3.8 HISTORIC AND CULTURAL RESOURCES

3.8.1 Extent of Historical and Cultural Resource Analysis

The proposed National Enrichment Facility (NEF) at the Lea County, New Mexico site had not been surveyed for cultural resources prior to site selection. Given the lack of this survey, LES, in consultation with the New Mexico State Historic Preservation Officer (SHPO), determined that a survey would be conducted to identify and evaluate any cultural resource properties that may be present within the 220-ha (543-acre) area of land. The initial survey of this site was performed in September 2003.

3.8.2 Known Cultural Resources in the Area

Southeastern New Mexico has been an area of human occupation for the last 12,000 years. Prehistoric land use and settlement patterns include short- and long-term habitation sites and are generally located on flood plains and alluvial terraces along drainages and on the edges of playas. Specialized campsites are situated along the drainage basins and playa edges. European interactions began in 1541 with a Spanish entrada into the area in search of great riches in "Quivira" by Francisco Vasquez de Coronado. Colonization of New Mexico began in 1595, though settlement in the NEF region did not occur until the late nineteenth century. The real boom to the region began with the discovery of oil and gas in the region and most settlement of the region began after the 1930's.

Prior to the survey of the NEF site, three cultural resource surveys had been conducted in the area. These included a survey by the New Mexico Highway and Transportation Department (NMSHTD) in 1984 of 8.4 ha (20.7 acres) (New Mexico Cultural Resource Information System [NMCRIS]) Activity No. 2934), a survey in 1997 by the University of New Mexico Office of Contract Archeology for the Lea County Landfill on the south side of New Mexico Highway 234 just south of the NEF site of 142 ha (350 acres) (UNM, 1997), and a survey in 2001 of 16 ha (40 acres) of private land north of the project for Marron and Associates by Archaeological Services (NMCRIS Activity No. 75255). The survey by NMSHTD recorded no cultural evidence on 3.7 ha (9.2 acres) of private land and 4.3 ha (10.5 acres) of State of New Mexico land (NMSHTD, 1984). A total of 13 isolated (non-connected) occurrences were recorded, but no prehistoric or historic archeological sites were encountered at the Lea County Landfill site (UNM, 1997). The survey of private land in 2001 recorded two isolated occurrences (Michalik, 2001).

3.8.3 Archaeological or Historical Surveys

3.8.3.1 Physical Extent of Survey

The physical extent of the survey of the NEF included the entire site, i.e., 220 ha (543 acres). An intensive pedestrian survey was conducted within the 220 ha (543 acres) of the APE. Survey findings revealed potentially eligible archaeological sites within 18.5 ha (46.3 acres) of this area.

3.8.3.2 Description of Survey Techniques

The survey of the 220-ha (543-acre) area included a pedestrian surface inventory of the area at 15-m (49-ft) intervals. Cultural resource sites were recorded by mapping the surface remains, plotting the sites on an aerial photograph and topographic USGS 7.5' map of the area, and testing cultural feature remains with a trowel to determine subsurface integrity of the features.

A facility layout map of the 220-ha (543-acre) study area was overlain on the USGS 7.5' map of the area and onto USGS orthographic aerial images to assist in locating and assessing the area. The survey was performed in zigzag transects spaced 15 m (49 ft) apart. Special attention was given to depressions, rodent burrows, and anthills. When an isolated occurrence was encountered, its attributes were recorded and a global positioning system (GPS) measurement was taken. Cultural resource sites were recorded on sketch maps produced by compass and pace with assistance from the GPS. The study sites were recorded on Laboratory of Anthropology Site Record forms, and photographs of the site and study area were taken. No artifacts were collected.

3.8.3.3 Cultural Resource Specialist Qualifications

The survey at the Lea County, New Mexico proposed NEF plant was performed by a six-member survey crew. All crew members have professional experience in historical and prehistoric archaeology in the American Southwest. Crew experience ranged between 2 and 23 years. The crew was supervised in the field by a degreed anthropologist.

3.8.3.4 Survey Findings

The survey of approximately 220 ha (543 acres) in the eastern portion of Lea County east of Eunice, New Mexico at the proposed location of a NEF resulted in the recording of seven prehistoric sites and 36 isolated occurrences (finds). Four sites (LA 140704–LA 140707) are potentially eligible for listing on the National Register of Historic Places (NRHP). Three of these sites (LA 140704, LA 140705, and LA 140706) are campsites consisting of lithic scatters and thermal features. The fourth potentially eligible site, LA 140707, is a lithic scatter with potential for intact thermal features. Each of the four sites contains or has the potential to contain data regarding the prehistory of the region. Only one of these sites considered potentially eligible for the NRHP (LA 140705) is within the proposed location of the facility. The results of the survey were submitted to New Mexico State Historic Preservation Officer (SHPO) in March 2004 for a determination of eligibility. On the advice of the SHPO, the location of these sites is not included in this ER so the sites will remain protected from curiosity seekers or vandals.

The SHPO review of the survey has resulted in their conclusion that all seven sites (LA 140701 through LA 140707) are eligible for listing on the NRHP. Three of these sites (LA 140701, LA 140702 and LA 140705) are within the proposed plant footprint. A treatment/mitigation plan is being developed by LES to recover any significant information from these sites.

3.8.4 List of Historical and Cultural Properties

A review of existing information revealed that no previously recorded historical or cultural properties are located within the study area, i.e., the entire NEF site.

3.8.5 Agency Consultation

Consultation will be performed with all appropriate federal and state agencies and affected Native American Tribes. Copies of all response letters are included in Appendix A.

3.8.6 Other Comments

None.

3.8.7 Statement of Site Significance

Seven archaeological sites (LA 140701, LA 140702, LA 140703, LA 140704, LA 140705, LA 140706, LA 140707) have been identified in the 220-ha (543-acre) parcel of land. Four of these (LA 140704, LA 140705, LA 140706, LA 140707) are potentially eligible for listing on the NRHP based on the presence of charcoal, intact subsurface features and/or cultural deposits, or the potential for subsurface features. Only one of these sites (LA 140705) is within the proposed location of the NEF plant. The results of the survey were submitted to the New Mexico SHPO in March 2004 for a determination of eligibility.

The SHPO review of the survey has resulted in their conclusion that all seven sites (LA 140701 through LA 140707) are eligible for listing on the NRHP. Three of these sites (LA 140701, LA 140702 and LA 140705) are within the proposed plant footprint. A treatment/mitigation plan is being developed by LES to recover any significant information from these sites.

3.9 VISUAL/SCENIC RESOURCES

3.9.1 Viewshed Boundaries

Urban development is relatively sparse in the vicinity of the proposed National Enrichment Facility (NEF) site. The nearest city, Eunice, New Mexico, is approximately 8 km (5 mi) to the west; the proposed site is not visible from the city. However, the site is visible from westbound traffic on New Mexico Highway 234, which borders the site to the south, from about the New Mexico/Texas state line, approximately 0.8 km (0.5 mi) to the east. A series of small sand dunes on the western portion of the site provide natural screening from eastbound highway traffic, up until traffic passes the sand dune buffer. Likewise, the onsite sand dunes limit view of the site from the nearest residences located approximately 4.3 km (2.63 mi) to the west. The proposed NEF site is also visible from adjacent industrial properties to the north and east (Wallach Concrete, Inc. and Waste Control Specialists, respectively) and somewhat from the south (Lea County Landfill) and west (DD Landfarm). Considering distances and that the NEF will be centered on the site, onsite structures may be visible from nearby locations, but their details will be weak and tend to merge into larger patterns.

3.9.2 Site Photographs

Figures 3.9-1A through 3.9-1H are site photographs. As shown in the photographs, there are no existing structures on the site.

3.9.3 Affected Residents/Visitors

Due to neighboring industrial properties and expansive oil and gas developments in the site vicinity, very few local residents or visitors will be affected aesthetically by changes to the proposed NEF site.

3.9.4 Important Landscape Characteristics

The landscape of the site and vicinity is typical of a semi-arid climate and consists of sandy soils with desert-like vegetation such as mesquite bushes, shinnery oak shrubs and native grasses. The NEF site is open, vacant land. Except for man-made structures associated with the neighboring industrial properties and the local oil and gas industry, nearby landscapes are similar in appearance. Local and county officials reported that the only agricultural activity in the site vicinity is domestic livestock ranching.

The proposed site is within the southern part of the Llano Estacado or Staked Plains, which is a remnant of the southern extension of the Southern High Plains. The Southern High Plains are remnants of a vast debris apron spread along the eastern front of the mountains of Central New Mexico by streams flowing eastward and southeastward during the Tertiary period. The site and surrounding area has a nearly flat surface. Natural drainage is south to southwest. Monument Draw, a shallow drainage way, situated 4 km (2.5 mi) west of the site, originates in the lower portions of the Southern High Plains and drains towards Texas to the south. It is the only extensive area drainage way. Due to low rainfall and the deposition of sediments along its course, Monument Draw is intermittently dry and contains water only during heavy rainfall periods (USDA, 1974). Surface drainage is into numerous undrained depressions.

The site area overlies prolific oil and gas geologic formations of the Pennsylvanian and Permian age. The Elliott Littman field is to the north, Drinkard field to the south and Monument Jal field to the west. Other common features of the Southern High Plains are undrained depressions called "buffalo wallows" which are believed to have formed by leaching of the caliche cap and the calcareous cement of the underlying sandstone and subsequent removal of the loosened material by wind.

Onsite soils are primarily of the Brownfield-Springer association, and Kermit soils and Dune Land. The Brownfield-Springer association 'BO' mapping unit has a 0% to 3% slope and consists mostly of Brownfield fine sand with Springer loamy fine sand and small inclusions of other soils. The Brownfield-Springer association 'BS' mapping unit is similar to the 'BO' mapping unit with hummocks and dunes forming a complex pattern of concave and convex rolling terrain. Blowing soil has exposed the red sandy clay loam and fine sandy loam subsoil in concave, barren areas. The Kermit soils and Dune Land mapping unit 'KM' consists of about half Kermit soils and half active dune land. Slopes range between 0% to 12%. Kermit soil is hummocky and undulating, consisting of excessively drained, non-calcareous loose sands that surround Dune Land areas. Dune Land consists of large barren sand dunes which shift with the wind. Its surface layer is fine sand to coarse sand. Soils associated with the Brownfield-Springer association and Kermit soils and Dune Land are used as range, wildlife habitat and recreational areas. On the western portion of the NEF site, in the vicinity of the sand dune buffer, soils are mapped as active dune land 'Aa', which is made up of light-colored, loose sands. Slope range is 5% to 12% or more. Typically, the surface of active dune land soil is mostly bare except for a few shinnery oak shrubs (USDA, 1974).

There are no mountain ranges in the site vicinity. Several "produced water" lagoons and a man-made pond stocked with fish are located on the quarry property to the north. "Produced water" is water that has been injected into oil wells to facilitate the extraction of oil. The water is often reclaimed and reused. Baker Spring, an intermittent surface water feature that contains surface water seasonally, is situated 1.6 km (1 mi) northeast of the site; however, there are no nearby, significant bodies of water such as rivers or lakes. Except for a small, roadside picnic area situated by a historical oil country marker 3.2 km (2 mi) west of the site, there are no parks, wilderness areas or other recreational areas located within or immediately adjacent to the NEF site. In addition, based on site visits and available local information, there are no architectural or aesthetic features that would attract tourists to the area.

3.9.5 Location of Construction Features

Refer to Figure 3.9-2, Constructed Features (Site Plan), for the location of constructed features on the proposed NEF site.

3.9.6 Access Road Visibility

Except for private roadways associated with the adjacent quarry to the north and WCS to the east, which are at slightly higher elevations, visibility of site facilities from access roads, both existing and proposed, will be mainly limited to taller onsite structures. This is partly due to centering the plant on the property, proposed perimeter fencing with natural landscaping that will provide a buffer between proposed facilities and potential viewing areas, and the sand dune buffer on the western portion of the site.

3.9.7 High Quality View Areas

Based on site visits and discussion with local officials, there are no regionally or locally important or high quality views associated with the proposed NEF site. The site is considered common in terms of scenic attractiveness, given the large amount of land in the area that appears similar.

3.9.8 Viewshed Information

Although the site is visible from neighboring properties and from New Mexico Highway 234, due to development of nearby land for various industrial purposes (e.g., WCS facility, landfill and quarry) and oil and gas exploration, very few local residents or visitors will be affected aesthetically by changes to the site. The sand dunes on the western portion of the subject property limit its view from eastbound traffic on New Mexico Highway 234 and from residences to the west. Refer to Figures 3.9-1A through 3.9-1H.

3.9.9 Regulatory Information

Currently the NEF site is not zoned. Based on discussions with the city of Eunice and Lea County officials, there are no local or county zoning, land use planning or associated review process requirements. However, development of the site will meet federal and state requirements for nuclear and radioactive material sites regarding design, siting, construction materials, effluent treatment and monitoring. In addition, all applicable local ordinances and regulations will be followed during construction and operation of the NEF.

3.9.10 Aesthetic and Scenic Quality Rating

The visual resource inventory process provides a means for determining visual values (BLM, 1984; BLM, 1986). The inventory consists of a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. Based on these three factors, lands are placed into one of four Visual Resource Classes. These classes represent the relative value of the visual resources: Classes I and II being the most valued, Class III representing a moderate value, and Class IV being of least value. The classes provide the basis for considering visual values in the resource management planning (RMP) process. Visual Resource Classes are established through the RMP process.

The NEF site was evaluated between September 15, 2003 and September 18, 2003 by LES using the BLM visual resource inventory process to determine the scenic quality of the site. The NEF site received a "C" rating and falls into Class IV. Refer to Table 3.9.1, Scenic Quality Inventory and Evaluation Chart. Scenic quality is a measure of the visual appeal of a tract of land which is given an A, B or C rating (A-highest, C-lowest) based on the apparent scenic quality using the seven factors outlined in Table 3.9-1, Scenic Quality Inventory and Evaluation Chart.

Class IV is of the least value and allows for the greatest level of landscape modification. The proposed use of the NEF site does not fall outside the objectives for Class IV, which are to provide for management activities that require major modifications of the existing character of the landscape. The level of change to the landscape characteristics may be extensive. These management activities may dominate the view and be the major focus of viewer attention (BLM, 1984).

3.9.11 Coordination with Local Planners

As noted in ER Section 3.9.9, Regulatory Information, discussions were held between LES and the City of Eunice and Lea County officials to coordinate and discuss local area community planning issues. No local or county zoning, land use planning or associated review process requirements were identified. All applicable, local ordinances and regulations will be followed during the construction and operation of the NEF.

3.9.12 Section 3.9 Tables

Table 3.9-1 Scenic Quality Inventory And Evaluation Chart

Key Factors	Rating Criteria and Score[1]		
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. Score: 5	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosion patterns or variety in size and shape or landforms; or detail features which are interesting though not dominant or exceptional. Score: 3	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. **Score: 1**
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns. Score: 5	Some variety of vegetation, but only one or two major types. **Score: 3**	Little or no variety or contrast in vegetation. Score: 1
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. Score: 5	Flowing, or still, but not dominant in the landscape. Score: 3	Absent, or present, but not noticeable. **Score: 0**
Color	Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. Score: 5	Some intensity or variety in colors and contrast of the soil, rock and vegetation, but not a dominant scenic element. Score: 3	Subtle color variations, contrast, or interest; generally mute tones. **Score: 1**
Influence of Adjacent Scenery	Adjacent scenery greatly enhances visual quality. Score: 5	Adjacent scenery moderately enhances overall visual quality. Score 3	Adjacent scenery has little or no influence on overall visual quality. **Score: 0**

Table 3.9-1 Scenic Quality Inventory And Evaluation Chart

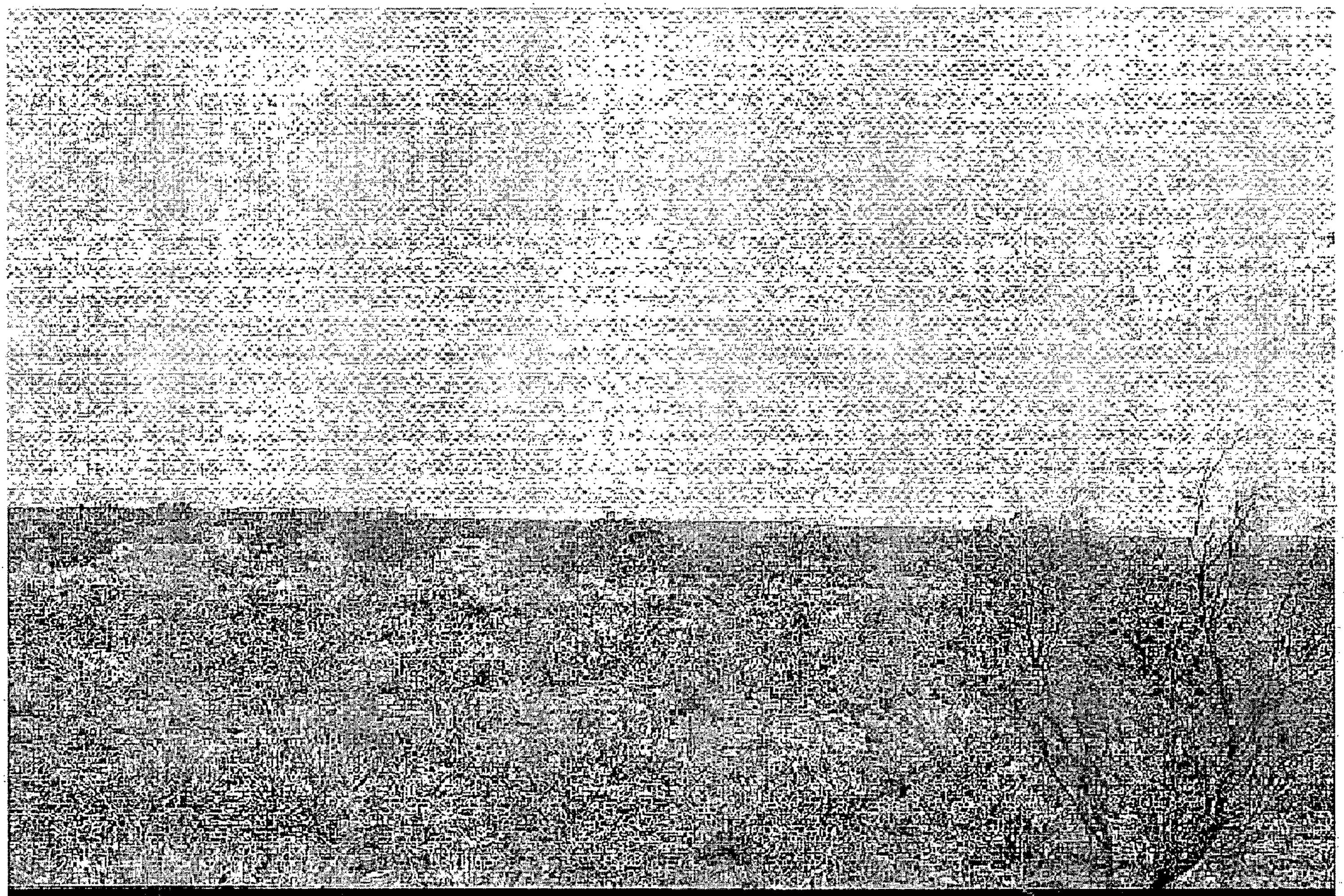
Key Factors	Rating Criteria and Score[1]		
Scarcity	One of a kind; or unusually memorable or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. Score: 5	Distinctive, though somewhat similar to others within the region. Score: 3	Interesting within its setting, but fairly common within the region. **Score: 1**
Cultural Modifications	Modifications add favorably to visual variety while promoting visual harmony. Score: 2	Modifications add little or no visual variety to the area, and introduce no discordant elements. Score: 0	Modifications add variety but are very discordant and promote strong disharmony. **Score: -4**

Total Score: 2 Scenic Quality: A = 19 or more; B = 12-18; C = 11 or less

Scores in bold represent scores assigned to the NEF site.

[1]Ratings developed from BLM, 1984; BLM, 1986

3.9.13 Section 3.9 Figures



VIEW OF PROPOSED NEF SITE LOOKING
FROM THE SOUTHEAST TO THE NORTHWEST

Figure 3.9-1A View of Proposed NEF Site Looking from the Southeast to the Northwest

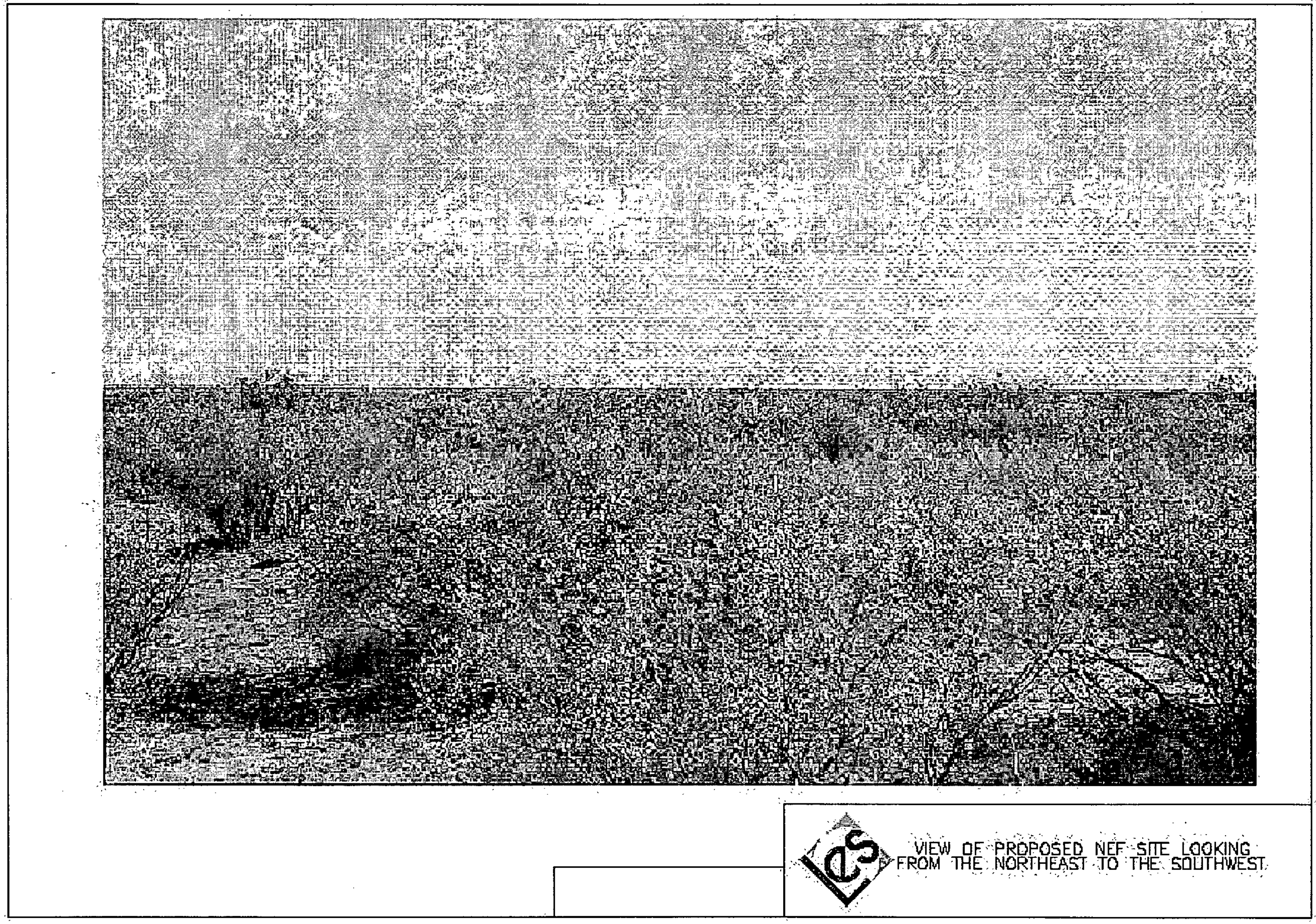


Figure 3.9-1B View of Proposed NEF Site Looking From The Northeast To The Southwest

VIEW OF PROPOSED NEF SITE LOOKING
FROM THE SOUTHWEST TO THE NORTHEAST

Figure 3.9-1C View of the Proposed NEF Site Looking From The Southwest To The Northeast

Figure 3.9-1D View of the Proposed NEF Site Looking From The Northwest To The Southeast

VIEW OF CENTER OF PROPOSED NEF SITE
FROM NEW MEXICO HIGHWAY 234

Figure 3.9-1E View of Center of the Proposed NEF Site from New Mexico Highway 234

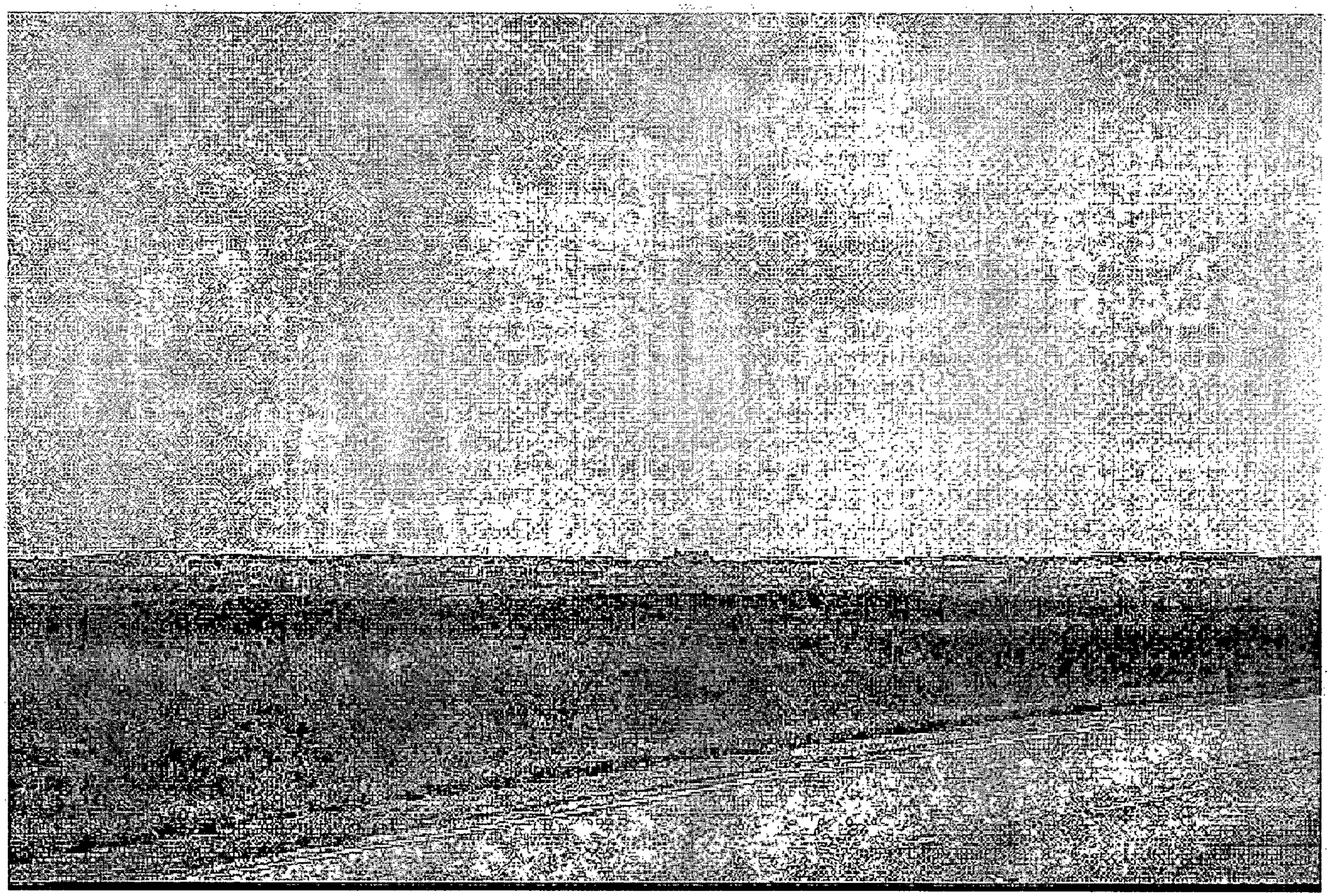


Figure 3.9-1F View of West Half of Proposed NEF Site (Sand Dune Buffer) from New Mexico Highway 234

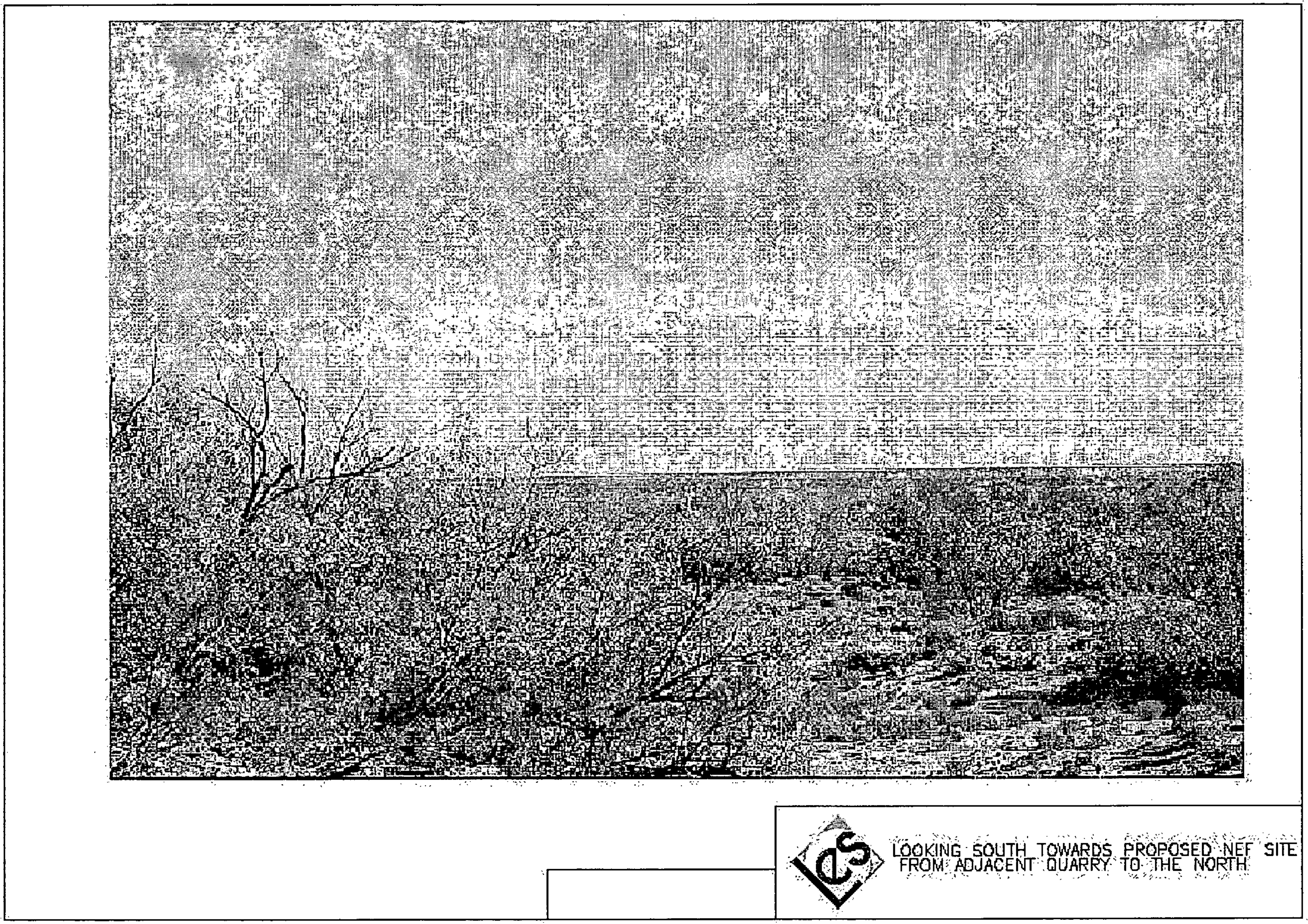
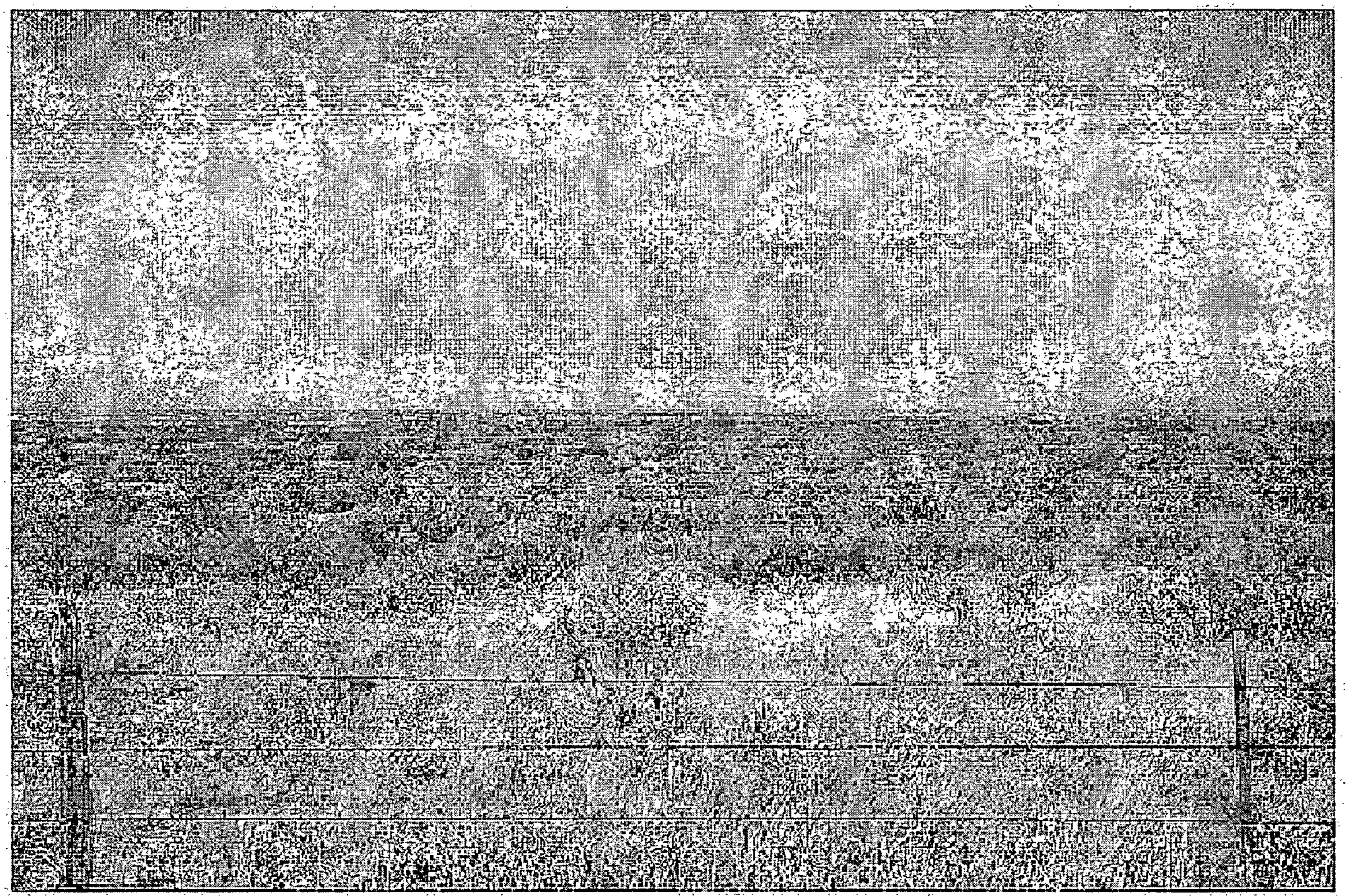


Figure 3.9-1G Looking South Towards Proposed NEF Site from Adjacent Quarry to the North



LOOKING WEST TOWARDS PROPOSED NEF SITE FROM NEIGHBORING WASTE CONTROL SPECIALIST PROPERTY TO THE EAST

Figure 3.9-1H Looking West Towards Proposed NEF Site from Neighboring Waste Control Specialist Property to the East

Security-Related Information
Figure Withheld Under 10 CFR 2.390

CONSTRUCTED FEATURES (SITE PLAN)

Figure 3.9-2 Constructed Features (Site Plan)

3.10 SOCIOECONOMIC

This section describes the social and economic characteristics of the two-county area around the proposed National Enrichment Facility (NEF). Information is provided on population, including minority and low-income areas (i.e., environmental justice as discussed in ER Section 4.11), economic trends, housing, and community services in the areas of education, health, public safety, and transportation. The information was gathered from a field team who visited local and regional offices, telephone conversations with local and regional officials, and documents from public sources. Local and regional offices and officials included public safety (police and fire), tax assessor, park and recreation, education, agriculture, and transportation. Other contacts included health providers and the county officials.

