-0157, Volume I, prepared for U.S. Department of Energy, Washington, DC, August 1992.*

LL DOE 1992d *DOE and University of California, Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore, DOE/EIS-0157, Volume II, prepared for U.S. Department of Energy, Washington, DC, August 1992.*

LL School 1995b *"Statistical School Data for Regional Economic Area/Region of Influence, Lawrence Livermore National Laboratory," Livermore, CA, 1995.*

LL USDA 1966a *Welch, L.E., R.C. Huff, R.A. Dierking, T.D. Cook, L.A. Bates, and W.F. Andrews, Soil Survey of the Alameda Area California, U.S. Department of Agriculture, Soil Conservation Service, in cooperation with Washington Agricultural Experiment Station, 1966.*

LL USDA 1988a *USDA, Soil Survey Alameda Area, California, Soil Conservation Survey, 1988.*

LL USGS 1981a *USGS, "Altamont Quadrangle: 7.5 Minute Series Topographic Map," U.S. Geological Survey, U.S. Department of the Interior, 1981.*

LL USGS 1989a *USGS, "Stockton, California: 1:100 000-" 30x60 minute quadrangle, 37121-E1-TM-100, U.S. Department of Interior, 1989.*

LLNL 1983a *Raber, E. and D.W. Carpenter (Editors), An Evaluation of the Hydrogeology and Groundwater Chemistry Associated with Landfills at LLNL's Site 300 , UCRL-53416, Lawrence Livermore National Laboratory, University of California, Livermore, CA, June 1983.*

LLNL 1984a *Carpenter, D.W., J.J. Sweeney, P.W. Kasameyer, N.R. Burkhard, K.G. Knauss, and R.J. Shlemon, Geology of the Lawrence Livermore National Laboratory Site and Adjacent Areas, UCRL-53316, Lawrence Livermore National Laboratory, University of California, Livermore, CA, August 1984.*

LLNL 1984b *Austin, D.F. and P.J. Reynolds, "A Case-Control Study of Malignant Melanoma Among Lawrence Livermore National Laboratory Employees," Lawrence Livermore National Laboratory Report 1984, UCRL-15629, Lawrence Livermore National Laboratory, Livermore, CA, 1984.*

LLNL 1984c *Hiatt, R.A. and B. Fireman, Malignant Melanoma in the Kaiser Foundation Health Plan of Northern California: A Comparison of Incidence and Measures of Health Care Utilization Between the Lawrence Livermore National Laboratory and Surrounding Health Plan Groups, UCRL-15591 S/C 4787901, Department of Medical Methods Research, Kaiser Foundation Research Institute, Oakland, CA, February 1984.*

LLNL 1985a *Shy, C.M., H. Checkoway, and E.G. Marshall, "Malignant Melanoma at a Scientific Laboratory. A Synthesis of Reviewer's Comments on the Austin and Reynolds' Study of Employees at the Lawrence Livermore National Laboratory," UCRL-15737, Lawrence Livermore National Laboratory Report 1985, 1985.*

LLNL 1991b *LLNL, Site 300 Site Development Plan, UCRL-AR-106744, Livermore, CA, April 1991.*

LLNL 1991d *Carpenter, D.W., J.R. Copland, A.L. Lamarre, R.S. Mateik, M.J. Taffett, and W.M. Wade, Investigation of Holocene Faulting Near Closed Landfill Pit 6, Lawrence Livermore National Laboratory Site 300, UCRL-ID-106316, Environmental Protection, Environmental Restoration Series, by Science Applications International Corporation, Pleasanton, CA, Weiss Associates, Emeryville, CA, and Lawrence Livermore National Laboratory, University of California, Environmental Restoration Division, Livermore, CA, April 1991.*

LLNL 1992a:1 *Zahn, K., LLNL Site Contact, "Aquatic Resources," PEIS request for information provided by U.S. Department of Energy, Lawrence Livermore National Laboratory, Livermore, CA, May 4, 1992.*

LLNL 1992a:3 *Zahn, K., LLNL Site Contact, "Biotic Resources," PEIS request for information provided U.S. Department of Energy, Lawrence Livermore National Laboratory, Livermore, CA, 1992.*

LLNL 1993b *Wilt, G.C. (Editor), Environmental Report 1992, UCRL-50027-92, prepared by the U.S. Department of Energy, Lawrence Livermore National Laboratory, Livermore, CA, 1993.*

LLNL 1994a *Wilt, G. C. (Editor), Environmental Report 1993, UCRL-50027-93, prepared by the*

U.S. Department of Energy, Lawrence Livermore National Laboratory, Livermore, CA, September 1, 1994.

LLNL 1994e *Moore, D.H., H.W. Patterson, F. Hatch, D. Discher, J.S. Schneider, and D. Bennett, "Workplace Investigation of Increased Diagnosis of Malignant Melanoma Among Employees of Lawrence Livermore National Laboratory," Lawrence Livermore National Laboratory Report 1994, UCRL-LR-106723,Lawrence Livermore National Laboratory, Livermore, CA, 1994.*

LLNL 1995b *LLNL, 1993 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1, prepared by Lawrence Livermore National Laboratory, Livermore, CA, January 13, 1995.*

LLNL 1995c *LLNL Stockpile Stewardship and Management Programmatic Environmental Impact Statement for Manufacture of Canned Secondary Assemblies and Radiation Cases at Lawrence Livermore National Laboratory, Data Report, SST-95-06-002, Rev 2, August 4, 1995.*

LLNL 1995d *LLNL, Waste Management Plan FY1995 Update in Accordance with DOE Order 5820.2A, UCRL-AR-111731-95, prepared by Environmental Protection Department, Hazardous Waste Management Division, Lawrence Livermore National Laboratory, University of California, Livermore, CA, 1995.*

LLNL 1995e *LLNL, Stockpile Stewardship and Management Programmatic Environmental Impact Statement (PEIS) - Canned Secondary Assembly and Case Manufacturing Facility Data Report, SST 95-07-006, Rev. 1, July 17, 1995.*

LLNL 1995f *Spellman, G., Stockpile Stewardship and Management Programmatic Environmental Impact Statement Nonnuclear Working Group Nonnuclear Alternative Report, UCRL-PROP-121323 Final, proposal from Lawrence Livermore National Laboratory, Livermore, CA, August 4, 1995.*

LLNL 1995h *DOE, Federal Facility Compliance Act Proposed Site Treatment Plan for Lawrence Livermore National Laboratory, prepared for the State of California, California Environmental Protection Agency, Department of Toxic Substances Control, Hazardous Waste Management Program, Sacramento, CA by the U.S. Department of Energy, Oakland Operations Office, Oakland, CA, March 1995.*

LLNL 1995i:1 *LLNL, "Affected Environment: No Action Data Call Response," LLNL response to the draft Affected Environment section provided to site representatives by the U.S. Department of Energy, April 1995.*

LLNL 1995i:2 *LLNL, "Data Resolution Comments," compilation of correspondence with LLNL clarifying data in the Secondary Manufacturing, Nonnuclear, and High Explosives Alternative Data Packages, (LLNL 1995c; LLNL 1995f; LLNL 1995j), 1995.*

LLNL 1995i:3 *LLNL and Albuquerque Operations Office, "Comments on Draft Versions of the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," (Version 3 and later), 1995.*

LLNL 1995i:5 *LLNL, "Annual Emissions Estimate of Toxic Air Contaminants for LLNL, SNL-CA, and Site 300," PEIS request for information provided by Lawrence Livermore National Laboratory,*

Livermore, Ca, May 24, 1995.

LLNL 1995j *Kolb, J.R., R.L. Atkins, D. Loftus, C.O. Pruneda, and R.L. Simpson, High Explosives Input Data Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSMPEIS) LLNL Proposed Alternative, UCRL-PROP-121403, Lawrence Livermore National Laboratory, Livermore, CA, July 20, 1995.*

LLNL 1995k *LLNL, 1994 Site Development Plan, UCRL-LR-110253-94, Lawrence Livermore National Laboratory, Livermore, CA, 1995.*

LLNL 1995m *LLNL, National Ignition Facility Site Requirements, NIF-LLNL-93-089.L-116083-1, Lawrence Livermore National Laboratory, Livermore, CA, July 1995.*

LLNL 1995n *LLNL, Environmental Management Programmatic Environmental Impact Statement Affected Environment for Lawrence Livermore National Laboratory, Revision 2 Draft, Livermore, CA, May 24, 1995.*

LLNL 1995o *LLNL, Institutional Plan FY 1996 - 2001 Lawrence Livermore National Laboratory, UCAR-10076-14, University of California, Lawrence Livermore National Laboratory, Livermore, CA, October 1995.*

LLNL 1996i:2 *LLNL, "Comments on the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," DOE/EIS-0236, Lawrence Livermore National Laboratory, Livermore, CA, February 1996.*

LLNL1996i:3 *Kato, T., "Special Status Species List," Database, PEIS request for information provided by Lawrence Livermore National Laboratory, Livermore, CA, Revision 4, May 31, 1996.*

McNally 1985a *Handy Railroad Atlas of the United States, Rand McNally, 1985.*

McNally 1990a *Standard Highway Mileage Guide, Rand McNally and Company, 1990.*

MO DNR 1992a *Missouri Department of Natural Resources, "Acceptable Ambient Levels of Clean Air Act Air Toxics and SARA Title III Chemicals," June 15, 1992.*

MO DNR 1994a *Missouri Department of Natural Resources, "Missouri Air Quality Standards," Environment Reporter, 10 CSR 10-6.010, pp 3-4, Amended January 31, 1994.*

MO DNR 1995a *Missouri Department of Natural Resources, "Acceptable Ambient Levels for Missouri," Missouri Air Pollution Control Program, June 16, 1995.*

NAS 1972a *National Academy of Sciences and National Research Council, The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Report of the Advisory Committee on the Biological Effects of Ionizing Radiations, Division of Medical Sciences, 1972.*

NAS 1985a *National Academy of Sciences and National Research Council, Mortality of Nuclear Weapons Test Participants, National Academy Press, Washington, DC, 1985.*

NAS 1990a *Committee on the Biological Effects of Ionizing Radiations, Health Effects of Exposure*

to Low Levels of Ionizing Radiation BEIR V, Board of Radiation Effects Research, Commission on Life Sciences, National Academy of Sciences and National Research Council, National Academy Press, Washington, DC, 1990.

***NCDC 1995a** National Climatic Data Center, "National Weather Service Station Airways Surface Observations Digital Data for 1994," National Weather Station Database, Asheville, NC, 1995.*

***NCRP 1987a** National Council on Radiation Protection and Measurements, Ionizing Radiation Exposure of the Population of the United States, NCRP Report No. 93, Pergamon Press, Elmsford, NY, September 1, 1987.*

***NEJM 1979a** Lyon, J.L., M.R. Klauber, J.W. Gardner, and K.S. Udall, "Childhood Leukemias Associated with Fallout from Nuclear Testing," New England Journal of Medicine, Vol. 300, No. 8, pp 397-402, 1979.*

***NIOSH 1972a** Karches, G.J., J.R. Lynch, and J. Lucas, "Health Hazard Evaluation, Bendix Corporation, Kansas City, MO," Report No. HHE-72-22-31-34-24, Unique Identifier NIOSH/00027221, Health Evaluation Services Branch, NIOSH, Cincinnati, OH, 1972.*

***NIOSH 1990a** National Institute for Occupational Safety and Health, Pocket Guide to Chemical Hazards, Publication No. 90-117, prepared by the U.S. Department of Health and Human Services, Public Health Service Centers for Disease Control, National Institute for Occupational Safety and Health, Washington, DC, June 1990.*

***NM DGF 1990b** New Mexico Department of Game and Fish, Handbook of Species Endangered in New Mexico, Sante Fe, NM, 1990.*

***NM DGF 1995a** New Mexico Department of Game and Fish, New Mexican Wildlife of Special Concern, New Mexico Conservation Services Division, March 1995.*

***NM DOH 1993a** Athas, W.F. and C.R. Key, "Los Alamos Cancer Rate Study: Phase I, Cancer Incidence in Los Alamos County, 1970-1990," 1993.*

***NM DOH 1994a** Athas, W., "Continuation Application; Los Alamos Cancer Study, Project Year 4," New Mexico Department of Health, November 2, 1994.*

***NM DOH 1996a** Athas, W., "Investigation of Excess Thyroid Cancer Incidence in Los Alamos County," Draft Report, New Mexico Department of Health, 1996.*

***NM EIB 1995a** New Mexico Environmental Improvement Board, "Title 20: Environmental Protection, Chapter 2: Air Quality [Statewide], Part 72: Construction Permits," New Mexico Air Quality Control Regulations, Santa Fe, NM, November 30, 1995.*

***NM EIB 1996a** New Mexico Environmental Improvement Board, "Title 20: Environmental Protection, Chapter 2: Air Quality [Statewide], Part 3:Ambient Air Quality Standards," New Mexico Air Quality Control Regulations, Santa Fe, NM, January 10, 1996.*

***NM FRCD 1995a** Sivinski, R. and K. Lightfoot (Editors), Inventory of Rare and Endangered Plants of New Mexico, Miscellaneous Publication No. 4, New Mexico Forestry and Resources Conservation*

Division, Energy, Minerals and Natural Resources Department, Santa Fe, NM, Third Edition, August 1995.

NOAA 1994a *National Oceanic and Atmospheric Administration (NOAA), Local Climatological Data Annual Summaries for 1993, Part III--Central Region, National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Asheville, NC, 1994.*

NOAA 1994c *NOAA, Local Climatological Data Annual Summaries for 1993, Part II--Southern Region, National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Asheville, NC, 1994.*

NOAA 1994d *NOAA, Local Climatological Data Annual Summaries for 1993, Part IV--Western Region, National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Asheville, NC, 1994.*

NRC 1977b *NRC, Regulatory Guide 1.109 Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I, prepared by the Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, DC, October 1977.*

NRC 1986a *Ramsdell, J.V. and G.L. Andrews, Tornado Climatology of the Contiguous United States, NUREG/CR-4461, prepared by Pacific Northwest Laboratory, Richland, WA, for the U.S. Nuclear Regulatory Commission, Washington, DC, 1986.*

NRC 1987c *NRC, Paleontological Collecting, prepared by the Committee on Guidelines for Paleontological Collecting, Board on Earth Sciences, Commission on Physical Sciences, Mathematics, and Resources, National Research Council; National Academy Press, Washington, DC, 1987.*

NRC 1992a *NRC, Directory of Certificates of Compliance for Radioactive Materials Packages, NUREG-0383, Volume 2, Division of Safeguards and Transportation, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC, Revision 15, October 1992.*

NSC 1994a *National Safety Council, Accident Facts, Washington, DC, 1994 Edition.*

NT City 1995a *"Statistical City Data for Regional Economic Area/Region of Influence, Nevada Test Site," Las Vegas, NV, 1995.*

NT County 1993a *District Board of Health of Clark County, Air Pollution Control Regulations, Section 11--Ambient Air Quality Standards, Clark County, Las Vegas, NV, May 27, 1993.*

NT County 1995b *"Statistical County Data for Regional Economic Area/Region of Influence, Nevada Test Site," Las Vegas, NV, 1995.*

NT County 1995c:1 *Taipale, C., "Unpublished 1994 Air Monitoring Data Summaries," transmittal from Clark county Health District to M. Monarch, Argonne National Laboratory, Argonne IL, July 18, 1995.*

NT DOE 1983a *Bowen, J.L. and R.T. Egami, Atmospheric Overview for the Nevada Nuclear Waste Storage Investigations, Nevada Test Site, Nye County, Nevada, NVO-269, prepared under Contract DE-AC08-80NV 10162 by the Desert Research Institute for the U.S. Department of Energy, Las Vegas, NV, 1983.*

NT DOE 1986b *DOE, Environmental Assessment, Yucca Mountain Site, Nevada Research and Development Area, Nevada, DOE/RW-0073, Volume 1, U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Washington, DC, May 1986.*

NT DOE 1988a *DOE, Environmental Survey Preliminary Report, Nevada Test Site, Mercury, Nevada, DOE/EH/OEV-15-P, prepared by Environment, Safety and Health, Office of Environmental Audit, Washington, DC, April 1988.*

NT DOE 1988d *Hunter, R.B. and P.A. Medica, Status of the Flora and Fauna on the Nevada Test Site, 1988, DOE/NV/10630-29, Nevada Operations Office, Las Vegas, NV, 1988.*

NT DOE 1988e *Shroba, R.R., D.R. Muhs, and J.N. Rosholt, Physical Properties and Radiometric Age Estimates of Surficial and Fracture-Fill Deposits Along a Portion of the Carpetbag Fault system, Nevada Test Site, Nye County, Nevada, DOE/NV/10583-1, prepared under Interagency Agreement DE-AI08-86NV10583 by the U.S. Geological Survey for the Nevada Operations Office, U.S. Department of Energy, Las Vegas, NV, July 1988.*

NT DOE 1989a *Chapman, J.B., Classification of Groundwater at the Nevada Test Site, prepared under Contract DE-AC08-85NV10384 by Water Resources Center, Desert Research Institute University of Nevada System prepared for the U.S. Department of Energy, Nevada Operations Office, Las Vegas, NV, January 1989.*

NT DOE 1991b *McDowell, E.M. and S.C. Black (Editors), U.S. Department of Energy Nevada Operations Office Annual Site Environmental Report--1990, DOE/NV/10630-20, Volume 1, prepared by Reynolds Electrical & Engineering Company, Inc., Las Vegas, NV, under Contract DE-AC08-89NV10630 for U.S. Department of Energy, Nevada Operations Office, Las Vegas, NV, September 1991.*

NT DOE 1992b *Sadler, W.R., M.E. Campana, R.L. Jacobson, and N.L. Ingraham, A Deuterium-Calibrated, Discrete-State Compartment Model of Regional Groundwater Flow, Nevada Test Site and Vicinity, DOE/NV/10845-09, prepared by Water Resources Center, Desert Research Institute, University of Nevada System, for the U.S. Department of Energy, March 1992.*

NT DOE 1992d *Black, S.C., A.R. Latham and Y.E. Townsend, (Editors), U.S. Department of Energy Nevada Field Office Annual Site Environmental Report--1991, DOE/NV/10630-33, Volume 1, prepared under Contract DE-AC08-89NV 10630, by Reynolds Electrical & Engineering Company, Inc., Las Vegas, for the U.S. Department of Energy, Nevada Field Office, Las Vegas, NV, September 1992.*

NT DOE 1993b *DOE, Technical Information Package Proposal for Reconfiguration of Nuclear Weapons Complex at the Nevada Test Site--Environment, Safety & Health, Volume 4, submitted by the U.S. Department of Energy, Nevada Operations Office, to the U.S. Department of Energy, Deputy Assistant Secretary, Office Weapons Complex Reconfiguration, Washington, DC, September 15,*

1993.

NT DOE 1993e *Black, S.C., A.R. Latham, and Y.E. Townsend, (Editors), U.S. Department of Energy Nevada Field Office Annual Site Environmental Report - 1992, DOE/NV/10630-66 UC-600, prepared under Contract DE-AC08-89NV10630 by Reynolds Electrical & Engineering Co., Inc., Las Vegas, NV 89193-8521 for the U.S. Department of Energy, Nevada Operations Office, September 1993.*

NT DOE 1994b *Reynolds Electrical & Engineering Co., Inc., U.S. Department of Energy Nevada Field Office Annual Site Environmental Report--1993, DOE/NV/11432-123, Volume 1, prepared for the U.S. Department of Energy, Nevada Operations Office, NV, September 1994.*

NT DOE 1994d *DOE, Nevada Test Site Development Plan, Las Vegas, NV, September 21, 1994.*

NT DOE 1994f *Reynolds Electrical & Engineering Co., Inc., 1993 Annual Report on Waste Generation and Waste Minimization Progress, Waste Management Division, U.S. Department of Energy, Nevada Operations Office, Las Vegas, NV, October 31, 1994.*

NT DOE 1994g *DOE, Nevada Site Development Plan, Part 2 North Las Vegas and Remote Sensing Laboratory Sites, Las Vegas, NV, 1994.*

NT DOE 1995b *Raytheon Services Nevada, SSM PEIS Assembly/Disassembly Nevada Test Site Alternative, Volumes 1 and 2, August 4, 1995.*

NT DOE 1995f *Raytheon Services Nevada, SSM PEIS Pit Reuse Nevada Test Site Alternative, August 4, 1995.*

NT DOE 1995g *DOE, Environmental Assessment for Construction of the Proposed Nevada Support Facility at the U.S. Department of Energy North Las Vegas Facility, DOE/EA-0955, January 1995.*

NT DOE 1995i *Greger, O.D., "Status of Horses, Deer, and Birds on the Nevada Test Site," Draft Status of the Flora and Fauna on the Nevada Test Site, DOE/NV.11432-195, Reynolds Electrical Engineering Co., Inc., Las Vegas, NV, 1995.*

NT DOE 1995j *Reynolds Electrical & Engineering Co., Inc., 1994 Baseline Biological Studies for the Device Assembly Facility at the Nevada Test Site, DOE/NV/11432-177, UC-600, prepared for the U.S. Department of Energy, Las Vegas, NV, February 1995.*

NT DOE 1996b *DOE, Nevada Test Site Site Treatment Plan and Federal Facility Compliance Act Consent Order, DOE/NV-397, prepared by the U.S. Department of Energy, Nevada Operations Office, Las Vegas, NV, Revision 2, March 1996.*

NT DOE 1996c *DOE, Final Environmental Impact Statement for the Nevada Test Site and Off-site Locations in the State of Nevada, DOE/EIS 0243, Volume 1, 1996.*

NT DOI 1991a *Hallock, L.L., "Ash Meadows and Recovery Efforts for its Endangered Aquatic Species," Endangered Species Technical Bulletin, Vol. XVI, No. 4, National Fisheries Research Center-Seattle, Reno, NV, Substation for U.S. Department of the Interior, Fish and Wildlife Service, April 1991.*

NT DOI 1992b *Harlow, D.L., Field Supervisor, "Biological Opinion on Nevada Test Site Activities," 1-5-91-F-225, PEIS request for information provided by David L. Harlow, U.S. Department of the Interior, Fish and Wildlife Service, Fish and Wildlife Enhancement, Reno Field Office, Reno, NV, May 20, 1992.*

NT DOI 1995a *Mendoza, C.H., "Listed Endangered and Threatened and Candidate Species that May Occur on the Nevada Test Site," 1-5-95-SP-264, PEIS request for information provided by Carlos H. Mendoza, State Supervisor, U. S. Department of the Interior, Fish and Wildlife Service, Nevada State Office, Reno, NV, June 23, 1995.*

NT EG&G 1987a *EG&G Energy Measurements, Site Survey, Nevada Test Site, 1987.*

NT EG&G 1991a *EG&G Energy Measurements, The Distribution and Abundance of Desert Tortoises on the Nevada Test Site, EGG 10617-2081, Santa Barbara Operations, Goleta, CA, January 1991.*

NT ERDA 1976a *O'Farrell, T.P. and L.A.Emery, Ecology of the Nevada Test Site: A Narrative Summary and Annotated Bibliography, NVO-167, prepared under Contract AT(29-2)-1253 by Applied Ecology & Physiology Center, Desert Research Institute, University of Nevada System, Boulder City, NV, for the U.S. Energy Research & Development Administration Nevada Operations, Modification 19, Nye County, NV, May 1976.*

NT ERDA 1977a *ERDA, Final Environmental Impact Statement Nevada Test Site Nye County, Nevada, ERDA-1551, UC-2,11, prepared by the U.S. Energy Research and Development Administration, September 1977.*

NT Greger 1992a *Greger, P.D., Bird List for the Nevada Test Site, Basic Environmental Compliance and Monitoring Program, University of California, Mercury, NV, 1992.*

NT Greger nda *Greger, P.D. and E.M. Romney, Wildlife Utilization of Natural Springs and Man-made Water Sources at the Nevada Test Site, BECAMP Objective 3 - Task 3 UCLA Laboratory of Biomechanical and Environmental Sciences, Mercury, NV, n.d.*

NT Hunter 1991a *Hunter, R., "Invasion on the Nevada Test Site: Present Status of Browus B.Tectorum with Notes on their Relationship to Disturbance and Altitude," Great Basin Naturalist, 1991.*

NT LLNL 1976a *Borg, I.Y., R. Stone, H.B. Levy and L.D. Ramspott, Information Pertinent to the Migration of Radionuclides in Ground Water at the Nevada Test Site Part 1: Review and Analysis of Existing Information, UCRL-52078 Pt. 1, prepared by Lawrence Livermore National Laboratory, University of California, Livermore, CA, May 25, 1976.*

NT LVVWD 1994a *Avon, L. and T.J. Durbin, Hydrologic Evaluation of Recent Water-Level Decline at Devil's Hole, Cooperative Water Project Report No. 12, Las Vegas Valley Water District, Las Vegas, NV, 1994.*

NT NPS 1983a *National Park Service, "Great Basin Timber Mountain Caldera, Nye County, Nevada," Natural Landmark Brief, compiled by the Wildlife and Vegetation Division, U.S.*

Department of the Interior, September 1983.

NT REECO 1990a *Engineering-Science, Project Report of Air Quality Study at the Nevada Test Site, Mercury, Nevada, report prepared under Task Order 30-CUC-01-0, submitted to Reynolds Electrical and Engineering Co, Las Vegas, NV, November 30, 1990.*

NT REECO 1994a *Reynolds Electrical and Engineering Company, Inc., Site Book for Waste Management, prepared by Waste Operations Department, P. O. Box 98521, Las Vegas, NV, prepared for the U.S. Department of Energy, May 1994.*

NT REECO 1995a *Reynolds Electrical and Engineering Company, Inc., Waste Management Plan for the Nevada Test Site, prepared by Waste Operations Department, U. S. Department of Energy, Nevada Operations Office, Las Vegas, NV, February 1995.*

NT School 1995b *"Statistical School Data for Regional Economic Area/Region of Influence, Nevada Test Site," Las Vegas, NV, 1995.*

NT SNL 1986a *Long, J.W., Component Ground Motion at the Nevada Test Site from Pahute Mesa Underground Nuclear Explosions, SAND 86-0439, Sandia National Laboratories, Albuquerque, NM, 1986.*

NT USAF 1993a *USAF, Final Environmental Impact Statement Space Nuclear Thermal Propulsion Program Particle Bed Reactor Propulsion Technology Development and Validation, May 1993.*

NT USGS 1975a *Winograd, I.J., and W. Thordarson, Hydrogeologic and Hydrochemical Framework, South-Central Great Basin, Nevada-California, with Special Reference to the Nevada Test Site, Geological Survey Professional Paper 712-C, prepared on behalf of the U.S. Atomic Energy Commission, 1975.*

NT USGS 1988a *Harrill, J.R., J.S. Gates, and J.M. Thomas, Major Ground-Water Flow Systems in the Great Basin Region of Nevada, Utah, and Adjacent States, Hydrologic Investigations Atlas HA-694-C, U.S. Geologic Survey, Reston, VA, 1988.*

NT USGS 1994a *Laczniak, R.J., J.C. Cole, D.A. Sawyer, and D.A. Trudeau, Summary of Hydrogeologic Controls on Ground Water Flow at the Nevada Test Site, Nye County, Nevada, USGS WRIR 94-XXXX, U.S. Geological Survey, 1994.*

NTS 1990a:1 *Unknown, "Mammal List for the Nevada Test Site," Basic Environmental Compliance and Monitoring Program, April 25, 1990.*

NTS 1990a:2 *Unknown, "Reptile List for the Nevada Test," Basic Environmental Compliance and Monitoring Program, April 25, 1990.*

NTS 1991a:1 *NTS, "Employee Residential Distribution," PEIS Datacall, November 1991.*

NTS 1992a:6 *Elle, D.R. (Site Contact), "Biotic Resources of the Nevada Test Site," PEIS request for information provided by U.S. Department of Energy, Nevada Operations Office, Las Vegas, NV, February 19, 1992.*

NTS 1993a:4 *Raytheon Services Nevada, "No Action Data Package," PEIS request for information provided by George W. Kronsbein, Engineering Division, U.S. Department of Energy, Nevada Test Site, 1993.*

NTS 1995a:1 *NTS, "Affected Environment: No Action Data Call Response," Nevada Test Site response to the draft Affected Environment section provided to site representatives by the U.S. Department of Energy, April 1995.*

NTS 1995a:2 *NTS, "Data Resolution Comments," compilation of correspondence with Nevada Test Site clarifying data in the Assembly/Disassembly Alternative Data Package (NT DOE 1995b), 1995.*

NTS 1995a:3 *NTS and Albuquerque Operations Office, "Comments on Draft Versions of the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," (Version 3 and later), 1995.*

NTS 1995a:4 *Lazaroff, G., "National Ignition Facility Siting Proposal," request for information provided by EG&G, North Las Vegas Facility, Las Vegas, NV to C. Burke, Argonne National Laboratory, Argonne, IL, June 22, 1995.*

NTS 1995a:5 *White, R., request for information provided by Raytheon Services, Nevada Operations Office, Las Vegas, NV to F. Kirchner, Argonne National Laboratory, Argonne, IL, August 7, 1995.*

NTS 1996a:1 *NTS, "Comments on the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," DOE/EIS-0236, February 1996.*

Nuttli 1990a *Nuttli, O.W., The Effect of Earthquakes in the Central United States, Second Edition, Second Edition, Center for Earthquake Studies, Southeast Missouri State University, Cape Girardeau, MO, May 1990.*

NV DCNR 1992a *Nevada Department of Conservation and Natural Resources, Air Quality Operating Permits Issued to the U.S. Department of Energy Nevada Operations Office, Division of Forestry, Department of Conservation and Natural Resources, Carson City, NV, 1992.*

NV DCNR 1995a *Nevada Department of Conservation and Natural Resources, Nevada Administrative Code Chapter 445B Air Pollution, compiled by the State Environmental Commission in cooperation with the Division of Environmental Protection's Bureau of Air Quality, Carson City, NV, 1995.*

NV FWS 1989a *FWS, "Endangered, Threatened, and Sensitive Plants of Nevada," computer printout, U.S. Fish and Wildlife Service, Reno Field Station, Reno, NV, February 13, 1989.*

NV NHP 1995a *Nevada Natural Heritage Program, "Nevada's Sensitive Species," Carson City, NV, Revised July 31, 1995.*

OR City 1990a *City of Oak Ridge, "Land Use Plan," Area Maps, April 1990.*

OR City 1991a *City of Oak Ridge, "Land Use Plan--Oak Ridge Area, Oak Ridge, Tennessee," Maps, Revised, April 8, 1991.*

OR City 1995b *"Statistical City Data for Regional Economic Area/Region of Influence, Oak Ridge Reservation," Oak Ridge, TN, 1995.*

OR County 1995a *"Statistical County Data for Regional Economic Area/Region of Influence, Oak Ridge Reservation," Oak Ridge, TN, 1995.*

OR DOE 1987a *Martin Marietta Energy Systems (MMES), Environmental Surveillance of the U.S. Department of Energy Oak Ridge Reservation and Surrounding Environs During 1986, ES/ESH-1/V1, Volume 1, prepared under Contract DE-AC05-84OR 21400 by Environmental and Safety Activities and Environmental Management Staffs Oak Ridge Operations for the U.S. Department of Energy, Oak Ridge, TN, April 1987.*

OR DOE 1989a *MMES, Oak Ridge Reservation Site Development and Facilities Utilization Plan, DOE/OR-885, prepared under Contract DE-AC05-84OR 21400 for the U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN, June 1989.*

OR DOE 1990a *MMES, Oak Ridge Reservation Environmental Report for 1989, ES/ESH-13/V1, Volume 1, prepared under Contract DE-AC05-84OR21400 by the Office of Environmental Compliance Documentation and Environmental Management Staff for the U.S. Department of Energy, Oak Ridge, TN, October 1990.*

OR DOE 1991b *DOE, Oak Ridge Reservation Environmental Report for 1990, ES/ESH-18/V1, Volume 1, prepared under Contract DE-AC05-85OR 21400 by Environmental, Safety, and Health Compliance and Environmental Management Staff of the Oak Ridge Operations for the U.S. Department of Energy, Oak Ridge, TN, September 1991.*

OR DOE 1991c *DOE, Oak Ridge Reservation Nuclear Weapons Complex Reconfiguration Site Proposal, Executive Summary, Oak Ridge, TN, 1991.*

OR DOE 1991f *MMES, Oak Ridge Reservation Site Development and Facilities Utilization Plan 1990 Update, DOE/OR-885/R1, prepared under Contract DE-AC05-84OR 21400 by Site and Facilities Planning, for the U.S. Department of Energy, Oak Ridge Operations, Oak Ridge, TN, June 1991.*

OR DOE 1992c *DOE, Oak Ridge Reservation Environmental Report for 1991, ES/ESH-22/V1, Volume 1, prepared under Contract DE-AC05-84OR 21400 by Environmental, Safety and Health Compliance and Environmental Management Staffs of the Oak Ridge Y-12 Plant, Oak Ridge National Laboratory, and Oak Ridge K-25 Site, for the U.S. Department of Energy, Oak Ridge, TN, October 1992.*

OR DOE 1993a *DOE, Oak Ridge Reservation Environmental Report for 1992, ES/ESH-31/V1, Volume 1, prepared under Contract DE-AC05-84OR 21400 by Environmental, Safety and Health Compliance and Environmental Management Staffs of the Oak Ridge Y-12 Plant, Oak Ridge National Laboratory, and Oak Ridge K-25 Site, for the U.S. Department of Energy, Oak Ridge, TN, June 1993.*

OR DOE 1993b *DOE, Oak Ridge Reservation Environmental Report for 1992, ES/ESH-31/V2, Volume 2, prepared under Contract DE-AC05-84OR 21400 by Environmental, Safety and Health*

Compliance and Environmental Management Staffs of the Oak Ridge Y-12 Plant, Oak Ridge National Laboratory, and Oak Ridge K-25 Site, for the U.S. Department of Energy, Oak Ridge, TN, June 1993.