The proposed NEF site is in Lea County, New Mexico, near the border of Andrews County, Texas, as shown on Figure 3.10-1, Lea-Andrews County Areas. The figure also shows the city of Eunice, New Mexico, the closest population center to the site, at a distance of about 8 km (5 mi). Other population centers are at distances from the site as follows:

- Hobbs, Lea County, New Mexico: 32 km (20 mi) north
- Jal, Lea County, New Mexico: 37 km (23 mi) south
- Lovington, Lea County, New Mexico: 64 km (39 mi) north-northwest
- Andrews, Andrews County, Texas: 51 km (32 mi) east
- Seminole, Gaines County, Texas: 51 km (32 mi) east-northeast
- Denver City, Gaines County, Texas: 65 km (40 mi) north-northeast

Aside from these communities, the population density around the site region is extremely low.

The primary labor market for the operation of the proposed facility will come from within about 120 km (75 mi) of the site. The basis for selection of the 120 km (75 mi) radius is that it encompasses the Midland-Odessa, Texas area which is approximately 103 km (64 mi) to the southeast. This is the farthest distance from which LES expects the bulk of the labor force to originate. Lea County, New Mexico, was established March 17, 1917, five years after New Mexico was admitted to the Union as a State. The county seat is located in Lovington, New Mexico, 64 km (39 mi) north-northwest of the site. The site area is very rural and semi-arid, with commerce in petroleum production and related services, cattle ranching, and the dairy industry. Among U. S. states, New Mexico also ranked 7th in crude oil production in 1999, Lea County, New Mexico ranked first among oil producing counties in New Mexico in 2001.

Lea County covers 11,378 km^2 (4,393 mi^2) or approximately 1,142,238 ha (2,822,522 acres) which is three times the size of Rhode Island and only slightly smaller than Connecticut. The county population density is 16% lower than the New Mexico state average (4.8 versus 5.8 population density per square kilometer) (12.6 versus 15.0 population density per square mile). The county housing density is 20% lower than the New Mexico state average (2.0 versus 2.5 housing units per square kilometer) (5.3 versus 6.4 housing units per square mile). Lea County is served by three local libraries, nine financial institutions, and two daily newspapers, the Hobbs News-Sun and Lovington Daily Leader.

Andrews County, Texas was organized in August 1875. The county seat is located in the city of Andrews, about 51 km (32 mi) east-southeast of the site; there are no population centers in Andrews County closer to the site. The surrounding area is very rural and semi-arid, with commerce in livestock production, agriculture (cotton, sorghum, wheat, peanuts, and hay), and significant oil and gas production, which produces most of the county's income. Andrews County covers 3,895 km^2 (1,504 mi^2). The county population density is 11% of the Texas state average (3.3 versus 30.6 per square kilometer) (8.7 versus 79.6 population density per square mile). The county housing density is low, at just over 11% of the Texas state average (1.4 versus 12.0 housing units per square kilometer) (3.6 versus 31.2 housing units per square mile). The community of Andrews is served by one library, nine financial institutions, and a weekly newspaper. Fraternal and civic organizations include the Lions Club, Rotary Club, 4H, and Boy Scouts/Girl Scouts of America. Local facilities serving the community of Andrews include 35 churches, a museum, a municipal swimming pool, golf course, tennis courts, parks and athletic fields. The two roughly comparably-sized cities of Seminole and Denver City are located in Gaines County Texas, 51 km (32 mi east-northeast) and 65 km (40 mi) north-northeast, respectively.

3.10.1 Population Characteristics

3.10.1.1 Population and Projected Growth

The combined population of the two counties in the NEF vicinity, based on the 2000 U.S. Census (DOC, 2002) is 68,515, which represents a 2.3% decrease over the 1990 population of 70,130 (Table 3.10-1, Population and Population Projections). This rate of decrease is counter to the trends for the states of New Mexico and Texas, which had population increases of 20.1% and 22.8%, respectively during the same decade. Over that 10-year period, Lea County New Mexico had a growth decrease of 0.5% and the Andrews County's, Texas decrease was 9.3%. Lea County experienced a sharp but brief population increase in the mid-1980's due to oil industry jobs that resulted in a population increase to over 65,000. The raw census data was tabulated and used to calculate the above percentage statistics. No other sources of data or information were used. LES has not identified any programs or planned developments in the region that would have an impact on area population.

Based on projections made using historic data (Table 3.10-1), and in consideration of the mature oil industry in the area, Lea County, New Mexico and Andrews County, Texas are likely to grow more slowly than their respective states growth rates over the next 30 years (the expected license period of the NEF) (DOC, 2002). ER Figure 1.2-1, Location of Proposed Site, shows population centers within 80 km (50 mi) of the NEF.

3.10.1.2 Minority Population

Based on U. S. census data the minority populations of Lea County, New Mexico and Andrews County, Texas as of 2000 were 32.9% and 22.9%, respectively. These percentages are consistent with their respective state averages of 33.2% and 29.0% (see Table 3.10-2, General Demographic Profile) (DOC, 2002). The raw census data was tabulated and used to calculate the above percentage statistics. No other sources of data or information were used.

The term “minority population” is defined for the purposes of the U. S. Census to include the five racial categories of black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, and some other race. It also includes those individuals who declared two or more races, an option added as part of the 2000 census. The minority population, therefore, was calculated to be the total population less the white population. In contrast to U. S. Census data, NUREG-1748, Appendix C defines minority populations to include individuals of Hispanic or Latino origin. This results in a difference between the minority population data discussed here and presented in Table 3.10-2, and the data presented in ER Section 4.11, Environmental Justice. LBDCR-07-0022

The U.S. Census data was used to calculate the minority population reported above consistent with the U.S. Census definition of minority population. This same data was also used in the Environmental Justice assessment (see ER Section 4.11), which manipulated the census data to yield minority population estimates consistent with the NRC definition applicable to environmental justice.

ER Section 4.11, Environmental Justice, provides the results of the LES assessment that demonstrates that no disproportionately high minority or low-income populations exist in proximity to the NEF that would warrant further examination of environmental impacts upon such populations.

3.10.2 Economic Characteristics

3.10.2.1 Employment, Jobs, and Occupational Patterns

In 2000, the civilian labor force of Lea County, New Mexico, and Andrews County, Texas, was 22,286 and 5,511, respectively, as shown in Table 3.10-3, Civilian Employment Data, 2000. Of these, 2,032 were unemployed in Lea County, New Mexico, for an unemployment rate of 9.1%. Unemployment in Andrews County, Texas was 447 persons, for an unemployment rate of 8.1%. The unemployment rates for both counties were both higher by about 2% than the rates for their respective states (DOC, 2002).

The distribution of jobs by occupation in the two counties is similar to that of their respective states (Table 3.10-3). However, Lea and Andrews Counties generally have fewer managerial and professional positions, and instead have more blue-collar positions like construction, production, transportation, and material moving, which is a reflection of the rural nature of the area and the presence of the petroleum industry (DOC, 2002).

Oil production and related services are the largest part of the site area economy. About 20% of jobs in both Lea County, New Mexico and Andrews County, Texas involve mining (oil production), as compared to approximately 4% and 3% for their respective states. Education, health and social services account for a combined 19% to 23% of jobs, which is generally similar to that for their respective states (DOC, 2002).

3.10.2.2 Income

Per capita income in the two area counties was lower than the state average at 82.2% in Lea County, New Mexico and 81.1% in Andrews County, Texas (Table 3.10-4, Area Income Data). Within the two-county area, per capita income ranged from $14,184 in Lea County, New Mexico to $15,916 in Andrews County, Texas, as compared to their respective state values of $17,261 and $19,617. Similarly, the median household income in the two counties was also below their respective state averages of $34,133 and $39,927 at 87.3% and 85.2%, respectively (DOC, 2002).

The per capita individual poverty levels in the area at 21.1% for Lea County, New Mexico and 16.4% in Andrews County, Texas, are higher than the respective state levels of 18.4% and 15.4% (Table 3.10-4) (DOC, 2002), respectively. The respective state household poverty levels of 14.5% and 12.0% were below that of Lea County, New Mexico (17.3%) and Andrews County, Texas (13.9%).

3.10.2.3 Tax Structure

New Mexico's property tax is perennially ranked among the three lowest states in the nation with any change requiring an amendment to the state constitution. The property assessment rate is uniform, statewide, at a rate of 33-1/3% of the value (except oil and gas properties). The tax applied is a composite of state, county, municipal, school district and other special district levies. Properties outside city limits are taxed at lower rates. Major facilities may be assessed by the New Mexico State Taxation and Revenue Department instead of by the county. The Lea County, New Mexico tax rate for non-residential property outside the city limits of Eunice is 18.126 mils per $1,000 of net taxable value of a property (EDCLC, 2000). New Mexico communities can abate property taxes on a plant location or expansion for a maximum of 30 years, (usually 20 years in most communities), controlled by the community.

The state also has a Gross Receipts Tax paid by product producers. This tax is imposed on businesses in New Mexico, but in almost every case it is passed to the consumer. In that way, the gross receipts tax resembles a sales tax. The gross receipts tax rate for the Eunice area, outside the city limits is 5.00% (NMEDD, 2003). Certain deductions may apply to this tax for plant equipment.

Property taxes provide a majority of revenue for local services in Texas. Local officials value property and set tax rates. Property taxes are based on the most current year's market value. Any county, municipality, school district or college district may levy property taxes. Andrews County, Texas has a county property tax rate (per $100 assessed value) of 6.152%, a school district rate of 1.50%, and a municipal rate for the city of Andrews of 3.754%. Texas also has a 6.45% sales tax, which may be augmented by local municipalities (TCPA, 2003).

See ER Section 4.10.2.2, Community Characteristic Impacts, for estimated tax revenue and estimated allocations to the State of New Mexico and Lea County resulting from the construction and operation of the NEF.

3.10.3 Community Characteristics

3.10.3.1 Housing

Housing in both Lea County, New Mexico, and Andrews County, Texas, varies from their respective states in general, reflecting the rural nature of the area. Although the number of rooms per housing unit is similar to state averages, the density of housing units and value of housing is considerably different, especially for Andrews County. The densities at 2.0 units per km^2 (5.3 units per mi^2) in Lea County, New Mexico and 1.4 units per km^2 (3.6 units per mi^2) in Andrews County, Texas, are about 82% and 11% of their respective state averages of 2.5 and 12.0 units per km^2 (6.4 and 31.2 units per mi^2). The median cost of a home in Lea County, New Mexico of $50,100 is about 18% higher than in Andrews County, Texas of $42,500. The cost of a home in both counties is about one-half or less of the respective median values for their states (Table 3.10- 5, Housing Information in the Lea, New Mexico-Andrews, Texas County Vicinity) (DOC, 2002).

The percentage of vacant housing units is 15.8% and 14.8% for Lea County, New Mexico and Andrews County, Texas, respectively. This compares to their state vacancy rates of 13.1% and 9.4%, respectively (DOC, 2002).

3.10.3.2 Education

There are four educational institutions within a radius of about 8 km (5 mi), an elementary school, middle school and high school and a private K-12 school, all in Lea County, New Mexico. Table 3.10-6, Educational Facilities Near the NEF, details the location of the educational facilities, population (including faculty/staff members), and student-teacher ratio (ESD, 2003; USDE, 2002; DOC, 2002). The closest schools in Andrews County, Texas, are in the community of Andrews about 51 km (32 mi) east of the NEF site. Apart from the schools in Eunice, New Mexico, the next closest educational institutions are in Hobbs, New Mexico, 32 km (20 mi) north of the site.

Table 3.10-7, Educational Information in the Lea, New Mexico – Andrews, Texas County Vicinity lists the percent ages of school enrollment for the population 3 years and over for the city of Eunice, New Mexico, as well as for Lea County, New Mexico, and Andrews County, Texas as well as their respective states. The table also lists the percent ages of educational attainment for the population 25 years and over in those same areas. In general, the population in Lea County, New Mexico, has less advanced education than the general population in their state. The state population with either a bachelor's, graduate or professional degree is about double the corresponding percentage in Lea County, New Mexico (DOC, 2002; ESD, 2003).

3.10.3.3 Health Care, Public Safety, and Transportation Services

<u>Health Care</u>

There are two hospitals in Lea County, New Mexico. The Lea Regional Medical Center is located in Hobbs, New Mexico about 32 km (20 mi) north of the proposed NEF site. Lea Regional Medical Center is a 250-bed hospital that can handle acute and stable chronic care patients. In Lovington, New Mexico, 64 km (39 mi) north-northwest of the site, Covenant Medical Systems manages Nor-Lea Hospital, a full-service, 27-bed facility. There are no nursing homes or retirement facilities in the site area. The closest such facilities are in Hobbs, New Mexico, about 32 km (20 mi) north of the site.

Public Safety

Fire support service for the Eunice area is provided by the Eunice Fire and Rescue, located approximately 8 km (5 mi) from the plant. It is staffed by a full-time Fire Chief and 34 volunteer firefighters. Equipment at the Eunice Fire and Rescue includes:

Three Ambulances;

Three Pumper Fire Trucks;

- one 340 m^3/hr (1,500 gal per min (gpm)) pump which carries 3,785 L (1,000 gal) of water,
- one 227 m^3/hr (1,000 gpm) pumper which carries 1,893 L (500 gal) of water,
- one 284 m^3/hr (1,250 gpm) pumper which carries 2,839 L (750 gal) of water,

One Water Truck 22,700 L (6,000 gal) with 114 m^3/hr (500 gpm) pumping capacity

Three Grass Fire Trucks:

- one 3,785 L (1,000 gal) water truck with a 68 m^3/hr (300 gpm) pump
- one 1,136 L (300 gal) water truck with a 34 m^3/hr (150 gpm) pump
- one 946 L (250 gal) water truck with a 34 m^3/hr (150 gpm) pump

One Rescue Truck:

- Vehicle Accident Rescue truck with 379 L (100 gal) of water and 45 m^3/hr (200 gpm) pump

If additional fire equipment is needed, or if the Eunice Fire and Rescue is unavailable, the Central Dispatch will call the Hobbs Fire Department. In instances where radioactive/hazardous materials are involved, knowledgeable members of the facility Emergency Response Organization (ERO) provide information and assistance to the responding offsite personnel.

Mutual aid agreements exist with all of the county fire departments. In particular, mutual aid agreements exist between Eunice, New Mexico, and the nearby City of Hobbs Fire Department, as well as with Andrews County, Texas, for additional fire services. If emergency fire services personnel in Lea County are not available, the mutual aid agreements are activated and the Eunice Central Dispatch will contact the appropriate agencies for the services requested at the NEF.

The Eunice Police Department, with five full-time officers, provides local law enforcement. The Lea County Sheriff's Department also maintains a substation in the community of Eunice. If additional resources are needed, officers from mutual aid communities within Lea County, New Mexico, and Andrews County, Texas, can provide an additional level of response. The New Mexico State Police provide a third level of response.

Transportation

The nearest active rail transportation is a short-line carrier, the Texas-New Mexico Railroad (TNMR#815) accessible in Eunice, New Mexico about 5.8 km (3.6 mi) from the site.

The nearest airport facilities are located just west of Eunice and are maintained by Lea County. That facility is about 16 km (10 mi) west from the proposed NEF. The airport consists two runways measuring about 1,000 m (3,280 ft) and 780 m (2,550 ft) each. Privately owned planes are the primary users of the airport. There is no control tower and no commercial air carrier flights (DOT, 2003a). The nearest major commercial carrier airport is Lea County Regional Airport in Hobbs, New Mexico, about 32 km (20 mi) north.

3.10.4 Section 3.10 Tables

Table 3.10-1 Population and Population Projections

Area (Population/Projected Growth)					
Year(s)	**Lea County, NM**	**Andrews County, TX**	**Lea-Andrews Combined**	**New Mexico**	**Texas**
1970	49,554	10,372	59,926	1,017,055	11,198,657
1980	55,993	13,323	69,316	1,303,303	14,225,512
1990	55,765	14,338	70,103	1,515,069	16,986,335
2000	55,511	13,004	68,515	1,819,046	20,851,820
2010	60,702	15,572	76,274	2,091,675	23,812,815
2020	62,679	16,497	79,176	2,358,278	26,991,548
2030	64,655	17,423	82,078	2,624,881	30,170,281
2040	66,631	18,348	84,979	2,891,483	33,349,013
Percent Change(%)					
Year(s)	**Lea County, NM**	**Andrews County, TX**	**Lea-Andrews Combined**	**New Mexico**	**Texas**
1970-1980	13.0%	28.5%	15.7%	28.1%	27.0%
1980-1990	-0.4%	7.6%	1.1%	16.2%	19.4%
1990-2000	-0.5%	-9.3%	-2.3%	20.1%	22.8%
2000-2010	9.4%	19.7%	11.3%	15.0%	14.2%
2010-2020	3.3%	5.9%	3.8%	12.7%	13.3%
2020-2030	3.2%	5.6%	3.7%	11.3%	11.8%
2030-2040	3.1%	5.3%	3.5%	10.2%	10.5%

Source: U. S. Census Bureau (DOC, 2002)

Table 3.10-2 General Demographic Profile

Profile	Areas							
	Lea County, NM		Andrews County, TX		New Mexico		Texas	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total Population	55,511	100.0	13,004	100.0	1,819,046	100.0	20,851,820	100.0
Minority Population*	18,248	32.9	2,980	22.9	604,743	33.2	6,052,315	29.0
Race								
One race	53,697	96.7	12,631	97.1	1,752,719	96.4	20,337,187	97.5
White	37,263	67.1	10,024	77.1	1,214,253	66.8	14,799,505	71.0
Black or African American	2,426	4.4	214	1.6	34,343	1.9	2,404,566	11.5
American Indian and Alaska Native	551	1.0	115	0.9	173,483	9.5	118,362	0.6
Asian	216	0.4	92	0.7	19,255	1.1	562,319	2.7
Native Hawaiian and Other Pacific Islander	24	0.0	3	0.0	1,503	0.1	14,434	0.1
Some other race	13,217	23.8	2,183	16.8	309,882	17.0	2,438,001	11.7
Two or more races	1,814	3.3	373	2.9	66,327	3.6	514,633	2.5

*Calculated as total population less white population

Source: U. S. Census Bureau (DOC, 2002)

Table 3.10-3 Civilian Employment Data, 2000

Topic	Area							
	Lea County, NM		Andrews County, TX		New Mexico		Texas	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Employment Status								
In labor force	22,286	100.0	5,511	100.0	823,440	100.0	9,830,559	100.0
Employed	20,254	90.9	5,064	91.9	763,116	92.7	9,234,372	93.9
Unemployed	2,032	9.1	447	8.1	60,324	7.3	596,187	6.1
Occupation (population 16 years and over)								
Management, professional, and related occupations	5,077	22.8	1,293	23.5	259,510	31.5	3,078,757	31.3
Service occupations	3,283	14.7	833	15.1	129,349	15.7	1,351,270	13.7
Sales and office occupations	4,670	21.0	1,060	19.2	197,580	24.0	2,515,596	25.6
Farming, fishing, and forestry occupations	331	1.5	64	1.2	7,594	0.9	61,486	0.6
Construction, extraction, and maintenance occupations	3,723	16.7	821	14.9	87,172	10.6	1,008,353	10.3
Production, transportation, and material moving occupations	3,170	14.2	993	18.0	81,911	9.9	1,218,910	12.4
Industry								
Agriculture, forestry, fishing and hunting, and mining	4,188	18.8	1,064	19.3	30,529	3.7	247,697	2.5
Construction	1,268	5.7	256	4.6	60,602	7.4	743,606	7.6
Manufacturing	715	3.2	435	7.9	49,728	6.0	1,093,752	11.1
Wholesale trade	658	3.0	128	2.3	20,747	2.5	362,928	3.7
Retail trade	2,418	10.8	578	10.5	92,766	11.3	1,108,004	11.3

Table 3.10-3 Civilian Employment Data, 2000

Topic	Area							
	Lea County, NM		Andrews County, TX		New Mexico		Texas	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Transportation and warehousing, and utilities	1,347	6.0	207	3.8	35,710	4.3	535,568	5.4
Information	227	1.0	90	1.6	18,614	2.3	283,256	2.9
Finance, insurance, real estate, and rental and leasing	642	2.9	177	3.2	41,649	5.1	630,133	6.4
Professional, scientific, management, administrative, and waste management services	918	4.1	234	4.2	71,715	8.7	878,726	8.9
Education, health and social services	4,173	18.7	1,244	22.6	165,897	20.1	1,779,801	18.1
Arts, entertainment, recreation, accommodation and food services	1,327	6.0	263	4.8	74,789	9.1	673,016	6.8
Other services (except public administration)	1,343	6.0	226	4.1	38,988	4.7	480,785	4.9
Public administration	1,030	4.6	162	2.9	61,382	7.5	417,100	4.2

Source: U. S. Census Bureau (DOC, 2002)

Table 3.10-4 Area Income Data

	Area			
Topic	**Lea County, NM**	**Andrews County, TX**	**New Mexico**	**Texas**
Individual				
Per Capita Income (dollars)	14,184	15,916	17,261	19,617
Percent of State (%)	82.2	81.1	100.0	100.0
% Below Poverty Level (1999)	21.1	16.4	18.4	15.4
Household				
Medial Income (dollars)	29,799	34,036	34,133	39,927
Percent of State	87.3	85.2	100.0	100.0
% Below Poverty Level (1999)	17.3	13.9	14.5	12.0

Source: U. S. Census Bureau (DOC, 2002)

Table 3.10-5 Housing Information in the Lea New Mexico Andrews Texas County Vicinity

	Area			
Topic	**Lea County, NM**	**Andrews County, TX**	**New Mexico**	**Texas**
Total Housing Units	23,405	5,400	780,579	8,157,575
Occupied housing units (percent)	84.2	85.2	86.9	90.6
Vacant housing units (percent)	15.8	14.8	13.1	9.4
Density -- Housing units (per square mile)	5.3	3.6	6.4	31.2
Number of rooms (median)	5.1	5.2	5.0	5.1
Median value (2000 dollars)	50,100	42,500	108,100	82,500

Source: U. S. Census Bureau (DOC, 2002)

Table 3.10-6 Educational Facilities Near the NEF

School	Grades	Distance km (miles)	Direction	Population	Student-Teacher Ratio
Lea County, New Mexico					
Eunice High School	9-12	8.6 (5.3)	W	207	16:1
Caton Middle School	6-8	8.6 (5.3)	W	128	15:1
Mettie Jordan Elementary School	DD, K-5	8.6 (5.3)	W	269	21:1
Eunice Holiness Academy	1-12	8.2 (5.1)	W	14	6:1

Note : DD – Development Delayed Class

Source: Eunice School District
National Center for Educational Statistics
Source: U.S. Census Bureau (DOC, 2002)

Table 3.10-7 Educational Information in the Lea, New Mexico-Andrews, Texas County Vicinity

	Area									
	Eunice, NM		Lea County, NM		Andrews County, TX		New Mexico		Texas	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
School Enrollment (≥3 years of age)	690	100.0	16,534	100.0	3,864	100.0	513,017	100.0	5,948,260	100.0
Nursery School, pre-school	14	2.0	766	4.6	185	4.8	28,681	5.6	390,094	6.6
Kindergarten	41	5.9	785	4.7	203	5.3	25,257	4.9	348,203	5.9
Elementary school	342	49.6	7,999	48.4	1,972	51.0	231,730	45.2	2,707,281	45.5
High school	207	30.0	4,220	25.5	1,170	30.3	114,669	22.4	1,299,792	21.9
College or graduate school	86	12.5	2,754	16.7	334	8.6	112,680	22.0	1,202,890	20.2
School Attainment (≥25 years of age)	1,759	100.0	32,291	100.0	7,815	100.0	1,111,241	100.0	12,790,893	100.0
Less than 9th grade	258	14.7	4,951	15.3	1,126	14.4	94,108	8.5	1,465,420	11.5
9th to 12th grade, no diploma	304	17.3	6,007	18.6	1,378	17.6	143,658	12.9	1,649,141	12.9
High School graduate (includes equivalency)	594	33.8	9,295	28.8	2,548	32.6	296,870	26.7	3,176,743	24.8
Some college, no degree	363	20.6	7,224	22.4	1,306	16.7	242,154	21.8	2,858,802	22.4
Associate's degree	63	3.6	1,939	6.0	389	5.0	63,847	5.7	668,498	5.2
Bachelor's degree	141	8.0	2,481	7.7	662	8.5	162,080	14.6	1,996,250	15.6
Graduate or professional degree	36	2.0	1,394	4.3	306	3.9	108,524	9.8	976,043	7.6

Sources: U. S. Census Bureau, Eunice School District (DOC, 2002)

3.10.5 Section 3.10 Figures

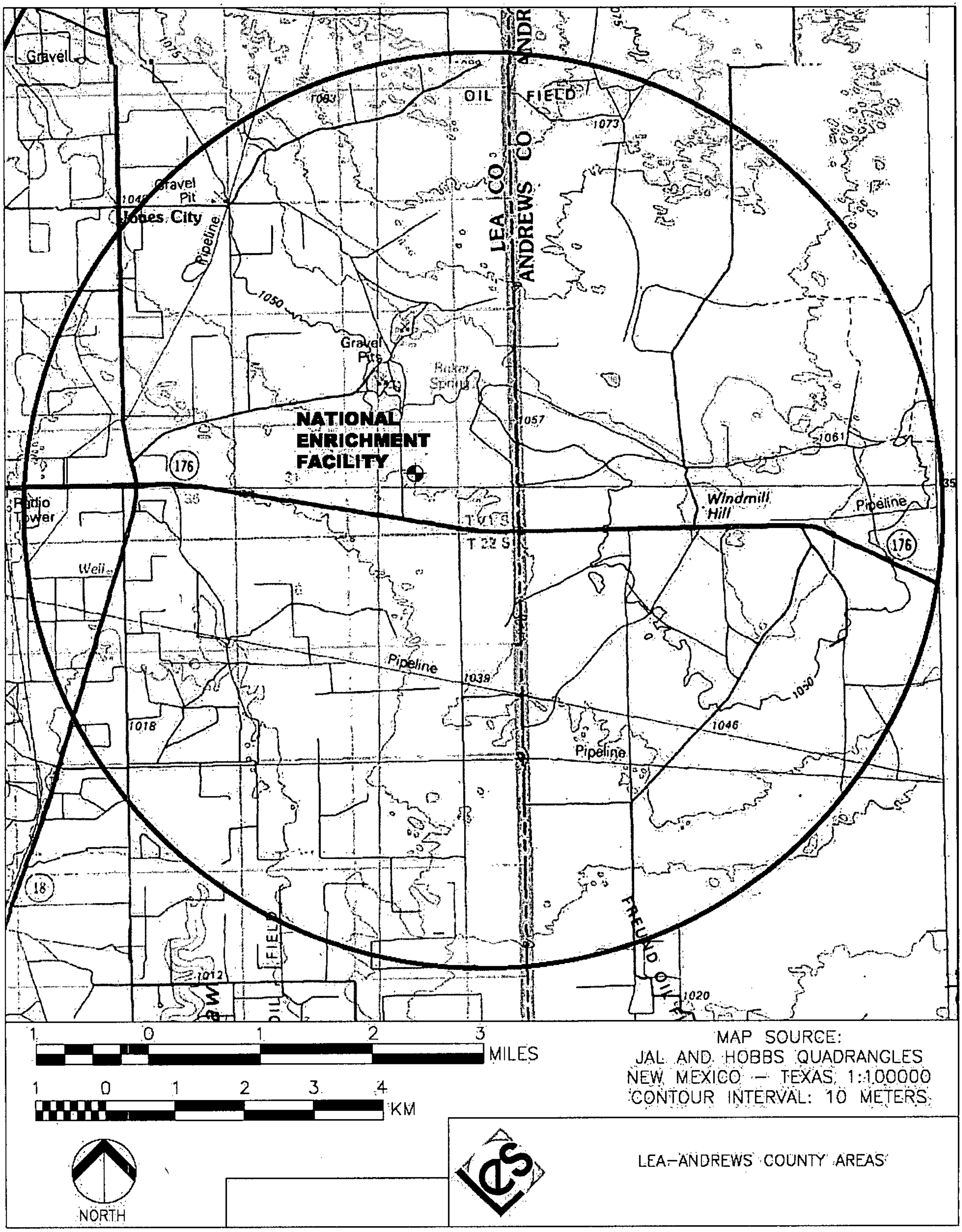


Figure 3.10-1 Lea-Andrews County Areas

3.11 PUBLIC AND OCCUPATIONAL HEALTH

Routine operations at the National Enrichment Facility (NEF) create the potential for radiation exposure to plant workers, members of the public, and the environment. Workers at the NEF are subject to higher potential radiation exposures than members of the public because they are involved directly with handling UF_6 feed and product cylinders, depleted UF_6 cylinders, processes for the enrichment of uranium, and decontamination of containers and equipment. In addition to the radiological hazards associated with uranium, workers may be potentially exposed to the chemical hazards associated with uranium. However, workers at the NEF are protected by the combination of a Radiation Protection Program and a Health and Safety Program. The Radiation Protection Program complies with all applicable NRC requirements contained in 10 CFR 20 (CFR, 2003q), Subpart B, and the Health & Safety Program at the NEF complies with all applicable OSHA requirements contained in 29 CFR 1910 (CFR, 2003o).

Members of the general public also may be subject to potential radiation exposure due to routine operations at the NEF. Public exposure to plant-related uranium may occur as the result of gaseous and liquid effluent discharges, including controlled releases from the uranium enrichment process lines during decontamination and maintenance of equipment, and transportation and storage of UF_6 feed, product, and Uranium Byproduct Cylinders (UBCs). In each case, the amount of exposure incurred by the general public is expected to be very low. Engineered effluent controls, effluent sampling, and administrative limits as described in Section 6.1.1, Effluent Monitoring Program, are in place to assure that any impacts on the health and safety of the public resulting from routine plant operations are maintained as low as reasonably achievable (ALARA). The effectiveness of the effluent controls will be confirmed through implementation of the Radiological Environmental Monitoring Program (described in ER Section 6.1.2, Radiological Environmental Monitoring Program).

For the public, the potential radiological impacts from routine operations at the NEF are those associated with chronic exposure to very low levels of radiation. It is anticipated that the total annual amount of uranium released to the environment via air effluent discharges from the NEF will be approximately 10 grams (0.35 ounces). Radiological impacts to the public are discussed in ER Section 4.12, Public and Occupational Health Impacts.