OR DOE 1993c *MMES, Tornado Special Study Report, ES/ESH-35, prepared under Contract DE-AC05-84OR 21400 by Martin Marietta Energy System for the U.S. Department of Energy, Oak Ridge, TN, June 14, 1993.*

OR DOE 1994a *DOE, Draft Site Treatment Plan for Mixed Wastes on the U.S. Department of Energy Oak Ridge Reservation, DOE/OR-2016/V1, DOE/OR-2016/V2, DOE/OR-2016/V3, August 1994.*

OR DOE 1994c *DOE, Oak Ridge Reservation Annual Site Environmental Report for 1993, ES/ESH-47, Volume 1, prepared under Contract DE-AC05-84OR 21400 by Environmental, Safety and Health Compliance and Environmental Management Staffs of the Oak Ridge Y-12 Plant, Oak Ridge National Laboratory, and Oak Ridge K-25 Site, for the U.S. Department of Energy, Oak Ridge, TN, November 1994.*

OR DOE 1994d *DOE, Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y-12 Plant, Oak Ridge, Tennessee, DOE/EA-0929, U.S. Department of Energy, Oak Ridge, TN, September 1994.*

OR DOE 1994f *MMES, Environmental Monitoring and Surveillance on the Oak Ridge Reservation: 1993 Data, ES/ESH-48, December 1994.*

OR DOE 1995e:1 *Trischman, S. (EM-321), "Low-Level Waste Disposal Assumption," memorandum from Program Manager, Oak Ridge/Chicago Operations Division, Office of Eastern Waste Management Operations Environmental Management to K. Gandee, MD-1, U.S. Department of Energy, Washington, DC, May 24, 1995.*

OR DOE 1995g *DOE, Proposed Site Treatment Plan for Mixed Waste on the U.S. Department of Energy Oak Ridge Reservation, DOE/OR-2030, Volumes 1 and 2, April, 1995.*

OR EG&G 1991a *Staub, W. P., Interim Report Y-12 Plant Generic Safety Analysis Report, Applied Physical Sciences Group, Energy Division, Oak Ridge National Laboratory, Oak Ridge, TN, September 30, 1991.*

OR FWS 1992b *Widlak, J., "Status Update on Possible Occurrence of Threatened and Endangered Species on the Oak Ridge Reservation," PEIS request for information provided by U.S. Fish and Wildlife Service, 1992.*

OR LMES 1995e *LMES, No Action Alternative and Phaseout Options for Long-Term Storage of Highly Enriched Uranium at the Oak Ridge Reservation, Y/ES-124, prepared by the Nuclear Materials Disposition Program Office, Y-12 Defense Programs, Lockeed Martin Energy Systems, Inc., Oak Ridge, TN for the U.S. Department of Energy, January 1995.*

OR LMES 1996i *Lockheed Martin Energy Systems (LMES), Stockpile Stewardship and Management Programmatic Environmental Impact Statement Data for the No Action and Phase-out Alternatives at the Oak Ridge Reservation, Y/ES-121/R1, Planning and Program Integration Office, Y-12 Plant*

Defense Programs, Oak Ridge, TN, July, 1996.

OR MMES 1993d *MMES, "Treatment, Storage, Disposal Unit Capability Report--Oak Ridge National Laboratory," Waste Management Information System (Database), Hazardous Waste Remedial Actions Program, Oak Ridge, TN, 1993.*

OR MMES 1993e *MMES, "Treatment, Storage, Disposal Unit Capability Report--Oak Ridge K-25 Site," Waste Management Information System (Database), Hazardous Waste Remedial Actions Program, Oak Ridge, TN, 1993.*

OR MMES 1993f *MMES, "Treatment, Storage, Disposal Unit Capability Report--Oak Ridge Y-12 Plant," Waste Management Information System (Database), Hazardous Waste Remedial Actions Program, Oak Ridge, TN, 1993.*

OR MMES 1995c *Energy Systems Waste Management Organization, Oak Ridge Reservation Waste Management Plan, ES/WM-30, prepared for U.S. Department of Energy, Office of Environmental Management, Environmental Restoration and Waste Management Programs, Oak Ridge, TN, February 1995.*

OR MMES 1996j *LMES, Stockpile Stewardship and Management Programmatic Environmental Impact Statement Y-12 Alternative Secondary Plant Design PEIS Data Report for Three Production Cases, Y/ES-076/R3, Planning and Program Integration Office, Y-12 Plant Defense Programs, Oak Ridge Reservation, Oak Ridge, TN, July, 1996.*

OR NERP 1991a *Cunningham, M. and L. Pounds, Resource Management Plan for the Oak Ridge Reservation Volume 28: Wetlands on the Oak Ridge Reservation, Volume 28, ORNL/NERP-5, prepared under Contract DE-AC05-84OR 21400 by Oak Ridge National Laboratory, for the Oak Ridge National Environmental Research Park, Environmental Sciences Division Publication No. 3765 Office of Health and Environmental Research, Oak Ridge, TN, December 1991.*

OR NERP 1993a *MMES, Pounds, L.R., P.D. Parr, and M.G. Ryon, Resource Management Plan for the Oak Ridge Reservation Volume 30: Oak Ridge National Environmental Research Park Natural Areas and Reference Areas - Oak Ridge Reservation Environmentally Sensitive Sites Containing Special Plants, Animals, and Communities, ORNL/NERP-8, prepared under Contract DE-AC05-84OR 21400 for Oak Ridge National Environmental Research Park, Office of Health and Environmental Research and Environmental Restoration Program, Program Interpretation and Administration, Regulatory Compliance Group, Oak Ridge, TN, 1993.*

OR NERP 1993b *Cunningham, M., L. Pounds, S. Oberholster, P. Parr, L. Edwards, B. Rosensteel, and L. Mann, Resource Management Plan for the Oak Ridge Reservation Volume 29: Rare Plants on the Oak Ridge Reservation, ORNL/NERP-7, Environmental Sciences Division Publication No. 4054, prepared under Contract DE-AC05-84OR 21400 by Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, for the Resource Management Organization and Oak Ridge National Environmental Research Park, Office of Health and Environmental Research, Oak Ridge, TN, August 1993.*

OR NERP nda *Parr, P. D. and J.W. Evans, Resource Management Plan for the Oak Ridge Reservation, unpublished Preliminary Draft, ORNL/NERP-6, prepared under Contract DE-AC05-84OR 21400 by Oak Ridge National Laboratory, Environmental Sciences Division, for the U.S.*

Department of Energy Oak Ridge, TN, n.d.

OR Robinson 1950a *Robinson, Jr., G.O., The Oak Ridge Story The Saga of People Who Share In History, Southern Publishers, Inc., Kingsport, TN, 1950.*

OR USGS 1986a *Lowery, J.F., P. H. Counts, H. L. Edmiston, and F. D. Edwards, Water Resources Data, Tennessee Water Year 1985, U.S. Geological Survey Water-Data Report TN-85-1, USGS/WRD/HD-86/21, prepared in cooperation with the Tennessee Department of Health and Environment, Office of Water Management; the Tennessee Valley Authority; and with other state, municipal and Federal agencies, TN, March 1986.*

ORNL 1981a *NUS, Environmental and Safety Report for Oak Ridge National Laboratory, ORNL-SUB-41B-38403C, NUS 3892, prepared by NUS Corporation Rockville, MD for the Oak Ridge National Laboratory, Oak Ridge, TN, September 30, 1981.*

ORNL 1981b *Loar, J.M., J.A. Solomon, and G.F. Cada, Technical Background Information for the ORNL Environmental and Safety Report: A Description of the Aquatic Ecology of White Oak Creek Watershed and the Clinch River Below Melton Hill Dam, Volume 2, Publication No. 1852, ORNL/TM-7509/V2, prepared by Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN, October 1981.*

ORNL 1982a *Fitzpatrick, F.C., Oak Ridge National Laboratory Site Data for Safety Analysis Reports, ORNL/ENG/TM-19, prepared under Contract W-7405-eng-26 by Union carbide Corporation, Nuclear Division, Oak Ridge National Laboratory for the U.S. Department of Energy, Oak Ridge, TN, 1982.*

ORNL 1984b *Kitchings, J.T. and J.D. Story, Resource Management Plan for U.S. Department of Energy, Oak RidgeReservation, ORNL-6026/V16, Volume 16, prepared under Contract DE-AC05-84OR 21400 by the Oak Ridge National Laboratory, Oak Ridge, TN, July 1984.*

ORNL 1986a *MMES, Environmental Surveillance of the Oak Ridge Reservation and Surrounding Environs During 1985, ORNL-6271, prepared under Contract DE-AC05-84OR 21400 by Environment, Safety, and Health, Martin Marietta Energy Systems, Inc., Oak Ridge, TN, April 1986.*

ORNL 1987a *Parr, P. D., and L. R. Pounds, Resource Management Plan for the Oak Ridge Reservation, Volume 23, ORNL/ESH-1/V23, prepared under DE-AC05-84OR 21400 by Martin Marietta Energy System, Inc., for U.S. Department of Energy, Oak Ridge, TN, May 1987.*

ORNL 1988b *Lietzke, D.A., S.Y. Lee, and R.E. Lambert, Soils, Surficial Geology, and Geomorphology of the Bear Creek Valley Low-Level Waste Disposal Development and Demonstration Program Site, Publication No. 3017, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN, 1988.*

ORNL 1988c *Cada G. F., R. L. Kroodsma, and P. D. Parr, Ecology of the Oak Ridge Reservation, ORNL/TM-10939/V1 and V2, Oak Ridge, TN, 1988.*

ORR 1991a:4 *MMES, "Historical/Future ORR & Y-12 Plant Employment," response to PEIS datacall by Martin Marietta Energy Systems, Inc., for the U.S. Department of Energy, Oak Ridge Operation, Oak Ridge, TN, November 1991.*

ORR 1991a:8 *Williams, C.K. (MMES Site Contact), "Meteorological and Climatological Data," PEIS request for information supplied by U.S. Department of Energy, Oak Ridge National Laboratory, Oak Ridge, TN, 1991.*

ORR 1992a:6 *Butz, T.R. (Site Contact), "Y-12 Plant Accident History," August 14, 1992.*

ORR 1993a:11 *Johnson, M., (MMES Site Contact), "TSCA Container and Tank Storage Building K-1435," PEIS request for information provided by Mike Johnson, K-25 Martin Marietta, Oak Ridge, TN, November 11, 1993.*

ORR 1995a:1 *ORR, "Affected Environment: No Action Data Call Response," Oak Ridge Reservation response to the draft Affected Environment section provided to site representatives by the U.S. Department of Energy, April 1995.*

ORR 1995a:3 *ORR, "Data Resolution Comments," compilation of correspondence with Oak Ridge Reservation clarifying data in the Secondary Fabrication Alternative Data Package, 1995.*

ORR 1995a:4 *ORR and Albuquerque Operations Office, "Comments on the Draft Versions of the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," (Version 3 and later), 1995.*

ORR 1995a:6 *Perry, T. (DOE Site Contact), "Map of 100-year and 500-year Floodplains on the Y-12 Site," GCM/95-228, derived from 1993 aerial photography, the Tennessee Valley Authority, and other sources. Produced by Geographic Information Systems & Computer Modeling, Oak Ridge National Laboratory, PEIS request for information provided by Teresa Perry, Oak Ridge National Laboratory, Oak Ridge, TN, 1995.*

OTA 1989a *U.S. Congress--101st Cong., The Containment of Underground Nuclear Explosions, OTA-ISC-414, Office of Technology Assessment, Washington, DC, October 1989.*

Owen 1981a *Owen, G.N., "Earthquake Engineering of Large Underground Structure," Proceedings, Workshop on Seismic Performance of Underground Facilities, Atlanta, Ga, February 1981.*

PM 1986a *Hiatt, R.A. and B. Fireman, "The Possible Effect of Increased Surveillance on the Incidence of Malignant Melanoma," Prev Medicine, pp 652-660, 1986.*

PX 1994a:2 *Greenly, G., "Employee Distribution for Pantex Plant Region of Influence--1994," PEIS request for information provided by George Greenly, Battelle Pantex Plant, Amarillo, TX, December 21, 1994.*

PX 1995a:2 *Pantex Plant, "Affected Environment: No Action Data Call Response," Pantex Plant's response to the draft Affected Environment section provided to site representatives by the U.S. Department of Energy, Amarillo TX, June 1995.*

PX 1995a:4 *Banner, E., "Emissions Update at Pantex Plant," U.S. Department of Energy, Amarillo TX, 1995.*

PX 1995a:5 *Pantex Plant, "Data Resolution Comments," compilation of correspondence with Pantex*

Plant clarifying data in the High Explosives, Pit Reuse, and Assembly/Disassembly Alternative Data Packages (PX DOE 1995e; PX DOE 1995k; PX MH 1995a), U.S. Department of Energy, Amarillo TX, 1995.

PX 1995a:6 *Pantex Plant and Albuquerque Operations Office, "Comments on Draft Versions of the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," (Version 3 and later), U.S. Department of Energy, Amarillo TX, 1995.*

PX 1996e:1 *Pantex Plant, "Comments on the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," DOE/EIS-0236, U.S. Department of Energy, Amarillo TX, February 1996.*

PX City 1990a *Barnard Dunkelberg & Company, Airport Master Plan Update, Amarillo International Airport, Amarillo, Texas, prepared for the city of Amarillo through a grant from the Federal Aviation Administration, October 1990.*

PX City 1995a *"Statistical City Data for Regional Economic Area/Region of Influence, Pantex Plant," Amarillo, TX, 1995.*

PX County 1995a *"Statistical County Data for Regional Economic Area/Region of Influence, Pantex Plant," Amarillo, TX, 1995.*

PX DOE 1983a *DOE, Final Environmental Impact Statement Pantex Plant Site, Amarillo, Texas, DOE/EIS-0098, prepared by the U.S. Department of Energy, Washington, DC, October 1983.*

PX DOE 1991a *Pantex Plant and Panhandle 2000 Task Force, Panhandle 2000, Pantex Nuclear Weapons Complex Reconfiguration Proposal, Volume 8 Site Flexibility, U.S. Department of Energy, Amarillo TX, May 1991.*

PX DOE 1993c *Johnston, M.C. and J.K. Williams, Report: Floristic Survey Pantex Plant Site, Carson County, Texas 1993, prepared under Contract FFP009901 by Environmental Consulting, Austin, TX, for the U. S. Department of Energy, Pantex Plant, Amarillo, TX, December 1993.*

PX DOE 1994b *Seyffert, K. D., Checklist of Birds Pantex Plant Site Carson County, Texas 1994, Report, prepared under Contract FFP016902 Amarillo, TX, for the U. S. Department of Energy, Pantex Plant, Amarillo, TX, June 1994.*

PX DOE 1994c *Mazeroll, A.I., L.S. Boatman, and L.H. Boomershine, Report: Herpetofaunal Survey Pantex Plant Site, Carson County, Texas 1994, prepared under contract FFP019934 by Enviro Con for the U. S. Department of Energy, Pantex Plant, Amarillo, TX, 1994.*

PX DOE 1994d *Rylander, M.K., Report: Resident and Migratory Animals Survey Pantex Plant Site, Carson County Texas 1994, prepared under contract FFP011684 by Department of Biological Sciences, Texas Tech University, Lubbock, TX for the U. S. Department of Energy, Pantex Plant, Amarillo, TX, 1994.*

PX DOE 1995a:1 *Johnson, J.S., "Pantex Plant Land Use Status," PEIS request for information provided by Assistant Area Manager for Projects & Environmental Management, U.S. Department of Energy, Albuquerque Field Office, Amarillo Area Office, Amarillo, TX, 1995.*

PX DOE 1995d *Mason & Hanger-Silas Mason Co., Inc., 1994 Environmental Report for Pantex Plant, DOE/AL/65030-9506, U.S. Department of Energy, Amarillo, TX, June 1995.*

PX DOE 1995e *Hallett, S.G., R.J. Slape, Final SSM PEIS Alternative Report High Explosive Production at Pantex Plant, DOE-AL-65030-9517, prepared under Contract DE-AC04-91AL-65050 by Mason & Hanger--Silas Mason Co., Inc., for the U.S. Department of Energy, Pantex Plant, Amarillo, TX, August 1995.*

PX DOE 1995g *Battelle and Mason and Hangar-Silas Mason Company, Inc., Pantex Plant Site Development Plan -- FY 95, PLN14, U.S. Department of Energy, Pantex Plant, Amarillo, TX, 1995.*

PX DOE 1995i *Battelle and Mason and Hangar-Silas Mason Company, Inc., Environmental Information Document The Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components Environmental Impact Statement, January 1995.*

PX DOE 1995k *Mason & Hanger-Silas Mason Co., Inc., Data Report for Pantex Plant Pit Recertification, Requalification, and Type A Reuse , DOE-AL-65030-9521, prepared for the U.S. Department of Energy under Contract DE-AC-04-91AL-65030, August 1995.*

PX DOE 1996b *Battelle and Mason and Hangar-Silas Mason Company, Inc., Draft Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components, DOE/EIS-0225-D, Volume I, prepared for the U.S. Department of Energy, Washington, DC, March 1996.*

PX EG&G 1988a *EG&G Energy Measurements, "Color Aerial Photographs of Pantex Plant: Various Scales," PERF 6218, Las Vegas, NV, November 30, 1988.*

PX EG&G 1988b *EG&G Energy Measurements, "Color Aerial Photographs of Los Alamos National Laboratory and Pantex Plant: Various Scales," PERF 6219, Las Vegas, NV, November 30, 1988.*

PX MH 1991c *Mason & Hanger-Silas Mason Company, Inc., Pantex Plant Site Environmental Report for Calendar Year 1990, MHSMP-91-06, prepared under Contract DE-AC04-76DP 00487 by Environmental Monitoring Section, Environmental Protection Department, Environment, Safety & Health Division, Amarillo, TX, July 1991.*