3.11.1 Major Sources and Levels of Background Radiation

The sources of radiation at the NEF site historically have been, and still are, associated with natural background radiation sources and residual man-made radioactivity from fallout associated with the atmospheric testing of nuclear weapons in the western United States and overseas in the 1950s and 1960s. Naturally-occurring radioactivity includes primordial radionuclides (nuclides that existed or were created during the formation of the earth and have a sufficiently long half-life to be detected today) and their progeny, as well as nuclides that are continually produced by natural processes other than the decay of the primordial nuclides. These primordial nuclides are ubiquitous in nature, and are responsible for a large fraction of radiation exposure referred to as background exposure. The majority of primordial radionuclides are isotopes of the heavy elements and belong to the three radioactive series headed by ^{238}U (uranium series), ^{235}U (actinium series), and ^{232}Th (thorium series) (NCRP, 1987a). Alpha, beta, and gamma radiation is emitted from nuclides in these series. The relationship among the nuclides in a particular series is such that, in the absence of chemical or physical separation, the members of the series attain a state of radioactive equilibrium, wherein the decay rate of each nuclide is essentially equal to that of the nuclide that heads the series. The nuclides in each series decay eventually to a stable nuclide. For example, the decay process of the uranium series leads to a stable isotope of lead. There are also primordial radionuclides, specifically 40K and ^{87}Rb, which decay directly to stable elements without going through a series of decay sequences. The primordial series of radionuclides represents a significant component of background radiation exposure to the public (NCRP, 1987a). Cosmogenic radionuclides make up another class of naturally occurring nuclides. Cosmogenic radionuclides are produced in the earth's crust by cosmic-ray bombardment, but are much less important as radiation sources (NCRP, 1987a).

Naturally-occurring radioactivity in soil or rock near the earth's surface belonging to the primordial series represents a significant component of background radiation exposure to the public (NCRP, 1987a). The radionuclides of primary interest are 40K and the radioactive decay chains of ^{238}U and 232Th. These nuclides are widely distributed in rock and soil. Soil radioactivity is largely that of the rock from which it was derived. The original concentrations may have been diminished by leaching and dilution by water and organic material added to the soil, or may have been augmented by adsorption and precipitation of nuclides from incoming water. Nevertheless, a soil layer about 0.25 m (0.8 ft) thick furnishes most of the external radiation from the ground (NCRP, 1987a). In general, typical soil and rock contents of these radionuclides indicate that the 232Th series and 40K each contributes an average of about 150 to 250 μGy per year (15 to 25 mrad per year) to the total absorbed dose rate in air for typical situations, while the uranium series contribute about half as much (NCRP, 1987a).

The public exposure from naturally-occurring radioactivity in soil varies with location. In the U.S., background radiation exposures in the Southwest and Pacific areas are generally higher than those in much of the Eastern and Central regions. The public exposure from naturally-occurring radioactivity in soil varies with location. There is also a wide variation in annual background terrestrial radiation across the State of New Mexico. The North Central region (Albuquerque area) exhibits an average annual absorbed dose in air of about 0.75 mGy (75 mrad), while the southeastern corner of the State (Carlsbad area), which includes the NEF site area in Lea County, measures annual average terrestrial absorbed dose of about 0.30 mGy (30 mrad) (NCRP, 1987a). Applying the same weighting factor, the annual average dose equivalent for the Albuquerque and Carlsbad areas are about 525 and 210 μSv (53 and 21 mrem), respectively. Some of the variation is linked to location, but factors such as moisture content of soil, the presence and amount of snow cover, the radon daughter concentration in the atmosphere, the degree of attenuation offered by housing structures, and the amount of radiation originating in construction materials may also account for variation (NCRP, 1987b).

Background radiation for the public also includes various sources of man-made radioactivity, such as fallout in the environment from weapons testing, and radiation exposures from medical treatments, x-rays, and some consumer products. All of these types of man-made sources contribute to the annual background radiation exposure received by members of the public. Of these, fallout from weapons testing should be included as an environmental radiation source for the NEF site. The two nuclides of concern with regard to public exposure from weapons testing are ^{137}Cs and ^{90}Sr due to their relative abundance, long half lives (30.2 and 29.1 years, respectively) and their ability to be incorporated into human exposure pathways, such as external direct dose and ingestion of foods. The average range of doses from weapons testing fallout to residents of New Mexico has been estimated as 1-3 mGy (100-300 mrad) (CDCP, 2001). Use of radiation in medicine and dentistry is also a major source of man-made background radiation exposure to the U.S. population. Although radiation exposures from medical treatments, X-rays, and some consumer products are considered to be background exposures, they would not be incurred by the public at the NEF site. Nevertheless, as a point of reference, medical procedures contribute an average of 0.39 mSv (39 mrem) for diagnostic xrays and nuclear medicine contributes an average of 0.14 mSv (14 mrem) to the annual average dose equivalent received by the U.S. population (NCRP, 1989). Exposures at these levels are approximately the same as the expected exposure in the southwest area of the country which includes the NEF site from primordial radionuclides. Consumer products (e.g., television receivers, ceramic products, tobacco products) also contribute to annual background radiation exposure. The average annual dose equivalent from consumer products and other miscellaneous sources (e.g., x-ray machines at airports, building materials) can range from fractions of a microsievert (millirems) to several Sieverts (hundreds of rems), as illustrated in Table 5.1 of NCRP Report No. 95 (NCRP, 1987b).

3.11.1.1 Current Radiation Sources

Workers at the NEF are subject to higher potential exposures than members of the public because they are involved directly with handling cylinders containing uranium, processes for the enrichment of uranium, and decontamination and maintenance of equipment. During routine operations, workers at the plant may potentially be exposed to direct radiation, airborne radioactivity, and limited surface contamination. These potential exposures include various types of radiation, including gamma, neutron, alpha, and beta. Annual doses to workers performing various tasks in an operating uranium enrichment plant have been evaluated. Activities primarily contributing to worker annual exposures include transporting cylinders, coupling and uncoupling containers, and other feed, product, and UBC handling tasks. Workers may also incur radiation exposure while performing other tasks, such as those related to the decontamination of cylinders and equipment. Office workers at the NEF may be exposed to direct radiation from plant operation associated with handling and storing feed, product, and UBCs.

Since the NEF site has not previously been developed for industrial or commercial purposes, there are no known past uses of the property that would have used man-made or enhanced concentrations of radioactive materials. Therefore, for members of the public, the only sources of radiation exposure currently present at the NEF site are associated with natural background radiation and residual radioactivity from weapons testing fallout.

Initial radiological characterization of the plant location was performed by gamma isotopic and Uranium specific analyses of 10 surface soil samples, which were collected randomly across the site property. All 10 samples indicated the presence of the naturally-occurring primordial radionuclides 40K, the Thorium decay series (as indicated by ^{228}Ac and ^{228}Th) and the uranium decay series (including both ^{238}U and ^{234}U). In addition, the man-made radionuclide ^{137}Cs, produced by past weapons testing, was also detected in all samples. The average soil concentration for 40K was determined to be 149 Bq/kg (4,027 pCi/kg). This falls in the lower end of the typical range in North America of 40K in soil, which is reported to be from 0.5 x 10^{-6} to 3.0 x 10^{-6} g/g (NCRP, 1976). This range equates to approximately 130 to 777 Bq/kg (3,500 to 21,000 pCi/kg). 238Ac/238Th was found to average 6.88 Bq/kg (186 pCi/kg) in the NEF site soils. If it is assumed that the observed ^{238}Ac/^{238}Th is in secular equilibrium with the parent of the Thorium decay series (232Th), then the observed concentrations are just below the typical lower end range value of 2 x 10-6 g/g (NCRP, 1976) or equivalent 8.1 Bq/kg (218 pCi/kg). With respect to the Uranium decay series, ^{238}U and its progeny, ^{234}U, were detected on the site property in approximately the same concentrations at 7.57 and 7.24 Bq/kg (205 and 196 pCi/kg), respectively. The typical range of ^{238}U concentrations in soil is from about 1 x 10^{-6} to 4 x 10^{-6} g/g (NCRP, 1976). The lower end of this range equates to about 12 Bq/kg (333 pCi/kg), with the observed value falling just below. The average 137Cs concentration was found to be 2.82 Bq/kg (76.3 pCi/kg) and is credited to past weapons testing fallout. These soil radionuclide concentrations are typical of southeastern New Mexico and consistent with natural background exposures from terrestrial sources in this part of the U.S.

In addition to the 10 soil samples discussed above, eight additional surface soil samples were subsequently collected and analyzed for both radiological and non-radiological chemical analyses. Refer to ER Section 3.3.2, Site Soils, for the locations of the soil samples and the non-radiological analytical results.

Analyses included gamma spectrometry and radiochemical analyses for thorium and uranium. Six of the additional eight soil sample locations were selected to represent background conditions at proposed plant structures. The other two sample locations are representative of up-gradient, on-site locations.

The radiological analytical results for the eight soil samples are provided in Table 3.11-6, Radiological Chemical Analyses of NEF Site Soil. The table provides a comparison of the results between the original 10 samples and the subsequent eight samples. All radionuclides detected in the original 10 samples were also detected in the eight samples taken later. Two radionuclides (230Th and ^{235}U) were detected in the eight soil samples but were not detected in the original 10 samples. 230Th was not analyzed in the initial ten soil samples. The laboratory achieved a lower minimum detectable concentration (MDC) for ^{235}U in the subsequent analyses than for the initial soil samples. 230Th is naturally occurring and associated with the decay of ^{238}U. Similar to ^{234}U and ^{238}U, ^{235}U is a natural uranium isotope found in the environment.

With respect to background exposure rates in the area of the NEF site, an inspector with the Radiation Control Bureau of the New Mexico Environment Department was contacted in May 2004. The inspector indicated that based on field measurements, the direct radiation background in the area of the proposed NEF is approximately 8 to 10 μR/hr. The inspector indicated that this value is somewhat lower than that for other parts of New Mexico.

ER Section 6.1.2, Radiological Environmental Monitoring Program, describes the Radiological Environmental Monitoring Program (REMP) for the NEF. The REMP includes the collection of data during pre-operational years in order to establish baseline radiological information that will be used in determining and evaluating impacts from operations at the plant on the local environment. The REMP will be initiated at least 2 years prior to plant operations in order to develop a sufficient database.

The data summarized above, supplemented with the REMP data, will fully characterize the background radiation levels at the NEF site.

3.11.1.2 Historical Exposure to Radioactive Materials

Annual whole-body dose equivalents accrued by workers at an operating uranium enrichment plant is typically low. The maximum individual annual dose equivalents for the years 1998 through 2002 at the Urenco Capenhurst plant, located in the United Kingdom, were 3.1 mSv (310 mrem), 2.2 mSv (220 mrem), 2.8 mSv (280 mrem), 2.7 mSv (270 mrem), and 2.3 mSv (230 mrem), respectively. For each of those years, the average annual worker dose equivalent was approximately 0.2 mSv (20 mrem) (URENCO, 2000; URENCO, 2001; URENCO, 2002a).

In the United States, individuals receive 2.0 to 3.0 mSv (200 to 300 mrem) per year dose equivalent, on the average, from normal background radiation.

3.11.1.3 Summary of Health Effects

Health effects from radiation exposure became evident soon after the discovery of x-rays in 1895 and radium in 1898. Following World War II, many studies were initiated to investigate the effect of radiation on Japanese populations who survived the atomic bombing of Hiroshima and Nagasaki. The reports of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) (UNSCEAR, 1986; UNSCEAR, 1988) and the National Academy of Sciences Committee of the Biological Effects of Ionizing Radiation (BEIR) (NAS, 1980; NAS, 1988) are comprehensive reviews of the Japanese data. In addition, numerous radiobiological studies have been conducted in animals (e.g., mouse, rat, hamster, dog), and in cells and tissue cultures. Extrapolations to humans from these experiments are problematic and despite the large amount of accumulated data, uncertainties still exist regarding the effects of radiation at low doses and low dose rates. The most reliably estimated risks are those associated with relatively high doses (i.e, greater than 1 Gy (100 rad)) (NCRP, 1989). The radiation health community is in general agreement that risks at smaller doses are at least proportionally smaller (e.g., no more than 1/100 the risk at 1/100 the dose). It is likely that the risks may be considerably smaller (NCRP, 1980).

Serious radiation-induced diseases fall into two categories: stochastic effects and nonstochastic effects. A stochastic effect is defined as one in which the probability of occurrence increases with increasing absorbed dose but the severity in affected individuals does not depend on the magnitude of the absorbed dose (NCRP, 1989). A stochastic effect is an all-or-none response as far as the individuals are concerned. Cancers such as solid malignant tumors, leukemia and genetic effects are regarded as the main stochastic effects to health from exposure to ionizing radiation at low absorbed doses (NCRP, 1989). It is generally agreed among members of the scientific community that a radiation dose of 100 mGy (10 rads) increases the risk of developing cancer in a lifetime by about one percent (NCRP, 1989). In comparison, a nonstochastic effect of radiation exposure is defined as a somatic effect which increases in severity with increasing absorbed dose in affected individuals, owing to damage to increasing numbers of cells and tissues (NCRP, 1989). Examples of nonstochastic effects from radiation exposure are damage to the lens of the eye, nausea, epilation, diarrhea, and a decrease in sperm production in the male (NCRP, 1980; NCRP, 1989). These effects have been observed only following high dose exposures, typically greater than 1 Gy (100 rads) to the whole body (NCRP, 1989). The potential doses to the public due to routine operations at the NEF are presented in ER Section 4.12, Public and Occupational Health Impacts, are several orders of magnitude below the natural background doses discussed here. For further information, NCRP Report No. 64 (NCRP, 1980) provides an overview of research results and data relating to biological effects from radiation exposures.

3.11.2 Major Sources and Levels of Chemical Exposure

The NEF site has no history as an industrial site. Consequently, there are currently no known major sources of chemical exposure at the site that may impact the public. Chemicals that may be brought onto the NEF site during construction or operation of the NEF facility are identified in ER Section 3.12.2.2. ER Section 3.6.2, Existing Levels of Air Pollution and Their Effects on Plant Operations, discusses the regional air quality for both Lea County, New Mexico and Andrews County, Texas for those parameters or pollutants tracked under EPA requirements, including a listing of existing sources of criteria pollutants, such as volatile organic compounds (VOC). In general, ambient air quality in the region is characterized as very good and in compliance of all EPA criteria for pollutants. ER Section 4.6, Air Quality Impacts, discusses expected NEF emissions of criteria pollutants from house boilers that power the facility's heating system.

3.11.2.1 Occupational Injury Rates

Occupational injury rate at the NEF is expected to be similar to other operating uranium enrichment plants. Common occupational accidents at those plants involve hand and finger injuries, tripping accidents, burns and impacts due to striking objects or falling objects (URENCO, 2000; URENCO 2001, URENCO, 2002a). Table 3.11-1, Lost Time Accidents in Urenco Capenhurst Limited (UCL), tabulates lost time accidents for Urenco Capenhurst Limited (UCL) for the years 1998-2002. The desirable number of lost time accidents is zero. However, URENCO sets a target maximum number of lost time accidents (LTAs) each year. The table specifies this goal as "target max LTAs." URENCO's intent is to foster improvement over time and ultimately bring the goal down to zero LTAs. The target maximum number of LTAs for the NEF is zero. The top three causes of accidents for all severity involve handling tools, slips, trips and falls on the same level and the impact from striking objects or objects falling, and resulted mostly to injuries to fingers and hands. These leading events causes have remained basically the same over the last five-year period (1998-2002). Figure 3.11-1, 2000-2002 Accidents by Cause, illustrates the main causes of all injuries sustained at UCL during 2000, which is representative of the distribution of all lost time accidents over the period 1998-2002.

3.11.2.2 Public and Occupational Exposure Limits

The radiation exposure limits for the general public have been established by the NRC in 10 CFR 20 (CFR, 2003q) and by the EPA in 40 CFR 190 (CFR, 2003f). Table 3.11-2, Public and Occupational Radiation Exposure Limits, summarizes these exposure limits.

The NRC exposure limits place annual restrictions on the total dose equivalent exposure (1 mSv (100 mrem)), which includes external plus internal radiation exposures and dose equivalent rate (0.02 mSv (2 mrem)) in any 1 hour in unrestricted areas that are accessible by members of the public who are not employees, but who may be present during the year at the NEF. The annual whole body (0.25 mSv (25 mrem)), organ (0.25 mSv (25 mrem)), and thyroid (0.75 mSv (75 mrem)) dose equivalent limits established by the EPA apply to members of the public who are at offsite locations (i.e., at or beyond the plant's site boundary). Public exposure at offsite locations due to routine operations comply with the more restrictive EPA limits. Annual exposure to the public is maintained ALARA through effluent controls and monitoring (ER Section 6.1, Radiological Monitoring).

The NRC also places restrictions on radiation exposures incurred by employees at the NEF. The NRC restricts the annual radiation exposure that an employee may receive to a total effective dose equivalent (TEDE) of 50 mSv (5 rem), which includes external and internal exposure. In addition, the NRC places restrictions of the dose equivalent to the lens of the eye (0.15 Sv (15 rem)), skin (0.5 Sv (50 rem)), extremities (0.5 Sv (50 rem)), and on the committed dose equivalent to any internal organ (0.5 Sv (50 rem)). Annual radiation exposure for an employee is controlled, monitored, and maintained ALARA through the radiation safety program at the NEF.

There have been no criticality events or events causing personnel overexposure at Urenco enrichment facilities. During the period from 1972 to 1984, there were 13 reportable worker exposure events of the Urenco Almelo facility in the Netherlands involving releases of small quantities of UF_6. These releases were due to flange or valve leakage. Urenco has stated that there was no impact to the public in any of these releases. In these events, 14 workers were found to have uranium in their urine greater than 50 μg of uranium. After two days, no uranium was detected in urine tests. There have been no reportable events at the Capenhurst or Gronau Urenco facilities. After 1984, there have been no reportable worker exposure events.

Urenco stated to the NRC (NRC, 2002d) that there were two releases to the environment at the Almelo facility in 1998 and 1999. During the releases, concentrations were measured to be 0.8 Bq/m^3 (2.2×10^{-11} μCi/mL) and 1.1 Bq/m^3 (3.0×10^{-11} μCi/mL), respectively, for less than one hour. The total release was less than the 24-hour release limit and much less than the annual release limit. The Dutch release limit is 0.5 Bq/m^3 (1.3×10^{-11} μCi/mL) in one hour. These two releases resulted in a modification to the ventilation system design to add carbon and high efficiency particulate air filters.

The Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) have developed exposure limits for Hydrogen Fluoride (HF). These regulations are enforceable by law. Recommendations for public health have also been developed, but cannot be enforced by law, however accidental release criteria have been established by the EPA for reportability and public protection. Federal organizations that develop recommendations for public health from toxic substances are the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH). The American Conference of Governmental Industrial Hygienists (ACGIH) also provide occupational exposure limits for HF, which are updated periodically and whose research is used by NIOSH, which in turn provides data and recommendations to OSHA. Lists of these regulations are detailed in Table 3.11-3, Hydrogen Fluoride (HF) Regulations And Guidelines (ACGIH, 2000).

Of primary importance to the NEF is the control of uranium hexafluoride (UF_6). The UF_6 readily reacts with air, moisture, and some other materials. The most significant UF_6 reaction products in this plant are hydrogen fluoride (HF), uranyl fluoride (UO_2F_2), and small amounts of uranium tetrafluoride (UF4). Of these, HF is the most significant hazard, being toxic to humans. When UF_6 reacts with moisture, it breaks down into UO_2F_2 and HF. See Table 3.11-4, Properties of UF_6 and Table 3.11-5, Chemical Reaction Properties, for further physical and reaction properties.

HF is a colorless, fuming liquid with a sharp, penetrating odor, which is also a highly corrosive chemical. The health dangers of UF_6 stem more from its chemical properties than from its radiological properties. Contact with HF can cause severe irritation of the eyes, inhalation can cause extreme irritation of the respiratory tract, and ingestion can cause vomiting, diarrhea and circulatory collapse. Initial exposure to HF may not cause the appearance of a typical acid burn; instead the skin may appear reddened and painful, with increasing damage occurring over a period of several hours or days. Tissue destruction and loss can occur with contact to HF, and in worst cases large doses of HF can cause death due to the fluoride affecting the heart and lungs. The actual amount of HF that can cause death has not been quantified. Breathing moderate amounts of HF for several months caused rats to develop kidney damage and nervous system changes, as well as learning problems. Inhalation of HF or HF-containing dust will cause skeletal fluorosis, or changes in bones and bone density (HHS, 2001).

OSHA has set a limit of 2.0 mg/m^3 for HF for an 8-hr work shift, while the NIOSH recommendation is 2.5 mg/m^3 (NIOSH, 2001). As with most toxicological information and health exposure regulations, limits have been established based on past exposures, biological tests, accident scenarios and lessons learned, and industrial hygiene data that is continually collected and researched in occupational environments.

It should be noted that the state of California (CAO, 2002) has proposed a much more conservative exposure limit of 30 µg/m^3 for an 8-hr work shift. This limit is by far the most stringent of any state or federal agency. LES has compared the OSHA and California exposure limits (2.0 mg/m^3 and 30 µg/m^3, respectively) to the expected HF annual average concentrations from NEF. The annual expected average HF concentration emission from a 3 million SWU/yr Urenco Centrifuge Enrichment Plant was calculated at 3.9 µg/m^3 at the point of discharge (rooftop) without atmospheric dispersion taken into consideration. This comparison demonstrates that the NEF gaseous HF emissions (at rooftop without dispersion considered) are well below any existing or proposed standards and therefore will have a negligible environmental and public health impact.

3.11.3 Section 3.11 Tables

Table 3.11-1 Lost Time Accidents in Urenco Capenhurst Limited (UCL)

Year	Total Number of Lost Time Accidents (LTAs)	Target Max LTAs[1]	RIDDOR[2] Reportable LTAs	Frequency Rate[3] for Reportable LTAs	OSHA[4] Lost Work Day Case Rate
1998	3	2	1	0.12	0.74
1999	3	2	3	0.37	0.74
2000	4	2	3	0.31	0.82
2001	1	1	0	0	0.23
2002	2	1	1	0.12	0.48

[1] Target maximum number of LTAs is set annually with the intent to foster improvement over time and bring the goal or target down to zero. Target max LTAs for the NEF is zero

[2] RIDDOR Reportable LTA – A lost time accident leading to a major injury or an absence from work of greater than three days (RIDDOR – Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations)

[3] Frequency Rate for Reportable LTAs – Total number of major and greater than three days lost time accidents x 100,000/total hours worked

[4] OSHA Lost Work Day Case Rate – Total number of injuries resulting in absence x 200,000/total hours worked

Table 3.11-2 Public and Occupational Radiation Exposure Limits

Individual	Annual Dose Equivalent Limit	Reference
Worker	50 mSv (5 rem) TEDE 0.5 Sv (50 rem) CDE to any organ 0.15 Sv (15 rem) lens of eye 0.5 Sv (50 rem) skin 0.5 Sv (50 rem) extremity	10 CFR 20 (CFR, 2003q)
General Public	1 mSv (100 mrem) TEDE 0.02 mSv (2 mrem) in any 1 hour period	10 CFR 20 (CFR, 2003q)
	0.25 mSv (25 mrem) whole body 0.25 mSv (25 mrem) any organ 0.75 mSv (75 mrem) thyroid	40 CFR 190 (CFR, 2003f)

Table 3.11-3 Hydrogen Fluoride (HF) Regulations And Guidelines

Agency	Description	Concentration or Quantity	Reference
ACGIH	STEL (ceiling)	3.0 ppm	(ACGIH, 2000)
NIOSH	REL (TWA)	2.5 mg/ m^3	(NIOSH, 2001)
NIOSH	IDLH	30 ppm	(NIOSH, 2001)
OSHA	PEL (8-hr TWA)	2.0 mg/m^3	(CFR, 2003o)
CA	REL	30 µg/m^3 (40 ppb)	(CAO, 2002)
EPA	Accidental release prevention Toxic end point	0.0160 mg/L	(CFR, 2003s)
EPA	Accidental release prevention Threshold quantity	454 kg (1,000 lbs)	(CFR, 2003t)
OSHA	Highly hazardous chemicals Threshold quantity	454 kg (1,000 lbs)	(CFR, 2003o)
EPA	Superfund – reportable quantity	2,268 kg (5,000 lbs)	(CFR, 2003u)

STEL, Short Term Exposure Limit
REL, Recommended Exposure Limit
IDLH, Immediately Dangerous to Life and Health
TWA, Time Weighted Average
PEL, Permissible Exposure Limit
ACGIH, American Conference of Governmental Industrial Hygienists
NIOSH, National Institute for Occupational Safety and Health
OSHA, Occupational Safety and Health Administration
EPA, Environmental Protection Agency
CA, California (which has its own limits that are open to public comment)
OEHHA, Office of Environmental Health Hazard Assessment

Table 3.11-4 Properties of UF_6

Sublimation Point	101 kPa (14.7 psia) (760 mm Hg) 56.6°C (133.8°F)
Triple Point	152 kPa (22 psia) (1140 mm Hg) 64.1°C (147.3°F)
Density, Solid 20°C (68°F) Liquid, 64.1°C (147.3°F) Liquid, 93°C (200°F) Liquid, 113°C (235°F) Liquid, 121°C (250°F)	5.1 g/cm^3 (317.8 lb/ft^3) 3.6 g/cm^3 (227.7 lb/ft^3) 3.5 g/cm^3 (215.6 lb/ft^3) 3.3 g/cm^3 (207.1 lb/ft^3) 3.3 g/cm^3 (203.3 lb/ft^3)
Heat of Sublimation, 64.1°C (147.3°F)	135,373 J/kg (58.2 BTU/lb)
Heat of Fusion, 64.1°C (147.3°F)	54,661 J/kg (23.5 BTU/lb)
Heat of Vaporization, 64.1°C (147.3°F)	81,643 J/kg (35.1 BTU/lb)
Critical Pressure	4610 kPa (668.8 psia) (34,577 mm Hg)
Critical Temperature	230.2°C (446.4°F)
Specific Heat, Solid, 27°C (81°F)	477 J/kg/°K (0.114 BTU/lb/°F)
Specific Heat, Liquid, 72°C (162°F)	544 J/kg/°K (0.130 BTU/lb/°F)

Table 3.11-5 Chemical Reaction Properties

Major Reactions	Heat of Reaction* kJ/kg-mole (Btu/lb-mole)	Free Energy of Reaction* kJ/kg-mole (Btu/lb-mole)
UF_6 Decomposition $UF_6 \Rightarrow U + 3F_2$ $UF_6 \Rightarrow UF_4 + F_2$	$+2.16 \times 10^6$ $(+ 9.29 \times 10^5)$ $+1.32 \times 10^5$ $(+ 1.3 \times 10^5)$	$+2.03 \times 10^6$ $(+ 8.73 \times 10^5)$ $+2.65 \times 10^5$ $(+ 1.14 \times 10^5)$
UF_6 Hydrolysis $UF_6(g) + 2H_2O(g) \Rightarrow UO_2F_2(s) + 4HF(g)$	-2.11×10^5 $(- 9.1 \times 10^4)$	-1.41×10^5 $(- 6.05 \times 10^4)$
HF Reaction with Glass $HF + SiO_2 \Rightarrow SiF_4 + 2H_2O$	-1.06×10^5 $(- 4.58 \times 10^4)$	-8.37×10^4 $(- 3.60 \times 10^4)$

* Reference point = 25°C (77°F) at 101.3 kPa (14.7 psia)

- UF_6 is completely stable with H_2, N_2, O_2 and dry air at ambient temperature.
- UF_6 reacts with most organic compounds to form HF and carbon fluorides.
- Fully fluorinated materials are quite resistant to UF_6 at moderate temperatures.
- UF_6 has metathesis reactions with oxides and hydroxides, for example:

$$UF_6 + 2NiO \Rightarrow UO_2F_2\ (s) + Ni{*}F_2(s)$$

$$UF_6 + Ni(OH)2 \Rightarrow UO_2F_2\ (s) + NiF_2(s) + 2HF$$

- UF_6 oxidizes metals, for example:

$$2UF_6 + Ni \Rightarrow 2UF_5 + NiF_2$$

The reaction of UF_6 with nickel, copper and aluminum produces a protective fluoride film, which slows or stops the reaction.

Table 3.11-6 Radiological Chemical Analyses of NEF Site Soil

Analytical Results Bq/kg (pCi/kg)									Comparative Soil Bq/kg (pCi/kg) (Initial 10 Samples)
Sample No.	**SS-2**	**SS-6**	**SS-9**	**SS-11**	**SS-12**	**SS-13**	**SS-15**	**SS-16**	
Nuclide[1]									
^{228}Ac ^{228}Th	6.7 (181)	5.6 (151)	6.2 (168)	6.5 (175)	7.6 (205)	6.4 (172)	5.8 (156)	7.4 (201)	8.1 (218)[2]
^{137}Cs	4.3 (115.5)	3 (80.7)	3.1 (84)	3.1 (83.5)	2.1 (57.6)	1.2 (32.6)	2.7 (74)	3.3 (89.9)	2.82 (76.3)[3]
^{40}K	137.8 (3720)	140 (3780)	135.2 (3650)	138.9 (3750	133.7 (3610)	135.6 (3660)	143 (3860)	139.6 (3770)	130 (3,500)[2]
^{228}Th	5.4 (146)	7.7 (207)	5.7 (154)	6.5 (175)	7.7 (207)	7.4 (199)	7.8 (211)	7.4 (200)	8.1 (218)[2]
^{230}Th	5.8 (157)	5.0 (136)	5.9 (160)	5.7 (155)	6 (163)	5.5 (149)	6 (161)	6.8 (183)	NA[4]
^{232}Th	7.6 (204)	6 (163)	6.1 (164)	6.7 (181)	7.3 (196)	7.2 (194)	7.7 (207)	7 (188)	8.1 (218)[2]
^{234}U	5.9 (159.2)	6.1 (165)	6.2 (168.4)	6.1 (165.4)	5.9 (159.4)	5.3 (143)	6.0 (161.5)	6.1 (165.4)	12 (333)[2]
^{235}U	0.24 (6.6)	0.25 (6.7)	0.39 (10.6)	0.43 (11.6)	0.41 (11.1)	0.36 (9.7)	0.28 (7.5)	0.24 (6.4	NA[4]
^{238}U	5.4 (146.8)	5.9 (158)	6 (161.2)	6.2 (168.5)	6 (162.5)	5.8 (157.6)	5.8 (156.4)	5.7 (152.8)	12 (333)[2]

[1] No other nuclides were detected above the laboratory measured MDC.

[2] Typical lower end range value.

[3] Average in NEF site soils Credited to past weapons testing fallout.

[4] Typical soil concentration data is not available.

3.11.4 Section 3.11 Figures

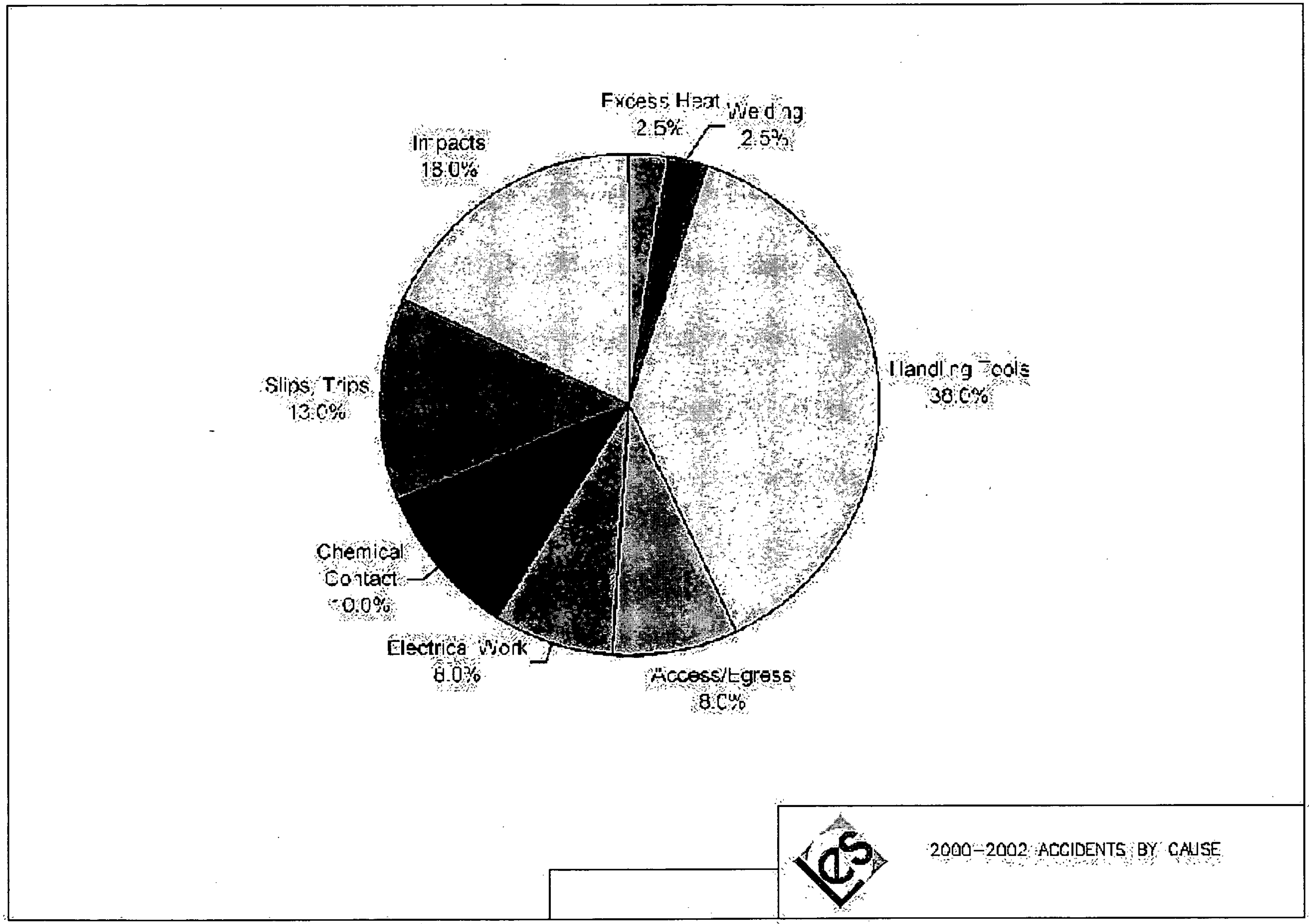


Figure 3.11-1 2000-2002 Accidents by Cause

3.12 WASTE MANAGEMENT

Waste Management for the National Enrichment Facility (NEF) is divided into gaseous and liquid effluents, and solid wastes. Descriptions of the sources, systems, and generation rates for each waste stream are discussed in this section. Disposal plans, waste minimization, and environmental impacts are discussed in ER Section 4.13, Waste Management Impacts.

3.12.1 Effluent Systems

The following paragraphs provide a comprehensive description of the NEF systems that handle gaseous and liquid effluent. The effectiveness of each system for effluent control is discussed for all systems that handle and release effluent.

3.12.1.1 Gaseous Effluent Vent System

The function of the Gaseous Effluent Vent System (GEVS) is to remove particulates containing uranium and hydrogen fluoride (HF) from potentially contaminated process gas streams. Prefilters and high efficiency particulate air (HEPA) filters remove particulates and potassium carbonate impregnated activated carbon filters are used for the removal of any HF. Electrostatic filters remove oil vapor from the gaseous effluent associated with exhaust from vacuum pump/chemical trap set outlets wherever necessary.

The systems produce solid wastes from the periodic replacement of prefilters, HEPA filters, and chemical filters. The systems produce no gaseous effluents of their own, but discharge effluents from other systems after treatment to remove hazardous materials. There are two GEVS for the plant: (1) the Separations Building Gaseous Effluent Vent System and (2) the Technical Services Building (TSB) Gaseous Effluent Vent System.

3.12.1.1.1 Sources and Flow Rates

Potentially contaminated exhaust air comes from the rooms and services within the TSB. Air from the Fomblin Oil Recovery System is part of the Decontamination Workshop discharge. The total airflow to be handled by the GEVS for the TSB and Separations Building are 18,700 m^3/hr (11,000 cfm) and 11,000 m^3/hr (6,474 cfm), respectively.

The design requirements for the facility provide a large safety margin between normal and accident conditions so that no single failure could result in the release of significant hazardous material. The amounts of UF_6 in the system also preclude the release of significant quantities of hazardous material from a single failure or multiple failures. Instrumentation is provided to detect abnormal process conditions so that the process can be returned to normal by operator actions.

These requirements and operating conditions also provide assurance that personnel exposure to hazardous materials are maintained "as low as reasonably achievable" and that effluent discharges comply with environmental and safety criteria.

3.12.1.1.2 System Description

The GEVS for the Separations Building and the TSB consists of the following major components:

- Duct system
- Prefilter
- High Efficiency Particulate Air (HEPA) Filter
- Activated carbon filter (impregnated with potassium carbonate)
- Centrifugal Fan
- Monitoring and controls
- Automatically controlled inlet and outlet isolation dampers
- Discharge stack

The GEVS serving the TSB consists of a duct network that serves all of the UF_6 processing systems and operates at negative pressure. The ductwork is connected to one filter station and vents through one fan. Both the filter station and the fan can handle 100% of the effluent. There is no standby filter station or fan. Operations that require the GEVS to be operational will be shut down if the system shuts down. The system capacity is estimated to be 18,700 m^3/hr (11,000 cfm). A differential pressure controller controls the fan speed and maintains negative pressure in front of the filter station.

Gases from the UF_6 processing systems pass through an 85% efficient prefilter. The prefilter removes dust particles and thereby prolongs the useful life of the HEPA filter. Gases then flow through a 99.97% efficient HEPA filter. The HEPA filter removes uranium aerosols which consist of UO_2F_2 particles. Finally, the gases pass through a 99% efficient activated charcoal for removal of HF. The cleaned gases pass through the fan, which maintains the negative pressure upstream of the filter stations. The cleaned gases are then discharged through the vent stack.

One Separation Building GEVS serves the entire Separations Building. It consists of a duct network that serves all of the uranium processing systems and operates at negative pressure. It is sized to handle the flow from all permanently ducted process locations, as well as up to 13 noncorrugated flexible duct exhaust points at one time. The flexible duct is used for cylinder connection/disconnection or maintenance procedures.

The ductwork is connected to two parallel filter stations. Each is capable of handling 100% of the effluent. One is online and the other is a standby. Each station consists of an 85% efficient prefilter, a 99.97% efficient HEPA filter and a 99% efficient activated charcoal filter for removal of HF. The leg of the distribution system securing the exhaust of the vacuum pump/trap set outlets is routed through an electrostatic filter. Electrostatic filters have an efficiency of 97%. The filter stations vent through one of two fans. Each fan is capable of handling 100% of the effluent. One fan is online, and the other is a standby. A switch between the operational and standby systems can be made using automatically controlled dampers. The system total airflow capacity is estimated to be 11,000 m^3/hr (6,474 cfm). A differential pressure controller controls the fan speed and maintains negative pressure upstream of the filter station.

Gases from the UF_6 processing systems pass through the prefilter which removes dust and protects the HEPA filter, then through the HEPA filter which removes uranium aerosols (mainly UO_2F_2 particles), then through the potassium carbonate impregnated activated carbon filters which captures HF. The remaining clean gases pass through the fan, which maintains the negative pressure upstream of the filter stations. Finally, the clean gases are discharged through a roof top vent on the TSB. One vent is common to the operational system and the standby system.

3.12.1.1.3 System Operation

For the TSB GEVS, and Separations Building GEVS, HF monitors and alarms are installed downstream of the filtration systems and immediately upstream of the vent stack to detect the release of hazardous materials to the environment. The alarms are monitored in the Control Room.

The units will be located in a dedicated room in the TSB. The filters will be bag-in bag-out. It is estimated that the filters will be changed on a yearly basis or multi-yearly basis.

If the GEVS stops operating, material within the duct will not be released into the building because each of the GEVS connections has a P-trap to catch entrained material that could otherwise fall back into the building from the ductwork during system failure.

3.12.1.1.4 Effluent Releases

Under normal operating conditions, the system will not be contaminated. In the event that an abnormal situation occurs, the GEVS is designed to protect plant personnel against UF_6 and HF exposure. The GEVS is designed to meet all applicable NRC requirements for public and plant personnel safety and effluent control and monitoring. The system design also complies with all standards of OSHA, EPA, and state and local agencies.

The annual discharge of uranium in routine gaseous effluent discharged from the NEF is expected to be less than 10 grams (0.35 ounces). The environmental impacts of gaseous releases and associated doses to the public are described in detail in ER Section 4.12.1.1, Routine Gaseous Effluent.

3.12.1.2 Centrifuge Test and Post Mortem Facilities Exhaust Filtration System

The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System provides exhaust of potentially hazardous contaminants from the Centrifuge Test and Post Mortem Facilities. The system also ensures the Centrifuge Post Mortem Facility is maintained at a negative pressure with respect to adjacent areas. The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is located in the Centrifuge Assembly Building and is monitored from the Control Room.

Potentially contaminated exhaust air comes from the Centrifuge Test and Post Mortem Facilities. The total airflow to be handled by the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is 9,345 m^3/hr (5,500 cfm). All flow rates and capacities are subject to change during final design.

The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System consists of a duct network that serves the Centrifuge Test and Post Mortem Facilities and operates at negative pressure. The ductwork is connected to one filter station and vents through either of two 100% fans. Both the filter station and either of the fans can handle 100% of the effluent. One of the fans will normally be in standby. Operations that require the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System to be operational are manually shut down if the system shuts down.

Gases from the associated areas pass through the 85% efficient prefilter which removes dust and protects downstream filters, then through the 99% efficient activated charcoal filter that captures HF. Remaining uranic particles, (mainly UO_2F_2) are treated by a 99.7% efficient HEPA filter. After filtration, the clean gases pass through a fan, which maintains the negative pressure upstream of the filter station. The clean gases are then discharged through the monitored (alpha and HF) stack on the Centrifuge Assembly Building.

3.12.1.3 Liquid Effluent System

Quantities of radiologically contaminated, potentially radiologically contaminated, and nonradiologically contaminated aqueous liquid effluents are generated in a variety of operations and processes in the TSB and in the Separations Building. The majority of all potentially radiologically contaminated aqueous liquid effluents are generated in the TSB. All aqueous liquid effluents are collected in tanks that are located in the Liquid Effluent Collection and Treatment System in the TSB. The collected effluent is sampled and analyzed.

3.12.1.3.1 Effluent Sources and Generation Rates

Numerous types of aqueous and non-aqueous liquid wastes are generated in the plant. These effluents may be significantly radiologically contaminated, potentially contaminated with low amounts of contamination, or non-contaminated. Effluents include:

- Hydrolyzed uranium hexafluoride and aqueous laboratory effluent

These hydrolyzed uranium hexafluoride solutions and the aqueous effluents are generated during laboratory analysis operations and require further processing for uranium recovery.

- Degreaser Water

This is water, which has been used for degreasing contaminated pump and plant components coated in Fomblin oil. The oil, which is heavier than water will be separated from the water via gravity separation, and the suspended solids filtered, prior to routing for uranium recovery. Most of the soluble uranium components dissolve in the degreaser water.

- Citric Acid

The decontamination process removes a variety of uranic material from the surfaces of components using citric acid. The citric acid tank contents comprise a suspension, a solution and solids, which are strongly uranic and need processing. The solids fall to the bottom of the citric acid tank and are separated, in the form of sludge, from the citric acid using gravity separation. The other sources of citric acid is from the UF_6 Sample Bottles cleaning rig and flexible hose decontamination cabinet. Part of the cleaning process involves rinsing them in 5-10% by volume citric acid.

- Laundry Effluent

This is water that has arisen from the washing of the plant personnel laundry including clothes and towels. The main constituents of this wastewater are detergents, bleach and very low levels of dissolved uranium based contaminants. This water is routed into a collection tank, monitored and neutralized as required. The effluent is contained and treated on the NEF site.

- Floor Washings

This is water, which has arisen from all the active areas of the plant namely the UF_6 Handling Area, Chemical Laboratories, Decontamination Workshop and Rebuild Workshop. The main constituents of this wastewater are detergents, and very low levels of dissolved uranium based contaminants. This water is routed into a collection tank and monitored prior to routing for uranium recovery.

- Miscellaneous Condensates

This is water which has arisen from the production plant during the defrost cycle of the low temperature take off stations. This water is collected in a common holding tank with floor washings, monitored and pumped into the Miscellaneous Effluent Collection Tank prior to routing.

- Radiation Areas Hand Washing and Shower Water

Plant personnel generate this uncontaminated water from hand washing and showering. This water is collected and monitored and then released to the Treated Effluent Evaporative Basin.

3.12.1.3.2 System Description

Aqueous laboratory effluents with uranic concentrations are sampled to determine their uranic content and then pumped from the labs to the agitated Miscellaneous Effluent Collection Tank in the Liquid Effluent Collection and Treatment Room. Floor washings are sampled to determine their uranic content and then manually emptied into the tank. Condensate may be either manually transported or piped to the tank after sampling.

All water from the personnel hand washes and showers in the TSB, Separations Building, Blending and Liquid Sampling Area, the Centrifuge Test Facility and the Centrifuge Post Mortem Facility goes to the Hand Wash/Shower Monitor Tanks in the Liquid Effluent Collection and Treatment Room. Since these effluents are expected to be non-contaminated, no agitation is provided in these tanks. Samples of the effluents are regularly taken to the laboratory for analysis. Lab testing determines pH, soluble uranic content, and insoluble uranic content.

All washing machine water is discharged from the clothes washers to the Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment Room. Due to the very low uranium concentration of this effluent and the constant flow into these tanks, they are not agitated. Samples of the effluents are regularly taken to the laboratory for determination of pH, soluble uranic content, and insoluble uranic content. Based on operating plant experience, the clothes washed contain very small amounts of uranyl fluoride (UO_2F_2) and trace amounts of uranium tetrafluoride (UF4). Following sampling, the laundry effluent is sent to the Treated Effluent Evaporative Basin.

Effluents containing uranium are treated in the Precipitation Treatment Tank to remove the majority of the uranium that is in solution. After the effluent is transferred to the Precipitation Treatment Tank, a precipitating agent, such as potassium hydroxide (KOH) or sodium hydroxide (NaOH), is added. The addition of the precipitating agent raises the pH of the effluent to the range of 9 to 12. This treatment renders the soluble uranium compounds insoluble and they precipitate from the solution. The tank contents are constantly agitated to provide a homogeneous solution. The precipitated compounds are then removed from the effluent by circulation through a small filter press. The material removed by the filter press is deposited in a container and sent for off-site low-level radioactive waste disposal.

The clean effluent is re-circulated back to the Precipitation Treatment Tank. Depending on the characteristics of the effluent, the effluent may have to be circulated through the filter press numerous times to obtain the percent of solids removal required. A sample of the effluent is taken to determine when the correct percent solids have been removed. When it is determined that the correct amount of solids have been removed, the effluent is transferred to the Contaminated Effluent Hold Tank.

The effluent in the Contaminated Effluent Hold Tank is then transferred to the agitated Evaporator/Dryer Feed Tank. Acid is added via a small chemical addition unit to reduce the pH back down to 7 or 8. This is necessary to help minimize corrosion in the Evaporator/Dryer.

From the Evaporator/Dryer Feed Tank, the effluent is pumped to the Evaporator/Dryer. The Evaporator/Dryer is an agitated thin film type that separates out the solids in the effluent. The Evaporator/Dryer is heated by steam in a jacket or from an electric coil. As the effluent enters the Evaporator/Dryer, the effluent is heated and vaporized. The Evaporator/Dryer discharges a "dry" concentrate into a container located at the bottom of the Evaporator/Dryer. Container contents are monitored for criticality, labeled, and stored in the radioactive waste storage area. When full, the container is sent for shipment off-site to a low-level radioactive waste disposal facility. Liquid vapor exits the evaporator and is condensed in the Evaporator/Dryer Condenser, which is cooled with chilled water.

The condensate from the Evaporator/Dryer Condenser is collected in the Distillate Tank before being transferred to one of the Treated Effluent Monitor Tanks. The effluent in these tanks is sampled and tested for pH and uranic content to ensure compliance with administrative guidelines prior to release to the double-lined Treated Effluent Evaporative Basin with leak detection. If the lab tests show the effluent does not meet administrative guidelines, the effluent can be further treated. Depending on what conditions the lab testing show, the effluent is either directed back to the Evaporator/Dryer Feed Tank for another pass through the Evaporator/Dryer, or it can be directed through the Mixed Bed Demineralizers. After either option, the effluent is transferred back to a Treated Effluent Monitor Tank where it is again tested. When the lab tests are acceptable, the effluent is released to the Treated Effluent Evaporative Basin.

The Citric Acid Tank in the Decontamination Workshop is drained, all the effluent is transferred to the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment Room. A "sludge" remains in the bottom of the Citric Acid Tank. This "sludge" consists primarily of uranium and metal particles. This sludge is flushed out with deionized water (DI). The combination of the sludge and the DI water also goes to the Spent Citric Acid Collection Tank. The spent citric acid effluent/sludge contains the wastes from the Sample Bottle and Flexible Hose Decontamination Cabinets, which are manually transferred to the Citric Acid Tank in the Main Decontamination System. The contents of the Spent Citric Acid Collection Tank are constantly agitated to keep all solids in suspension and to provide a homogeneous solution. This is necessary to prevent build-up of uranic material in the bottom of the tank.

The Degreaser Tank in the Decontamination Workshop is drained, and the effluent is transferred to the Degreaser Water Collection Tank in the Liquid Effluent Collection and Treatment Room. A "sludge" remains in the bottom of the Degreaser Tank after the degreasing water is drained. This "sludge" consists primarily of Fomblin oil and uranium. This sludge is flushed out with DI water. The combination of the sludge and the DI water also goes to the Degreaser Water Collection Tank. The contents of the Degreaser Water Collection Tank remain agitated to keep all solids in suspension and to provide a homogeneous solution. This is necessary to prevent build-up of uranic material in the bottom of the tank. Since this effluent contains Fomblin oil, it is not possible to send the degreaser water to the Precipitation Treatment Tank for treatment. Therefore, the Fomblin oil must be removed first.

For Fomblin oil removal, the contents of the Degreaser Water Collection Tank circulate through a small centrifuge. The oil and sludge are centrifuged off, collected in a container, and sent for offsite low-level radioactive waste disposal.

3.12.1.3.3 System Operation

Handling and eventual disposition of the aqueous liquid effluents is accomplished in two stages, collection and treatment. All aqueous liquid effluents are collected in tanks that are located in the Liquid Effluent Collection and Treatment Room in the TSB.

There are other tanks in the Liquid Effluent Collection and Treatment Room used for monitoring and treatment prior to release to the Treated Effluent Evaporative Basin.

The Spent Citric Acid Collection Tank, Degreaser Water Tank, Miscellaneous Effluent Collection Tank, and Precipitation Treatment Tank are all located in a contained area. The containment consists of a curb around all the above-mentioned tanks. The confined area is capable of containing at least one catastrophic failure of one given tank 1,325 L (350 gal), minimum. In the event of a tank failure, the effluent in the confined area is pumped out with a portable pump set.

Reduced volume, radiologically contaminated wastes that are a by-product of the treatment system, as well as contaminated non-aqueous wastes, are packaged and shipped to a licensed low-level radioactive waste disposal facility.

3.12.1.3.4 Effluent Discharge

Total liquid effluent from the NEF is estimated at 2,535 m^3/yr (669,844 gal/yr). The uranium source term used in this report for routine liquid effluent releases from the NEF is 2.1×10^6 Bq (56 µCi) per year and is comprised of airborne uranium particulates created due to resuspension at times when the Treated Effluent Evaporative Basin is dry. There is no plant tie-in to a Publicly Owned Treatment Works (POTW). Instead, all effluents are contained on the NEF site. Accordingly, all contaminated liquid effluents are treated and sent to the double-lined Treated Effluent Evaporative Basin with leak detection on the NEF site.

Decontamination, Laboratory and Miscellaneous Liquid Effluents are treated to meet the requirements of 10 CFR 20, Appendix B, Table 2 (CFR, 2003q) and the administrative levels recommended by Regulatory Guide 8.37. The treated effluent is discharged to the double-lined Treated Effluent Evaporative Basin, which has leak detection. LBDCR-07-0022

The Treated Effluent Evaporative Basin consists of two synthetic liners with soil over the top liner. The Treated Effluent Evaporative Basin will have leak detection capabilities. At the end of plant life, the sludge and soil over the top of the uppermost liner and the liner itself will be disposed of, as required, at a low-level radioactive waste repository.

Hand Wash and Shower Effluents are not treated. These effluents are discharged to the same Treated Effluent Evaporative Basin as for the Decontamination, Laboratory and Miscellaneous Effluents. Laundry Effluent is treated if necessary and discharged to this basin as well.

Cooling Tower Blowdown Effluent is discharged to a separate on-site basin, the UBC Storage Pad Stormwater Retention Basin. The single-lined retention basin is used for the collection and monitoring of rainwater runoff from the UBC Storage Pad and to collect cooling tower blowdown and heating boiler blowdown water. A third unlined basin is used for the collection and monitoring of general site stormwater runoff.

Six septic systems are planned for the NEF site. Each septic system will consist of a septic tank with one or more leachfields. Figure 3.12-1, Planned Septic Tank System Locations, shows the planned location of the six septic tank systems.

The six septic systems are capable of handling approximately 40,125 liters per day (10,600 gallons per day) based on a design number of employees of approximately 420. Based on the actual number of employees, 210, the overall system will receive approximately 20,063 liters per day (5,300 gallons per day). Total annual design discharge will be approximately 14.6 million liters per year (3.87 million gallons per year). Actual flows will be approximately 50 percent of the design values.

The septic tanks will meet manufacturer specifications. Utilizing the percolation rate of approximately 3 minutes per centimeter (8 minutes per inch) established by actual test on the site, and allowing for 76 to 114 liters (20 to 30 gallons) per person per day, each person will require 2.7 linear meters (9 linear feet) of trench utilizing a 91.4-centimeter (36-inch) wide trench filled with 61 centimeters (24 inches) of open graded crushed stone. As indicated above, although the site population during operation is expected to be 210 persons, the building facilities are designed by architectural code analysis to accommodate up to 420 persons. Therefore, a total of approximately 975 linear meters (3,200 linear feet) of percolation drain field will be required. The combined area of the leachfields will be approximately 892 square meters (9,600 square feet).

3.12.2 Solid Waste Management

Solid waste generated at the NEF will be grouped into industrial (nonhazardous), radioactive and mixed, and hazardous waste categories. In addition, solid radioactive and mixed waste will be further segregated according to the quantity of liquid that is not readily separable from the solid material. The solid waste management systems will be a set of facilities, administrative procedures, and practices that provide for the collection, temporary storage, (no solid waste processing is planned), and disposal of categorized solid waste in accordance with regulatory requirements. All solid radioactive wastes generated will be Class A low-level wastes (LLW) as defined in 10 CFR 61 (CFR, 2003r).

Industrial waste, including miscellaneous trash, vehicle air filters, empty cutting oil cans, miscellaneous scrap metal, and paper will be shipped offsite for minimization and then sent to a licensed waste landfill. The NEF is expected to produce approximately 172,500 kg (380,400 lbs) of this normal trash annually. Table 3.12-2, Estimated Annual Non-Radiological Wastes, describes normal waste streams and quantities.

Radioactive waste will be collected in labeled containers in each Restricted Area and transferred to the Radioactive Waste Storage Area for inspection. Suitable waste will be volume-reduced and all radioactive waste disposed of at a licensed low-level waste (LLW) disposal facility.

Hazardous wastes (e.g., spent blasting sand, empty spray paint cans, empty propane gas cylinders, solvents such as acetone and toluene, degreaser solvents, diatomaceous earth, hydrocarbon sludge, and chemicals such as methylene chloride and petroleum ether) and some mixed wastes will be generated at the NEF. These wastes will also be collected at the point of generation, transferred to the Waste Storage Area, inspected, and classified. Any mixed waste that may be processed to meet land disposal requirements may be treated in its original collection container and shipped as LLW for disposal. Table 3.12-2, Estimated Annual Non-radiological Wastes, denotes hazardous waste and quantities.

3.12.2.1 Radioactive and Mixed Wastes

Solid radioactive wastes are produced in a number of plant activities and require a variety of methods for treatment and disposal. These wastes are categorized into wet solid waste and dry solid waste due to differences in storage and disposal requirements found in 40 CFR 264 (CFR, 2003v) and 10 CFR 61 (CFR, 2003r), respectively. For disposal of solid waste (radioactive waste and mixed waste), 10 CFR 61.56(a)(3) (CFR, 2003a) requires: "Solid waste containing liquid shall contain as little free standing and noncorrosive liquid as reasonably achievable, but in no case shall the liquid exceed 1% of the volume." For this facility, dry solid waste is waste that meets the requirement in its as-generated form and wet solid waste is waste that requires treatment prior to disposal to meet this requirement. LBDCR-07-0021

All solid radioactive wastes generated are Class A low-level wastes as defined in 10CFR 61 (CFR, 2003r). Wastes are transported offsite for disposal by contract carriers. Transportation is in compliance with 49 CFR 107 and 49 CFR 173 (CFR, 2003k; CFR 2003l).

The Solid Waste Collection System is simply a group of methods and procedures applied as appropriate to the various solid wastes. Each individual waste is handled differently according to its unique combination of characteristics and constraints. Wet and dry waste handling is described separately below. (Wastes produced by waste treatment vendors are handled by the vendors and are not addressed here.)

3.12.2.1.1 Wet Solid Wastes

The wet waste portion of the Solid Waste Collection System handles all radiological, hazardous, mixed, and industrial solid wastes from the plant that do not meet the above definition of dry waste. This portion handles several types of wet waste: wet trash, oil recovery sludge, oil filters, miscellaneous oils (e.g., cutting machine oil) solvent recovery sludge, and uranic waste precipitate. The system collects, identifies, stores, and prepares these wastes for shipment. Waste that may have a reclamation or recycle value (e.g., miscellaneous oils) may be packaged and shipped to an authorized waste reclamation firm for that purpose.

Wet solid wastes are segregated into radioactive, hazardous, mixed, or industrial waste categories during collection to minimize recycling and/or disposal problems. Mixed waste is that which includes both radioactive and hazardous waste. Industrial waste does not include either hazardous or radioactive waste.

The Solid Waste Collection System involves a number of manual steps. Handling of each waste type is addressed below.

3.12.2.1.1.1 Wet Trash

In this plant trash typically consists of waste paper, packing material, clothing, rags, wipes, mop heads, and absorption media. Wet trash consists of trash that contains water, oil, or chemical solutions.

Generation of radioactive wet trash is minimized insofar as possible. Trash with radioactive contamination is collected in specially marked plastic-bag-lined drums. These drums are located throughout each Restricted Area. Wet trash is collected in separate drums from dry trash. When the drum of wet trash is full, the plastic bag is removed from the drum and sealed. The bag is checked for leaks and excessive liquid. The exterior of the bag is monitored for contamination. If necessary, excess liquids are drained and the exterior is cleaned. The bag may be placed in a new clean plastic bag. The bag is then taken to the Radioactive Waste Storage Area where the waste is identified, labeled, and recorded.

The radioactive trash is shipped to a Control Volume Reduction Facility (CVRF) that can process wet trash. The licensed CVRF reduces the volume of the trash and then repackages the resulting waste for disposal. The waste package is then shipped to a licensed radioactive waste disposal facility.

Trash with hazardous contamination is collected in specially marked plastic-lined drums. Wet trash is collected separately from dry trash. When full, the drum is taken to the Solid Waste Collection Room (SWCR) and the plastic bag containing wet trash is removed from the container, sealed, and the exterior is monitored for hazardous material, and cleaned if necessary. The trash is identified, labeled, and recorded. All hazardous trash is stored in the Hazardous Waste Area until it is shipped to a hazardous waste disposal facility. Different types of hazardous materials are not mixed in order to avoid accidental reactions.

Empty containers that at one time contained hazardous materials are a special type of hazardous waste, as discussed in 40 CFR 261 (CFR, 2003p). After such a container is emptied, it is resealed and taken to the Hazardous Waste Area for identification, labeling, and recording. The container is handled as hazardous waste and is shipped to a hazardous waste processing facility for cleaning or disposal. Alternately, the container is used to store compatible hazardous wastes and to ship those wastes to a hazardous waste processing facility for processing and container disposal.

"Mixed" trash results from using wipes and rags with solvent on uranium-contaminated components. It is collected in appropriate containers and segregated from other trash. The waste is identified, labeled, recorded, and stored in accordance with regulations for both hazardous and radioactive wastes. Mixed waste is shipped to a facility licensed to process mixed waste. Waste resulting from the processing is then forwarded to a qualified disposal facility licensed to dispose of the particular resulting waste.

Industrial trash is collected in specially marked receptacles in all parts of the plant. The trash from Restricted Areas is collected in plastic bags and taken to the Radioactive Waste Storage Room in the TSB for inspection to ensure that no radioactive contamination is present. The inspected trash and the trash from the Controlled Area are then taken to one of several large containers around the plant. The trash is stored in these containers until a contract carrier transports them to a properly permitted sanitary landfill.

3.12.2.1.1.2 Oil Recovery Sludge

The process for recovering used Fomblin oil generates an oily sludge that must be disposed of offsite. The sludge results from the absorption of hydrocarbons in activated carbon and diatomaceous earth. Sodium carbonate, charcoal, and celite also contribute to this sludge. A contracted radioactive waste processor will process the waste at an offsite location. Alternatively, the waste may be shipped offsite to a CVRF for volume reduction. Regulations and technology current at the time of waste production will dictate treatment methods. In either case the waste is finally disposed of at a licensed low-level radioactive waste disposal facility.

3.12.2.1.1.3 Oil Filters

Used oil filters are collected from the diesel generators and from plant vehicles. No filters are radioactively contaminated. The used filters are placed in containers and transported to the waste storage area of the TSB. There the filters are drained completely and transferred to a drum. The drained waste oil is combined with other waste oil and handled as hazardous waste. The drum is then shipped to an offsite waste disposal contractor.

3.12.2.1.1.4 Resins

Spent resins will not be part of any routine waste stream at the NEF. Use of the Mixed-Bed Demineralizer in liquid waste treatment is a final polishing step, and the resin is expected to last the life of the plant. The demineralizer resin will be properly processed and disposed when the NEF is decommissioned.

3.12.2.1.1.5 Solvent Recovery Sludge

Solvent is used in degreasers and in the workshops. The degreasers are equipped with solvent recovery stills. The degreasers in the decontamination area and the contaminated workshop area handle radioactive components. Solids and sludge removed from these stills and degreasers are collected, labeled, and stored as mixed waste. The waste is shipped to a facility licensed to process mixed waste. Waste resulting from the processing is then forwarded to a licensed disposal facility for the particular resulting waste.

The Vacuum Pump Rebuild Workshop degreaser handles only decontaminated components, so the solids and sludge removed from this degreaser (after checking for radioactivity) are collected, labeled, and stored as hazardous waste. This hazardous waste is shipped to a licensed hazardous waste disposal facility.

3.12.2.1.1.6 Uranic Waste Precipitate

Aqueous uranic liquid waste is processed to remove most of the uranium prior to evaporation of the liquid stream in the Evaporator/Dryer. This aqueous waste is primarily from the decontamination degreaser, citric acid baths and the laboratory. The uranium is precipitated out of solution and water is removed by filter press. The remaining precipitate is collected, labeled, and stored in the radioactive waste storage area. The waste is sent to a licensed low-level radioactive waste disposal facility.

3.12.2.1.2 Dry Solid Wastes

The dry waste portion of the Solid Waste Collection and Processing System handles dry radiological, hazardous, mixed, and industrial solid wastes from the plant. These wastes include: trash (including miscellaneous combustible, non-metallic items), activated carbon, activated alumina, activated sodium fluoride, HEPA filters, scrap metal, laboratory waste and dryer concentrate. The system collects, identifies, stores, and prepares these wastes for shipment.

All solid radioactive wastes generated are Class A low-level wastes as defined in 10 CFR 61 (CFR, 2003r).

The Solid Waste Collection and Processing System involves a number of manual steps. Handling for each waste type is addressed below.

3.12.2.1.2.1 Trash

Trash consists of paper, wood, gloves, cloth, cardboard, and non-contaminated waste from all plant areas. Some items require special handling, and are not included in this category, notably: paints, aerosol cans, and containers in which hazardous materials are stored or transported. Trash from Restricted Areas is collected and processed separately from non-contaminated trash.

The sources of dry trash are the same for the wet trash, and dry trash is handled in much the same way as wet trash. ER Section 3.12.2.1.1.1, Wet Trash, describes the handling of wet trash in more detail. Only the differences between wet and dry trash handling are discussed below.

Steps to remove liquids are of course unnecessary for dry trash. The dry waste portion of the Solid Waste Collection System accepts wet trash that has been dewatered, as well as dry trash.

Radioactive trash is shipped to a CVRF. The CVRF reduces the volume of the trash and then repackages the resulting waste for disposal. Waste handled by the CVRF will be disposed of in a radioactive waste disposal facility.

Trash containing hazardous material is handled as described above in ER Section 3.12.2.1.1.1 regarding the wet waste portion of the Solid Waste Collection System.

Aerosol spray cans may be disposed of as trash if they are first totally discharged and then punctured. Special receptacles for spray cans used in the Separations Building are provided. Each can is inspected for radioactive contamination to ensure total discharge and puncture before it can be included with industrial trash.

"Mixed" trash is handled as described above in ER Section 3.12.2.1.1.1. Mixed trash is generated by the use of rags and wipes, with solvent, on radioactively contaminated components.

3.12.2.1.2.2 Activated Carbon

Activated carbon is used in a number of systems to remove uranium compounds from exhaust gases. Due to the potential hazard of airborne contamination, personnel use respiratory protection equipment during activated carbon handling to prevent inhalation of material. Spent or aged carbon is carefully removed, immediately packaged to prevent the spread of contamination and transported to the Ventilated Room in the TSB. There the activated carbon is removed and placed in an appropriate container to preclude criticality. The contents of that container are sampled to determine the quantities of HF and ^{235}U present. The container is then sealed, monitored for external contamination, and properly labeled. It is then temporarily stored in the Waste Storage Room with radioactive waste. Depending on the mass of uranium in the carbon material, the container may be shipped directly to a low-level radioactive waste disposal facility or to a CVRF. The CVRF reduces the volume of the waste and then repackages the resulting waste for shipment to a low-level radioactive waste disposal facility. The NEF shall comply with all limitations imposed by the burial site and the CVRF on the contained mass of ^{235}U in the carbon filter material that is shipped to their facilities by the NEF.

GEVS carbon filters are discussed in ER Section 3.12.2.1.2.5, Filter Elements, below. Carbon filters are also used in the laboratories where they can become contaminated with hazardous as well as radioactive material. The filters are handled according to their known service. Those filters that are potentially hazardous are handled as hazardous, and those potentially containing both hazardous and radioactive material are handled as mixed wastes. Each type of waste is collected, labeled, stored, and recorded, and is then shipped to an appropriately licensed facility for processing/disposing of hazardous and/or mixed waste.