PX MH 1994c *Mason and Hanger-Silas Mason Company, Inc., Pantex Plant Safety Analysis Report General Information Document, Draft 2, prepared by Pantex Plant, Amarillo, TX, Revision 1, June 10, 1994.*

PX MH 1995a *Mason and Hanger-Silas Mason Company, Inc., SSM PEIS Data Report for Pantex Plant Assembly/Disassembly Operations, Pantex Plant, Amarillo, TX, August 1995.*

PX MH 1995b *Mason and Hanger-Silas Mason Company, Inc., Basis for Interim Operation for the Pantex Plant Amarillo, Texas, prepared by Pantex Plant, Risk Management Department, Amarillo, TX, June 1995.*

PX School 1995b *"Statistical School Data for Regional Economic Area/Region of Influence, Pantex Plant," Amarillo, TX, 1995.*

PX USDA 1962a *Jacquot, L. L., Soil Survey, Carson County, Texas, Series 1959, No. 10, U.S. Department of Agriculture, Soil Conservation Service in cooperation with the Texas Agricultural Experiment Station, July 1962.*

PX USDA 1980a *Pringle, F., Supplement to the Soil Survey of Carson County, Texas, U.S. Department of Agriculture, Soil Conservation Service, 1980.*

PX USGS 1986a *USGS, "Amarillo--Texas: 1:100 000-Scale Metric Topographic Map," 30x60 minute series, 35101-A1-TM-100, U.S. Department of the Interior, U.S. Geological Survey, Reston, VA, 1986.*

PX WDB 1993a *Peckham, D.S. and J.B. Ashworth, The High Plains Aquifer System of Texas, 1980 to 1990 Overview and Projections, Draft, prepared by Texas Water Development Board, Final in progress 1993.*

RR 1989a *Gilbert, E.S., S.A. Fry, L.D. Wiggs, G.L. Voelz, D.L. Cragle, and G.R. Petersen, "Analyses of Combined Mortality Data on Workers at the Hanford Site, Oak Ridge National Laboratory, and Rocky Flats Nuclear Weapons Plant," Radiation Research, Vol. 120, pp 19-35, Academic Press, Inc., 1989.*

RR 1990a *Frome, E.L., D.L. Cragle, and R.W. McLain, "Poisson Regression Analysis of the Mortality Among a Cohort of World War II Nuclear Industry Workers," Radiation Research, Vol. 123, 138-152, 1990.*

RR 1993a *Gilbert, E.S., D.L. Cragle, and L.D. Wiggs, "Updated Analyses of Combined Mortality Data for Workers at the Hanford Site, Oak Ridge National Laboratory, and Rocky Flats Weapons Plant," Radiation Research, Vol. 136, pp 408-421, Academic Press, Inc., 1993.*

RR 1995a *Cardis, E., E.S. Gilbert, L. Carpenter, G. Howe, I. Kato, B.K. Armstrong, V. Beral, G. Cowper, A. Douglas, J. Fix, S.A. Fry, J. Kaldor, C. Lave, L. Salmon, P.G. Smith, G.L. Voelz, and L.D. Wiggs," "Effects of Low Doses and Low Dose Rates of External Ionizing Radiation: Cancer Mortality Among Nuclear Industry Workers in Three Countries," Radiation Research, Vol. 142, pp 117-132, Radiation Research Society, 1995.*

SAIC 1995a:1 *SAIC, "Five-Year Summary of Hazardous and Nonhazardous Cargo Shipped by Commercial Carriers to and from Each of the Candidate Sites," PEIS request for information provided by Robert Morris, Transportation Analyst, Science Applications International Corporation, Oak Ridge, TN, April 26, 1995.*

SAIC 1995a:2 *SAIC, "Summary of all Hazardous Materials by Chemical Name to and from Selected Sites for 1994," PEIS request for information provided by Robert Morris, Transportation Analyst, Science Applications International Corporation, Oak Ridge, TN, April 5, 1995.*

SC DHEC 1991a *South Carolina Department of Health and Environmental Control, Air Pollution Control Regulations (Regulation No. 62.5), Air Pollution Control Standards (Standard No. 8), Toxic Air Pollutants, Bureau of Air Quality Control, Columbia, SC, June 28, 1991.*

SC DHEC 1992a *South Carolina Department of Health and Environmental Control, "Water*

Classifications and Standards," April 24, 1992.

SC DHEC 1992b *South Carolina Department of Health and Environmental Control, Air Pollution Control Regulations (Regulation No. 62.5), Air Pollution Control Standards (Standard No. 2), Ambient Air Quality Standards , Bureau of Air Quality Control, Columbia, SC, June 26, 1992.*

SC WD 1995a *South Carolina Wildlife Department, Rare and Endangered Species of South Carolina, Nongame and Heritage Trust Section, Columbia, SC, September 11, 1995.*

Science 1983a *Beck, H.L. and P.W. Krey, "Radiation Exposures in Utah from Nevada Nuclear Tests," Science, Vol 220, pp 18-24, 1983.*

Science 1984a *Land, C.E., F.W. McKay, and S.G. Machado, "Childhood Leukemia and Fallout from the Nevada Nuclear Tests," Science, Vol. 223, pp 139-144, January 1984.*

SN City 1995a *"Statistical City Data for Regional Economic Area/Region of Influence, Sandia National Laboratories," Albuquerque, NM, 1995.*

SN County 1995a *"Statistical County Data for Regional Economic Area/Region of Influence, Sandia National Laboratories," Albuquerque, NM, 1995.*

SN DOE 1991b *SNL, Land Use Permits, Facilities Geographical Information System, Sandia National Laboratories Plant Engineering, Albuquerque, NM, April 13, 1991.*

SN DOE 1992d *DOE and University of California, Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore, Volume II Appendices A-D, DOE/EIS-0157, prepared for U.S. Department of Energy, Washington, DC, August 1992.*

SN ERDA 1977a *Energy Research Development Administration, Environmental Impact Assessment Sandia Laboratories , Albuquerque, New Mexico, EIA/MA 77-1, Division of Military Application, May 1977.*

SN NPS 1988a *Mariah Associates, Inc., An Assessment of Cultural Resource Studies Conducted at Kirtland Air Force Base, Bernalillo County, New Mexico, prepared under Contract CX-1200-7-B014 with Funds Provided by the United States Air Force, Military Airlift Command, Kirtland Air Force Base Through the National Park Service, Interagency Archaeological Services, Denver, CO, June 1988.*

SN School 1995b *"Statistical School Data for Regional Economic Area/Region of Influence, Sandia National Laboratories," Albuquerque, NM, 1995.*

SN USAF 1989a *United States Air Force (USAF), Military Airlift Command Comprehensive Plan, Kirtland Air Force Base, Albuquerque, New Mexico, Directorate of Civil Engineering, DSC-PR-Washington, DC, October 30, 1989.*

SN USAF 1990a USAF*, Draft Environmental Impact Statement Proposed Closure of Los angeles Air Force Base, California and Relocation of Space Systems Division , July 1990.*

SN USDA 1977a *USDA, Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico , Soil Conservation Service and Forest Service and the U.S. Department of the Interior, Bureau of Indian Affairs and Bureau of Land Management in cooperation with New Mexico Agricultural Experiment Station, 1977.*

SN USGS 1978a *USGS, "Albuquerque, New Mexico," 30x60 Minute Series, U.S. Department of the Interior, Denver, CO, 1978.*

SN USGS 1979a *USGS, "Belen, New Mexico," 30x60 Minute Series, U.S. Department of the Interior, Denver, CO, 1979.*

SNL 1979a *Vortman, L.J., Prediction of Ground Motion from Nuclear Weapons Test at Nevada Test Site, SAND79-1002, Sandia National Laboratories, Albuquerque, NM, 1979.*

SNL 1982a *Rao, R.K., E.L. Wilmot, and R.E. Luna, Non-Radiological Impacts of Transporting Radioactive Material, SAND81-1703, prepared under Contract DE-AC04-76DP 00789 by NUS Corporation, Rockville, MD and Transportation Analysis and Information Division 4551, Transportation Technology Center, Sandia National Laboratories, Albuquerque, NM, February 1982.*

SNL 1982b *Vortman, L.J., Effects of Ground Motion on Repository Depth, The Yucca Flat Data, SAND82-1647, Sandia National Laboratories, Albuquerque, NM, 1982.*

SNL 1986a *Cashwell, J.W., K.S. Neuhauser, P.C. Reardon, and G.W. McNair, Transportation Impacts of the Commercial Radioactive Waste Management Program, SAND85-2715, prepared under Contract DE-AC04-76DP 00789 by Sandia National Laboratories, Albuquerque, NM and Livermore, CA for the U.S. Department of Energy, April 1986.*

SNL 1990a *Fischer, N. T., Revision of Species Inventory Checklists for Sandia National Laboratories, Albuquerque Bernalillo County, New Mexico, SAND90-7098, Final Report, prepared by International Technology Corporation, Albuquerque, NM, for U.S. Department of Energy, Sandia National Laboratories, Albuquerque, NM, October 1990.*

SNL 1991b:1 *SNL, "Total Chemical Emissions by Building," PEIS request for information provided by Sandia National Laboratories, Albuquerque, NM, 1991.*

SNL 1991c *Hwang, S.G., et al, 1990 Environmental Monitoring Report, SAND91-0592 UC-630, prepared under Contract DE-AC04-76D00789 by Sandia National Laboratories, Albuquerque, NM and Livermore, CA, for the U.S. Department of Energy, May 1991.*

SNL 1992c SNL*, Sandia National Laboratories, Albuquerque Environmental Baseline Update, Albuquerque, NM, May 1992.*

SNL 1993c *Hoagland, S.R. and K.J. Lord, Cultural Resources Regulatory Analysis, Area Overview, and Assessment of Previous Department of Energy and Kirtland Air Force Base Inventories for Sandia National Laboratories, New Mexico, SAND92-7345, prepared under Sandia Contract 44-2121 by Chambers Group, Inc., Santa Ana, CA for Sandia National Laboratories, Albuquerque, NM, January 1993.*

SNL 1994a *Culp, T. A., C. F. Cheng, W. Cox, N. Durand, M. Irwin, A. Jones, F. Lauffer, M. Lincoln, Y. McClellan, K. Molley, and T. Wolff, 1993 Site Environmental Report Sandia National Laboratories, Albuquerque, New Mexico, SAND94-1293, UC-630, prepared under Contract DE-AC04-94AL 85000 by Sandia National Laboratories, Albuquerque, New Mexico and Livermore, CA, for the U.S. Department of Energy, November 1994.*

SNL 1995b:1 *SNL, "Affected Environment: No Action Data Call Response," Sandia National Laboratories response to the draft Affected Environment section provided to site representatives by the U.S. Department of Energy, April 1995.*

SNL 1995b:4 *SNL, "Data Resolution Comments," compilation of correspondence with Sandia National Laboratories clarifying data in the Nonnuclear Alternative Data Package (SNL 1995e), 1995.*

SNL 1995b:5 *SNL and Albuquerque Operations Office, "Comments on the Draft Versions of the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," (Version 3 and later), 1995.*

SNL 1995c *SNL/NM, Compliance Order and Site Treatment Plan for Mixed Waste Sandia National Laboratories/New Mexico , prepared by Waste Management and Regulatory Projects Department, October 6, 1995.*

SNL 1995d SNL, *Standard Data Report 1993 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1, prepared by Sandia National Laboratories, Albuquerque, NM, January 13, 1995.*

SNL 1995e SNL, *Stockpile Stewardship and Management Programmatic Environmental Impact Statement Nonnuclear Alternative Proposal , Sandia National Laboratories, Albuquerque, NM, August 2, 1995.*

SNL 1995f SNL, *Standard Data Report 1994 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1 , prepared by Sandia National Laboratories, Albuquerque, NM, October 23, 1995.*

SNL 1995g *Shyr, L. (Editor), 1994 Site Environmental Report Sandia National Laboratories, Albuquerque, NewMexico, SAND95-1953, prepared under Contract DE-AC04-94AL 85000 by Sandia National Laboratories, Albuquerque, NM and Livermore, CA, for the U.S. Department of Energy, September 1995.*

SNL 1995h *IT Corporation, Sensitive Species Survey Results Environmental Restoration Project Sandia National Laboratories, New Mexico , prepared for Sandia National Laboratories/New Mexico, Albuquerque, NM, February 1995.*

SNL 1995i *SNL, Sandia National Laboratories Institutional Plan FY 1996-2001, Sandia National Laboratories, October 1995.*

SNL 1996a *Johnson, K., J. Keller, C. Ekdahl, R. Krajcik, L. Salazar, E. Kelly, and R. Paulsen, Stockpile Surveillance: Past and Future, SAND95-2751, UC-700, prepared under Contract DE-*

AC04-94AL85000 by Sandia National Laboratories, Albuquerque, NM and Livermore, CA for the U.S. Department of Energy, Washington, DC, September 1985. Reprint January 1996.

Socio 1996b *"Compilation of Models/Projections Used in the Preparation of Data for the Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," July 1996.*

SR City 1995a *"Statistical City Data for Regional Economic Area/Region of Influence, Savannah River Site," Aiken, SC, 1995.*

SR County 1995a *"Statistical County Data for Regional Economic Area/Region of Influence, Savannah River Site," Aiken, SC, 1995.*

SR DOE 1982a *DOE, Final Environmental Impact Statement, Defense Waste Processing Facility Savannah River Plant, DOE/EIS-0082, Savannah River Plant, Aiken, SC, February 1982.*

SR DOE 1987b *DOE, Final Environmental Impact Statement, Alternative Cooling Water Systems, DOE/EIS-0121, Savannah River Plant, Aiken, SC, October 1987.*

SR DOE 1990a *DOE, Final Environmental Impact Statement Continued Operation of K-, L-, and P-Reactors, Savannah River Site, Aiken, South Carolina, DOE/EIS-0147, Volume I, U.S. Department of Energy, Washington, DC, December 1990.*

SR DOE 1991b *DOE, Proposal for the Nuclear Weapons Complex Reconfiguration Site, prepared by Savannah River Operations, Aiken, SC for the U.S. Department of Energy, Office of the Assistant Secretary for Defense Programs, Washington, DC, 1991.*

SR DOE 1991e *NUS Corporation and RDN, Inc., American Indian Religious Freedom Act (AIRFA) Compliance at the Savannah River Site, prepared for the U.S. Department of Energy, Savannah River Operations Office, Aiken, SC, 1991.*

SR DOE 1993c *DOE, Environmental Assessment for the Centralization and Upgrading of the Sanitary Wastewater System at the Savannah River Site , DOE/EA-0878, September 1993.*

SR DOE 1994a *DOE, Final F-Canyon Plutonium Solutions Environmental Impact Statement, DOE/EIS-0219, U.S. Department of Energy, Savannah River Site, Aiken, SC, December 1994.*

SR DOE 1994b *DOE, Final Environmental Impact Statement Defense Waste Processing Facility, DOE/EIS-0082-S, U.S. Department of Energy, Savannah River Site, Aiken, SC, November 1994.*

SR DOE 1994c *WSRC, 1993 Annual Report on Waste Generation and Waste Minimization Progress as Required by DOE Order 5400.1, prepared by Westinghouse Savannah River Company, Waste Minimization and Pollution Prevention Group for the U.S. Department of Energy, Savannah River Site, Aiken, SC, October 28, 1994.*

SR DOE 1995b *DOE, Savannah River Site Waste Management Final Environmental Impact Statement, DOE/EIS-0217, Volume I, U.S. Department of Energy, Savannah River Site, Aiken, SC, July 1995.*

SR DOE 1995c *DOE, Savannah River Site Waste Management Final Environmental Impact Statement, DOE/EIS-0217, Volume II, U.S. Department of Energy, Savannah River Site, Aiken, SC, July 1995.*

SR DOE 1995e *DOE, Final Environmental Impact Statement Interim Management of Nuclear Materials, DOE/EIS-0220, U.S. Department of Energy, Savannah River Site, Aiken, SC, October 1995.*

SR duPont 1984b *Sauer, H. andAssociates, "Mortality Trends in Counties Near the Savannah River Plant, 1949-1978," Technical Report, prepared in fulfillment of Purchase Order No. AX 522037H for E.I. DuPont de Nemours and Company, Inc., Savannah River Site, Aiken, SC, 1984.*

SR duPont 1988a *Stephenson, D.E., August 1988 Savannah River Plant Earthquake, DPST-88-84, prepared under Contract DE-AC09-76SR00001 by E.I. du Pont De Nemours & Co., Savannah River Laboratory, Aiken, SC, for the U.S. Department of Energy, September 1988.*

SR MMES 1993a *MMES, "Treatment, Storage, Disposal Unit Capability Report" Waste Management Information System (Database), Hazardous Waste Remedial Actions Program, Oak Ridge, TN, 1993.*

SR NERP 1989a *Schalles, J.F., R.R. Sharitz, J.W. Gibbons, G.J. Leversee, and J.N. Knox, Carolina Bays of the Savannah River Plant, SRO-NERP-18, Savannah River Plant National Environmental Research Park Program, Aiken, SC, March 1989.*

SR NERP 1990b *Knox, J.N. and R.R. Sharitz, Endangered, Threatened, and Rare Vascular Flora of the Savannah River Plant, SRO-NERP-20, prepared by Division of Wetland Ecology, Savannah River Ecology Laboratory, for the Savannah River Site, National Environmental Research Park Program, Aiken, SC, March 1990.*

SR School 1995b *"Statistical School Data for Regional Economic Area/Region of Influence, Savannah River Site," Aiken, SC, 1995.*

SR USDA 1990a *Rogers, V. A., Soil Survey of Savannah River Plant Area, Parts of Aiken, Barnwell, and Allendale Counties, South Carolina, prepared by the U.S. Department of Agriculture, Soil Conservation Service in cooperation with U. S. Department of Energy; U.S. Department of Agriculture Forest Service; South Carolina Agricultural Experiment Station; and South Carolina Land Resources Conservation Commission, June 1990.*

SR USGS 1982a *USGS, "Barnwell, South Carolina--Georgia: 1:100 000-Scale Metric Topographic Map," 30x60 Minute Series, 33081-A1-TM-100, U.S. Department of the Interior, U.S. Geological Survey, Reston, VA, Edited 1982.*

SRS 1991a:3 *WSRC Site Contact, "Employee Residential Distribution," PEIS request for information provided U.S. Department of Energy, Savannah River Plant, Aiken, SC, November 1991.*

SRS 1993a:4 *Dukes, M.D., "SCDHEC Regulation No. 62.5 Standard No. 8, Compliance Modeling Input/Output Data (U)," ESH-ESS-93-0305, request for information provided by Environmental Support Section, Westinghouse Savannah River Company, Aiken, SC, to James A. Joy, P.E. Chief,*

Bureau of Air Quality Control, South Carolina Department of Health and Environmental Control, Columbia, SC, September 29, 1993.