3.12.2.1.2.3 Activated Alumina

Activated alumina in alumina traps is used in a number of systems to remove HF from exhaust gases. Activated alumina (Al203) as a waste is in granular form. Most activated alumina in the plant is contaminated; instrument air desiccant is not contaminated. The hold up of captured contaminants on the alumina is checked by weighing and the alumina is changed out when near capacity.

Spent or aged alumina is carefully removed in the Ventilated Room in the TSB to prevent the spread of contamination. There the activated alumina is removed and placed in an appropriate container. The contents of a full container are sampled to determine the quantity of ^{235}U present. The container is then sealed, the exterior is monitored for contamination, and the container is properly labeled. It is stored in the Radioactive Waste Storage Room until it is shipped to a radioactive waste disposal facility.

Activated alumina is also used as a desiccant in the Compressed Air System. This alumina is not radioactively contaminated, is non-hazardous and is replaced as necessary. It is disposed of in a landfill.

3.12.2.1.2.4 Activated Sodium Fluoride

Activated sodium fluoride (NaF) is used in the Contingency Dump System to remove UF_6 and HF from exhaust gases. NaF adsorbs up to either 150% of its weight in UF_6 or 50% of its weight in HF. The Contingency Dump System is not expected to operate except during transient conditions that occur during a power failure. The NaF is not expected to saturate during the life of the plant. However, if the system is used often and the NaF saturates, the NaF is removed by personnel wearing respirators and using special procedures for personnel protection. A plastic bag is placed over the vessel and sealed, and the vessel is turned upside down to empty the NaF. Spent contaminated NaF, if ever produced, is processed by a contractor to remove uranium so the wastes may be disposed at a licensed waste facility. It is expected that NaF will not require treatment and disposal until decommissioning.

3.12.2.1.2.5 Filter Elements

Prefilters and HEPA filters are used in several places throughout the plant to remove dust and dirt, uranium compounds, and hydrogen fluoride. Air filters, as a waste, consist of fiberglass or cellulose filters. Generally, only the Gaseous Effluent Vent System filters are contaminated and will contain much less than 1% by weight of UO_2F_2. HVAC filters, instrument air filters, air cooling filters from product take-off and blending systems, and standby generator air filters are not contaminated. HF-resistant HEPA filters are composed of fiberglass.

Filters associated with the HVAC System in the Centrifuge Assembly Building are used to remove dust and dirt from incoming air to ensure the cleanliness of the centrifuge assembly operation. When removed from the housing, the filter elements are wrapped in plastic to prevent the loss of particulate matter. These filter elements are not contaminated with radioactive or hazardous materials so disposal occurs with other industrial trash.

Filters used in the Gaseous Effluent Vent Systems, and Centrifuge Test and Post Mortem Facilities Exhaust Filtration System are used to remove HF and trace uranium compounds from the exhaust air stream. When the filters become loaded with particulate matter, they are removed from the housings and wrapped in plastic bags to prevent the spread of radioactive contamination. Due to the hazard of airborne contamination, either portable ventilation equipment or respiratory protection equipment is used during filter handling to prevent the inhalation of material by plant personnel. The filters are taken to the Solid Waste Collection Room in the TSB where they are sampled to determine the quantity of ^{235}U present. The exterior of the bag is monitored for contamination, the package is properly marked and placed in storage. The filter elements are sent to a CVRF for processing and shipped to a low-level radioactive waste disposal facility.

Air filters from the non-contaminated HVAC systems, Compressed Air System and the Diesel Generators are handled as industrial waste.

3.12.2.1.2.6 Scrap Metal

Metallic wastes are generated during routine and abnormal maintenance operations. The metal may be clean, contaminated with radioactive material hazardous material. Radioactive contamination of scrap metal is always in the form of surface contamination caused by uranium compounds adhering to the metal or accumulating in cracks and crevices. No process in this facility results in activation of any metal materials.

Clean scrap metal is collected in bins located outside the Technical Services Building. This material is transported by contract carrier to a local scrap metal vendor for disposal. Items collected outside of Restricted Areas are disposed of as industrial scrap metal unless there is reason to suspect they contain hazardous material.

Scrap metal is monitored for contamination before it leaves the site. Metal found to be contaminated is either decontaminated or disposed of as radioactive waste. When feasible, decontamination is the preferred method.

Decontamination is performed in situ for large items and in the Decontamination Workshop for regular items used in performing maintenance. Decontamination of large items should not be required until the end of plant life. Items that are not suitable for decontamination are inspected to determine the quantity of uranium present, packaged, labeled, and shipped either to a CVRF or a radioactive waste disposal facility.

Metallic items containing hazardous materials are collected at the location of the hazardous material. The items are wrapped to contain the material and taken to the Waste Storage Room. The items are then cleaned onsite if practical. If onsite cleaning cannot be performed then the items are sent to a hazardous waste processing facility for offsite treatment or disposal.

3.12.2.1.2.7 Laboratory Waste

Small quantities of dry solid hazardous wastes are generated in laboratory activities, including small amounts of unused chemicals and materials with residual hazardous compounds. These materials are collected, sampled, and stored in the Waste Storage Room of the TSB. Precautions are taken when collecting, packaging, and storing to prevent accidental reactions. These materials are shipped to a hazardous waste processing facility where the wastes will be prepared for disposal.

Some of the hazardous laboratory waste may be radioactively contaminated. This waste is collected, labeled, stored, and recorded as mixed waste. This material is shipped to a licensed facility qualified to process mixed waste for ultimate disposal.

3.12.2.1.2.8 Evaporator/Dryer Concentrate

Potentially radioactive aqueous waste is evaporated in the Evaporator/Dryer to remove uranium prior to release to the dedicated double-lined Treated Effluent Evaporative Basin. The Liquid Waste Disposal (LWD) Dryer discharges dry concentrate directly into drums. These drums are checked for ^{235}U content, labeled, and stored in the radioactive waste storage area. The concentrate is shipped to a licensed low-level radioactive waste disposal facility.

3.12.2.1.2.9 Depleted UF_6

The enrichment process yields depleted UF_6 streams with assays ranging from 0.20 to 0.34 $^w/_o$ ^{235}U. The approximate quantity and generation rate for depleted UF_6 is 7,800 MT (8,600 tons) per year. This equates to approximately 625 cylinders of UF_6 per year. The Uranium Byproduct Cylinders (UBCs) will be temporarily stored onsite before transfer to a processing facility and subsequent reuse or disposal. The UBCs are stored in an outdoor storage area known as the UBC Storage Pad.

The UBC Storage Pad consists of an outdoor storage area with concrete saddles on which the cylinders rest. A mobile transporter transfers cylinders from the Cylinder Receipt and Dispatch Building (CRDB) to the UBC Storage Area. UBC cylinder transport between the Separations Building and the storage area is discussed in the Safety Analysis Report Section 3.4.11.2, Cylinder Transport Within the Facility. Refer to ER Section 4.13.3.1, Radioactive and Mixed Waste Disposal Plan, for information regarding LES's depleted UF_6 management practices (LES, 1994; NRC, 1994a).

Storage of UBC will be for a temporary period until shipped offsite for use or disposal. Refer to ER Section 4.13.3.1 for the range of options for UBC disposition.

The Depleted Uranium Hexafluoride Management Study (LES, 1991b), provides a plan for the storage of UBCs in a safe and cost-effective manner in accordance with all applicable regulations to protect the environment (DOE, 2001b).

The potential environmental impacts from direct exposure are described in ER Section 4.12.2.1.3, Direct Radiation Impacts. For the purposes of the dose calculation in that section, the UBC Storage Pad has a capacity of 15,727 containers. A detailed discussion on the environmental impacts associated with the storage and ultimate disposal of UBCs is provided in ER Section, 4.13.3.1.1, Uranium Byproduct Cylinder (UBC) Storage.

3.12.2.2 Construction Wastes

Efforts are made to minimize the environmental impact of construction. Erosion, sedimentation, dust, smoke, noise, unsightly landscape, and waste disposal are controlled to practical levels and permissible limits, where such limits are specified by regulatory authorities. In the absence of such regulations, LES will ensure that construction proceeds in an efficient and expeditious manner, remaining mindful of the need to minimize environmental impacts.

Wastes generated during site preparation and construction will be varied, depending on the activities in progress. The bulk of the wastes will consist of non-hazardous materials such as packing materials, paper and scrap lumber. These type of wastes will be transported off site to an approved landfill. It is estimated there will be an average of 3,058 m^3 (4,000 yd3) (non-compacted) per year of this type of waste.

Hazardous wastes that may be generated during construction have been identified and annual quantities estimated as shown below. Any such wastes that are generated will be handled by approved methods and shipped off site to approved disposal sites.

Paint, solvents, thinners, organics – 11,360 L (3,000 gal)

Petroleum products, oils, lubricants – 11,360 L (3,000 gal)

Sulfuric acid (battery) – 379 L (100 gal)

Adhesives, resins, sealers, caulking – 910 kg (2,000 lbs)

Lead (batteries) – 91 kg (200 lbs)

Pesticides – 379 L (100 gal)

Management and disposal of all wastes from the NEF site is performed by a staff professionally trained to properly identify, store, ship wastes, audit vendors, direct and conduct spill cleanup, interface with state agencies, maintain inventories and provide annual reports.

A Spill Prevention, Control and Countermeasure (SPCC) Plan is implemented during construction to minimize both the possibility of spills of hazardous substances, and to minimize the environmental impact of actual spills. The SPCC ensures prompt and appropriate remediation. Spills during construction are more likely to occur around vehicle maintenance and fueling operations, storage tanks, painting operations and warehouses. The SPCC plan identifies sources, locations and quantities of potential spills and provides appropriate response measures. The plan will identify individuals and their responsibilities for implementation of the plan and provides for prompt notifications of state and local authorities, when required.

3.12.3 Effluent and Solid Waste Quantities

Quantities of radioactive and non-radioactive wastes and effluent are described in this section. The information includes quantities and average uranium concentrations. Portions of the waste considered hazardous or mixed are identified.

The first two tables for this section address wastes: Table 3.12-1, Estimated Annual Radiological and Mixed Wastes, and Table 3.12-2, Estimated Annual Non-Radiological Wastes. The next two tables address effluents: Table 3.12-3, Estimated Annual Gaseous Effluent, Table 3.12-4, Estimated Annual Liquid Effluent.

The waste and effluent estimates were developed specifically for the NEF. Each system was analyzed to determine the wastes and effluents generated during operation. These values were analyzed and a waste disposal path was developed for each. LES considered the facility site, facility operation, applicable URENCO experience, applicable regulations, and the existing U.S. waste processing/disposal infrastructure in developing the paths. The Liquid Waste and the Solid Waste Collection Systems were designed in accordance with these considerations.

Applicable experience was derived from each of the existing three URENCO enrichment facilities. The majority of the wastes and effluents from the facility are from auxiliary systems and activities and not from the enrichment process itself. Waste and effluent quantities of specific individual activities instead of scaled site values were used in the development of NEF estimates. An example is the NEF laboratory waste and effluent estimate which was developed by determining which analyses would be performed at the NEF, and using URENCO experience to perform that analysis, determine the resulting expected wastes and effluents. The cumulative waste and effluent values were then compiled.

The customs of URENCO as compared to LES also affect the resultant wastes and effluents. For example, in Europe, employers typically provide work clothes such as coveralls and lab coats for their employees. These are typically washed onsite with the resulting effluent sent to the municipal sewage treatment system. LES provides only protective clothing for employees, and the small volume of effluent that results has a higher quantity of contaminants which must be treated onsite.

Each of the URENCO facilities produces different wastes and effluents depending on the specific site activities, the type of auxiliary equipment installed, and the country-specific regulations. Each of the URENCO facilities is located either in an industrial or municipal area so that the facility water supply and sewage treatment are obtained and performed by municipal systems. The proposed NEF site will use municipal water supplies. However, all liquid effluents will be contained on the NEF site. Unlike other URENCO facilities, LES does not perform any interior cylinder washing activities. Thus, the generation of significant quantities of uranic wastewater is precluded.

3.12.4 Resources and Materials Used, Consumed or Stored During Construction and Operation

Typical construction commodities are used, consumed, or stored at the site during the construction phase. Construction commodities are typically used immediately after being brought to the site. Some materials are stored for a short duration until they are used or installed. Table 3.12-5, Commodities Used, Consumed or Stored at the NEF During Construction, summarizes the resources and materials used during the 3-year period of site preparation and major building construction.

Tables 3.12-1, Estimated Annual Radiological and Mixed Wastes, 3.12-2, Estimated Annual Non-Radiological Wastes, and 3.12-3, Estimated Annual Gaseous Effluent, provide listings of materials and resources that are expected to be used, consumed, or stored on site during plant operation. The resources and materials provided in Table 3.12-6, Commodities Used, Consumed, Or Stored at the NEF During Operation, are also expected to be used, consumed, or stored on an annual basis at the NEF during operation.

3.12.5 Section 3.12 Tables

Table 3.12-1 Estimated Annual Radiological and Mixed Wastes

	Radiological Waste		Mixed Waste	
	Total Mass Kg (lb)	Uranium Content Kg (lb)	Total Mass Kg/lb	Uranium Content Kg/lb
Waste Type				
Activated Carbon	300 (662)	25 (55)	-	-
Activated Alumina	2,160 (4,763)	2.2 (4.9)	-	-
Fomblin Oil Recovery Sludge	20 (44)	5 (11)	-	-
Liquid Waste Treatment Sludge	400 (882)	57 (126)[4]	-	-
Activated Sodium Fluoride[1]	-	-	-	-
Assorted Materials (paper, packing, clothing, wipes, etc.)	2,100 (4,631)	30 (66)		
Ventilation Filters	61,464 (135,506)	5.5 (12)	-	-
Non-Metallic Components	5,000 (11,025)	Trace[5]	-	-
Miscellaneous Mixed Wastes (organic compounds)[1 2]			50 (110)	2 (4.4)
Combustible Waste	3,500 (7,718)	Trace[5]	-	-
Scrap Metal	12,000(26,460)	Trace[5]	-	-

1 No NaF wastes are produced on an annual basis. The Contingency Dump System NaF traps are not expected to saturate over the life of the plant.

2 A mixed waste is a low-activity radioactive waste containing listed or characteristic of hazardous wastes as specified in 40 CFR 261, subparts C and D (CFR, 2003p).

3 Representative organic compounds consist of acetone, toluene, ethanol, and petroleum ether

4 The value of 57 kg (126 lb) is comprised of uranium in the Decontamination System citric acid and degreaser tanks, precipitated aqueous solutions, uranium in precipitated laboratory/miscellaneous effluents, and uranium in sludge from the Decontamination System citric acid and degreaser tanks.

5 Trace is defined as not detectable above naturally-occurring background concentrations.

Table 3.12-2 Estimated Annual Non-Radiological Wastes

Waste	Annual Quantity
Spent Blasting Sand	125 kg (275 lbs)
Miscellaneous Combustible Waste	9,000 kg (19,800 lbs)
Cutting Machine Oils	45 L (11.9 gal)
Spent Degreasing Water (from clean workshop)	1 m^3 (264 gal)
Spent Demineralizer Water (from clean workshop)	200 L (53 gal)
Empty Spray Paint Cans*	20 each
Empty Cutting Oil Cans	20 each
Empty Propane Gas Cylinders*	5 each
Acetone*	27 L (7.1 gal)
Toluene*	2 L (0.5 gal)
Degreaser Solvent SS25*	2.4 L (0.6 gal)
Petroleum Ether*	10 L (2.6 gal)
Diatomaceous Earth*	10 kg (22 lbs)
Miscellaneous Scrap metal	2,800 kg (6,147 lbs)
Motor Oils (For I.C. Engines)	3,400 L (895 gal)
Oil Filters	250 each
Air Filters (vehicles)	50 each
Air Filters (building ventilation)	160,652 kg (354,200 lbs)
Hydrocarbon Sludge*	10 kg (22 lbs)
Methylene Chloride*	1,850 L (487 gal)

* Hazardous waste as defined in 40 CFR 261 (in part or whole) (CFR, 2003p)

Table 3.12-3 Estimated Annual Gaseous Effluent

Area	Quantity (yr^{-1})	Discharge Rate m^3/yr (SCF/yr (STP)
Gaseous Effluent Vent Systems	NA	2.6×10^8 (9.18×10^9)
HVAC Systems	NA	
Radiological Areas	NA	1.5×10^9 (max) (5.17 $\times 10^{10}$)
Non-Radiological Areas	NA	1.0×10^9 (max) (3.54×10^{10})
Total Gaseous HVAC Discharge	NA	2.5×10^9 (max) (8.71×10^{10})
Constituents:		
Helium	440 m^3 (STP) (15,540 ft^3)	NA
Nitrogen	52 m^3 (STP) (1,836 ft^3)	NA
Ethanol	40 L (10.6 gal)	NA
Laboratory Compounds	Traces (HF)	NA
Argon	190 m^3 (STP) (6,709 ft^3)	NA
Hydrogen Fluoride	<1.0 kg (<2.2 lb)	NA
Uranium	<10 g (<0.0221 lb)	NA
Methylene Chloride	610 L (161 gal)	NA
Thermal Waste:		
Summer Peak	3.2×10^6 J/hr (3.1×10^6 BTU/hr)	NA
Winter Peak	1.0×10^7 J/hr (9.5×10^6 BTU/hr)	NA

NA – Not Applicable

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Table 3.12-4 Estimated Annual Liquid Effluent

Effluent	Typical Annual Quantities	Typical Uranic Content
Contaminated Liquid Process Effluents:	**m^3 (gal)**	**kg (lb)**
Laboratory Effluent/Floor Washings/Miscellaneous Condensates	23.14 (6,112)	16 (35)[1]
Degreaser Water	3.71 (980)	18.5 (41)[1]
Spent Citric Acid	2.72 (719)	22 (49)[1]
Laundry Effluent	405.8 (107,213)	0.2 (0.44)[2]
Hand Wash and Showers	2,100 (554,820)	None
Total Contaminated Effluent :	2,535 (669,884)	56.7 (125)[3]
Cooling Tower Blowdown:	19,123 (5,051,845)	None
Heating Boiler Blowdown:	138 (36,500)	None
Sanitary:	7,253 (1,916,250)	None
Stormwater Discharge:		
Gross Discharge[4]	174,100 (46 E+06)	None

1 Uranic quantities are before treatment, volumes for degreaser water and spent citric acid include process tank sludge.

2 Laundry uranic content is a conservative estimate.

3 Uranic quantity is before treatment. After treatment approximately 1% or 0.57 kg (1.26 lb) of uranic material is expected to be discharged into the Treated Effluent Evaporative Basin.

4 Maximum gross discharge is based on total annual rainfall on the site runoff areas, contributing runoff to the Site Stormwater Detention Basin and the UBC Storage Pad Stormwater Retention Basin, neglecting evaporation and infiltration.

Table 3.12-5 Commodities Used, Consumed, or Stored at the NEF During Construction

Item Description	Quantity
Architectural Finishes, All Areas	77,588 m^2 (835,153 ft^2)
Asphalt Paving	79,767 m^2 (95,400 yd^2)
Chain Link Fence	15,011 m (49,250 ft)
Concrete (including embedded items)	59,196 m^3 (77,425 yd^3)
Concrete Paving	1,765 m^2 (2,111 yd^2)
Copper and Aluminum Wiring	361,898 m (1,187,328 ft)
Crushed Stone	287,544 m^2 (343,900 yd^2)
Electrical Conduit	120,633 m (395,776 ft)
Fence Gates	14 each
HVAC Units	109 each
Permanent Metal Structures	2 each
Piping (Carbon & Stainless Steel)	55,656 m (182,597 ft)
Roofing Materials	52,074 m^2 (560,515 ft^2)
Stainless & Carbon Steel Ductwork	515,125 kg (1,135,657 lbs)
Temporary Metal Structures	2 each

Table 3.12-6 Commodities Used, Consumed, or Stored at the NEF During Operation

Item	Quantity	Comments
Electrical Power	17 MVA	Separation Plant
Diesel Fuel	236,210 L (62,400 gal)	Periodic start tests and runs of standby diesel generators
Silicon Oil	50 L (13.2 gal)	--
Corrosion Inhibitor	8,000 kg (17,637 lb)	Contracted work on cooling water systems: consumed, not stored on site
Growth Inhibitor	1,800 kg (3,968 lb)	Contracted work on cooling water systems: consumed, not stored on site

3.13 SECTION 3.12 FIGURES

Security-Related Information
Figure Withheld Under 10 CFR 2.390

PLANNED SEPTIC TANK SYSTEM LOCATIONS

Figure 3.12-1 Planned Septic Tank System Locations

4.0 ENVIRONMENTAL IMPACTS

This chapter evaluates the potential environmental impacts associated with the construction and operation of the proposed National Enrichment Facility (NEF). The chapter is divided into sections that assess the impact to each related resource described in Chapter 3, Description of Affected Environment. These include land use (4.1), transportation (4.2), geology and soils (4.3), as well as water resources (4.4), ecological (4.5), air quality (4.6), noise (4.7), historic and cultural (4.8), and visual/scenic (4.9). Other topics included are socioeconomic (4.10), environmental justice (4.11), public and occupational health (4.12), and waste management (4.13).

4.1 LAND USE IMPACTS

4.1.1 Construction Impacts

The proposed NEF will be built on land for which a 35-year easement has been granted by the State of New Mexico. Since the site is currently undeveloped, potential land use impacts will be from site preparation and construction activities.

The proposed NEF site comprises an area of approximately 220 ha (543 acres). Construction activities, including permanent plant structures and temporary construction facilities, could potentially disturb or impact the entire 543 acre site. The contractor lay-down and parking area will be restored after completion of plant construction. This includes the cutting and filling of approximately 611,033 m^3 (797,000 yd3) of soil and caliche with the deepest cut at 4 m (13 ft) and the deepest fill at 3.3 m (11 ft). Select engineered fill material may be brought onsite to achieve the backfill specifications for building footprints and some volume of native soil may be disposed of offsite to maintain a desirable soil stockpile balance. The plot plan and site boundaries of the permanent facilities indicating the areas to be cleared for construction activities are shown in ER Figure 2.1-2, Site Area and Facility Layout Map, and Figure 2.1-3, Existing Conditions Site Aerial Photograph.

During the construction phase of the NEF site, conventional earthmoving and grading equipment will be used. The removal of very dense soil or caliche may require the use of heavy equipment with ripping tools. Soil removal work for foundations will be controlled to reduce over-excavation to minimize construction costs. In addition, loose soil and/or damaged caliche will be removed prior to installation of foundations for seismically designed structures. Though the entire site could be impacted, wildlife on the site will have an opportunity to move to areas of suitable habitat bordering the NEF site. The loss of cattle grazing lands represented by site construction will be minimal due to the abundance of other nearby grazing areas. No mitigation is necessary to offset this minimal impact.

The relocation of the CO2 pipeline will be performed in accordance with all applicable regulations, so as to minimize any direct or indirect impacts on the environment.

The anticipated effects on the soil during construction activities are limited to a potential short-term increase in soil erosion. However, this will be mitigated by proper construction best management practices (BMPs). These practices include minimizing the construction footprint to the extent possible, limiting site slopes to a horizontal to vertical ratio of three to one or less, the use of a sedimentation detention basin, protection of undisturbed areas with silt fencing and straw bales as appropriate, and site stabilization practices such as placing crushed stone on top of disturbed soil in areas of concentrated runoff. In addition, as indicated in ER Section 4.2.5, Mitigation Measures, onsite construction roads will be periodically watered down, if required, to control fugitive dust emissions. Water conservation will be considered when deciding how often dust suppression sprays will be applied. After construction is complete, the site will be stabilized with natural, low-water maintenance landscaping and pavement.

Impacts to land and groundwater will be controlled during construction through compliance with the National Pollution Discharge Elimination System (NPDES) Construction General Permit obtained from Region 6 of the Environmental Protection Agency (EPA). A Spill Prevention, Control and Countermeasures (SPCC) plan will also be implemented during construction to minimize environmental impacts from potential spills and to ensure prompt and appropriate remediation. Potential spills during construction are likely to occur around vehicle maintenance and fueling locations, storage tanks, and painting operations. The SPCC plan will identify sources, locations and quantities of potential spills and response measures. The plan will also identify individuals and their responsibilities for implementation of the plan and provide for prompt notifications of state and local authorities, as required.

Waste management BMPs will be used to minimize solid waste and hazardous materials. These practices include the placement of waste receptacles and trash dumpsters at convenient locations and the designation of vehicle and equipment maintenance areas for the collection of oil, grease and hydraulic fluids. Where practicable, materials suitable for recycling will be collected. If external washing of construction vehicles is necessary, no detergents will be used, and the runoff will be diverted to onsite retention basins. Adequately maintained sanitary facilities will be provided for construction crews.

4.1.2 Utilities Impacts

The NEF will require the installation of water, natural gas and electrical utility lines. In lieu of connecting to the local sewer system, six onsite underground septic tanks each with one or more leach fields will be installed for the treatment of sanitary wastes. Septic systems are described in Section 3.12.1.3.4, Effluent Discharge.

A new potable water supply line will be extended from the city of Eunice, New Mexico to the NEF site. The line from Eunice will be about 8 km (5 mi) in length. Placement of the new water supply line along New Mexico Highways 18 and 234 would minimize impacts to vegetation and wildlife. (Refer to Figure 3.1-1, Land Use Map.) Since there are no bodies of water between the site and the city of Eunice, New Mexico, no waterways will be disturbed. However, as indicated in ER Section 3.2.1, Transportation Access, there is a 61-m (200-ft) right-of-way easement along both sides of New Mexico Highway 234. Therefore, an application for utility line installation within highway easements will be submitted to the New Mexico State Highway and Transportation Department. Utility line installation coordinated with state planned highway upgrades would minimize traffic impact on New Mexico Highway 234 between the site and the city of Eunice, New Mexico. LBDCR-07-0005 LBDCR-07-0005

The natural gas line feeding the site will connect to an existing, nearby line. This will minimize impacts of short-term disturbances related to the placement of the tie-in line.

Two new electrical transmission lines on a large loop system are proposed for providing electrical service to the NEF. These lines would tie into a trunk line about 13 km (8 mi) to the west. Similar to the new water supply lines, land use impacts would be minimized by placing associated support structures along New Mexico Highway 234. An application for highway easement modification will be submitted to the state. As noted in ER Chapter 2, Alternatives, there are currently several power poles along the highway in front of the adjacent, vacant parcel east of the site. In conjunction with the new electrical lines serving the site, the local company providing electrical service, Xcel Energy, will install two onsite transformers to ensure redundant service. Six underground septic tanks will be installed onsite. The leach fields will require about 975 linear meters (3,200 linear feet) of percolation drain field. The drain fields will either be placed below grade or buried in a mound consisting of sand, aggregate and soil.

Overall land use impacts to the site and vicinity will be minimal considering that the majority of the site will remain undeveloped, the current industrial activity on neighboring properties, the nearby expansive oil and gas well fields, and the placement of most utility installations along highway easements. LES is not aware of any Federal action that would have cumulatively significant land use impacts.

4.1.3 Comparative Land Use Impacts of No Action Alternative Scenarios

ER Chapter 2 provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The impact would be less since less land is disturbed by building only one centrifuge plant instead of two.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The land use would be the same if undisturbed land is used for the original or increased capacity site(s). If the site(s) were previously disturbed, the impact would be less.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The impact of this would be less because no new land would be disturbed.

4.2 TRANSPORTATION IMPACTS

The NEF site is located in southeastern New Mexico near the New Mexico/Texas state line in Lea County, New Mexico. The site lies along the north side of New Mexico Highway 234, which provides direct access to the site. To the north, U.S. Highway 62/180 intersects New Mexico Highway 18 providing access from the city of Hobbs, New Mexico south to New Mexico Highway 234. To the east in Texas, U.S. Highway 385 intersects Texas Highway 176 providing access from the town of Andrews, Texas, west to New Mexico Highway 234. To the south in Texas, Interstate 20 intersects Texas Highway 18 which becomes New Mexico Highway 18, providing access from the city of Jal, New Mexico north to New Mexico Highway 234. West of the site, New Mexico Highway 8 provides access from the city of Eunice east to New Mexico Highway 234. See ER Figure 2.1-1, 80-Kilometer (50-Mile) Radius With Cities and Roads, which depicts highways in the vicinity of the NEF.

4.2.1 Construction of Access Road

Near the proposed NEF site, New Mexico Highway 234 is a two-lane highway with 3.6-m (12-ft) driving lanes, 2.4-m (8-ft) shoulders and a 61-m (200-ft) right-of-way easement on either side. Access to the site is directly off of New Mexico Highway 234. An onsite, gravel covered road currently bisects the east and west halves of the site. Two construction access roadways off of New Mexico Highway 234 will be built to support construction. The materials delivery construction access road will run north off of New Mexico Highway 234 along the west side of the NEF. The personnel construction access road will run north off of New Mexico Highway 234 along the east side of the NEF. Both roadways will eventually be converted to permanent access roads upon completion of construction. Therefore, impacts from access road construction will be minimized.

4.2.2 Transportation Route

The transportation route for conveying construction material from areas north and south of the site is by way of New Mexico Highway 18 to New Mexico Highway 234. The intersection of New Mexico Highways 18 and 234 is a short distance west of the site. Construction material may also be transported from the east by way of Texas Highway 176 which becomes New Mexico Highway 234 at the New Mexico/Texas state line. Construction material transported from the west will be by way of New Mexico Highway 8 which becomes Highway 234 near the city of Eunice, west of the site. The mode of transportation for conveying construction material will consist of over-the-road trucks, ranging from heavy-duty 18-wheeled delivery trucks, heavy-duty trucks and dump trucks, to box and flatbed type light-duty delivery trucks. Due to the presence of a quarry directly north of the site, concrete mixing trucks might also use the onsite gravel road which currently leads to the quarry.

4.2.3 Traffic Pattern Impacts

New Mexico Highway 234 provides direct access to the site. Considering that New Mexico Highway 234 serves as a main east-west trucking thoroughfare for local industry, it should be able to handle the increased heavy-duty traffic adequately. However, similar to nearby industrial properties to the east, the construction of dedicated turning lanes would help alleviate congestion that might otherwise occur from increased truck traffic. According to the New Mexico Department of Transportation, upgrades to New Mexico Highway 234 are planned and include the resurfacing, restoration and rehabilitation of existing lanes in order to improve roadway quality, enhance safety and for economic development (NMDOT, 2003).

No timeframe has been established for the upgrades; however, the highway upgrade bonds were recently approved and signed by the Governor of New Mexico. The upgrades could start as soon as January 2004, but no definitive schedule has been established.

ER Section 4.10.2.1 states that the operational workforce at the NEF will be 210 people. Thus the maximum potential increase to traffic due to operational workers is 210 roundtrips per day. This is an upper bound estimate since all workers do not work on any given day. Operational shift changes for site personnel are estimated to average 40 to 50 vehicles per shift change. The range of vehicles per shift change is based on three shifts per day, seven days per week. This yields a total of 21 shift changes per week. Based on five shifts per employee per week, it would require approximately 4.2 employees to staff each position around the clock each week. Since the entire operational staff is 210, this would result in an average of approximately 50 positions per shift on average. Allowing for some routine absences, i.e., sick and vacation time and car pooling, the average vehicles per shift should be less than 50. The day shift (first shift) during the normal work week will generate more vehicles per shift change since some of these positions are not staffed around the clock, e.g., some administration positions. Second and third shifts as well as weekend shifts will have less vehicles per shift change than the average since all staff positions will not routinely work during these off shifts. Most vehicles would likely travel west from the site on New Mexico Highway 234, towards the city of Eunice, New Mexico or turn north onto New Mexico Highway 18 towards the city of Hobbs, New Mexico or south towards the city of Jal, New Mexico. Eastbound vehicles would travel from the site on New Mexico Highway 234 and continue on Texas Highway 176.

The maximum potential increase to traffic due to operational deliveries and waste removal is 4,300 roundtrips per year. This value is based on an estimated 1,500 radiological shipments per year plus 2,800 non-radiological shipments per year. Table 4.2-3, Annual Shipments to/from NEF (by Truck), presents the materials, container types, and estimated annual number of truck radiological shipments to the NEF. Car pooling will be encouraged to minimize the impact to traffic due to operational workers.

Referring to Table 4.10-1, Estimated Number of Construction Workers by Annual Pay, the maximum number of construction workers is 800 during the peak of the eight-year construction period. Thus the maximum potential increase to traffic due to construction workers is 800 roundtrips per day. The maximum potential increase to traffic due to construction deliveries and waste removal is 10,318 roundtrips over the site preparation and major building construction period. This value is based on the estimated number of material deliveries and construction waste shipments during the three-year period of site preparation and major building construction. This value does not include the number of truck deliveries for centrifuge and process equipment since this information is not available at this time. Work shifts will be implemented and car pooling will be encouraged to minimize the impact to traffic due to construction workers in the site vicinity.

Current traffic volume for nearby impacted road systems as shown below:

Road Name	Traffic Volume Per Day
New Mexico Highway 234	Refer to Texas Highway 176
New Mexico Highway 18	5,417[a,b,e]
U.S. Highway 62/180	9,522[b,c,e]
Texas Highway 176	2,550[a,d]

Notes:

[a]At junction with New Mexico Highway 234

[b]Source: (NMSHTD, 2003)

[c]At junction with New Mexico Highway 18

[d]Source: (TDOT, 2002)

[e]Denoted as a major intersection

Considering the amount of traffic that nearby roadways experience on a daily average, the temporary increase in vehicle flow associated with onsite operations is considered tolerable for short periods of time. Generally, as distance from the site increases, impacts to the transportation network decrease as traffic becomes more dispersed.

4.2.4 Construction Transportation Impacts

Impacts from construction transportation will include the generation of fugitive dust, changes in scenic quality, and added noise.

Dust will be generated to some degree during the various stages of construction activity. The amount of dust emissions will vary according to the types of activity. The first five months of construction will likely be the period of highest emissions with potentially the entire site (543 acres) being involved, along with the greatest number of construction vehicles operating on an unprepared surface. However, it is expected that no more than 18 ha (45 acres) will be involved in this type of work at any one time.

Air quality impacts from construction site preparation for the NEF were evaluated using emission factors and air dispersion modeling. Emission rates for fugitive dust were calculated using emission factors provided in AP-42, the U.S. Environmental Protection Agency's Compilation of Air Pollutant Emission Factors (EPA, 1995). A more detailed discussion of air emissions and dispersion modeling can be found in ER Section 4.6.1, Air Quality Impacts from Construction.

Emission rates for fugitive dust, as listed in Table 4.6-1, Peak Emission Rates were estimated for a 10-hour workday assuming peak construction activity levels were maintained throughout the year. The calculated Total Work-Day Average Emissions result for fugitive emission particulates is 2.4 g/s (19.1 lbs/hr). Fugitive dust will originate predominantly from vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing, and to a lesser extent from wind erosion. Fugitive dust emissions were estimated using an AP-42 emission factor for construction site preparation that was adjusted to account for dust suppression measures, and the fraction of total suspended particulate that is expected to be in the range of particulates less than or equal to 10 micrometers (PM10) in diameter.

Emissions were modeled as a uniform area source with emissions occurring 10 hours per day, 5 days per week, and 50 weeks per year. PM10 emissions from fugitive dust were also below the National Ambient Air Quality Standards (NAAQS) (CFR, 2003w). The results of the fugitive dust estimates should be viewed in light of the fact that the peak anticipated fugitive emissions were assumed to occur throughout the year, and that only 50% reduction in the fugitive dust emissions was assumed for dust suppressant activities. These conservative assumptions will result in predicted air concentrations that tend to overestimate the potential impacts.

Although site construction will significantly alter its natural state, and considering that there are no high quality viewing areas and the industrial development of surrounding properties, impacts to the scenic quality of the site are not considered to be significant. Also, construction vehicles will be comparable to trucks servicing neighboring facilities.

As detailed in ER Section 4.7, Noise Impacts, the temporary increase in noise levels along New Mexico Highways 18 and 234 and Texas Highway 176 due to construction vehicles are not expected to impact nearby receptors significantly, due to substantial truck traffic currently using these roadways.

4.2.5 Mitigation Measures

To control fugitive dust production, reasonable precautions will be taken to prevent particulate matter and/or suspended particulate matter from becoming airborne. These precautions will include the following:

- The use of water in the control of dust on dirt roads, when necessary, in clearing and grading operations, and construction activities. Water conservation will be considered when deciding how often dust suppression sprays will be applied. See ER Section 4.4.7, Control of Impacts for Water Quality, for a discussion of water conservation measures;
- The use of adequate containment methods during excavation and other similar operations;
- Open-bodied trucks transporting materials likely to give rise to airborne dust will be covered when in motion;
- The prompt removal of earthen materials on paved roads placed there by trucks or earth moving equipment, or by wind erosion; and
- Prompt stabilization or covering of bare areas once earthmoving activities are completed.

4.2.6 Agency Consultations

Based on conversations with officials from the New Mexico State Highway and Transportation Department and the Texas Department of Transportation, except for potential weight, height and length restrictions placed on trucks traveling certain routes, there are no roadway restrictions. Should the decision be made to provide dedicated turning lanes for site access from New Mexico Highway 234, an application for a state highway access permit for highway modification will be submitted to the New Mexico State Highway and Transportation Department. Modifications would be coordinated with the planned upgrades to New Mexico Highway 234 by the state. Likewise, an application for the installation of utilities and other easement modifications along New Mexico Highway 234 will be submitted.

4.2.7 Radioactive Material Transportation

Radioactive material shipments will be transported in packages that meet the requirements of 10 CFR 71 and 49 CFR 173 (CFR, 2003e; CFR, 2003l). The Nuclear Regulatory Commission (NRC) has evaluated the environmental impacts resulting from the transport of nuclear materials in NUREG-0170, Final Environmental Statement on the Transportation of Radioactive Material By Air and Other Modes (NRC, 1977a), updated by NUREG/CR-4829, Shipping Container Response to Severe Highway and Railway Accident Conditions (NRC, 1987a). These references include accident scenarios related to the transportation of radioactive material. The NRC found that these accidents have no significant environmental impacts. The materials that will be transported to and from the NEF are within the scope of the environmental impacts previously evaluated by the NRC. Because these impacts have been addressed in a previous NRC environmental impact statement, these impacts do not require further evaluation in this report (NRC, 1977a).

The dose equivalent to the public and worker for incident-free transportation has been conservatively calculated to illustrate the relative impact resulting from transporting radioactive material. Uranium feed, product and associated low-level waste (LLW) will be transported to and from the NEF. The following sections describe each of these conveyances, associated routes, and the dose contribution to the public and worker.

4.2.7.1 Uranium Feed

The uranium feed for the NEF is natural uranium in the form of uranium hexafluoride (UF_6). No reprocessed uranium is used as feed material for the facility. The UF_6 is transported to the facility predominantly in 48Y cylinders; however, a small amount may be shipped in 48X cylinders. These cylinders are designed, fabricated and shipped in accordance with American National Standards Institute (ANSI) N14.1, Uranium Hexafluoride – Packaging for Transport. LBDCR-07-0022
Feed cylinders are transported to the site by 18-wheeled trucks, one per truck (48Y) or two per truck (48X). Since the NEF has an operational capacity of 690 feed cylinders per year, it is anticipated that approximately 690 shipments of feed cylinders per year will arrive at the site per year.

4.2.7.2 Uranium Product

The product of the NEF is transported in 30B cylinders. These cylinders are designed, fabricated and shipped in accordance with the ANSI standard for packaging and transporting UF_6 cylinders, N14.1. Product cylinders are transported from the site to fuel fabrication facilities by modified flat bed truck. A shipment frequency of one shipment per three days (122 per year) is typical, which equals approximately three cylinders per truck to meet the facility output of 350 cylinders per year.

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4.2.7.3 Depleted Uranium and Uranium Wastes

Depleted uranium in UBCs will be shipped to conversion or storage facilities via truck in 48Y cylinders similar to feed cylinders. These cylinders are designed, fabricated and shipped in accordance with ANSI N14.1, Uranium Hexafluoride – Packaging for Transport. UBCs will be transported from the site by 18-wheeled trucks, one per truck (48Y). In the future, rail transport may also be used for ship UBCs from the site. Since the NEF has an operational capacity of approximately 625 UBCs per year (type 48Y), approximately 625 shipments of UBCs per year will leave the site. At present, UBCs will be temporarily stored onsite until conversion or storage facilities are available.

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Waste materials are transported in packages by truck via highway in accordance with 10 CFR 71 and 49 CFR 171-173 (CFR, 2003e; CFR, 2003k; CFR 2003l). Detailed descriptions of radioactive waste materials which will be shipped from the NEF facility for disposal are presented in ER Section 3.12, Waste Management. ER Table 3.12-1, Estimated Annual Radiological and Mixed Wastes, presents a summary of these waste materials. Based on the expected generation rate of low-level waste (see Table 3.12-1), an estimated 477 fifty-five gallon drums of solid waste are expected annually. Using a nominal 60 drums per radwaste truck shipment, approximately 8 low level waste shipments per year are anticipated.

4.2.7.4 Transportation Modes, Routes, and Distances

The feed and product materials of the facility will be transported by truck by way of highway travel only. However, the use of rail for feed and product shipments is being investigated. Feed material is obtainable from UF_6 conversion facilities near Port Hope, Ontario and Metropolis, IL. The product could be transported to fuel fabrication facilities near Hanford, WA, Columbia, SC, and Wilmington, NC. The designation of the supplier of UF_6 and the product receiver is the responsibility of the customer. Waste generated from the enrichment process may be shipped to a number of disposal sites or processors depending on the physical and chemical form of the waste. Potential disposal sites or processors are located near Barnwell, SC (if available to New Mexico), Clive, UT, Oak Ridge, TN, Paducah, KY and Portsmouth, OH. Refer to ER Section 3.12.2.1.2.9 for disposition option of other wastes

The primary transportation route between the site and the conversion, fuel fabrication and disposal facilities is via New Mexico Highway 234 to northbound New Mexico Highway 18. These two highways intersect one another a short distance west of the site. New Mexico Highway 18 is accessible from eastbound and westbound highways in the city of Hobbs, approximately 32 km (20 mi) north of the site. ER Table 4.2-1, Possible Radioactive Material Transportation Routes, lists the approximate highway distances from the NEF to the respective conversion facilities, fuel fabrication facilities, and radioactive waste disposal sites.

4.2.7.5 Radioactive Treatment and Packaging Procedure

There will be no treatment of hazardous materials or mixed waste at the NEF that would require a Resource Conservation and Recovery Act (RCRA) permit. Specific handling of radioactive and mixed wastes are discussed in detail in ER Section 3.12, Waste Management.

Packaging of product material, radioactive waste and mixed waste will be in accordance with plant implementation procedures that follow 10 CFR 71 (CFR, 2003e) and 49 CFR 171-173 (CFR, 2003k; CFR, 2003l). Product shipments will have additional packaging controls in accordance with ANSI N14.1, Uranium Hexafluoride - Packaging For Transport. Waste materials will have additional packaging controls in accordance with each respective disposal or processing site's acceptance criteria (CFR, 2003e; ANSI N14.1). LBDCR-07-0022 LBDCR-07-0022

4.2.7.6 Incident-Free Scenario Dose

The radiological dose equivalents from incident-free transportation for categories of shipping are presented in Table 4.2-2, Incident-Free Transportation Dose to the Public and Worker. Each shipment category represents the various material shipments to and from the NEF. Within each category, radioactive material may be shipped to different locations. For calculation purposes, the worst-case dose equivalent was calculated and showed minimal impact. The collective dose equivalent to the general public from the worst case (highest dose) route in each shipping category (feed, product, waste and depleted UF_6) totaled 2.33×10^{-6} person-Sv/year

(2.33×10^{-4} person-rem/year). Similarly, the dose equivalent to the onlooker, driver and worker were 1.05×10^{-3}, 9.49×10^{-2}, 6.98×10^{-4} person-Sv/year (1.05×10^{-1}, 9.49 and 6.98×10^{-2} person-rem/year), respectively.

The source of radiation is that from the uranium isotopes and their progeny in each of the following:

- Natural uranium (in the feed to the process)
- Enriched uranium (final product, at 5 wt % ^{235}U)
- Depleted uranium (at 0.34 wt % ^{235}U), and
- Solid waste (at 370 Bq (10 nanocuries) of natural uranium per gram of waste).

The cumulative dose equivalent to the general public from transportation of UF_6 and solid waste was based on the model in NUREG/CR-0130 (NRC, 1978), which in turn was based on WASH-1238 (NRC, 1972). NUREG/CR-0130 (NRC, 1978) defines the dose to the general public resulting from the transportation of radioactive materials as equal to 1.2×10^{-7} Person-Sieverts/km (1.9×10^{-5} Person-rem/mi), based on several demographic variables. This dose equivalent per distance was corrected for each route to or from the NEF. New 2000 census demographics information was proportioned to each route, resulting in a correlated dose equivalent to the general public, while still employing the same assumption in NUREG/CR-0130 (NRC, 1978) and WASH-1238 (NRC, 1972).

The dose to the onlooker, worker and driver were based on a calculated dose rate from containerized radioactive material at a distance of 2.0 m (6.6 ft). The same assumptions from the above references were similarly applied to identify durations and the associated dose. Other assumptions used in the transportation dose calculations are listed in the footnotes for Table 4.2-2, Incident-Free Transportation Dose to the Public and Worker.

4.2.7.7 Environmental Impacts from Transportation of Radioactive Material

The NRC has evaluated the environmental impacts resulting from the transport of nuclear materials in NUREG-0170, Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes (NRC, 1977a), updated by NUREG/CR-4829, Shipping Container Response to Severe Highway and Railway Accident Conditions (NRC,1987a). These references include accident scenarios related to the transportation of radioactive material. The NRC found that these accidents have no significant environmental impacts (NRC, 1977a; NRC, 1987a).

The most current NRC studies analyzing transportation impacts of high level waste and spent fuel resulting from the license renewal of power reactors found the associated impacts to be small. Cumulative impacts of transporting high-level waste to a single repository site at Yucca Mountain, Nevada and the impacts of transporting spent fuel enriched up to 5% ^{235}U with average burn-up for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU are found to not appreciably change the impact values contained in 10 CFR 51.52(c), Summary Table S-4-Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. (See 10 CFR 51.53(c)(3)(ii)(M)) (CFR, 2003a). Note that radioactive shipments from the NEF will be low-level only.

The data supporting these newest studies are contained in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (NRC, 1996) and NUREG-1437, Addendum 1, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplemental Analysis for Cumulative Environmental Impacts of Spent Nuclear Fuel Transport and Implications of Higher Burnup Fuel for the Conclusions in 10 CFR 51.52, "Environmental Effects of Transportation of Fuel and Waste -Table S-4," December 1998; (NRC, 1998).

The materials that will be transported to and from the NEF are uranium feed cylinders, product cylinders, and radioactive waste (listed in Table 3.12-1, Estimated Annual Radiological and Mixed Wastes). The radioactivity contained in those materials is substantially lower than the amount of radioactivity contained in the high-level waste and spent fuel used in the NRC studies. The impacts associated with transportation of radioactive materials to and from the NEF are well within the scope of the environmental impacts previously evaluated by the NRC. Because these impacts have been addressed in a previous NRC environmental impact statement, these impacts do not require further evaluation.

4.2.8 Comparative Transportation Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The transportation impact for the USEC centrifuge plant would be greater if the plant is located near the GDP facility because it would concentrate the shipments in one location. The transportation impact for the USEC centrifuge plant would be the same as NEF, if located at a site other than the GDP site.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The transportation impact for a USEC centrifuge plant with increased capability would be greater because it would concentrate the shipments in one location.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The transportation impact would be greater because it would concentrate the shipments in one location.

4.2.9 Section 4.2 Tables

Table 4.2-1 Possible Radioactive Material Transportation Routes

Facility	Description	Distance, km (mi)
UF_6 Conversion Facility Port Hope, Ontario	Feed	2,869 (1,782)
UF_6 Conversion Facility Metropolis, IL	Feed	1,674 (1,040)
Fuel Fabrication Facility Hanford, WA	Product	2,574 (1,599)
Fuel Fabrication Facility Columbia, SC	Product	2,264 (1,406)
Fuel Fabrication Facility Wilmington, NC	Product	2,576 (1,600)
Barnwell Disposal Site Barnwell, SC	LLW Disposal	2,320 (1,441)
Envirocare of Utah Clive, UT	LLW and Mixed Disposal	1,636 (1,016)
GTS Duratek[1] Oak Ridge, TN	Waste Processor	1,993 (1,238)
Depleted UF_6 Conversion Facility[2] Paducah, KY	Depleted UF_6 Disposal	1,670 (1,037)
Depleted UF_6 Conversion Facility[2] Portsmouth, OH	Depleted UF_6 Disposal	2,243 (1,393)

[1]Other offsite waste processors may also be used.

[2]To be operational in approximately 3-5 years.

Table 4.2-2 Annual Incident-Free Transportation Dose Equivalent To The Public And Worker

		Dose Equivalent to General Public[1,6]		Dose Equivalent to the Onlookers[2,6]		Dose Equivalent to the Drivers[3,6]		Dose Equivalent to the Garage Personnel[4,6]	
Facility	Description[5]	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem
UF_6 Conversion Facility Port Hope, Ontario	Feed (48Y, 690)	1.46E-06	1.46E-04	4.84E-04	4.84E-02	4.96E-02	4.96E+00	3.23E-04	3.23E-02
UF_6 Conversion Facility Metropolis, IL	Feed (48Y, 690)	4.32E-07	4.32E-05	4.84E-04	4.84E-02	2.89E-02	2.89E+00	3.23E-04	3.23E-02
Fuel Fabrication Facility Hanford, WA	Product (30B, 350)	6.03E-08	6.03E-06	1.24E-04	1.24E-02	1.01E-02	1.01E+00	8.25E-05	8.25E-03
Fuel Fabrication Facility Columbia, SC	Product (30B, 350)	1.77E-07	1.77E-05	1.24E-04	1.24E-02	8.90E-03	8.90E-01	8.25E-05	8.25E-03
Fuel Fabrication Facility Wilmington, NC	Product (30B, 350)	2.16E-07	2.16E-05	1.24E-04	1.24E-02	1.01E-02	1.01E+00	8.25E-05	8.25E-03
Barnwell Disposal Site Barnwell, SC	Waste (55-gal, 160)	1.53E-09	1.53E-07	1.03E-06	1.03E-04	1.54E-04	1.54E-02	6.86E-07	6.86E-05
Envirocare of Utah Clive, UT	Waste (55-gal, 160)	2.91E-10	2.91E-08	1.03E-06	1.03E-04	1.08E-04	1.08E-02	6.86E-07	6.86E-05
GTS Duratek Oak Ridge, TN	Waste (55-gal, 160)	1.35E-09	1.35E-07	1.03E-06	1.03E-04	1.32E-04	1.32E-02	6.86E-07	6.86E-05
Depleted UF_6 Conversion Facility Paducah, KY	Depleted UF_6 Disposal (48Y, 625)	3.87E-07	3.87E-05	4.38E-04	4.38E-02	2.60E-02	2.60E+00	2.92E-04	2.92E-02

Table 4.2-2 Annual Incident-Free Transportation Dose Equivalent To The Public And Worker

		Dose Equivalent to General Public[1,6]		Dose Equivalent to the Onlookers[2,6]		Dose Equivalent to the Drivers[3,6]		Dose Equivalent to the Garage Personnel[4,6]	
Facility	**Description[5]**	**Person-Sv**	**Person-rem**	**Person-Sv**	**Person-rem**	**Person-Sv**	**Person-rem**	**Person-Sv**	**Person-rem**
Depleted UF_6 Conversion Facility Portsmouth, OH	Depleted UF_6 Disposal (48Y, 625)	6.52E-07	6.52E-05	4.38E-04	4.38E-02	3.50E-02	3.50E+00	2.92E-04	2.92E-02

1 Collective dose equivalent based on population density along route.

2 Collective dose equivalent to onlookers was calculated by multiplying the dose equivalent rate at 2 m (6.6 ft) on side from the container, times 3 minutes, times 10 people exposed to each container, times number of shipments.

3 Collective dose equivalent based on two truck drivers per shipment.

4 Collective dose equivalent to garage personnel was calculated by multiplying the dose equivalent rate at 2 m (6.6 ft) on side from the container times 10 minutes, times two garage personnel exposed, times the number of shipments.

5 Type and number of containers shipped per year given parenthetically. The dose equivalent for 48Y containers (feed or tails) bound those from 48X containers.

6 Annual collective doses assuming all containers (type and numbers) are shipped to/from the site during the year.

Table 4.2-3 Annual Shipments to/from NEF (by Truck)

Material	Container Type	Estimated Number of Shipments[1]
Natural U Feed (UF_6)	48X or 48Y	345 to 690
Enriched U Product (UF_6)	30B	70 to 175
Depleted U (UF_6)	48Y	625
Solid Waste	55 gallon drum	8

(1) 48Y cylinders are shipped one per truck. 48X cylinders are typically shipped two per truck. 30B cylinders are typically shipped two per truck, although up to five cylinders per truck can be shipped.

4.3 GEOLOGY AND SOIL IMPACTS

Site geology and soils, briefly summarized here, are fully described in ER Section 3.3, Geology and Soils. A physiographic summary for the site area is presented in Figure 3.3-1, Regional Physiography.

Subsurface geologic materials at the NEF site generally consist of competent clay red beds, a part of the Chinle Formation of the Triassic-aged Dockum Group. Bedrock is covered with about 6.7 to 16 m (22 to 54 ft) of silty sand, sand, and sand and gravel, an alluvium that is part of the Gatuña and/or Antlers Formation.

Foundation conditions at the site are generally good and no potential for mineral development exists or has been found at the site, as discussed in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems.

The site terrain currently ranges in elevation from +1,030 to +1,053 m (+3,380 to +3,455 ft) mean sea level (msl) (Figure 3.3-3, Site Topography). Because the NEF facility requires an area of flat terrain, cut and fill will be required for significant portions of the site to bring it to a final grade of +1,041 m (+3,415 ft) msl. Select engineered fill material may be brought onsite to achieve the backfill specifications for building footprints and some volume of native soil may be disposed of offsite to maintain a desirable soil stockpile balance. The resulting terrain change for the site from gently sloping to flat topography is not expected to cause significant environmental impact. Numerous such areas of flat terrain exist in the region due to natural erosion processes. Surface stormwater runoff for the permanent facility will be controlled by an engineered system described in ER Section 3.4.1.2, Facility Withdrawals and/or Discharges to Hydrologic Systems. Those controls will essentially eliminate any potential for discharge of runoff from the NEF site. LBDCR-07-0053

Construction activities may cause some short-term increases in soil erosion at the site, although rainfall in the region is limited. Erosional impacts due to site clearing and grading will be mitigated by utilization of construction and erosion control BMPs. (See ER Section 4.1, Land Use Impacts, for a discussion of construction BMPs.) Disturbed soils will be stabilized as part of construction work. Earth berms, dikes and sediment fences will be utilized as necessary during all phases of construction to limit runoff. Much of the excavated areas will be covered by structures or paved, limiting the creation of new dust sources. Watering will be used to control potentially fugitive construction dust. Water conservation will be considered when deciding how often dust suppression sprays will be applied. See ER Section 4.4.7, Control of Impacts for Water Quality, for a discussion of water conservation measures.

The Lea County Soils Survey (USDA, 1974) describes soils found at the NEF site (Figure 3.3-6, Site Soil Map Per USDA Data) as applicable for range, wildlife and recreation areas, and not for any standard agricultural activities. Construction and operation of the NEF plant are thus not anticipated to displace any potential agrarian use.

4.3.1 Comparative Geology and Soil Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios. .

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The geology and soil impacts would be less since less land is disturbed by building only one centrifuge plant instead of two.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The geology and soil impacts would be the same if the centrifuge plant is located on previously undisturbed land; otherwise, the impact would be less if the plant is located on previously disturbed land.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The geology and soil impacts would be less because no new geology or soil would be disturbed.

4.4 WATER RESOURCE IMPACTS

Water resources at the site are virtually nonexistent. There are no surface waters on the site and appreciable groundwater resources are only at depths greater than approximately 340 m (1,115 ft). The site region has semi-arid climate, with low precipitation rates and minimal surface water occurrence. Thus, the potential for negative impacts on those water resources are very low due to lack of water presence and formidable natural barriers to any surface or subsurface water occurrences. Groundwater at the site would not likely be impacted by any potential releases. The pathways for planned and potential releases are discussed below.

Permits related to water must be obtained for site construction and NEF operation are described in ER Section 1.3, Applicable Regulatory Requirements, Permits and Required Consultation. The purpose of these permits is to address the various potential impacts on water and provide mitigation as needed to maintain state water quality standards and avoid any degradation to water resources at or near the site. These include:

- *A National Pollutant Discharge Elimination System (NPDES) General Permit for Industrial Stormwater:* This permit is required for point source discharge of stormwater runoff from industrial or commercial facilities to the waters of the state. All new and existing point source industrial stormwater discharges associated with industrial activity require a NPDES Stormwater Permit from the EPA Region 6 and an oversight review by the New Mexico Water Quality Bureau (NMWQB). The NEF is eligible to claim the "No Exposure" exclusion for industrial activity of the NPDES storm water Phase II regulations. As such, the LES would submit a No Exposure Certification immediately prior to initiating operational activities at the NEF site. LES also has the option of filing for coverage under the Multi-Section General Permit (MSGP) because the NEF is one of the 11 eligible industry categories. If this option is chosen, LES will file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the initiation of NEF operations. A decision regarding which option is appropriate for the NEF will be made in the future.
- *NPDES General Permit for Construction Stormwater:* Because construction of the NEF will involve the disturbance of more than 0.4 ha (1 acre) of land an NPDES Construction General Permit from the EPA Region 6 and an oversight review by the New Mexico Water Quality Bureau (NMWQB) are required. LES will develop a Storm Water Pollution Prevention Plan (SWPPP) and file a NOI with the EPA, Washington, D.C., at least two days prior to the commencement o construction activities.
- *Groundwater Discharge Permit/Plan:* The NMWQB requires that facilities that discharge an aggregate waste water of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems apply for and submit a groundwater discharge permit and plan. This requirement is based on the assumption that these discharges have the potential of affecting groundwater. NEF will discharge treated process water, stormwater, cooling tower blowdown water and heating boiler blowdown water to surface impoundments, as well as domestic septic wastes. A groundwater discharge permit/plan will be required under 20.6.2.3104 NMAC. Section 20.6.2.3.3104 NMAC of the New Mexico Water Quality Control Commission (NMWQCC) Regulations (20.6.2 NMAC) requires that any person proposing to discharge effluent or leachate so that it may move directly or indirectly into groundwater must have an approved discharge permit, unless a specific exemption is provided for in the Regulations. LBDCR-07-0022

- *Section 401 Certification:* Under Section 401 of the federal Clean Water Act, states can review and approve, condition, or deny all federal permits or licenses that might result in a discharge to State waters, including wetlands. A 401 certification confirms compliance with the State water quality standards. Activities that require a 401 certification include Section 404 permits issued by the USACE. The State of New Mexico has a cooperative agreement and joint application process with the USACE relating to 404 permits and 401 certifications. By letter dated March 17, 2004, the USACE notified LES of its determination that there are no USAEC jurisdictional waters at the NEF site and for this reason the project does not require a 404 permit (USACE, 2004). As a result, a Section 401 certification is not required.

NEF site design addresses:

- Discharge of stormwater and waste water to site retention/detention basins
- Septic system design and construction
- General construction activities
- Potential for filling or alteration of an arroyo, should one be identified on the site

Discharge of operations waste water will be made exclusively to the Treated Effluent Evaporative Basin for only those liquids that meet physical and chemical criteria per prescribed standards. That basin, described in ER Section 3.4.1.2, is double-lined to prevent infiltration, provided with leak detection, and open to allow evaporation. An annual volume of about 2,535 m^3/yr (669,844 gal/yr) will be discharged to the Treated Effluent Evaporative Basin for evaporation.

Collection and discharge of stormwater runoff will be made to two basins, the Site Stormwater Detention Basin and the Uranium Byproduct Cylinder (UBC) Storage Pad Stormwater Retention Basin. These basins are described in ER Section 3.4.1.2. The Site Stormwater Detention Basin will allow infiltration into the ground as well as evaporation and it has an outlet structure to allow its drainage. The UBC Storage Pad Stormwater Retention Basin is single-lined and will not have an outfall. For an average annual rainfall at the site of 35.94 cm/yr (14.15 in/yr) the potential runoff volumes (before evapotranspiration) are about 33,160 m^3/yr (8,760,000 gal/yr), 139,600 m^3/yr (36,880,000 gal/yr) and 617,000 m^3/yr (163,000,000 gal/yr) for the UBC Storage Pad Stormwater Retention Basin area, the Site Stormwater Detention Basin area, and the balance (i.e., undeveloped) of the site area, respectively.

Industrial construction for the NEF site will provide a short-term risk with regard to a variety of operations and constituents used in construction activities. These will be controlled by employing BMPs including control of hazardous materials and fuels. BMPs will assure stormwater runoff related to construction activities will be detained prior to release to the surrounding land surface. BMPs will also be used for dust control associated with excavation and fill operations during construction. See ER Section 4.1, Land Use Impacts, for more information on construction BMPs. Impact from stormwater runoff generated during plant operations is not expected to differ significantly from impacts currently experienced at the site.

The water quality of the discharge from the site stormwater detention basin will be typical of runoff from building roofs and paved areas from any industrial facility. Except for small amounts of oil and grease typically found in runoff from paved roadways and parking areas, the discharge is not expected to contain contaminants. Other potential sources for runoff contamination during plant operation include an outdoor storage pad containing UBCs of depleted uranium. Although a highly unlikely occurrence, this pad is a potential source of low-level radioactivity that could enter runoff. The engineering of cylinder storage systems (high-grade sealed cylinders as described in ER Section 2.1.2, Proposed Action) and environmental monitoring of the UBC Storage Pad Stormwater Retention Basin, combine to make the potential for contamination release through this system extremely low. An initial analysis of maximum potential levels of radioactivity in rainwater runoff due to surface contamination of UBCs shows that any potential levels of radioactivity in discharges will be well below (two orders of magnitude or more) the effluent discharge limits of 10 CFR 20, Appendix B (CFR, 2003q). The UBC Storage Pad Stormwater Retention Basin is also the discharge location for cooling tower blowdown water and heating boiler blowdown water.

4.4.1 Receiving Waters

The NEF will not obtain any water or discharge any process effluents onto the site or into surface waters other than into engineered basins. Sanitary waste water discharges will be made through site septic systems. Rain runoff from developed portions of the site will be collected in retention/detention basins, described previously and in ER Section 3.4, Water Resources. These include the Site Stormwater Detention Basin and the UBC Storage Pad Stormwater Retention Basin.

Discharge from the Site Stormwater Detention Basin will be by evaporation and by infiltration into the ground. Discharge from the UBC Storage Pad Stormwater Retention Basin will be by evaporation only.

Discharge from the double-lined Treated Effluent Evaporative Basin, with leak detection, will be by evaporation only. NEF effluent flow rates providing input to this basin are relatively low, as described in ER Section 3.4.1.2.

The NEF site includes no surface hydrologic features. Groundwater was encountered at depths of 65 to 68 m (214 to 222 ft). Significant quantities of groundwater are only found at a depth over 340 m (1,115 ft) where cover for that aquifer is provided by 323 to 333 m (1,060 to 1,092 ft) of clay, as described in ER Section 3.4.1.1.1, Site Groundwater Investigations.

Due to high evapotranspiration rates for the area, it is not anticipated that there will be any receiving waters for runoff derived from the NEF facility other than residual amounts from that collected in the Site Stormwater Detention Basin. At shallower depths vegetation at the site provides highly efficient evapotranspiration processes, as described in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems. That natural process will remove the major part of stormwater runoff at the site.

Stormwater runoff detention/retention basins for the site, shown in Figure 4.4-1, Site Plan with Stormwater Detention/Retention Basins are designed to provide a means of controlling discharges of rainwater and runoff chemistry for about 39 ha (96 acres) of the NEF site plus an additional 9.2 ha (22.8 acres) of the UBC Storage Pad. These areas represent a combined 48.2 ha (118.8 acres) of the 220 ha (543 acre) total NEF site area.

The UBC Storage Pad Stormwater Retention Basin, which will exclusively serve that paved, outdoor storage area, will be lined to prevent any infiltration, and designed to retain a volume (77,700 m^3 (63 acre-ft)) slightly more than twice that for the 24-hour duration, 100-year frequency storm plus an allowance for cooling tower blowdown and heating boiler blowdown. The basin configuration will allow for radiological testing of water and sediment (see ER Section 4.4.2, Impacts on Surface Water and Groundwater Quality), but the basin will contain no flow outlet. All discharge for the UBC Storage Pad Retention Basin will be through evaporation. The UBC Storage Pad will be constructed of reinforced concrete with a minimal number of construction joints, and pad joints will be provided with joint sealer and water stops as a leak-prevention measure. The ground surface around the UBC Storage Pad will be contoured to prevent rainfall in the area surrounding the pad from entering the pad drainage system.

The Site Stormwater Detention Basin will be designed with an outlet structure for drainage, as needed. Local terrain serves as the receiving area for this basin. The basin will be included in the site environmental monitoring program as described in ER Section 6.1, Radiological Monitoring and ER Section 6.2, Physiochemical Monitoring.

4.4.2 Impacts on Surface Water and Groundwater Quality

Although quantities are severely limited, local shallow groundwater is of a minimally suitable quality to provide sources of potable water. Water for most domestic and industrial uses should contain less than 1,000 mg/L Total Dissolved Solids (TDS) (Davis, 1966), and this compares with a EPA secondary standard of 500 mg/L TDS (CFR, 2003h). The nearby Waste Control Specialists (WCS) facility wells have routinely been analyzed with TDS concentrations between about 2,880 and 6,650 mg/L.

The NEF will not obtain any water from the site or discharge process effluents to groundwater and surface waters other than to the double-lined Treated Effluent Evaporative Basin with leak detection. Therefore, no impacts on natural water systems quality due to facility water use are expected.

Control of surface water runoff will be required for NEF construction activities, covered by the NPDES Construction General Permit. As a result, no significant impacts are expected for either surface water bodies or groundwater.

During NEF operation, stormwater from the site will be collected in a collection system that includes runoff detention/retention basins, as described in ER Section 4.4.1, Receiving Waters and shown in ER Figure 4.4-1, Site Plan with Stormwater Detention/Retention Basins.

No wastes from facility operational systems will be discharged to stormwater. In addition, stormwater discharges during plant operation will be controlled by a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP will meet the requirements of U.S. EPA Construction General Permit (CGP) Section 3. The SWPPP will identify all potential sources of pollution that may reasonably be exspected to affect the quality of stormwater discharge from the site, describe the practices used to reduce pollutants in stormwater, and assure compliance with the terms and conditions of the CGP.