SRS 1995a:1 *SRS, "Affected Environment: No Action Data Call Response," Savannah River Site response to the draft Affected Environment section provided to site representatives by the U.S. Department of Energy, April 1995.*

SRS 1995a:2 *SRS, "No Action, Upgrade, Phaseout," U.S. Department of Energy, Savannah River Site, Aiken, SC, 1995.*

SRS 1995a:10 *Stewart, J., "Sitewide Total Emissions of Criteria Pollutants," SRT-ETS-95-0369, PEIS request for information provided by Westinghouse Savannah River Company, Aiken, SC, August 16, 1995.*

SRS 1995a:11 *Hanson, D., "Groundwater Data for H-Area at Savannah River Site," computer printout, PEIS request for information provided by Exploration Resources, Westinghouse Savannah River Company, Aiken, SC, August 30, 1995.*

SRS 1996a:2 *SRS, "Comments on the Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," DOE/EIS-0236, U.S. Department of Energy, Savannah River Site, Aiken, SC, February 1996.*

TIH 1985a *Polednak, A.P. and D.R. Hollis, "Mortality and Causes of Death Among Workers Exposed to Phosgene in 1943-1945," Toxicol Ind Health, Vol. 1, pp 137-147, 1985.*

TMM 1993a *Tennessee Medical Management, Inc., "Cancer Mortality and Incidence," presented to the Oak Ridge Health Agreement Steering Panel, February 18, 1993.*

TN DEC 1994a *Tennessee Department of Environment and Conservation, "Chapter 1200-3-3-Ambient Air Quality Standards," prepared by the Bureau of Environment, Division of Air Pollution Control, Nashville, TN, 1994.*

TN DEC 1995a *Tennessee Department of Environment and Conservation, "Rare Vertebrates of the State of Tennessee," Division of Natural Heritage, Nashville, TN, August 2, 1995.*

TN DEC 1995b *Tennessee Department of Environment and Conservation, "Rare Invertebrates of the State of Tennessee," Division of Natural Heritage, Nashville, TN, August 2, 1995.*

TN DEC 1995c *Tennessee Department of Environment and Conservation, "Rare Plants of the State of Tennessee," Tennessee Rare Plant Protection Program, Division of Natural Heritage, Nashville, TN, August 2, 1995.*

TN DEC 1995d *Tennessee Department of Environment and Conservation, "Tennessee County Distribution Records for Endangered, Threatened, and Status Review Species," Division of Ecological Services, Nashville, TN, prepared in cooperation with the U.S. Fish and Wildlife Service, January 20, 1995.*

TN DHE 1984a *Word, J. E., Oak Ridge Pilot Study, presented by the Commissioner, State of Tennessee, Department of Health and Environment, Nashville, TN, 1984.*

TN DHE 1991a *Tennessee Department of Health and Environment, "Hazardous Air Pollution Review and Evaluation Including Public Law 101-549," memorandum from Harold E. Hodges to APC Program Chiefs, Nashville, TN, August 1, 1991.*

TN USGS 1979a *USGS and TVA, "Oak Ridge, Tennessee--1:100 000-Scale Metric Topographic Map," 30x60 Minute Series, N3600-W8400/30x60, produced in cooperation with the U.S. Department of the Interior, U.S. Geological Survey, Denver, CO by Tennessee Valley Authority, Chattanooga, TN, 1979.*

TN USGS 1981a *USGS and TVA, "Watts Bar Lake, Tennessee--1:100 000-Scale Metric Topographic Map," 30x60 Minute Series, N3530-W8400/30x60, produced in cooperation with the U.S. Department of the Interior, Geological Survey, Washington, DC by Tennessee Valley Authority, Chattanooga, TN, 1981.*

TN WRA 1995a *Todd, R. M., "Tennessee Commercial Fishing," PEIS request for information provided by Fisheries Biologist, Tennessee Wildlife Resources Agency, Nashville, TN, May 17, 1995.*

TN WRC 1991a *Tennessee Wildlife Resources Commission, Proclamation--Wildlife in Need of Management , Proc. 86-29, March 2, 1991.*

TN WRC 1991b *Tennessee Wildlife Resources Commission, Proclamation--Endangered or Threatened Species , Proc. 86-30, March 2, 1991.*

TTI 1996b *Tetra Tech, Inc., Chemical Health Effects Technical Reference, July 1996.*

TX ACB 1987a *Texas Air Control Board, Regulation III (31 TAC Chapter 113) Control of Air Pollution from Toxic Materials, Revised August 14, 1987.*

TX ACB 1993a *Texas Air Control Board, "General Provisions - The National Primary and Secondary Ambient Air Quality Standards," Title 31 Pt. III Ch. 101.21, March 15, 1993.*

TX DOH 1994a *Texas Department of Health, "Study of Cancer in Selected Counties Near the Pantex Nuclear Weapons Plant," Texas Department of Health, Cancer Registry Division, Austin, TX, 1994.*

TX NRCC 1992a *Texas Natural Resource Conservation Commission and Air Control Board, Regulation II (30 TAC Chapter 112) Control of Air Pollution from Sulfur Compounds, Air Quality Planning Division, Austin, TX, Revised September 18, 1992.*

TX NRCC 1995a *Texas Natural Resources Conservation Commission, "List of Effects Screening Levels (ESLs)," PEIS request for information provided by Health Effects Staff, April 1, 1995.*

TX PWD 1993a *Texas Parks and Wildlife Department, Special Animal List, Texas Natural Heritage Program, October 19, 1993.*

TX PWD 1995a *Texas Parks and Wildlife Department, Special Animal List, Texas Natural Heritage Program, October 19, 1995.*

TX PWD 1995b *Texas Parks and Wildlife Department, Special Plant List, Texas Natural Heritage*

Program, February 1995.

USDA 1977a *Garrison, G.A., A.J. Byugstad, D.A. Duncan, M.E. Lewis, and D.R. Smith, Vegetation and Environmental Features of Forest and Range Ecosystems, U.S. Department of Agriculture, Forest Service, Washington, DC, 1977.*

USGS 1972a *USGS, National Atlas, Scale 1:2 000 000, Department of the Interior, Washington, DC, revised 1972.*

VDL 1990a *van der Leeden, F., F.L. Troise, and D.K. Todd, The Water Encyclopedia, Geraghty & Miller Ground-Water Series, Second Edition, Lewis Publishers, Chelsea, MI, 1990.*

WJM 1985a *Reynolds, P. and D.F. Austin, "Cancer Incidence among Employees of the Lawrence Livermore National Laboratory 1969 - 1980," The Western Journal of Medicine, Vol. 142, No. 2, pp. 214-218, 1985.*

WSRC 1989e *Wike, L. D., W.L. Specht, H. E. Mackey, M. H. Paller, E. W. Wilde, and A. S. Dicks, Reactor Operation Environmental Information Document, Volume II Ecology, WSRC-RP-89-816, prepared under Contract DE-AC09-88SR 18035 by Environmental Sciences Section, Westinghouse Savannah River Company for the U.S. Department of Energy, Savannah River Site, Aiken, SC, December 1989.*

WSRC 1990b *Parker, M.J. and R.J. Kurezeja, October 1, 1989 Tornado at the Savannah River Site, WSRC-RP-89-1288, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, January 1990.*

WSRC 1991a *WSRC, Tritium in the Savannah River Site Environment, WSRC-RP-90-424-1, Revision 1, U.S. Department of Energy, Savannah River Site, Aiken, SC, May 1991.*

WSRC 1992a *WSRC, Savannah River Site Environmental Report for 1991, WSRC-TR-92-186, prepared under Contract DC-AC09-89SR 18035, for U.S. Department of Energy, Savannah River Site, Aiken, SC, 1992.*

WSRC 1992c *CDM Federal Programs Corporation, Final Report Groundwater Modeling for the Nuclear Weapons Complex Reconfiguration Site at the Savannah River Site Aiken, South Carolina, 7901-003-RT-BBXZ, prepared for Westinghouse Savannah River Company, Aiken, SC, May 27, 1992.*

WSRC 1992h *Parker, M.J., et al, The 1987-1991 Savannah River Site Meteorological Data Base (U), WSRC-RP-92-598, Westinghouse Savannah River Company, Aiken SC, May 19, 1992.*

WSRC 1993a *Arnett, M. W., L. K. Karapalatakis, and A. R. Mamatey, (Editors), Savannah River Site Environmental Report for 1992, WSRC-TR-93-075, prepared by Westinghouse Savannah River Company under Contract DE-AC09-89SR 18035 for the U.S. Department of Energy, Savannah River Site, Aiken, SC, 1993.*

WSRC 1993b *Wike, L.D., Savannah River Site Ecology Environmental Information Document, WSRC-TR-93-496, prepared under Contract DE-AC09-89SR18035 by the Westinghouse Savannah River Company, Aiken, SC, September 1993.*

WSRC 1994c *WSRC, Savannah River Site FY 1994 Predecisional Draft Solid Waste Management Plan, WSRC-RP-93-1448, Revision 2, March 29, 1994.*

WSRC 1994d *Arnett, M.W., L.K. Karapatakis, and A.R. Mamatey, Savannah River Site Environmental Report for 1993, WSRC-TR-94-075, prepared under Contract DE-AC09-89SR 18035 by Westinghouse Savannah River Company for the U.S. Department of Energy, Savannah River Site, Aiken, SC, 1994.*

WSRC 1995a *WSRC, P roposed Site Treatment Plan, Volumes I and II, WSRC-TR-94-0608, May 30, 1995.*

WSRC 1995b *WSRC, Proposed Site Treatment Plan Reference Document, WSRC-TR-94-0608, May 30, 1995.*

WSRC 1995c *WSRC, Stockpile Stewardship and Management Programmatic Environmental Impact Statement Draft of Alternative Report for Pit Manufacturing at Savannah River Site, NMP-PLS-950176-DV, December 4, 1995.*

The References are obtained from a database that contains references common to the Programmatic Environmental Impact Statement for Tritium Supply and Recycling, the Stockpile Stewardship and Management Programmatic Environmental Impact Statement, the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement, and the Disposition of Surplus Highly Enriched Uranium Environmental Impact Statement. Therefore, the list of references may include perceived gaps in references. For example, NT DOE 1993c may not appear, while NT DOE 1993b and NT DOE 1993d both do. These gaps occur because the references are all a part of a larger set of references, not all of which appear in this Programmatic Environmental Impact Statement.

CHAPTER 7: LIST OF PREPARERS

Annett, John R., Air Quality Technical Lead, Halliburton NUS Corp.
B.A., Mathematics, 1969, Hartwick College, Oneonta, NY
Years of Experience: 25

Biegel, Herbert K., Technical Analyst and Data Coordinator for SRS, Lamb Associates, Inc.
B.S., Naval Science, 1955, U.S. Naval Academy, Annapolis, MD
B.S., Electrical Engineering, 1965, U.S. Naval Postgraduate School, Monterey, CA
Years of Experience: 41

Bienenfeld, Paula, Cultural and Paleontological Technical Lead, Tetra Tech, Inc.
Ph.D., Anthropology, 1986, State University of New York at Binghamton, Binghamton, NY
M.A., Anthropology, 1979, State University of New York at Binghamton, Binghamton, NY
B.A., Anthropology, 1973, University of Michigan, Ann Arbor, MI
Years of Experience: 17

Boucher, Marc, Technical Analyst and Data Coordinator for LLNL and LANL, SRA Technologies, Inc.
B.S., Nuclear Engineering, 1991, University of Florida, Gainesville, FL
Years of Experience: 4

Brennan, Casey, Geology and Soils Technical Lead, Tetra Tech, Inc.
B.S., Civil Engineering, 1993, Brown University, Providence, RI
Years of Experience: 2

Brouwer, Chris, Document Coordinator, Tetra Tech, Inc.
B.A., Political Science, 1992, Binghamton University, Binghamton, NY
Years of Experience: 3

Cambria, Michael J., Technical Analyst and Data Coordinator for ORR and SNL, SRA Technologies, Inc.
M.S., Nuclear Engineering, 1964, Pennsylvania State University, State College, PA
B.S., Physics, 1963, Villanova University, Villanova, PA
Years of Experience: 31

Chambers, Matthew J., Waste Management Group Member, Lamb Associates, Inc.
M.S., Environmental Engineering, 1995, Johns Hopkins University, Baltimore, MD
B.S., Chemical Engineering, 1989, University of Maryland, College Park, MD
Years of Experience: 6

Chase, Stephen P., Environmental Protection Specialist, DP-45, DOE
B.A., Biochemistry, 1984, Rice University, Houston, TX
M.S., Radiation Science, Georgetown University, Washington, DC, Thesis Pending
Years of Experience: 10

Choephel, Ann Marie, Technical Data Coordinator, Halliburton NUS Corp.
M.S., Public Administration, 1981, George Washington University, Washington, DC

B.S., Education, 1973, Virginia Commonwealth University, Richmond, VA
Years of Experience: 22

Collier, Crystal, D., Publications Manager, Tetra Tech, Inc.
M.A., English, 1992, Virginia Polytechnic Institute and State University, Blacksburg, VA
B.A., English, 1990, Virginia Polytechnic Institute and State University, Blacksburg, VA
Years of Experience: 6

Cowan, David N., Hazardous Chemical Group Member, SRA Technologies, Inc.
Ph.D., Epidemiology, 1989, School of Public Health, University of Massachusetts at Amherst, MA
M.P.H., Epidemiology, 1974, School of Public Health and Tropical Medicine, Tulane University, New Orleans, LA
B.S., Psychology, 1971, Old Dominion University, Norfolk, VA
Years of Experience: 24

Cramp, Stacey, A., Technical Editor, Tetra Tech, Inc.
B.A., English, 1991, Bates College, Lewiston, ME
Years of Experience: 4

Davis, Larry J., Technical Coordinator for Nuclear Weapons Design and Engineering, Lamb Associates, Inc.
M.S., Physics, 1971, Naval Postgraduate School, Monterey, CA
B.S., Mathematics, 1964, Jacksonville State University, Jacksonville, AL
Years of Experience: 30

Davis, Rodney J., Intersite Transportation Group Member, Halliburton NUS Corp.
Ph.D., Physical Chemistry, 1954, Iowa State University, Iowa City, Iowa
M.S., Chemistry, 1949, University of New Hampshire, Durham, New Hampshire
B.S., Chemistry, 1948, University of New Hampshire, Durham, New Hampshire
Years of Experience: 32

Deal, L. Joe, Nuclear Safety Assessment Technical Lead, Lamb Associates, Inc.
B.S., Physics/Math, 1944, Lenoir Rhyne College, Hickory, NC
Years of Experience: 42

Eisemann, Dan, Document Reviewer, Tetra Tech, Inc.
B.S., Chemical Engineering, 1994, Johns Hopkins University, Baltimore, MD
Years of Experience: 1

Enslen, Greg, Volume III Document Coordinator, Tetra Tech, Inc.
B.A., English, California State University, Los Angeles, CA
Years of Experience: 3

Feldt, Al, Environmental Protection Specialist, DP-45, DOE
B.A., Economics, 1971, American University, Washington, DC
Years of Experience: 20

Felkner, Ira Cecil, Hazardous Chemical Assessments Technical Lead, SRA Technologies, Inc.
Ph.D., Microbiology/Biochemistry, 1966, University of Texas, Austin, TX
M.A., Bacteriology/Genetics, 1960, University of Texas, Austin, TX

B.A., Zoology/Chemistry, 1958, University of Texas, Austin, TX
Years of Experience: 37

Fisher, Michael, Technical Coordinator Volume III, Tetra Tech, Inc.
M.E., Nuclear Engineering, 1974, University of Virginia
B.S., Science and Engineering, 1968, U.S. Military Academy, West Point, NY
Years of Experience: 27

Fleming, William R., Technical Coordinator for Social Sciences, SRA Technologies, Inc.
Ph.D., Public Policy, 1987, Florida State University, Tallahassee, FL
M.P.A., Urban Administration and Planning, 1979, Florida Atlantic University,
Boca Raton, FL
B.A., Political Science, 1976, Saint Leo College, Saint Leo, FL
Years of Experience: 14