The UBC Storage Pad Stormwater Retention Basin will collect the runoff water from the UBC Storage Pad. This water runoff has the extremely remote potential to contain low-level radioactivity from cylinder surfaces or leaks. Runoff from the pad will be channeled to a dedicated retention basin that is single-lined with a synthetic fabric with ample soil cover over the liner to prevent surface damage and ultraviolet degradation. This basin is described in ER Section 3.4.1.2, Facility Withdrawal and/or Discharges to Hydrologic Systems. It is suitable to contain at least the volume of water from slightly more than twice the 100-year, 24-hour-frequency rainfall of 15.2 cm (6.0 in) plus an allowance for cooling tower blowdown and heating boiler blowdown. The drainage system will include precast catch basins and concrete trench drains; piping will be reinforced concrete with rubber gasketed joints to preclude leakage. An assessment was made by LES that assumed a conservative level of radioactive contamination level on cylinder surfaces and 100% washoff to the UBC Storage Pad Stormwater Retention Basin from a single rainfall event. Results show the level of radioactivity in such a discharge to the basin will be well below the regulatory unrestricted release criteria (CFR, 2003q).

The UBC Storage Pad Stormwater Retention Basin will be provided with a means to sample sediment. Refer to ER Section 6.1, Radiological Monitoring, for more information regarding environmental monitoring of stormwater site detention/retention basins.

4.4.3 Hydrological System Alterations

Excavation and placement of fill will provide the site with a finished level grade of about +1,041 m (+3,415 ft), msl. This work will not require alteration or filling of any surface water features on the site.

No alterations to groundwater systems will occur due to facility construction. Referring to ER Section 3.4.12, since there is no consistent groundwater in the sand and travel layer above the Chinle Formation, it does not provide a likely contaminant pathway in a lateral or vertical direction. Although engineered fill will be used during site preparation and will likely be placed against the existing dense sand and gravel layer in some locations, the potential for water or other liquids from spills or pipeline leaks to introduce sufficient amounts of liquid to saturate the sand and gravel layer to a point where significant contaminant migration reaches and flows along the top of the Chinle Formation, is considered unlikely. The addition of on-site fill is not expected to alter this situation. Furthermore, the travel time to downstream users through a lateral contaminant pathway would be significant since potential contamination would travel laterally at very small rates, if at all. Groundwater travel through the Chinle clay would be on the order of thousands of years.

4.4.4 Hydrological System Impacts

Due to absence of water extraction, limited effluent discharge from the facility operations, the lack of groundwater in the sand and gravel layer above the Chinle Formation and the considerable depth to groundwater at the NEF site, no significant impacts are expected for the site's hydrologic systems.

Control of surface water runoff will be required for NEF construction activities, covered by the NPDES Construction General Permit. As a result, no significant impacts are expected to either surface or groundwater bodies. Control of impacts from construction runoff is discussed in ER Section 4.4.7, Control of Impacts to Water Quality.

The volume of water discharged into the ground from the Site Stormwater Detention Basin is expected to be minimal, as evapotranspiration is expected to be the dominant natural influence on standing water.

4.4.5 Ground and Surface Water Use

The NEF will not obtain any water from the site or have any planned surface discharges at the site other than to the retention and detention basins. All potable, process and fire water supply used at the NEF will be obtained from the Eunice, New Mexico, municipal water system. Wells serving these systems are about 32 km (20 mi) from the site. Anticipated normal plant water consumption and peak plant water requirements are provided in Table 3.4-4, Anticipated Normal Plant Water Consumption, and Table 3.4-5, Anticipated Peak Plant Water Consumption, respectively. LBDCR-07-0005

Site groundwater will not be utilized for any reason, and therefore, should not be impacted by routine NEF operations. The NEF water supply will be obtained from the city of Eunice, New Mexico. Current capacities for the Eunice, New Mexico municipal water supply system is 16,350 m^3/day (4.32 million gpd) and current usage is 5,600 m^3/day (1.48 million gpd). Average and peak potable water requirements for operation of the NEF are expected to be approximately 240 m^3/day (63,423 gpd) and 85 m^3/hr (378 gpm), respectively. These usage rates are well within the capacity of the water system. LBDCR-07-0005 LBDCR-07-0005

For both peak and the normal usage rates, the needs of the NEF facility should readily met by the municipal water systems. Impacts to water resources onsite and in the vicinity of the NEF are expected to be negligible.

4.4.6 Identification of Impacted Ground and Surface Water Users

Location of an intermittent surface water feature and groundwater users in the site vicinity including an area just beyond a 1.6-km (1-mi) radius of the site boundary are shown on Figure 3.4-7, Water and Oil Wells in the Vicinity of the NEF Site. These locations were provided by the Office of New Mexico State Engineer (NMSE) (NMSE, 2003), the Texas Water Development Board (TWDB) (TWDB, 2003) and the United States Geological Survey (USGS) (USGS, 2003b). No producing supply water wells are within 1.6 km (1 mi) of the boundaries of the NEF site as shown on Figure 3.4-7. However, nearby facilities do have groundwater monitoring wells within this region.

The absence of near-surface groundwater users within 1.6 km (1 mi) from the site and the absence of surface water on the NEF site will prevent any impact to local surface or groundwater users. Due to the lack of process water discharge from the facility to the environment, no impact is expected for these water users.

Effluent discharges will be controlled in a way that will also prevent any impacts. The locations of the closest municipal water systems for both Eunice and Hobbs are in Hobbs, New Mexico, 32 km (20 mi) north northwest of the site. There is no potential to impact these sources.

4.4.7 Control of Impacts to Water Quality

Site runoff water quality impacts will be controlled during construction by compliance with NPDES Construction General Permit requirements and BMPs will be described in a site Stormwater Pollution Prevention (SWPP) plan.

Wastes generated during site construction will be varied, depending on activities in progress. Any hazardous wastes from construction activities will be handled and disposed of in accordance with applicable state regulations. This includes proper labeling, recycling, controlling and protected storage and shipping offsite to approved disposal sites. Sanitary wastes generated at the site will be handled by portable systems until such time that the site septic systems are available for use.

The need to level the site for construction will require some soil excavation as well as soil fill. Fill placed on the site will provide the same characteristics as the existing natural soils thus providing the same runoff characteristics as currently exist due to the presence of natural soils on the site.

During operation, the NEF's stormwater runoff detention/retention system will provide a means to allow controlled release of site runoff from the Site Stormwater Detention Basin only. Stormwater discharge will be periodically monitored in accordance with state and/or federal permits. This system will also be used for routine sampling of runoff as described in ER Section 6.1.1.2, Liquid Effluent Monitoring. A Spill Prevention Control and Countermeasure (SPCC) plan will be implemented for the facility to identify potential spill substances, sources and responsibilities. A SWPP will also be implemented for the NEF to assure that runoff released to the environment will be of suitable quality. These plans are described in ER Section 4.1, Land Use Impacts.

Water discharged to the NEF site septic systems will meet required levels for all contaminants stipulated in any permit or license required for that activity, including the 10 CFR 20 (CFR, 2003q) and a Groundwater Discharge Permit/Plan. The facility's Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant. The system provides for collection, treatment, analysis, and processing of liquid wastes for disposal. Effluents unsuitable for release to the Treated Effluent Evaporative Basin are processed onsite or disposed of offsite in a suitable manner in conformance with U.S. EPA and State of New Mexico regulatory requirements. The State of New Mexico has adopted the U.S. EPA hazardous water regulations (40 CFR Parts 260 through 266, 268 and 270) (CFR, 2003cc; CFR, 2003p; CFR, 2003dd; CFR, 2003ee; CFR, 2003v; CFR, 2003ff; CFR, 2003gg; CFR, 2003hh; CFR, 2003ii) governing the generation, handling, storage, transportation, and disposal of hazardous materials. These regulations are found in 20.4.I NMAC, "Hazardous Waste Management". LBDCR-07-0022

The UBC Storage Pad Stormwater Retention Basin, which exclusively serves the UBC Storage Pad, cooling tower blowdown water and heating boiler blowdown water discharges, is lined to prevent infiltration. It is designed to retain a volume slightly more than twice that for the 24-hour, 100-year frequency storm plus an allowance for cooling tower blowdown and heating boiler blowdown. Designed for sampling and radiological testing of the contained water and sediment, this basin has no flow outlet. All discharge is through evaporation.

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin. During a rainfall event larger than the design basis, the potential exists to overflow the basin if the outfall capacity is insufficient to pass beyond design basis inflows to the basin. Overflow of the basin is an unlikely event. The additional impact to the surrounding land over that which would occur during such a flood alone, is assumed to be small. Therefore, potential overflow of the Site Stormwater Detention Basin during an event beyond its design basis is expected to have a minimal impact to surrounding land. The Site Stormwater Detention Basin will also receive runoff from a portion of the site stormwater diversion ditch. The purpose of the diversion ditch is to safely divert surface runoff from the area upstream of the NEF around the east and west sides of the NEF structures during extreme precipitation events. There is no retention or attenuation of flow associated with this feature. The east side will divert surface runoff into the Site Stormwater Detention Basin. The basin is designed to provide no flow attenuation for this component of flow The west side will divert surface runoff around the site where it will continue on as overland flow. Since there are

no modifications or attenuation of flows, there are no adverse impacts and no mitigative measures are required.

Discharge of operations-generated potentially contaminated waste water is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on prescribed standards) are discharged to this basin. The basin is double-lined with leak detection and open to allow evaporation.

Mitigation measures will be in place to minimize potential impact on water resources. These include employing BMPs and the control of hazardous materials and fuels. In addition, the following controls will also be implemented:

- Construction equipment will be in good repair without visible leaks of oil, greases, or hydraulic fluids.
- The control of spills during construction will be in conformance with Spill Prevention Control and Countermeasures (SPCC) plan.
- Use of the BMPs will assure stormwater runoff related to these activities will not release runoff into nearby sensitive areas (EPA, 2003g). See ER Sections 4.1.1 and 4.2.5 for construction BMPs.
- BMPs will also be used for dust control associated with excavation and fill operations during construction. Water conservation will be considered when deciding how often dust suppression sprays will be applied (EPA, 2003g).
- Silt fencing and/or sediment traps will be used.
- External vehicle washing (no detergents, water only).
- Stone construction pads will be placed at entrance/exits if unpaved construction access adjoins a state road.
- All temporary construction and permanent basins are arranged to provide for the prompt, systematic sampling of runoff in the event of any special needs.
- Water quality impacts will be controlled during construction by compliance with the National Pollution Discharge Elimination System – General Permit requirements and by applying BMPs as detailed in the site Stormwater Pollution Prevention (SWPP) plan.

- A Spill Prevention Control and Countermeasure Plan (SPCC), will be implemented for the facility to identify potential spill substances, sources and responsibilities.
- All above-ground diesel storage tanks will be bermed.
- Any hazardous materials will be handled by approved methods and shipped offsite to approved disposal sites. Sanitary wastes generated during site construction will be handled by portable systems, until such time that plant sanitary facilities are available for site use. An adequate number of these portables systems will be provided.
- The NEF Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant including the collection, analysis, and processing of liquid wastes for disposal.
- Control of surface water runoff will be required for activities covered by the EPA Region 6 NPDES Construction General Permit.

The NEF is designed to minimize the use of natural and depletable water resources as shown by the following measures:

- The use of low-water consumption landscaping versus conventional landscaping reduces water usage.
- The installation of low flow toilets, sinks and showers reduces water usage when compared to standard flow fixtures.
- Localized floor washing using mops and self-contained cleaning machines reduces water usage compared to conventional washing with a hose twice per week.
- The use of high efficiency washing machines compared to standard machines reduces water usage.
- The use of high efficiency closed cell cooling towers (water/air cooling) versus open cell design reduces water usage.
- Closed-loop cooling systems have been incorporated to reduce water usage.

4.4.8 Identification of Predicted Cumulative Effects on Water Resources

The NEF will not extract any surface or groundwater from the site or discharge any effluent to the site other than into the engineered basins. As a result, no significant effects on natural water systems are anticipated. Thus no cumulative effects are predicted.

4.4.9 Comparative Water Resources Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

The discussion of alternative scenarios in ER Section 2.0 compares the impacts of NEF with those that could result from expansion of the existing USEC gaseous diffusion plant (GDP) and a proposed centrifuge plant. Plant water usage by the GDP is reported to be 26 million gal/d (USEC, 2003a). NEF water usage is projected to be 87,625 m^3/yr (23.15 million gal/yr), less than 0.5% of the GDP usage.

Significant water usage is also required to generate the electric power needed for GDP operations. NEF will use far less electric power and thus far less water per SWU compared with GDP.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The water resources impact would be greater because of the higher water usage of the GDP and the water use to meet GDP electricity needs.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The water resources impact would be greater in the short term to support the GDP operation, while the centrifuge plant capability is increased. The impact would be the same or greater in the long term once GDP production is terminated.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The water resources impact for continued operation of the GDP would be significantly greater since additional water consumption would be necessary to meet the increased production and associated electricity needs of the GDP.

4.4.10 Section 4.4 Figures

Security-Related Information
Figure Withheld Under 10 CFR 2.390

CONSTRUCTED FEATURES (SITE PLAN)

Figure 4.4-1 Site Plan with Stormwater Detention/Retention Basins

4.5 ECOLOGICAL RESOURCES IMPACTS

4.5.1 Maps

See Figure 4.5-1, Ecological Resource Impacts.

4.5.2 Proposed Schedule of Activities

The following is a tentative, abbreviated schedule of proposed activities. Refer to ER Section 1.2.4, Schedule on Major Steps Associated With the Proposed Action, for a complete schedule of all major steps in the proposed action:

- December 2003 — Submit Facility License Application
- August 2006 — Initiate Facility Construction
- October 2008 — Start First Cascade
- October 2013 — Achieve Full Nominal Production Output
- April 2025 — Submit License Termination Plan to NRC
- April 2027 — Complete Construction of Decommissioning and Decontamination (D&D) Facilities
- April 2036 — D&D Completed

4.5.3 Area of Disturbance

The area of land to potentially be disturbed is approximately 220 ha (543 acres). This area includes 8 ha (20 acres) that will be used for contractor parking and lay-down areas. The contractor lay-down and parking area will be restored after completion of plant construction. (See ER Figure 3.4-1, Local Hydrological Features, for a map indicating proposed buildings, land to be cleared and surrounding areas.)

4.5.4 Area Of Disturbance By Habitat Type

The proposed NEF site consists of one vegetation community type. The Plains Sand Scrub vegetation community is identified by the dominant presence of deep sand tolerant and deep sand adapted plants. The Plains Sand Scrub vegetation community is common in parts of southeastern New Mexico. Density of specific plant species, quantified by individuals per acre, varies slightly across the proposed site. Differences in the composition of the vegetation community within the proposed site are accounted for by slight variations in soil texture and structure and small changes in aspect.

The Plains Sand Scrub vegetation community is interrupted by a single access road through the NEF site. The road is void of vegetation. This area represents a small fraction of the total area and is not considered a habitat type.

The majority of the proposed site is suitable for use by wildlife resources. The Plains Sand Scrub provides potential habitat for an assortment of birds, mammals, and reptiles (Reference ER Section 3.5.2, General Ecological Conditions of the Site).

The total area of potential disturbance proposed for the NEF site is approximately 220-ha (543-acre). The disturbance would affect the Plains Sand Scrub vegetation community.

4.5.5 Maintenance Practices

Maintenance practices such as the use of chemical herbicides, roadway maintenance, and clearing practices will be employed both during construction and/or plant operation. However, none of the practices are anticipated to permanently affect biota (see ER Sections 4.1.1 and 4.2.5 for construction and maintenance BMPs) (EPA, 2003g).

No herbicides will be used during construction, but may be used in limited amounts according to government regulations and manufacturer's instructions to control unwanted noxious vegetation during operation of the facility. Additionally, natural, low-water consumption landscaping will be used and maintained. Any eroded areas that may develop will be repaired and stabilized.

Roadway maintenance practices will be employed both during construction and operational phases of the NEF. However, these practices are currently being employed by the Wallach Quarry along the existing access road, and do not represent a new or significant impact to biota.

Clearing practices will be employed during the construction phase of the NEF project. The additional noise, dust and other factors associated with the clearing practices will be short-lived in duration and will represent only a temporary impact to the biota of the NEF site.

Potentially, 220 ha (543 acres) of the site will be disturbed affording the biota of the site an opportunity to move to areas of suitable habitat bordering the NEF site. Refer to ER Section 4.1, Land Use Impacts, for construction and clearing BMPs.

4.5.6 Short Term Use Areas And Plans For Restoration

The area to be used on a short-term basis during construction, including contractor parking and lay-down areas, will be limited to approximately 8.1 ha (20 acres). These areas will be revegetated with native plant species and other natural, low-water consumption landscaping to control erosion upon completion of site construction and returned as close as possible to original conditions. Lay-down (short term use areas) will be selected as to minimize the impacts to local vegetation.

4.5.7 Activities Expected To Impact Sensitive Communities Or Habitats

No communities or habitats that have been defined as rare or unique or that support threatened and endangered species have been identified on the 220-ha (543-acre) NEF site. Thus, no proposed activities are expected to impact communities or habitats defined as rare or unique or that support threatened and endangered species within the 220-ha (543-acre) site.

The vegetation community at the NEF Site does have the potential to provide habitat for the lesser prairie chicken (Tympanchus pallidicinstus), the sand dune lizard (Sceloporus arenicolus) and the black-tailed prairie dog (Cynomys ludovicianus). The lesser prairie chicken is currently on the federal candidate list for listing as a threatened species. The sand dune lizard is currently listed as a threatened species on the New Mexico State Rare, Threatened and Endangered (RTE) Species List. The black-tailed prairie dog is a federal listed candidate species; however, it has no state listing.

No lesser prairie chickens (Tympanchus pallidicinstus) have been observed at the NEF site. The closest known occurrence of this species to the NEF site is a breeding ground or lek, located approximately 6.4 km (4 mi) north of the NEF site. Located in the vegetation community, the NEF site does provide potential habitat for the lesser prairie chicken, although the vegetation community is not uncommon in the general area. There have been no known sightings of the lesser prairie chicken at the NEF site. Field surveys for the lesser prairie chicken on the NEF site, conducted in September 2003 and April 2004, indicated that the specie does not occur on the NEF site.

Dune formations in combination with the Plains Sand Scrub vegetation community at the NEF site have the potential to provide habitat for the sand dune lizard (Sceloporus arenicolus). Some dune formations are included in the proposed area of disturbance. Surveys were conducted at the NEF site in October 2003 and June 2004 to detect the presence of the sand dune lizard. No individuals were identified during the surveys and although the area has some components of sand dune lizard habitat, various factors make it unsuitable. (See ER Section 3.5.3, Description of Important Wildlife and Plant Species.) The closest known sand dune lizard population is approximately 4.8 km (3 mi) north of the NEF site. Areas to the west, south and east of the site have no suitable habitat for the sand dune lizard within 16 to 32 km (10 to 20 mi).

The sand dune formation on the NEF site, that has been determined not to be suitable habitat for the sand dune lizard, comprises approximately 40.5 ha (100 acres). The percent of the sand dune formation that could potentially be impacted by the NEF footprint is approximately 40.5 ha (100 acres). In the general region of the NEF site, there are several thousand acres of sand dune formation that will not be impacted by the project.

Although black-tailed prairie dogs (Cyonomys ludovicianus) have expanded their range into shinnery oak and other grass-shrub habitats, they usually establish colonies in short grass vegetation types. The predominant vegetation type, plains-mesa sand scrub, on the NEF site is not optimal prairie dog habitat due to high density shrubs. There have been no sightings of black-tailed prairie dogs, active or inactive prairie dog mounds/burrows, or any other evidence, such as trimming of the various shrub species, at the NEF site.

Pursuant to the two wildlife species discussed in ER Section 3.5.6 potentially attracted to NEF site habitats, the swift fox is vulnerable to construction activities that would result in a direct loss of breeding habitat (burrows/dens) and to a decrease in the rodent population that is the primary food source for the swift fox. Because the species has adapted to areas of human activities such as overgrazed pastures, plowed fields, and fence rows, it could potentially be present during the NEF operations phase. Decommissioning activities would have similar impacts on the swift fox as the construction phase with the potential for den/burrows being destroyed and the disruption of the rodent/rabbit food source.

The western burrowing owl is generally vulnerable to construction activities because of the possibility that burrows, and possibly birds or eggs in the burrows, may be destroyed by machinery or structures. The species is generally tolerant of human activity, provided they are not harassed. Relocation of active burrowing owl colonies may allow continued existence of the birds in the area if usable burrows and appropriate open habitats are provided. However, the lack of existing burrows at the NEF site reduces the potential impact on this species.

4.5.8 Impacts Of Elevated Construction Equipment Or Structures

The construction of new towers can create a potential impact on migratory birds, especially night-migrating species. Some of the species affected are also protected under the Endangered Species Act and Bald and Golden Eagle Act. However, the estimate of the potential impacts of elevated construction equipment or structures on species is extremely low for the NEF site. The tallest proposed structure is 40 m (131 ft), which is well under the 61 m (200 ft) threshold that requires lights for aviation safety. This avoidance of lights, which attract species, and the low above ground level structure height, also reduces the relative potential for impacts. Additionally, security lighting for all ground level facilities and equipment will be down-shielded to keep light within the boundaries of the site, also helping to reduce the potential for impacts (USFWS, 1998).

4.5.9 Tolerances And Susceptibilities Of Important Biota To Pollutants

Three of the species indicated as important species in ER Section 3.5.3, Description of Important Wildlife and Plant Species (i.e., game species (the mule deer, the lesser prairie chicken and the scaled quail)), are highly mobile species and are not susceptible to localized physical and chemical pollutants as other less mobile species such as invertebrates and aquatic species. Due to the lack of direct discharge of water, stormwater management practices (i.e., fenced detention basins), and the lack of aquatic systems at the NEF site, no significant impacts to aquatic systems are expected. Additionally, the three identified species of concern in the general area, the lesser prairie chicken, the sand dune lizard and the black-tailed prairie dog, do not occur on the NEF site.

The mule deer has a relatively high tolerance to physical pollution such as noise, as do other smaller wildlife species such as rodents and coyotes that may inhabit the NEF site. Larger wildlife species such as mule deer, may be effected by chemical pollution by direct ingestion or contamination of plant species that serve as a food source. Depending on the type of chemical pollution, mule deer have tolerance levels that range from low to high (Newman, 1979; DOE, 2001h; Haney, 1996). Small wildlife species will exhibit a greater susceptibility to chemical pollution by direct ingestion. The important biota identified at the NEF site will generally have a high tolerance to physical pollutants and will have varying susceptibility to chemical pollution depending on the nature and extent of the pollutant.

4.5.10 Construction Practices

Standard land clearing methods, primarily the use of heavy equipment, will be used during the construction phase of the NEF site. Erosion, runoff and situation control methods both temporary and permanent will follow the BMPs referenced in ER Section 4.1, Land Use Impacts. Additionally, stormwater detention basins will be constructed prior to land clearing and used as sedimentation collection basins during construction then converted to detention basins once the site is revegetated and stabilized. When required, applications of controlled amounts of water will be used to control dust in construction areas. Water conservation will be considered when deciding how often dust suppression sprays will be applied. See ER Section 4.4.7 for water conservation measures. After construction is complete the site will be stabilized with native grass species, pavement, and crushed stone to control erosion. Ditches, unless excavated in rock, will be lined with riprap, vegetation, or other suitable material as dictated by water velocity to control erosion. Furthermore, any eroded areas that may develop will be repaired and stabilized. See ER Section 4.1 for additional information on BMPs that LES will use for the NEF construction activities.

4.5.11 Special Maintenance Practices

No important habitats (e.g.; marshes, natural areas, bogs) have been identified within the 220-ha (543-acre) NEF site. Therefore, no special maintenance practices are proposed.

4.5.12 Wildlife Management Practices

LES is proposing to incorporate several wildlife management practices in association with the NEF. These wildlife management practices include:

- Use of BMPs recommended by the State of New Mexico to minimize the construction footprint to the extent possible.
- The use of detention and retention ponds.
- Site stabilization practices to reduce the potential for erosion and sedimentation.

Proposed wildlife management practices include:

- The placement of a raptor perch in an unused open area.
- The use of bird feeders at the visitor's center.
- The placement of quail feeders in the unused open areas away from the NEF buildings.
- The use of native, low-water consumption landscaping in and around the stormwater retention/detention basins.
- The management of unused open areas (i.e. leave undisturbed), including areas of native grasses and shrubs for the benefit of wildlife.
- The use of native plant species to revegetate disturbed areas to enhance wildlife habitat.
- The use of netting or other suitable material to ensure migratory birds are excluded from evaporative ponds that do not meet New Mexico Water Quality Control Commission (NMWQCC) surface water standards for wildlife usage.
- The use of animal-friendly fencing around ponds or basins which may contain contaminated process water so that wildlife cannot be injured or entangled. LBDCR-08-0009
- During plant construction and relocation of the CO2 pipeline, minimize the amount of open trenches at any given time and keep trenching and backfilling crews close together.
- During plant construction and relocation of the CO2 pipeline, trench during the cooler months (when possible).
- During plant construction and relocation of the CO2 pipeline, avoid leaving trenches open overnight. Escape ramps will be constructed at least every 90 m (295 ft). The slope of the ramps will be less than 45 degrees. Trenches that are left open overnight will be inspected and animals removed prior to backfilling.

In addition to these proposed wildlife management practices, LES will consider all recommendations of appropriate state and federal agencies including the U.S. Fish and Wildlife Service (USFWS) and the New Mexico Department of Game and Fish.

4.5.13 Practices And Procedures To Minimize Adverse Impacts

Several practices and procedures have been designed to minimize adverse impacts to the ecological resources of the NEF site. These practices and procedures include the use of BMPs recommended by various state and federal management agencies (refer to ER Section 4.5.10, Construction Practices), minimizing the construction footprint to the extent possible, avoiding all direct discharge (including stormwater) to any waters of the United States (i.e., the use of detention ponds), the protection of all undisturbed naturalized areas, and site stabilization practices to reduce the potential for erosion and sedimentation. Based on recommendations from the New Mexico Department of Game and Fish, ponds will be fenced to exclude wildlife and the pond surface areas netted, or other suitable means utilized, to minimize the use of process ponds by birds and waterfowl. The use of native plant species in disturbed area revegetation will enhance and maximize the opportunity for native wildlife habitat to be re-established at the site.

4.5.14 Comparative Ecological Resource Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The ecological resource impact would be greater because the continued GDP operation and associated electric generation needs increases the impacts on ecological resources.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The ecological resource impact would be the same or greater since there is additional concentration of activity at a single location.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at increased capacity: The ecological resource impact would be significantly greater because of the significant amount of energy required to operate the GDP at the increased capacity.

4.5.15 Section 4.5 Figures

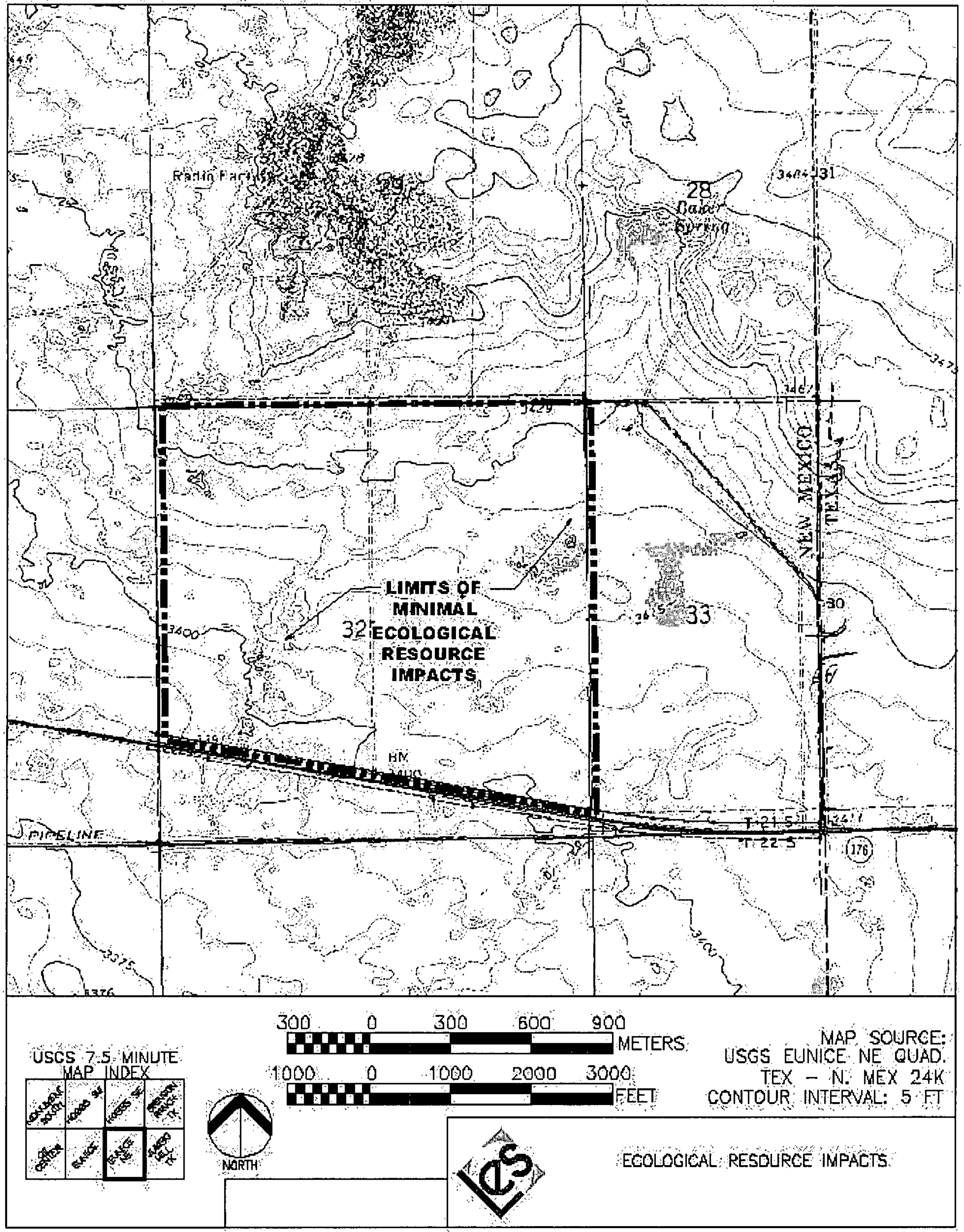

Figure 4.5-1 Ecological Resource Impacts

4.6 AIR QUALITY IMPACTS

This section describes the air quality impacts of the proposed action (construction and operation of the NEF).

4.6.1 Air Quality Impacts From Construction

Air quality impacts from site preparation for the NEF were evaluated using emission factors and air dispersion modeling. Emission rates of Clean Air Act Criteria Pollutants and non-methane hydrocarbons (a precursor of ozone, a Criteria Pollutant) were estimated for exhaust emissions from construction vehicles and for fugitive dust using emission factors provided in AP-42, the U.S. Environmental Protection Agency's Compilation of Air Pollutant Emission Factors (EPA, 1995). The total emission rates were used to scale the output from the Industrial Source Complex Short-Term (ISCST3) air dispersion model (air concentrations derived using a unit source term) to estimate both short-term and annual average air concentrations at the facility property boundary. ISCST3 is a refined, U.S. EPA-approved air dispersion model in the Users Network for Applied Modeling of Air Pollution (UNAMAP) series of air models (EPA, 1987). It is a steady-state Gaussian plume model that can be used to estimate ground-level air concentrations from industrial sources out to a distance of 50 km (31 mi). The air emissions calculations and air dispersion modeling are discussed in more detail in Appendix B.

Emission rates from vehicle exhaust and fugitive dust, as listed in Table 4.6-1, Peak Emission Rates, were estimated for a 10-hour workday assuming peak construction activity levels were maintained throughout the year. Fugitive dust will originate predominantly from vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing, and to a lesser extent from wind erosion. Fugitive dust emissions were estimated using an AP-42 emission factor for construction site preparation that was adjusted to account for dust suppression measures and the fraction of total suspended particulate that is expected to be in the PM10 range. It was assumed that no more than 18 ha (45 acres) would be involved in construction work at any one time.

Of the combustion sources, vehicle exhaust will be the dominant source. Fugitive volatile emissions will also occur because vehicles will be refueled onsite. Estimated vehicles that will be operating on the site during construction consist of two types: support vehicles and construction equipment. The support vehicles will include twenty pickup trucks, ten gators (a gasoline powered cart), three stakebody trucks, five fuel trucks, five mechanic's trucks and five boom trucks. Emission factors in AP-42 for "highway mobile sources" were used to estimate emissions of criteria pollutants and non-methane hydrocarbons for these vehicles. The construction equipment that will be operating on the site during peak construction consists of five bulldozers, three graders, three pans (diesel-powered fill transporter), six dump trucks, three backhoes, four loaders, four rollers, three water trucks and two tractors. Emission factors provided in AP-42 for diesel-powered construction equipment were used for these vehicles.

Emissions were modeled in ISCST3 as a uniform area source with emissions occurring 10 hours per day, 5 days per week, and 50 weeks per year. The maximum predicted air concentrations at the site boundary for the various averaging periods predicted using five years (1987 to 1991) of hourly meteorological data from the Midland-Odessa, Texas, National Weather Service (NWS) station are presented in ER Table 4.6-2, Predicted Property Boundary Air Concentrations and Applicable NAAQS. These concentrations are compared to the appropriate National Ambient Air Quality Standard (NAAQS). No NAAQS has been set for hydrocarbons; however, the total annual emissions of hydrocarbons predicted from the site (approximately 4,535 kg (5 tons)) are well below the level of 36,287 kg (40 tons) that defines a significant source of volatile organic compounds (40 CFR 50.21) (CFR, 2003w). Air concentrations of the Criteria Pollutants predicted for vehicle emissions were all at least an order of magnitude below the NAAQS. PM10 emissions from fugitive dust were also below the NAAQS. The results of the fugitive dust estimates should be viewed in light of the fact that the peak anticipated fugitive emissions were assumed to occur throughout the year. These conservative assumptions will result in predicted air concentrations that tend to overestimate the potential impacts. ER Section 1.3.2, State Agencies, presents information regarding the status of all State of New Mexico permits.