Fontenelle, Samantha, Document Reviewer, Tetra Tech, Inc.
M.A., Environmental Studies/Risk Assessment, 1994, Sangamon State University, Springfield, IL
B.A., Environmental Science, 1992, University of Virginia, Charlottesville, VA
Years of Experience: 3

Fulca, Michael J., Technical Analyst and Data Coordinator, Lamb Associates, Inc.
M.S., Engineering Management, 1995, Catholic University of America, Washington D.C.
B.A., Mathematics, 1975, College of the Holy Cross, Worcester, MA
Years of Experience: 20

Gerard, Thomas A., Regulatory Technical Analyst and HE Fabrication Lead, SRA Technologies, Inc.
M.B.A., Management, 1989, Golden Gate University, San Francisco, CA
M.S., Civil Engineering, 1976, California Institute of Technology, Pasadena, CA
B.S., Engineering, 1970, U.S. Military Academy, West Point, NY
Years of Experience: 24

Grant, Johnnie W., Waste Management Technical Lead, Lamb Associates, Inc.
M.S., Physics, 1978, Arizona State University, Tempe, AZ
B.S., Physics and Engineering, 1969, U.S. Military Academy, West Point, NY
Years of Experience: 25

Goins, Charissa, Volume IV Document Coordinator, Tetra Tech, Inc.
B.A., Political Science, 1991, University of Oklahoma, Norman, OK
Years of Experience: 6

Guidice, Stephen J., DOE SSM PEIS Program Manager and Technical Lead for Stockpile Stewardship, DOE Albuquerque Operations Office
M.S., Management, 1972, Rensselaer Polytechnic Institute, Troy, NY
B.S., Engineering, 1968, Rensselaer Polytechnic Institute, Troy, NY
Years of Experience: 28

Howard, Rob, Cumulative Impacts Technical Lead, Tetra Tech, Inc.
B.S., Civil Engineering, 1992, Virginia Polytechnic Institute and State University, Blacksburg, VA
Years of Experience: 4

Jackson, Frederick W., PEIS Project Task Manager, Tetra Tech, Inc.
B.S., Natural Resources, 1975, The Ohio State University, Columbus, OH
Years of Experience: 20

Jacobs, Maryce M., Hazardous Chemical Group Member, SRA Technologies, Inc.
M.B.A., Business Administration, 1991, Strayer College, Washington, DC
Ph.D., Biological Chemistry, 1971, University of California at Los Angeles, Los Angeles, CA
B.S., Chemistry, 1966, New Mexico State University
Years of Experience: 24

Jones, Russell S., Hazardous Chemical Group Member, SRA Technologies, Inc.
Ph.D., Plant Physiology, 1985, University of Arkansas, Fayetteville, AR
M.S., Plant Physiology/Soils, 1979, North Carolina State University, Raleigh, NC
B.A., Biology, 1974, Mansfield University, Mansfield, PA
Years of Experience: 16

Joyce, William E., Human Health Technical Lead, Halliburton NUS Corp.
B.S.Ch.E., Chemical Engineering, 1968, University of Connecticut, Storrs, CT
Years of Experience: 26

Karnovitz, Alan F., Socioeconomics Technical Lead, Tetra Tech, Inc.
M.P.P., Public Policy, 1981, Wharton School, University of Pennsylvania, Philadelphia, PA
B.S., Biology of Natural Resources, 1979, University of California, Berkeley, CA
Years of Experience: 12

Leichter, Irving, Waste Management Group Member, SRA Technologies, Inc.
M.S., Meteorology, 1974, South Dakota School of Mines and Technology, Rapid City, SD
B.S., Meteorology and Oceanography, 1972, New York University, New York, NY
Years of Experience: 22

MacConnell, James M., Biotic Resources Group Member, Halliburton NUS Corp.
B.S., Zoology, 1974, University of Maryland, College Park, MD
Years of Experience: 21

Magette, Thomas E., P.E., Program Manager, Tetra Tech, Inc.
M.S., Nuclear Engineering, 1979, University of Tennessee, Knoxville, TN
B.S., Nuclear Engineering, 1977, University of Tennessee, Knoxville, TN
Years of Experience: 19

Maltese, Jasper G., Human Health Technical Lead, Halliburton NUS Corp.
M.S., Operations Research, 1970, George Washington University, Washington, DC
B.S., Mathematics, 1961, Fairleigh Dickinson University, Rutherford, NJ
Years of Experience: 33

Miller, James D., Jr., Project Security Officer, SRA Technologies, Inc.
M.S., Nuclear Engineering, 1972, University of New Mexico, Albuquerque, NM
B.S., Electrical Engineering/Computer Science, 1970, University of New Mexico, Albuquerque, NM
Years of Experience: 23

Morgan, Lynn, Water Resources Technical Lead, Tetra Tech, Inc.
B.S., Geology, 1994, West Virginia University, Morgantown, WV
Years of Experience: 2

Minnoch, John K., Jr., Intersite Transportation Technical Lead, SRA Technologies, Inc.
M.B.A., Finance, 1972, University of Utah, Salt Lake City, UT
B.S., Air Science, 1960, Oklahoma State University, Stillwater, OK
Years of Experience: 32

O'Day, Ronald Y., Hazardous Chemical Group Member, SRA Technologies, Inc.
M.P.H., Epidemiology/Biostatistics, 1994, The George Washington University, Washington, DC
B.S., Chemistry, 1990, Hobart College, Geneva, NY
Years of Experience: 3

Olson, David G., PEIS QA Representative, Halliburton NUS Corp.
B.S., Chemistry, 1963, Duquesne University, Pittsburgh, PA
Years of Experience: 29

Rikhoff, Jeffrey J., Technical Coordinator for Air Quality, Biotic Resources, Human Health: Normal Operations and Accidents, Halliburton NUS Corp.
M.R.P., Regional Planning, 1988, University of Pennsylvania, Philadelphia, PA
M.S., Development Economics, 1987, University of Pennsylvania, Philadelphia, PA
B.A., English, 1980, DePauw University, Greencastle, IN
Years of Experience: 11

Rose, James J., PEIS Document Manager, DP-45, DOE
J.D., 1994, Columbus School of Law, Catholic University, Washington, DC
B.S., Ocean Engineering, 1983, U.S. Naval Academy, Annapolis, MD
Years of Experience: 12

Sarrel, Rachel S., Comment Database Manager, Tetra Tech Inc.
M.S., Environmental Science, 1995, State University of New York College of Environmental Science and Forestry, Syracuse, N.Y.
B.A., Environmental Studies, 1993, State University of New York at Binghamton, Binghamton, N.Y.
Years of Experience: 1

Schinner, James R., Biotic Resources Technical Lead, Halliburton NUS Corp.
Ph.D., Wildlife Management, 1974, Michigan State University, East Lansing, MI
B.S., Zoology, 1967, University of Cincinnati, Cincinnati, OH
Years of Experience: 22

Schlegel, Robert L., Radiological Health Risk Assessment Group Member, Halliburton NUS Corp.
M.S., Nuclear Engineering, 1961, Columbia University, New York, NY
B.S., Chemical Engineering, 1959, Massachusetts Institute of Technology, Cambridge, MA
Years of Experience: 30

Silhanek, Jay S., Waste Management Group Member, Lamb Associates, Inc.
M.P.H., Health Physics, 1961, University of Michigan, Ann Arbor, MI

M.S., Sanitary Engineering, 1957, University of Wisconsin, Madison, WI
B.S., Civil Engineering, 1956, Case Western Reserve, Cleveland, OH
Years of Experience: 37

Slemmons, Hazel C., Halliburton NUS Deputy Technical Coordinator, Halliburton NUS Corp.
B.S., Business Administration, 1986, University of Maryland, College Park, MD
A.A., Management/Marketing, 1983, Montgomery College, Rockville, MD
Years of Experience: 10

Smith, Mark E., Deputy Project Task Manager/Technical Coordinator, Tetra Tech, Inc.
B.S., Civil Engineering, 1987, Carnegie Mellon University, Pittsburgh, PA
Years of Experience: 8

Steibel, John, Waste Management Group Member, SRA Technologies, Inc.
B.S., Industrial Engineering, Management Systems, 1958, General Motors Institute, Flint, MI
Years of Experience: 38

Sullivan, Barry D., Facility Accidents Group Member, Halliburton NUS Corp.
M.B.A., Management, 1964, Hofstra University, Hempstead, NY
B.S., Electrical Engineering, 1960, Rutgers University, New Brunswick, NJ
Years of Experience: 34

Swedock, Robert D., Project Definition Technical Lead, Lamb Associates, Inc.
M.S., Civil Engineering, 1975, Stanford University, Stanford, CA
B.S., Military Science, 1968, U.S. Military Academy, West Point, NY
Years of Experience: 26

Tammara, Rao S.R., Intersite Transportation Group Member, Halliburton NUS Corp.
M.S., Environmental Engineering (Pollution Control), 1976, University of Maryland, College Park, MD
M.S., Chemical/Nuclear Engineering, 1970, University of Maryland, College Park, MD
M. Tech (M.S.), Chemical Engineering, Plant Design, 1968, Osmania University, India
B. Sci (B.S.), Mathematics, Physics and Chemistry, 1961, Osmania University, India
Years of Experience: 28

Thayer, Patrick M., Technical Analyst, WeaponsAssembly/Disassembly and Nonnuclear Fabrication Lead, SRA Technologies, Inc.
M.B.A., 1979, University of Colorado, Boulder, CO
B.G.S., Business, 1973, University of Nebraska, Omaha, NE
Years of Experience: 30

Toblin, Alan L., Human Health Group Member, Halliburton NUS Corp.
M.S., Chemical Engineering, 1970, University of Maryland, College Park, MD
B.E., Engineering, 1968, The Cooper Union, New York, NY
Years of Experience: 24

Tray, Michaela, Reference Coordinator, Tetra Tech, Inc.
Currently enrolled, University of Virginia, Falls Church, VA
Years of Experience: 25

Tsou, James, Air Quality Group Member, Halliburton NUS Corp.
M.S., Environmental Science, 1991, University of Cincinnati, Cincinnati, OH
B.S., Atmospheric Science, 1985, National Taiwan University, Taiwan
Years of Experience: 7

Van Every, Danica, Cumulative Impacts Technical Lead, Tetra Tech, Inc.
B.S., Environmental Studies, 1994, Radford University, Radford, VA
Years of Experience: 2

Waldman, Gilbert, Radiological Normal Operations Technical Lead, Halliburton NUS Corp.
B.S., Nuclear Engineering, 1991, University of Florida, Gainesville, FL
Years of Experience: 4

Whiteman, Albert E., DOE SSM PEIS Deputy Program Manager and Technical Lead for Stockpile Management, DOE Albuquerque Operations Office
M.B.A., Business Administration, 1972, Oklahoma State University, Tulsa, OK
M.S., Physics, 1970, Oklahoma State University, Tulsa, OK
B.A., Physics and Mathematics, 1968, Friends University, Wichita, KS
Years of Experience: 24

Wilbur, Thomas M., Deputy Program Manager, Tetra Tech, Inc.
M.S., Nuclear Physics, 1987, Naval Postgraduate School, Monterey, CA
B.S., Nuclear Engineering, 1978, Pennsylvania State University, State College, PA
Years of Experience: 26

Williams, Kathleen A., Land Resources Technical Lead, Comment Response Document Lead, Tetra Tech, Inc.
B.S., General Engineering, 1992, University of Maryland, College Park, MD
Years of Experience: 3

CHAPTER 8: LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS STATEMENT WERE SENT

This chapter lists agencies, organizations, and persons who requested Volumes I, II, III, and IV of the *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* . Not listed are the organizations and persons who requested only the Summary or Volumes II, III, or IV.

Federal-Elected Officials Representing Affected Areas

States

Arizona
California
Georgia
Kansas
Missouri
Nevada
New Mexico
South Carolina
Tennessee
Texas
Utah

Governors Representing Affected Areas

States

Arizona
California
Georgia
Kansas
Missouri
Nevada
New Mexico
South Carolina
Tennessee
Texas
Utah

State Elected Officials Representing Affected Areas

States

Arizona
California
Georgia
Kansas
Missouri
Nevada
New Mexico
South Carolina
Tennessee
Texas
Utah

NEPA State Single Points of Contact

States

Arizona
California
Georgia
Kansas
Missouri
Nevada
New Mexico
South Carolina
Tennessee
Texas
Utah

Native American Groups

Agua Caliente Tribal Council, CA
All Indian Pueblo Council, NM
Alturas Rancheria, CA
Amah Tribal Band
Augustine Band of Cahuilla Mission, CA
Barona General Business, CA
Battle Mountain Band Council, NV
Benton Paiute Indian Tribe, CA
Berry Creek Rancheria, CA
Big Pine Paiute Tribe, CA
Big Sandy Rancheria, CA
Big Valley Rancheria, CA
Bishop Indian Tribe Council, CA
Blue Lake Rancheria, CA
Bridgeport Indian Colony, CA
Buena Vista Rancheria, CA
Bureau of Indian Affairs

Cabazon Indians of California, CA
Cahuilla Band of Mission Indians, CA
Carson Colony Council, NV
Carson Community Council, NV
Cawtawba Indian Nation, SC
Cedarville Rancheria, CA
Chemehuevi Paiute Tribe, NV
Chemehuevi Paiute Tribal Council, NV
Chicken Ranch Rancheria, CA
Cloverdale Rancheria, CA
Coast Indian Community of the Resighini, CA
Cochiti Pueblo, NM
Colusa Rancheria, CA
Cortina Rancheria, CA
Council of the Te-Moak, NV
Coyote Valley Reservation, CA
Cuyapaipe Band of Mission Indians, CA
Dresslerville Community Council, NV
Dry Creek Rancheria, CA
Duckwater Shoshone Indian Tribe, NV
Elem Indian Colony of Pomo Indians
Elk Valley Rancheria, CA
Elko Band Council, NV
Ely Colony Tribal Council, CA
Fallon Business Council, NV
Fort Independence Paiute Tribe, NV
Fort McDermitt Paiute-Shoshone Tribes, NV
Greenville Rancheria, CA
Grindstone Rancheria, CA
Guidiville Rancheria, CA
Hoopa Valley Indian Reservation, CA
Hopland Reservation, CA
Isleta Pueblo, NM
Jackson Rancheria, CA
Jamul Band of Mission Indians, CA
Jemez Pueblo, NM
Jicarilla Apache Tribe, NM
Karuk Tribe of California, CA
La Jolla Band of Mission Indians, CA
La Posta Band of Mission Indians, CA
Las Vegas Indian Colony, NV
Laytonville Rancheria, CA
Lone Pine Paiute/Shoshone Tribe, CA
Los Coyotes Band of Mission Indians, CA
Lytton Rancheria, CA
Manchester/Point Arena Rancheria, CA
Manzanita General Council, CA
Mesa Grande Band of Mission Indians, CA
Mescalero Apache Tribe, NM
Middletown Rancheria, CA

Moapa Paiute Indian Tribe, NW
Mooretown Rancheria, CA
Morongo Band of Mission Indians, CA
Nambe Pueblo, NM
National Congress of American Indians, DC
North Fork Rancheria, CA
Northwestern Band of Shoshoni Nation
Pahrump Paiute Indian Tribe, NV
Pala Band of Mission Indians, CA
Pascua Yagui Tribal Council, NV
Pauma Band of Mission Indians, CA
Pinoleville Rancheria, CA
Pit River Tribal Council, NV
Pojoaque Pueblo, NM
Potter Valley Rancheria, CA
Pyramid Lake Paiute Tribal Council, NV
Quartz Valley Indian Reservation, CA
Ramah Navajo Chapter, NM
Ramona Band of Cahuilla Indians, CA
Redding Rancheria, CA
Redwood Valley Rancheria, CA
Reno/Sparks Tribal Council, NV
Rincon Band of Cahuilla Indians, CA
Robinson Rancheria, CA
Rohnerville Rancheria, CA
Rumsey Rancheria, CA
San Felipe Pueblo, NM
San Ildefonso Pueblo
San Juan Pueblo, NM
San Manuel Band of Mission Indians, CA
San Pasqual General Council, CA
Santa Ana Pueblo, NM
Santa Clara Pueblo, NM
Santa Rosa Rancheria, CA
Santa Ynez Band of Mission Indians, CA
Santa Ysabel Band of Mission Indians, CA
Santa Domingo Pueblo, NM
Scotts Valley Band Band of Pomo Indians, CA
Sherwood Valley Rancheria, CA
Shingle Springs Rancheria, CA
Shoshone Bannock Tribe, NV
Shoshone Paiute Business Council, NV
Smith River Rancheria, CA
Soboba Band of Mission Indians, CA
South Fork Band Council, NV
Stewart Community Council, NV
Stewarts Point Rancheria, CA
Summit Lake Paiute Council, NV
Susanville Rancheria, CA
Sycuan Business Committee, CA

Table Bluff Rancheria, CA
Table Mountain Rancheria, CA
Tesuque Pueblo, NM
Timbisha Shoshone Tribe, CA
Torres-Martinez Band of Mission Indians, CA
Trinidad Rancheria, CA
Tule River Reservation, CA
Tuolumne Me-Wuk Rancheria, CA
Twenty Nine Palms Band of Mission Indians, CA
Walker River Paiute Tribal Council, NV
Washoe Tribal of Nevada and California, NV
Wells Indian Colony Band Council, NV
Western Shoshone Elders Council, NV
Western Shoshone National Council, NV
Winnemucca Indian Colony, NV
Woodfords Community Council, CA
Yerington Paiute Tribal Council, NV
Yomba Shoshone Indian Tribe, NV
Ysleta del Sur Pueblo, TX
Yurok Tribe, CA
Zia Pueblo, NM
Zuni Pueblo, NM

Mayors Representing Affected Areas

California

Livermore
Oakland
Manteca
Pleasanton
Tracy

Georgia

Atlanta
Augusta
Bath
Blyth
Evans
Girard
Harlem
Hephzibah
Keysville
Martinez
Millen
Sardis

Savannah
Statesboro
Thomson
Waynesboro
Wrens

Kansas

Kansas City
Leawood
Lenexa
Merriam
Mission Hill
Olathe
Overland Park
Prairie Village
Shawnee

Nevada

Alamo
Amargosa Valley
Ash Springs
Beatty
Blue Diamond
Henderson
Hiko
Indian Springs
Las Vegas
North Las Vegas
Pahrump
Warm Spring

New Mexico

Albuquerque
Espanola
Santa Fe

South Carolina

Aiken
Allendale
Augusta
Bamberg
Barnwell
Batesburg
Blackville
Beech Island

Columbia
Denmark
Edgefield
Estill
Gaston
Gloverville
Graniteville
Hampton
Jackson
Johston
Leesville
Monmorenci
New Ellenton
North
North Augusta
Norway
Orangeburg
Owdoms
Pelion
Perry
Salley
Saluda
Springfield
Sycamore
Trenton
Vanville
Wagener
Windsor
Williston

Tennessee

Andersonville
Alcoa
Allardt
Athens
Bethel
Blaine
Briceville
Caryville
Clarkrange
Clinton
Coalfield
Corrytown
Crossville
Dandridge
Decatur
Deer Lodge
Elgin

Etowah
Town of Farragut
Fairfield Glade
Fairview
Friendsville
Gatlinburg
Grandview
Greenback
Harriman
Halls Crossroads
Huntsville
Jacksonboro
Jamestown
Jefferson City
Jellico
Karns
Kingston
Knoxville
Kodak
La Follette
Lake City
Lancing
Lenoir City
Loudon
Louisville
Luttrell
Madisonville
Maryville
Mascot
Maynardville
Midtown
New Market
New Tazwell
Niota
Norris
Oakdale
Oak Ridge
Old Washington
Oliver Springs
Oneida
Petros
Philadelphia
Pigeon Forge
Pomona
Powell
Rockford
Rockwood
Rutledge
Sevierville
Sharps Chapel

Solway
Speedwell
Spring City
Strawberry Plains
Sunbright
Sweetwater
Talbot
Tellico Plains
Ten Mile
Townsend
Washington
Vonore
Walland
Wartburg
Wildwood

Texas

Amarillo
Ashota
Borger
Bushland
Canyon
Channing
Clarendon
Claude
Cliffside
Conway
Dial
Dawn
Dumas
Electric City
Fritch
Goodnight
Groom
Happy
Hereford
Lake Tanglewood
Paloduro
Pampa
Pullman
Philips
Sanford
Skelleytown
Spearman
Silverton
Stinnett
Tulia
Vega

Washburn
Wildorado

Individuals Requesting Copies

Arkansas

Tanya R. Shelter

California

Carl Anderson
Vernon Brechin
Paul G. Corrado
Laurence Ebersole
M. Fulk
Stephen Gale
Maria T. Jordan
Valerie Kuletz
Donald K. Larkin
Deborah J. Neitz
Jeff Paisner
Barbra Perkins

Colorado

Jerry Anderson
Robert Knudson
Frank Smith
Leslie Wildesen

District of Columbia

Markus Puder

Georgia

Charles Beers, Jr., USN
Richard Geddes
Carolyn White
Rosalie Zeis

Florida

Richard Burnette

Iowa

Janie Marie Stein

Idaho

Beatrice Brailsford
George Bridges
Casey Burns
Dennis Donnelly
Liceltel Gibson
William Hurt
William G. Lussie
Steven Maheras
Victor Pearson
Horace B. Pomeroy
Bill Poulsen

Illinois

Bruce Biwer

Indiana

Kevin Haub

Kansas

Earl Bean
Gary Hall
Mike Osborne

Kentucky

William R. Haynes

Massachusetts

Brenda Davies

Maryland

Richard Denton
John DiMarzio
Kathryn Schoene
Rick Starostecki

Missouri

George A. Baggett
Jerry Bublitz

John W. Fraser
Robert Hanson
Daniel L. Stoltz
Scott N. Wright

North Carolina

Brita Clark
Robert Duffield
Tom Schrager

New Jersey

Peter Allen

New Mexico

Jerome Beery
Mike Butler
Robert Duff
Ron Faich
Katherine Hanson
Karen Lam
Richard O. Deyo
Wanda Martin
Frank Martinez
Melvin McCorkle
Suzanne M. Noga
Ruth W. Parrish
Chuck Pergler
Donivan R. Porterfield
Randy F. Reddick
Carmen M. Rodriguez
Jay S. Samuels
Elliott Skinner
Helen J. Starling
Clement Switlik, Jr.
Charles C. Thomas, Jr.
Gary Van Valin
Jamie Welles
Chris Wentz
Wayne N. Weseloh
Steve Yanicak

Nevada

M.L. Brown
Linda A. Cardenas
William Crismon

Sally Devlin
Becky Gurka
Edwin Hanson
Diane Harrison
Mark Manendo
John Martin
McGowan
Mary O'Brien
Joseph Ruggieri
Jewell Tidwell
Engelbrecht L. Tiesenhausen
Fred Toomey
Janene Zimmerman

New York

Jolie Lonner
Richard Powell

Ohio

John L. Hehmeyer
Floyd R. Hertweck
Paul Lamberger
Velma Shearer

Oregon

Larry Caldwell

Pennsylvania

Tyler Cyronak
Judith Joshrud
Joseph L. Redding, Jr
Mike Travis

Rhode Island

John Doherty

South Carolina

James Angelos
John C. Beard, Jr.
John Cecil
Dave Ecklund
Jerry Edmunds
Robert W. Folsom

Charles Goergen
Thomas Greene
Gail Jernigan
Donald Kepler
Barbara MacWilliams
Ben Maddox
Sam P. Manning
R.S. Matthews
William R. McDonell
Gary Mullis
Philip Permer
William Lee Poe
Josephine Stegall
Michael Williams
Jim Willison
Steve Wilson

Tennessee

William Arendale
Anne Banks Redwine
J.R. Barkman
Ken Bernander
Ralph Best
William Bibb
Alfred Boch
Harry Bryson
Robert B. Burditt
Walter Coin
Lesley T. Cusick
Spivey Douglass
William S. Dritt
Dan Fairfax
James C. Franklin
Annie Freeman
Douglas Greene
Gerald R. Guinn
Robert M. Hill
James Hodges
Jeannine Honicker
Charles N. Jolly
P.H. Johson
John Jones, Jr.
Bill Leinart
Fred Maienshien
William T. Mee
W. Mccullough
R.W. Mitchell
John N. Napier

Ralph Newcomb
Walter N. Perry
Jim Phelps
Richard Philippone
Guy Ragan
Stan Roberts
Jim Short
Jane Simons
John Smarsh
Harwell F. Smith, Jr.
Richard Smith
Edward G. St Clair
William E. Tewes
Steven Thomas
Myra Traugot
Charles K. Valentine
Alan K. VanHull
James E. Wescott
William J. Wilcox, Jr.
William J. Yaggi

Texas

Tom Albritton
Don Alexander
Hardy Allen
Howard Allen
Peggy W. Alley
Dennis Almquist
Johnell Archer
Jerry Arnold
Richard Ashford
Charles Atkins
Laurence Auman
Beverly Axmacher
Dee Barman
Barbara Barnard
Carol Barnhill
Robert Beckley
Luther Belcher
Martha Berends
C. Ronald Beukenkamp
Cliff Bickerstaff
Jerry Bishop
George Blake
Rodney Bohannon
Jon D. Booker
Steven Boone
Glenda Bouker

Inez Brackens
R. Brady
Russell L. Breeding
Linda Briggs
Ben Brister
Curtis Broaddus
Neal Bryson
Steven Bullard
Karen Bullion
Mae Burk
Richard Burke
Robert Burnside
Samuel Burton
William Buyers
Alvis Byrd
John Carlson
Brenda Carnes
Christi Carthel
Christopher Carthel
Jay Cartwright
Elizabeth A. Casida
Michael Chafee
Roy Champeau
Addis Charless, Jr.
Jay Childress
Shelley Ciskowski
Carolena Cogdill
Judith Conley
Paul Cook
Winfield Cooper
Michael Coppinger
Michael Coyne
William Crumpleu
Joyce Cunningham
Mary Jane Dailey
Phil Daniels
Thomas Davidson
Ernest Davis
Irvin Davis
J. Frank Davis
Jeffrey Davis
Lavonna Davis
Barbra Deck
Rocky Deckard
Brian Denny
Diana Densmore
John Denton
L.P. Detterline
Gwynn Dockins
Mary Dowd

Sarah Dworzack
Eddie Edwards
Robert Elliott
Judy Elliston
J. Dianne Ely
George English, III
Deborah Erwin
Alonzo Everhart
Richard Failla
Guy Fairweather
Jim Fellers
David Ferguson
Bruce Fields
Victor Fite
Lisa Flanagan
Ralph Fletcher
Grant Fondaw
Nelda Foster
Patricia Foster
R.D. Frymoyer
John Fulgenli
James George
Robert Gleason
Ricky Goforth
Pamela Gonce
Edward J. Gorski
Winnie Graves
Robert Griffith, Jr.
Donna Grove
Karen Grove
Gilbert Guzman
Allen Hale, Jr.
Linda Kay Hall
Ethel Harris
Michael Harris
Shayne Harris
Sue Harrison
Kathy Hawkins
Lisa Hawthorne
Saleem Hayat
Billy Head
Sharon Hemphill
L.A. Hennig
Oscar Hernandez
John Herrera
Ronnie Hill
Greg Hodge
Jerry Hodges
Stephanie Hodges
Ruth Honaker

David Hooten
G.M. Horton, Jr.
Eva Houston
Janice Hubbard
Jewett Huff
Linda Hulse
John Hunt
Ronald Isabell
J.H. Ishern, MD
Mark Jack
Paul Jefferson
Jimmy Jenkins
Shirley Jennings
Barbra Jones
Diana Kay Jones
Harold Jones
Murle Jones
Jason Judd
Sharon Junell
Doris Kaczmarek
Ronnie Kerr
Louis Keyser
F.C. Killebrew
Angela Kleffman
Reinhard Knerr
Henrietta Kohn
J.O. Koontz
Rita Koontz
June Lanham
Steve Laughter
June Lawler
Doyle Leathers
John F. Lemming
Jimmy Lemons
Howard Leos
Thomas Lester
H.W. Lichte
Randy Little
Delcie Loftin
John Long
Rustin Long
Vincent LoPresti
Terrie Lovelady
Gregory Loyall
Bruce Lucas
Penny Lucero
Richard Mackie
Darryl Maddox
Virginia Maples
Joe Marcum

H. Martin
Genevieve Martinez
Jesus Martinez
Larry Martinez
Bobby Massel
Brent Matlock
Craig Matthews
David Mayer
Margie McAlister
David McDonald
Nancy McDonald
Lonnie McGinnis
Daniel McGrath
Forrest McLaughlin
Andrew McMurry
Robert McNeil
Alan Meier
Heidt Melson
Dean Metcalf
John Metcalf
David Michaels
Thomas Miller
Henry Mitchell
Kevin Mitchell
H.C. Montgomery
Ted Montgomery
Patricia Moore
Arthur Morton
Jarrel Rex Mulkey
Deborah Mundell
Clyde A. Murray
Faye Naylor
Trish Neusch
Jim Nicks
Michael Nims
Jerry Noel
Jeri Osborne
James Otto
Jenna Ownbey
Catherine Pachta
Patrick Padilla
A.G. Papp
Gary Parrish
Brenda Pascal
Tammi Pedro
Carl Phagan
Gary Phenix
Dena Phipps
Judy Pitts
Billie Poteet

Steven Poteet
Sherry Potter
Dawn Preiss
Gerald Priest
Jerry Pybus
J.M. Rackley
Matthew M. Randolph
Rudy Rangel
K. Raulston
Jerry Ann Rhea
Blair Rhodes
Helen Riepma
Carol Rippy
Gabriel Rivas
Wayne Rodin
Jesse Rome
Robert Roulston
Loreen Rowe
Jackie Ruland
Ronald Ryder
Armando Saenz
Elvira Sanchez
Kenneth Sanders
Ralph Schell
Rhonda Schuelke
Sharon Scott
William Seewarld
Henry Sena
Mary Shennum
Theadore Shutt
Billy Sims
Luis Sisneros
Dicky Smith
Marshall Smith
Wayne Smith
Tamara Snodgrass
Steven Sottile
Elizabeth A. Sproul
Dirk Stapleton
Susan Steen
Earlene Steffensmeier
Alice Steiert
B. Stemman
Brent Stephens
Clayton Stephens
Helen Stewart
Marjorie Storseth
Toye Ann Stubblefield
Flory Stucky
Billy Sutton

Hank Swanson, Sr.
Lee Taylor
Twanda Taylor
Larry Thomas
Bryan Tidwell
Michael Tipton
Greg Titus
Jeff Tseng
Venetia Tugwell
William Tull
Michael Turner
Randy Twombly
Cleta Upton
Dennis Vaughan
Ben Velasquez
E.M. Velasquez
Ernst Vitaliani
Leonard R Voellinger
Paul Walker
Donald Walsh
Mitch Warren
Mack Watson
Patsy Wells
Fred Wieck
Russell Wiley
Tim Wilhelm
Cynthia Williams
Neva Winkler
Robin Woosley
Frank Wray
Craig Wricht
Susan Young

Virginia

Rita Bowser
Ronald E. Buchanan
Warren Donnelly
Michael Frieders
Mary Holland

Washington

Harold Heacock Patricia Herbert
Norton T. Hidreth
Liz Marshall
Joe Masco
Robert L. Miller
Walbridge Powell

Wayne Ross
Paul Sutley
Harry Wilson

United Kingdom

Ian Fairlie

Organizations Requesting Copies

Alabama

Tennessee Valley Authority	Jim S. Chardos

California

Abalone Alliance	
American Nuclear Society	Sidney Langer
Bechtel Corporation, 50/17/C37	R.T. Taussig
California Alliance for Jobs	George Fink
California State Energy Commission	Barbara Byron
California Water Resources Control Board	Leslie Laudon
CEA	Pierre J. Kumurdjian
Decision Insights, Inc.	Detlof Von Winterfeldt
Dendix Environmental Research	Grace Doi
Department of Environmental Engineering	Leslie Jardine
Ecology Center	
Economic Development Advisory Board	Robert Sakai
Fluor-Daniel	Tom Bullock
Ground Work Magazine	Victoria Woodard
Healing Global Wounds	No Nukes
Holmes and Narver	JoAnn Milam
Holmes and Narver	Diana Toner
International Conference of Building Officials	Roy Fewell
Jason Associates Corporation	Elizabeth Williams
Labor Union 342	Angela M. Torres
Lawrence Livermore National Lab	Bert Heffner
Lawrence Livermore National Lab	Thomas T. Kato
Lawrence Livermore National Lab	Hank M. Khan
Lawrence Livermore National Lab	Dustin Riggs
Lawrence Livermore National Lab	Stanley H. Terusaki
National Coalition to Stop Food Irradiation	Alan Horn
Northcoast Environmental Center	Tim McKay
Peace and Justice Network	

Physicians for Social Responsibility	Robert Gould
Physicians for Social Responsibility	Isadore Kolman
Plumbers and Steamfitters Union #342	Donald W. Higgins
Plumbers and Steamfitters Union #342	W. Barlow Manning
PQP Environmental Engineering Services	Clyde Morton
Seniors for Political Action	
Ralph M. Parsons, Co.	Frank DeMartino
The Resources Agency of California	Maureen Gorson
Tetra Tech, Inc.	Nisha Bansal
The Independent Newspaper	Janet Armantrout
Tracy Press	Kristin M. Kraemer
Tri-Valley CARES	Marylia Kelley
Tri-Valley CARES	Donald F. King
U.S. Bureau of Land Management	Lynda Roush
U.S. Department of Energy	Walter Perry
U.S. Department of Energy	Don Randall
U.S. Department of Energy	Scott Samuelson
U.S. Department of Energy	John M. Yatabe
U.S. Department of Energy Public Reading Room	Lauren Noble
U.S. Department of the Interior	Sammie Cervantes
U.S. Department of the Interior	Patricia S. Port
University of California	Elaine Stamman
Valley Times	Peter Weiss
Vectra Government Services	Miguel Manrique
Vertex Associates, Inc.	Glenn Niblock
Western States Legal Foundation	Jacqueline Cabasso
Western States Legal Foundation	Andrew Lichterman
Western States Legal Foundation	Michael J. Veiluva

Colorado

American Friends Service Committee	Thomas Rauch
Colorado College	Bill Weida
Colorado Department of Human Health	Steve Tarleton
Colorado State College	Whitstock Kara
E and C Johnson Company	Charles Johnson
Federal Aviation Administration	Fred Thompkins
Parsons Brinckerhoff	David Aboll
Parsons Engineering Science Inc	Terry A. Kuykendall
Raytheon Engineers and Constructors	Ronald Claussen
Rocky Flats Cleanup Commission	James Stone
Rocky Flats Environmental Technology Site	Bob Williamson

Savant Enterprises LLC	Leslie Hatch
United Steelworkers of America	David M. Navarro
U.S. Department of Housing and Urban Development	Howard Kutzer
Connecticut	
NES, Inc.	Dennis Reisenweaver
SM Stoller Corporation	Ralph L. Klein
Transplex, Inc.	John Helm
UNC Naval Products	W.F. Kirk
District of Columbia	
Afton Associates	Holmes Brown
Allied Science Aerospace Co.	Steve May
Argonne National Laboratory	Gary Williams
ASTSWMO	Thomas J. Kennedy
Bechtel National, Inc.	Robert R. Monroe
Bridge Structural and Ornamental Iron Workers	Jake West
British Embassy	David Prince
Brookhaven Technology Group	Nikita Wells
Brookings Institution	Christina Woodward
Bureau of National Affairs	James H. Kennedy
Chemical and Engineering News	Richard Seltzer
Defense Nuclear Facilities Safety Board	A.J. Eggenbeger
Defense Nuclear Facilities Safety Board	Kent Fortenberry
Defense Nuclear Facilities Safety Board	Lawrence Zull
Defense Nuclear Facilities Safety Board	Steve Krahn
Edlow International Co.	Linda Parikh
Embassy of Australia	Allan Murray
The Energy Daily	George Lobzens
Exchange Monitor Publications	Karen Yourish
GAO - Energy and Science Issues	William Lanouette
Institute for Science and International Security	Tom Zamora-Collina
Jordan News Service	Uchijo
Library of Congress	Jonthan Medalia
Library of Congress	Richard Rowberg
Lockheed Martin	Gary P. Patterson
McGraw-Hill	David Airozo
Military Production Network	Maureen Eldridge
Natural Resources Defense Council	Andrew Caputo
Nuclear Control Institute	Steven Dolley

Numark Associates	Heather S. Bergman
Office of Management and Budget	Robert Civiak
Pepper, Hamilton, and Scheets	McLanie Oliver
Resources for the Future	Kieran McCarthy
TRW	Paul M. Krisana
U.S.Department of Agriculture/Natural Resources Conservation Service	Robert R. Shaw
U.S.Department of Energy	Carolyn Lawson
U.S. Department of Energy	Mark Pellechi
U.S. Department of Labor	Edward Stern

Florida

League of Women Voters	Jane Hammer

Georgia

Citizens for Environmental Justice	Mildred McClain
Georgia Department of Natural Resources	Lonice Barrett
Georgia State Clearinghouse	Trip Reid
U.S. Department of Health and Human Services	Kenneth Holt
U.S. Environmental Protection Agency	Heinz Mueller
WRDW-TV	Charles Moody

Idaho

Argonne National Lab West	Robert Peralta
Construction and Support	Cosette Landon
LITCO INEL	Gray Chang
Lockheed Idaho Technologies Company	Nathan Chipman
SAIC	Lori DeLuca
Snake River Alliance	Brian Goller
State of Idaho	Bob Ferguson
U.S. Department of Health and Welfare	Wallace W. Cory

Illinois

American Nuclear Society	Sharon Kerrick
Argonne National Laboratory	A. DeVolpi
Argonne National Laboratory	Anthony Dvorak
Argonne National Laboratory	John F. Hoffecker
U.S. Department of Housing and Urban Development	Eugene Goldfarb

Kansas

Allied Signal	Peter Black

Kansas Department of Health and Environment	Ronald Hammerschmidth
Kentucky	
Mason and Hanger	Rick Loghry
Mason and Hanger	Richard Nathan
Louisiana	
The Shreveport Times	John Andrews
Maryland	
21st Century Industries, Inc.	SCT McDowell
Defense Conversion Tech, Inc.	Victor V. Yevshikov
Energetics	Terence Bates
Health and Energy Institute	Kathleen M. Tucker
Institute for Energy and Environmental Research	Hisham Zerriffi
Jupiter Corporation	Clyde Jupiter
Lawrence Livermore National Lab	Corry Wilkinson
Lawrence Livermore National Lab	Ellen Taylor
Magnus Associates	D. Keith Magnus
Maryland State Clearinghouse	Bob Resenbush
National Clearinghouse	
Nuclear Waste News	Thecla Fabian
SAIC	Peter Lobner
SAIC	Cheri Maddox
SAIC	Abe Zeitoun
Scientech, Inc.	Jeffrey L. Kotsch
U.S. Department of Energy	Michele Oshaughnessy
Massachusetts	
Arthur D. Little, Inc.	Pamela D. Galaid
Simons Rock College	Charlie Maddox
Michigan	
Grand Valley State University	Teresa Castelao-Lawless
Missouri	
Allied Signal	Karen Clegg
Allied Signal	Michael D. Sestric, Jr.
Allied Signal Aerospace	Charles Cook
City of Grandview	Dennis Lemon
Critical Technologies Partnership	Laurie A. Peterfreund
Department of Elementary and Secondary Schools	Dewayne Cossey

Kansas City Area Office	David Hampton
Kansas City Missouri Police Department	Thomas Mills
United Plant Guard Workers of America	Neal L. McGregor
Mississippi	
Mississippi Department of Health	Eddie S. Fuente
North Carolina	
Clean Water Fund of North Carolina	Carl Rupert
Department of Administration	Chrys Baggett
Duke Engineering and Services	Gary Hedrick
New Jersey	
Raytheon	Tom Hendrickson
New Mexico	
Albuquerque Journal-North	Doug McClellan
Anti-Nuke	Al Shapolia
Battelle	Glen Hanson
Battelle Pantex	Frank Douglas
Bernalillo County Commission	Ken Sanchez
Big J Enterprises, Inc.	Greg Kirsch
CCNS	Jay Coghlan
Dames and Moore	J. Lane Butler
Environmental Evaluation Group of New Mexico	Robert Neill
Espanola Ranger District	Robert Remillard
G Cubed	Gregg C. Giesler
Gram, Inc.	Dave Ball
Gram, Inc.	Randy G. Balice
Gram, Inc.	Jeffrey G. Johnson
Gram, Inc.	Rhonda K. Methvin
Gram, Inc.	Robert Monsalve-Jones
Harderwijk Press	Donald R. Westervelt
Jacobs Engineering	Rebecca Neri Zagal
Keystone International	Ray George
Legions of Living Light	Bonnie Bonneau
Los Alamos National Laboratory	Linda Anderman
Los Alamos National Laboratory	Larry Austin
Los Alamos National Laboratory	Gregory S. Cunningham

Los Alamos National Laboratory	Leah Dimarco
Los Alamos National Laboratory	Doris B. Garvey
Los Alamos National Laboratory	Philip D. Goldstone
Los Alamos National Laboratory	Jocelyn Mandell
Los Alamos National Laboratory	Greg Mello
MARA, Inc.	Margaret Ann Rogers
New Mexico Environmental Law Center	Douglas Mieklejohn
Prindle-Hinds Environmental, Inc.	Lucy Archamboult
REAL	Christine Chandler
Representative Steve Schiff's Office	Melissa Maestas
Responsible Environmental Action	Milton Lockhart
San Jose Commerce Aware Council	Dolores Herrera
Sandia National Labs	Garry S. Brown
Sandia National Labs	Jim Woodard
Santa Clara Pueblo	Edwin Tafoya
Scientech	Anthony Ladind
SEA, Inc.	James Lynch
Senator Bingaman's Office	Ricardo Zuniga
Southwest Research and Information Center	Don Hancock
Southwest Research and Information Center	Paul Robinson
SWES, Inc.	Jon T. Higgins
Switlik and Assoc. Engrs	Clement T. Switlik, Jr.
Tetra Tech, Inc.	Clifford Jarman
U.S. Department of Energy	Burce J. Buvinger
U.S. DOE/AL	Richard E. Cameron
U.S. Department of Energy	Tony Ladino
U.S. Department of Energy	Diana Lewte
U.S. Department of Energy	Dennis Umshler
U.S. Department of Energy	Elizabeth Winters
U.S. Department of Energy Community Reading Room	Carmen M. Rodriguez
U.S. Forest Service	Floyd Thompson III
Nevada	
Bechtel Nevada	W. Curt McGee
Citizen Alert	Richard A Nielsen
Defense Contract Administration	Ron Sadora
Department of Administration	Julie Butler
Education Directions	Richard Telfer
EG and G/EM	Lee Davies
Horne Engineering and Environmental Services	Marcus B. Brown

IT Corporation
Lawrence Livermore National Laboratory
Los Alamos Technical Associates, Inc.
Mac/JAG Tech, Inc.
Nevada Alliance for Defense Energy and Business
NTS Contractors Assoc
Professional Analysis, Inc.
Raytheon Services
Raytheon Services Nevada
Raytheon Services Nevada
SAIC
SAIC
SAIC
Salazar Association International
State Historic Preservation Office
State of Nevada
Tetra Tech Las Vegas
U.S. Fish and Wildlife Service
U.S. Department of Energy
U.S. Department of Interior
University of Nevada Las Vegas
Yucca Mountain Science Center

Barbara Hampton
Barbara Iden
Kenneth D. Kok
Lathia McDaniels
Troy Wade
Cheryl Oar
Donald Wrubble
Harold Begley
James Henderson
Gordon Macleod
Julie Gardner
Karen Olsson
Jane Tolman
Thomas L. Pettil
Ronald James
John Walker
Felicia Bradfield

Cynthia Ashley
Curtis Tucker
William B. Andrews
Maomi Lewis

New York

Brookhaven National Laboratory
City Newspaper
Economists Allied for Arms Reduction
Raytheon Nuclear, Inc.
Square Y Consultants
St Lawrence University

George Greene
Jack Spula
Alice Slater
Gregory G. Hofer
Lynn C. Yuan
Kenneth Gould

North Carolina

Department of Administration

Leslie Jardine

Ohio

Battelle Memorial Institute
Morrison Knudsen Corp.
Pastman Pike Resident Environment Safety and Security

Tom McSweeney
William G. Rueb
Vina K. Colley

Oregon

Hanford Watch

Lynn Sims

Oregon State University	John C. Ringle
Physicians for Social Responsibility	Richard Belsey
U.S. Department of Energy	Dirck Dunning
Pennsylvania	
Lehigh University	Kenneth Kraft
U.S. Department of Energy	Darrell Wittenburg
Versar, Inc.	Michael J. Norvell
Westinghouse Electric Corporation	Andy Jarabak
Westinghouse Electric Corporation	George Uram
South Carolina	
Aiken Standard	Shannon Baynham
Citizens for Nuclear Technology Awareness	William Bell
Citizens for Nuclear Technology Awareness	William C. Reining
Energy Research Foundation	Brian Costner
Governor's Division of Natural Resources	Carlisle Roberts, Jr.
Hass and Hilderbrand, Inc.	Todd Hass
Office of the Governor	Omeagia Burgess
South Carolina Academy of Physicians Association	Elizabeth P. Gouge
Stone and Webster South Operations	Carl A. Mazzola
U.S. Department of Energy	Paul Lewis
Westinghouse Savannah River Company	William Brizes
Westinghouse Savannah River Company	Gail F. Jernigan
Westinghouse Savannah River Company	William R. McDonell
Westinghouse Savannah River Company	Robert Smith
Westinghouse Savannah River Company	Doug Wilhelm
Tennessee	
American Nuclear Society	David L. Moses
Anderson County Commission	Jacqueline C. Holloway
Anderson County Emergency Management	Kenneth Flitts
Citizens for Safety	Robert R. Burditt
City of Oak Ridge	Kathleen Moore
Department of Environment and Conservation	Michael Mobley
EASI	Malcolm Thiesen
East Tennessee Development District	Robert Freeman
International Chemical Workers Union	Frank Scott
LOC	Charlotte Robinson
Lockheed Martin	Shirley O. Cox
Lockheed Martin Energy Systems	James Doane

Lockheed Martin Energy Systems
Lockheed Martin Energy Systems
Lockheed Martin Energy Systems
Martin Marietta Energy Systems, Inc.
Martin Marrietta
Midwest Technical, Inc.
Nashville Peace Action
Nashville Peace Action
Nuclear Fuel Services, Inc.
Nuclear Fuel Services, Inc.
Oak Ridge Associated Universities
Oak Ridge City Council
Oak Ridge Local Oversight Committee, Inc.
Oak Ridge National Lab
Operating Engineers
Radian Corp
SAIC
State of Tenn Department of Environment and Conservation
State of Tenn Department of Environment and Conservation
Tennessee Division of Radiological Health
Tennessee Historical Commission
Tennessee Historical Commission
The Scientific Ecology Group, Inc.
Theta Technologies, Inc.
U.S. Department of Energy
U.S. Department of Energy
U.S. Department of Energy
University of Tennessee

David A. Jones
Trygve C. Myhre
Katherine Whaley
Trygve C. Myhre
John Arrowood
Franklin M. Bolin
Joseph Donoso
David Hedgepeth
Keith Guinn
Ruth Salts
Leslie P. Crawford
David R. Bradshaw
Amy Fitzgerald
Scott Ludwig
John Holliday
Joseph Brown
Ruth Maddigan
Adam D. Deweese
David Moran
Roger L. Macklin
Joe Garrison
Herbert Harper
Dewey Large
Michael Moore
Pam Buchanan
Patricia Greeson
Robert Spence
Martin Clauberg

Texas

Abraham and Associates
AFL/CIO
Amarillo National Bank
Amarillo Resource Center
American Inspection Services
Battelle Pantex
Capitol Peace Vigil
Chamber of Commerce
City of Amarillo
Denman Building Products
Environmental Protection Department

Frank George, Jr.
William J. Sticksel
Igor Carron
Daniel F South
Thomas Halliday
Brad Massingill
Tom Patterson
Kevin Knapp
Gene Jeter
Steven Pomeroy

First Care Chiropractic Clinic
Holiday Inn
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mason and Hanger
Mid-Stream, Inc.
Office of the Governor
Panhandle 2000
Panhandle 2000
Panhandle Regional Planning Commission
Pantex Plant
Pantex Plant Citizens Advisory Board
Pantex Plant Citizens Advisory Board
Peace Farm
Senator Tom Haywood's Office
Southwestern Public Service Co.
Southwestern Public Service Company
St. Anthony's Hospital
STAND of Amarillo, Inc.
STAND/STAR
Tetra Tech, Inc.
Texas AandM University
Texas Department of Health
Texas Governor's Office of Budget and Planning
Texas Historical Commission
Texas Tech University
The Mur-Tex Company
The People's Federal Credit Union
U.S. Department of Energy
U.S. Department of Energy Public Reading Room
University of Texas

Kevin Matney
Clyde D. Alley
Herbert S. Berman
Wayne Hardin
Alvin Hill, Jr.
Carolyn Hodges
Troy E. Jones
Dale Milner
David C. Nester
Wayne Sievers
Gregory M. Spiker
Beth Turner
Lawrence V. Whicker
John Wright
Doug Pewitt
Roger Mulder
Randall Erben
Jerome W. Johnson
Gary Pitner
Pam George
Stacy A. Mansoor
Ronald W. Zerm
Mavis Belisle
Trey Powers
Wade Olguin
William Crenshaw
Thomas Birkbeck
Beverly Gattis
William H. Seewald
Bret Simpkins
David A. Thompson
Joseph Martillotti
Thomas C. Adams
Curtis Tunnell
Mark Frautschi
Taylor Fyfe
Charlotte Howard
Karen McIntosh
Terry Koetting
Kenan Unlü

Upshaw	Georgiana Lane
W.C. Environmental Group	Perry Williams
West Texas A&M University	Jerry Miller
Utah	
Utah Peace Test	Brian Meacham
Virginia	
Babcock and Wilcox Advanced Systems	George Kulynych
Defense Nuclear Agency (OPTR)	Sandy Barker
Babcock and Wilcox Advanced Systems	Matt Forsbacka
Flour Daniel	Leslie Bowen
Future Past, Inc.	Shideler
Hampton Talmadge Associates, Inc.	Karen Preston
IDA	James Silk
LATA	James Jacobs
McDermott, Inc.	Anne Hosford
MITRE Corporation	Brenda Fox
Newport News Shipbuilding	Jim Steinke
PPC	Alex Walsh
Tetra Tech, Inc.	Fred Jackson
The Sierra Club	Robert Deegan
TRW	Jim Vaughn
TRW	Linda Wildman
Washington	
Aero-Mechanics	Keith Smith
AFL-CIO	Gordon A. Baxter
Hanford Education Action League	Diana Ellis
Kamerrer Bros.	John Kamerrer
Local 14 Iron Workers	William Burns
Local 598 UA	James Morris
Military Production Network	Susan Gordon
Tri-City Industrial Development	Heacock Harold
U.S. Department of Energy	Annabelle L. Rodriguez
Washington Department of Ecology and Nuclear Waste	Jeffery Breckel
Washington Department of Health	Ed Bricker
Westinghouse Hanford Company B1-10	Walter Blair
Wisconsin	

University of Wisconsin Madison	Gerald Kulcinski
United Kingdom	
United Kingdom Nivex, Ltd.	John Mathieson