Other onsite air quality impacts will occur due to the construction work, such as portable generator exhaust, air compressor exhaust, welding torch fumes, and paint fumes. Since the NEF will be constructed using a phased construction plan, some of the facility will be operational while construction continues. As such, other air quality impacts will occur due to the operation of boilers and emergency diesel generators. Construction emission types, source locations, and emission quantities are presented in Table 4.6-4, Construction Emission Types.

During the three-year period of site preparation and major building construction, offsite air quality will be impacted by passenger vehicles with construction workers commuting to the site and trucks delivering construction materials and removing construction wastes. Emission rates from passenger vehicle exhaust were estimated for a 64.4-km (40-mi) roundtrip commute for 800 vehicles per workday. No credit was taken fr the use of car pools. Emission rates from delivery trucks were estimated for a 322-km (200-mi) roundtrip for 14 vehicles per workday. It was assumed that there are 250 workdays per year (five-day work week and fifty-week work year). Emission factors are based on AP-42. The resulting emission factors, tons of daily emissions, number of vehicles and heavy duty engines are provided in Table 4.6-5, Offsite Vehicle Air Emissions During Construction.

The construction estimates for daily emissions are based on the average number of trucks per day. There will be peak days, such as when large concrete pours are executed, where there will be more than the average number of trucks per day. This peak daily value of truck trips is not available at this time. It is estimated, however, that the daily emission values presented in Table 4.6-5, that are based on the average number of trucks could be about an order of magnitude higher on the peak days.

4.6.2 Air Quality Impacts From Operation

Onsite air quality will be impacted during operation due to the operation of boilers and emergency diesel generators. Operation emission types, source locations, and emission quantities are presented in Table 4.6-6, Air Emissions During Operations.

During operation, offsite air quality will be impacted by passenger vehicles with NEF workers commuting to the site, delivery trucks, UF_6 cylinder shipment trucks, and waste removal trucks. Emission rates from passenger vehicle exhaust were estimated for a 64.4-km (40-mi) roundtrip commute for 210 vehicles per workday. No credit was taken for the use of car pools. Emission rates from trucks were estimated for an average distance of 805-km (500-mi) for 18 vehicles per workday. It was assumed that there are 250 workdays per year (five-day work week and fifty-week work year). Emission factors are based on AP-42. The resulting emission factors, tons of daily emissions, number of vehicles and heavy duty engines are provided in Table 4.6-7, Offsite Vehicle Air Emissions During Operations.

NUREG-1748 requires that atmospheric dispersion factors (X/Q's) be used to assess the environmental effects of normal plant operations and facility accidents. In the following subsections, information is presented about the gaseous effluents, the gaseous effluent control systems, and computer models and data used to calculate atmospheric dispersion and deposition factors. LBDCR-07-0022

4.6.2.1 Description of Gaseous Effluents

Uranium hexafluoride (UF_6) will be the radioactive effluent for gaseous pathways. Average source term releases to the atmosphere are estimated to be 8.9 MBq (240 μCi) per year for the purposes of bounding routine operational impats. Urenco's experience in Europe indicates that uranium discharges from gaseous effluent vent systems are less than 10 g (0.35 ounces) per year. Therefore, 8.9 MBq (240 μCi) is a very conservative estimate and is based upon an NRC estimate (NRC, 1994a) for a 1.5 million SWU plant that LES has doubled for the 3 million SWU NEF.

Nonradioactive gaseous effluents include hydrogen fluoride (HF), ethanol and methylene chloride. HF releases are estimated to be about 1.0 kg (2.2 lbs) each year. Approximately 40 L (10.6 gal) and 610 L (161 gal) of ethanol and methylene chloride, respectively, are estimated to be released each year. Two natural gas-fired boilers (one in operation, one spare) will be used to provide hot water for the plant heating system. These boilers will be located in the Central Utilities Building (CUB). Emission data provided by the vendor for the boilers indicate that they will not emit more than 90,700 kg (100 tons) per year of any regulated air pollutant. At 100% power, each boiler will emit 499 kg (0.55 tons) per year of Carbon Monoxide (CO), 5,008 kg (5.52 tons) per year of Nitrogen Oxides (NOx) and 798 kg (0.88 tons) per year of volatile organic compounds (VOC). The boilers will not require an air quality permit from the State of New Mexico (AQB, 2004)

In addition, there will be two diesel generators onsite for use as emergency power sources. However, the use of these diesel generators will be administratively controlled (i.e., only run a limited number of hours per year) and are exempt from air permitting requirements of the State of New Mexico.

Other smaller standby diesel generators may also be used to provide backup power to some specific systems. The number and size of these other diesel generators are not defined at this time.

4.6.2.2 Description of Gaseous Effluent Vent System

The principal function of the gaseous effluent vent system (GEVS) is to protect both the operator during the connection/disconnection of uranium hexafluoride (UF_6) process equipment, and the environment, by collecting and cleaning all potentially hazardous gases from the plant prior to release to the atmosphere. Releases to the atmosphere will be in compliance with regulatory limits.

The stream of air and water vapor drawn into the GEVS can have suspended within it uranium hexafluoride (UF_6), hydrogen fluoride (HF), oil and uranium particulates (mainly UO_2F_2). Online instrument measurements will provide a continuous indication to the operator of the quantity of radioactive material and HF in the emission stream. This will enable rapid corrective action to be taken in the event of any deviation from the normal operating conditions.

There are two Gaseous Effluent Vent Systems for the plant: (1) the Separations Building Gaseous Effluent Vent System and (2) the Technical Services Building (TSB) Gaseous Effluent Vent System. In addition, the Centrifuge Test and Post Mortem Facilities have an exhaust filtration system that serves the same purpose as the GEVS. The Technical Services Building (TSB) heating, ventilation and air conditioning (HVAC) system performs a confinement ventilation function for potentially contaminated areas in the TSB.

The Separations Building GEVS sub-atmospheric duct system transports potentially contaminated gases to a set of redundant filters (pre-filter, high efficiency particulate air filter, potassium carbonate impregnated activated charcoal filter) and fans. The cleaned gases are discharged via rooftop stacks to the atmosphere. The fan will maintain an almost constant sub-atmospheric pressure in front of the filter section by means of a differential pressure controller.

The TSB GEVS is the same as the Separations Building GEVS except that it has one set of filters and a single fan. The GEVS and TSB HVAC exhaust points are on the roof of the TSB. The Centrifuge Test and Post Mortem Exhaust Filtration System Consists of a filter and fan with the exhausts point on the roof of the Centrifuge Assembly Building (CAB). LBDCR-07-0022

Instrumentation is provided to detect and signal via alarm all non-routine process conditions so that the process can be returned to normal by local operator actions. Trip actions from the same instrumentation automatically put the system into a safe condition.

4.6.2.3 Calculation of Atmospheric Dispersion and Deposition Factors

NUREG-1748 requires that atmospheric dispersion factors (X/Q's) be used to assess the environmental effects of normal plant operations and facility accidents. In the absence of onsite meteorological data, the analysis may be conducted using data from 5-year NWS summaries, provided applicability of these data to the proposed site is established. The X/Q's have been calculated using meteorological data from Midland-Odessa, Texas (1987 to 1991) and the XOQDOQ dispersion computer program listed in NUREG/CR-2919. Use of the Midland-Odessa data for predicting the dispersion of gaseous effluents was deemed appropriate. Midland-Odessa, Texas is the closest first-order NWS station to the NEF site and both Midland-Odessa and the NEF site have similar climates. A first-order weather data source is one that is a major weather station staffed by NWS personnel.

The Nuclear Regulatory Commission (NRC) computer program XOQDOQ is intended to provide estimates of atmospheric transport and dispersion of gaseous effluents in routine releases from nuclear facilities. XOQDOQ implements NRC Regulatory Guide 1.111 and has been used by the NRC staff in their independent meteorological evaluation of routine airborne radionuclide releases. LBDCR-07-0022

XOQDOQ is based on the theory that material released to the atmosphere will be normally distributed (Gaussian distribution) about the plume centerline. In predicting concentrations for longer time periods, the horizontal plume distribution is assumed to be evenly distributed within the directional sector, the so-called sector average model. A straight-line trajectory is assumed between the point of release and all receptors.

The meteorological data used were discussed in ER Section 3.6. XOQDOQ requires the meteorological data to be in the form of a joint frequency distribution (either number of hours or percent). The Midland-Odessa, Texas data, obtained from the EPA Support Center for Regulatory Air Models, were converted into joint frequency distributions.

The EPA computer program STAR (STability ARray) was used to produce joint frequency distributions. The STAR program processes NWS meteorological data to generate joint frequencies of six wind speeds, sixteen wind directions, and six stability categories (Pasquill – Gifford stability classes A through F) for the station and time period provided as input, one year at a time.

Distances to the site boundary were determined using guidance from NRC Regulatory Guide 1.145 (NRC, 1982b). The distance to the nearest resident was determined using global positioning system (GPS) measurements.

Annual average atmospheric dispersion and deposition factors for the site boundary, nearest resident, and nearest business and school are presented in Table 4.6-3A, Annual Average Atmospheric Dispersion and Deposition Factors from NWS (1987 to 1991) Data. The highest site boundary χ/Q was 1.0×10^{-5} s/m^3 at a distance of 17 km (1,368 ft) in the south sector. The nearest resident χ/Q was 2.0×10^{-7} s/m^3 at a distance of 4.3 km (2.63 mi) in the west sector. Tables 4.6-3B through 4.6-3D present atmospheric dispersion and deposition factors out to 80 km (50 mi).

4.6.3 Visibility Impacts

Visibility impacts from construction will be limited to fugitive dust emissions. Fugitive dust will originate predominantly from vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing, and to a lesser extent from wind erosion. The only potential visibility impacts from operation of the NEF is from the cooling towers. The cooling towers that NEF will use at the site combine adiabatic and evaporative heat transfer processes to significantly reduce visible plumes. Therefore, LES has concluded that any visibility impacts from cooling tower plumes will be minimal. Visibility impacts from decommissioning will be limited to fugitive dust. Fugitive dust will originate predominately from building demolition bulldozing, and vehicle traffic on unpaved surfaces.

4.6.4 Air Quality Impacts from Decommissioning

Air quality impacts will occur during decommissioning work, such as fugitive dust, vehicle exhaust, portable generator exhaust, air compressor exhaust, cutting torch fumes, and solvent fumes. Decommissioning emission types, source locations, and emission quantities are presented in Table 4.6-8, Decommissioning Emission Types. Fugitive dust and vehicle exhaust during decommissioning are assumed to be bounded by the emissions during construction.

4.6.5 Mitigative Measures for Air Quality Impacts

Air concentrations of the Criteria Pollutants for vehicle emissions and fugitive dust will be below the NAAQS and thus will not require mitigative measures. Visibility impacts from fugitive dust emissions will be minimized by watering of the site, during the construction phase to suppress dust emissions. Water conservation will be considered when deciding how often dust suppression sprays will be applied.

Mitigative measures for all credible accident scenarios considered in the Safety Analysis Report (SAR) are summarized in ER Section 4.12, Public and Occupational Health Impacts and ER Chapter 5, Mitigation Measures.

Mitigation measures will be in place to minimize potential impact on air quality. These include the following items:

- The TSB and Separations Building Gaseous Effluent Vent Systems (GEVS) are designed to collect and clean all potentially hazardous gases from the plant prior to release into the atmosphere. Instrumentation is provided to detect and signal via alarm, all non-routine process conditions, including the presence of radionuclides or hydrogen fluoride in the exhaust stream that will trip the system to a safe condition, in the event of effluent detection beyond routine operational limits.
- The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is designed to collect and clean all potentially hazardous gases from the serviced areas in the CAB prior to release into the atmosphere. Instrumentation is provided to detect and signal the Control Room via alarm, all non-routine process conditions, including the presence of radionuclides or hydrogen fluoride in the exhaust stream. Operators will then take appropriate actions to mitigate the release.
- Construction BMPs will be applied as described previously to minimize fugitive dusts.
- Air concentrations of the criteria pollutants for vehicle emissions and fugitive dust will be below the National Ambient Air Quality Standards (NAAQS) and thus will not require further mitigation measures.

Waste Control Specialists (WCS) produces Total Suspended Particulate (TSP) emissions during the process of treating hazardous waste contaminated soils. Therefore, the only potential air quality cumulative effect is increases in TSP from combined emissions from the WCS and construction activities at the NEF. This potential cumulative effect (impact) will be transitioning and limited to the construction period.

The only potential air quality cumulative effect is increases in the Total Suspended Particulate (TSP) from combined emissions from the Waste Control Specialists (WCS) and construction activities at the NEF. This potential cumulative effect (impact) will be transitory and limited to the construction period.

4.6.6 Comparative Air Quality Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The air quality impact would be greater because of continued GDP operation and the associated electric generation needs.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The air quality impact would be greater in the short term because of continued GDP operation and associated electric generation needs while the centrifuge capability is increased. Air quality impact would be the same or greater in the long term once GDP operation is terminated.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The air quality impact for continued operation of the GDP would be significantly greater since a significant amount of additional energy is required to operate the GDP at the increased capacity.

4.6.7 Section 4.6 Tables

Table 4.6-1 Peak Emission Rates

Pollutant	Total Work-Day Average Emissions g/s (lbs/hr)
VEHICLE EMISSIONS:	
Hydrocarbons	0.58 (4.6)
Carbon Monoxide	3.70 (29.4)
Nitrogen Oxides	7.53 (59.8)
Sulfur Oxides	0.76 (6.0)
Particulates	0.54 (4.3)
FUGITIVE EMISSIONS:	
Particulates	2.4 (19.1)

Table 4.6-2 Predicted Property-Boundary Air Concentrations And Applicable NAAQS

	Maximum 1-Hr Average (µg/m³)		Maximum 3-Hr Average (µg/m³)		Maximum 8-Hr Average (µg/m³)		Maximum 24-Hr Average (µg/m³)		2nd Highest 24-Hr Average (µg/m³)		Maximum Annual Average (µg/m³)	
Pollutant	**Predicted**	**NAAQS**	**Predicted**	**NAAQS**	**Predicted**	**NAAQS**	**Predicted**	**NAAQS**	**Predicted**	**NAAQS**	**Predicted**	**NAAQS**
VEHICLE EMISSIONS												
Hydrocarbons	635.3	NA	238.9	NA	84.5	NA	36.9	NA	18.8	NA	2.9	NA
Carbon Monoxide	4,036.5	40,000	1,518.1	NA	537.0	10,000	234.4	NA	119.6	NA	18.5	NA
Nitrogen Oxides	8,204.2	NA	3,085.5	NA	1,091.5	NA	476.5	NA	243.1	NA	37.6	100
Sulfur Oxides	822.9	NA	309.5	1,310(a)	109.5	NA	47.8	365	24.4	NA	3.8	80
Particulates	591.8	NA	222.6	NA	78.7	NA	34.4	NA	17.5	150	2.7	50
FUGITIVE DUST												
Particulates	2,615.8		983.8		348.0		151.9		77.5	150	12.0	50

(a) Secondary standard

Table 4.6-3A Annual Average Atmospheric Dispersion And Deposition Factors From NWS (1987-1991) Data

Release ID	Type of Location	Direction From Site	Distance (Miles)	Distance (Meters)	X/Q (SEC/CUB.METER) No Decay Undepleted	X/Q (SEC/CUB.METER) No Decay Depleted	D/Q (PER SQ. METER)
B	TSB to SB (m)	S	.26	417.	1.0E-05	9.6E-06	3.1E-08
B	TSB to SB (m)	SSW	.26	417.	5.2E-06	4.9E-06	2.2E-08
B	TSB to SB (m)	SW	.26	422.	5.4E-06	5.1E-06	2.6E-08
B	TSB to SB (m)	WSW	.31	503.	3.8E-06	3.6E-06	2.0E-08
B	TSB to SB (m)	W	.48	769.	3.0E-06	2.8E-06	1.3E-08
B	TSB to SB (m)	WNW	.67	1071.	1.5E-06	1.3E-06	6.8E-09
B	TSB to SB (m)	NW	.62	1072.	2.2E-06	1.9E-06	9.2E-09
B	TSB to SB (m)	NNW	.62	995.	3.8E-06	3.4E-06	1.5E-08
B	TSB to SB (m)	N	.47	995.	5.6E-06	5.0E-06	2.8E-08
B	TSB to SB (m)	NNE	.36	754.	4.3E-06	4.0E-06	1.6E-08
B	TSB to SB (m)	NE	.34	581.	4.0E-06	3.7E-06	1.8E-08
B	TSB to SB (m)	ENE	.34	540.	4.3E-06	4.0E-06	1.7E-08
B	TSB to SB (m)	E	.34	540.	4.6E-06	4.3E-06	1.6E-08
B	TSB to SB (m)	ESE	.30	540.	3.8E-06	3.5E-06	8.9E-09
B	TSB to SB (m)	SE	.26	487.	5.2E-06	4.8E-06	1.2E-08
B	TSB to SB (m)	SSE	2.63	417.	6.8E-06	6.4E-06	1.7E-08
B	NRESTRES	W	6.87	4232.	2.0E-07	1.6E-07	7.2E-10
B	NRESTRES	ESE	1.16	11063.	3.6E-08	2.5E-08	5.0E-11

Table 4.6-3A Annual Average Atmospheric Dispersion And Deposition Factors From NWS (1987-1991) Data

Release ID	Type of Location	Direction From Site	Distance (Miles)	Distance (Meters)	X/Q (SEC/CUB.METER) No Decay Undepleted	X/Q (SEC/CUB.METER) No Decay Depleted	D/Q (PER SQ. METER)
B	BUSINESS	NNW		1871.	1.3E-06	1.1E-06	5.2E-09
B	BUSINESS	NNW	1.06	1712.	1.5E-06	1.3E-06	6.0E-09
B	BUSINESS	NE	2.72	4377.	1.6E-07	1.2E-07	5.9E-10
B	BUSINESS	ENE	.94	1520.	7.5E-07	6.6E-07	3.2E-09
B	BUSINESS	SE	.57	925.	1.8E-06	1.6E-06	4.2E-09
B	SCHOOL	W	4.91	7895.	7.9E-08	5.9E-08	2.4E-10
B	CHURCH	W	4.41	7090.	9.2E-08	7.0E-08	2.9E-10
B	CAB to SB (m)	S	.44	707.	4.3E-06	4.0E-06	1.4E-08
B	CAB to SB (m)	SSW	.44	707.	2.2E-06	2.0E-06	9.6E-09
B	CAB to SB (m)	SW	.44	714.	2.3E-06	2.1E-06	1.2E-08
B	CAB to SB (m)	WSW	.53	853.	1.6E-06	1.4E-06	8.7E-09
B	CAB to SB (m)	W	.69	1114.	1.6E-06	1.5E-06	7.2E-09
B	CAB to SB (m)	WNW	.62	996.	1.7E-06	1.5E-06	7.6E-09
B	CAB to SB (m)	NW	.48	768.	3.8E-06	3.5E-06	1.6E-08
B	CAB to SB (m)	NNW	.44	713.	6.6E-06	6.0E-06	2.6E-08
B	CAB to SB (m)	N	.44	713.	9.8E-06	9.0E-06	4.8E-08
B	CAB to SB (m)	NNE	.43	694.	5.0E-06	4.6E-06	1.8E-08
B	CAB to SB (m)	NE	.33	534.	4.6E-06	4.3E-06	2.0E-08

Table 4.6-3A Annual Average Atmospheric Dispersion And Deposition Factors From NWS (1987-1991) Data

Release ID	Type of Location	Direction From Site	Distance (Miles)	Distance (Meters)	X/Q (SEC/CUB.METER) No Decay Undepleted	X/Q (SEC/CUB.METER) No Decay Depleted	D/Q (PER SQ. METER)
B	CAB to SB (m)	ENE	.31	496.	4.9E-06	4.6E-06	2.0E-08
B	CAB to SB (m)	E	.31	496.	5.2E-06	4.9E-06	1.9E-08
B	CAB to SB (m)	ESE	.31	496.	4.3E-06	4.0E-06	1.0E-08
B	CAB to SB (m)	SE	.34	540.	4.4E-06	4.1E-06	9.9E-09
B	CAB to SB (m)	SSE	.44	707.	2.9E-06	2.7E-06	7.3E-09

NOTES:

TSB = Technical Services Building

SB = Site Boundary

NRESTRES = Nearest Resident

BUSINESS = Nearest Business

CAB = Centrifuge Assembly Building

Table 4.6-3B Annual Average Atomospheric Dispersion and Deposition Factors From NWS (1987-1991) Data

No Decay, Undepleted

Annual Average CHI/Q (SEC/METER CUBED) | Distance in Miles from the Site

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	1.080E-05	3.494E-06	1.757E-06	1.095E-06	5.772E-07	3.720E-07	2.665E-07	2.037E-07	1.628E-07	1.342E-07	1.134E-07
SSW	5.492E-06	1.739E-06	8.701E-07	5.404E-07	2.829E-07	1.812E-07	1.291E-07	9.821E-08	7.813E-08	6.420E-08	5.405E-08
SW	5.821E-06	1.840E-06	9.207E-07	5.714E-07	2.986E-07	1.909E-07	1.358E-07	1.032E-07	8.201E-08	6.731E-08	5.662E-08
WSW	5.537E-06	1.743E-06	8.720E-07	5.410E-07	2.826E-07	1.806E-07	1.285E-07	9.758E-08	7.753E-08	6.362E-08	5.351E-08
W	8.833E-06	2.822E-06	1.417E-06	8.810E-07	4.626E-07	2.971E-07	2.121E-07	1.617E-07	1.289E-07	1.060E-07	8.939E-08
WNW	7.700E-06	2.447E-06	1.227E-06	7.619E-07	3.992E-07	2.559E-07	1.825E-07	1.389E-07	1.106E-07	9.095E-08	7.662E-08
NW	1.088E-05	3.501E-06	1.761E-06	1.097E-06	5.772E-07	3.714E-07	2.656E-07	2.028E-07	1.618E-07	1.333E-07	1.125E-07
NNW	1.661E-05	5.372E-06	2.704E-06	1.685E-06	8.882E-07	5.722E-07	4.096E-07	3.130E-07	2.499E-07	2.060E-07	1.739E-07
N	2.491E-05	7.979E-06	4.008E-06	2.493E-06	1.309E-06	8.407E-07	6.003E-07	4.577E-07	3.648E-07	3.002E-07	2.531E-07
NNE	1.206E-05	3.898E-06	1.960E-06	1.221E-06	6.431E-07	4.143E-07	2.967E-07	2.267E-07	1.811E-07	1.493E-07	1.261E-07
NE	7.304E-06	2.342E-06	1.175E-06	7.304E-07	3.834E-07	2.463E-07	1.759E-07	1.342E-07	1.070E-07	8.808E-08	7.429E-08
ENE	6.847E-06	2.202E-06	1.105E-06	6.877E-07	3.616E-07	2.325E-07	1.663E-07	1.269E-07	1.013E-07	8.343E-08	7.041E-08
E	7.321E-06	2.364E-06	1.188E-06	7.398E-07	3.895E-07	2.508E-07	1.795E-07	1.371E-07	1.095E-07	9.024E-08	7.620E-08
ESE	5.981E-06	1.952E-06	9.832E-07	6.135E-07	3.243E-07	2.095E-07	1.504E-07	1.151E-07	9.212E-08	7.607E-08	6.433E-08
SE	6.962E-06	2.274E-06	1.146E-06	7.149E-07	3.781E-07	2.445E-07	1.756E-07	1.345E-07	1.077E-07	8.894E-08	7.524E-08
SSE	7.142E-06	2.330E-06	1.174E-06	7.328E-07	3.874E-07	2.503E-07	1.796E-07	1.375E-07	1.100E-07	9.085E-08	7.682E-08

Table 4.6-3B Annual Average Atmospheric Dispersion and Depostition Factors from NWS (1987-1991) Data (continued)

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	9.760E-08	5.527E-08	3.716E-08	2.142E-08	1.458E-08	1.084E-08	8.524E-09	6.962E-09	5.847E-09	5.014E-09	4.373E-09
SSW	4.639E-08	2.599E-08	1.734E-08	9.888E-09	6.683E-09	4.944E-09	3.871E-09	3.150E-09	2.638E-09	2.256E-09	1.963E-09
SW	4.857E-08	2.713E-08	1.806E-08	1.027E-08	6.926E-09	5.116E-09	4.001E-09	3.254E-09	2.722E-09	2.327E-09	2.023E-09
WSW	4.589E-08	2.562E-08	1.704E-08	9.679E-09	6.521E-09	4.813E-09	3.761E-09	3.056E-09	2.555E-09	2.183E-09	1.897E-09
W	7.682E-08	4.321E-08	2.890E-08	1.654E-08	1.120E-08	8.299E-09	6.505E-09	5.299E-09	4.441E-09	3.801E-09	3.309E-09
WNW	6.580E-08	3.694E-08	2.468E-08	1.410E-08	9.539E-09	7.063E-09	5.533E-09	4.506E-09	3.774E-09	3.230E-09	2.811E-09
NW	9.674E-08	5.457E-08	3.658E-08	2.099E-08	1.424E-08	1.056E-08	8.287E-09	6.756E-09	5.665E-09	4.852E-09	4.226E-09
NNW	1.496E-07	8.456E-08	5.675E-08	3.262E-08	2.216E-08	1.645E-08	1.292E-08	1.054E-08	8.842E-09	7.577E-09	6.602E-09
N	2.175E-07	1.223E-07	8.183E-08	4.684E-08	3.174E-08	2.352E-08	1.844E-08	1.503E-08	1.260E-08	1.078E-08	9.389E-09
NNE	1.085E-07	6.142E-08	4.127E-08	2.377E-08	1.618E-08	1.204E-08	9.464E-09	7.731E-09	6.492E-09	5.568E-09	4.855E-09
NE	6.388E-08	3.602E-08	2.414E-08	1.386E-08	9.421E-09	6.999E-09	5.498E-09	4.487E-09	3.766E-09	3.228E-09	2.813E-09
ENE	6.057E-08	3.422E-08	2.296E-08	1.321E-08	8.984E-09	6.678E-09	5.249E-09	4.286E-09	3.598E-09	3.085E-09	2.690E-09
E	6.558E-08	3.711E-08	2.494E-08	1.436E-08	9.775E-09	7.270E-09	5.716E-09	4.669E-09	3.920E-09	3.362E-09	2.932E-09
ESE	5.544E-08	3.152E-08	2.126E-08	1.230E-08	8.394E-09	6.255E-09	4.926E-09	4.029E-09	3.388E-09	2.908E-09	2.538E-09
SE	6.486E-08	3.694E-08	2.494E-08	1.445E-08	9.872E-09	7.363E-09	5.802E-09	4.748E-09	3.993E-09	3.429E-09	2.994E-09
SSE	6.620E-08	3.763E-08	2.537E-08	1.467E-08	9.999E-09	7.446E-09	5.860E-09	4.791E-09	4.026E-09	3.455E-09	3.014E-09

Table 4.6-3C Annual Average Atmospheric Dispersion And Depostion Factors From NWS (1987-1991) Data

Decay, Depleted

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

Sector	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	1.022E-05	3.190E-06	1.566E-06	9.583E-07	4.902E-07	3.081E-07	2.159E-07	1.618E-07	1.270E-07	1.030E-07	8.572E-08
SSW	5.198E-06	1.588E-06	7.754E-07	4.730E-07	2.403E-07	1.500E-07	1.046E-07	7.801E-08	6.097E-08	4.928E-08	4.086E-08
SW	5.509E-06	1.680E-06	8.205E-07	5.002E-07	2.536E-07	1.581E-07	1.100E-07	8.196E-08	6.399E-08	5.167E-08	4.281E-08
WSW	5.240E-06	1.592E-06	7.770E-07	4.735E-07	2.400E-07	1.496E-07	1.040E-07	7.751E-08	6.050E-08	4.884E-08	4.046E-08
W	8.359E-06	2.577E-06	1.262E-06	7.712E-07	3.929E-07	2.460E-07	1.718E-07	1.284E-07	1.006E-07	8.140E-08	6.759E-08
WNW	7.288E-06	2.235E-06	1.093E-06	6.670E-07	3.390E-07	2.119E-07	1.478E-07	1.104E-07	8.632E-08	6.982E-08	5.793E-08
NW	1.029E-05	3.197E-06	1.570E-06	9.600E-07	4.902E-07	3.075E-07	2.152E-07	1.611E-07	1.263E-07	1.023E-07	8.504E-08
NNW	1.572E-05	4.905E-06	2.410E-06	1.475E-06	7.543E-07	4.738E-07	3.318E-07	2.486E-07	1.950E-07	1.581E-07	1.315E-07
N	2.357E-05	7.286E-06	3.571E-06	2.182E-06	1.112E-06	6.961E-07	4.863E-07	3.636E-07	2.846E-07	2.304E-07	1.914E-07
NNE	1.141E-05	3.559E-06	1.747E-06	1.069E-06	5.462E-07	3.431E-07	2.403E-07	1.801E-07	1.413E-07	1.146E-07	9.534E-08
NE	6.913E-06	2.138E-06	1.047E-06	6.394E-07	3.256E-07	2.039E-07	1.425E-07	1.066E-07	8.349E-08	6.762E-08	5.617E-08
ENE	6.480E-06	2.011E-06	9.851E-07	6.020E-07	3.071E-07	1.926E-07	1.347E-07	1.008E-07	7.903E-08	6.405E-08	5.324E-08
E	6.929E-06	2.159E-06	1.059E-06	6.476E-07	3.308E-07	2.077E-07	1.454E-07	1.089E-07	8.543E-08	6.927E-08	5.761E-08
ESE	5.660E-06	1.783E-06	8.762E-07	5.371E-07	2.754E-07	1.735E-07	1.218E-07	9.146E-08	7.188E-08	5.839E-08	4.864E-08
SE	6.589E-06	2.077E-06	1.021E-06	6.258E-07	3.211E-07	2.024E-07	1.422E-07	1.068E-07	8.401E-08	6.827E-08	5.689E-08
SSE	6.759E-06	2.128E-06	1.046E-06	6.415E-07	3.290E-07	2.072E-07	1.455E-07	1.092E-07	8.586E-08	6.974E-08	5.809E-08

Table 4.6-3C Annual Average Atmospheric Disprsion And Deposition Factors from NWS (1987-1991) Date (continued)

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	7.275E-08	3.897E-08	2.496E-08	1.332E-08	8.512E-09	5.999E-09	4.496E-09	3.515E-09	2.835E-09	2.342E-09	1.971E-09
SSW	3.458E-08	1.832E-08	1.165E-08	6.149E-09	3.903E-09	2.736E-09	2.041E-09	1.591E-09	1.279E-09	1.054E-09	8.847E-10
SW	3.620E-08	1.912E-08	1.213E-08	6.383E-09	4.045E-09	2.831E-09	2.110E-09	1.643E-09	1.320E-09	1.087E-09	9.118E-10
WSW	3.421E-08	1.806E-08	1.145E-08	6.019E-09	3.809E-09	2.663E-09	1.984E-09	1.543E-09	1.239E-09	1.019E-09	8.549E-10
W	5.726E-08	3.046E-08	1.942E-08	1.028E-08	6.541E-09	4.592E-09	3.431E-09	2.676E-09	2.153E-09	1.775E-09	1.491E-09
WNW	4.905E-08	2.604E-08	1.658E-08	8.766E-09	5.571E-09	3.908E-09	2.918E-09	2.275E-09	1.830E-09	1.508E-09	1.267E-09
NW	7.211E-08	3.847E-08	2.457E-08	1.305E-08	8.315E-09	5.844E-09	4.371E-09	3.411E-09	2.747E-09	2.266E-09	1.904E-09
NNW	1.115E-07	5.961E-08	3.813E-08	2.029E-08	1.294E-08	9.104E-09	6.813E-09	5.321E-09	4.288E-09	3.538E-09	2.975E-09
N	1.621E-07	8.624E-08	5.498E-08	2.913E-08	1.853E-08	1.302E-08	9.727E-09	7.588E-09	6.108E-09	5.036E-09	4.231E-09
NNE	8.090E-08	4.330E-08	2.773E-08	1.478E-08	9.451E-09	6.661E-09	4.992E-09	3.903E-09	3.148E-09	2.600E-09	2.188E-09
NE	4.762E-08	2.539E-08	1.622E-08	8.621E-09	5.502E-09	3.873E-09	2.900E-09	2.266E-09	1.826E-09	1.507E-09	1.268E-09
ENE	4.515E-08	2.412E-08	1.543E-08	8.213E-09	5.247E-09	3.695E-09	2.768E-09	2.164E-09	1.745E-09	1.441E-09	1.212E-00
E	4.888E-08	2.616E-08	1.675E-08	8.932E-09	5.709E-09	4.023E-09	3.015E-09	2.357E-09	1.901E-09	1.570E-09	1.321E-09
ESE	4.132E-08	2.222E-08	1.428E-08	7.648E-09	4.902E-09	3.461E-09	2.598E-09	2.034E-09	1.643E-09	1.358E-09	1.144E-09
SE	4.835E-08	2.604E-08	1.675E-08	8.987E-09	5.766E-09	4.074E-09	3.060E-09	2.397E-09	1.936E-09	1.602E-09	1.349E-09
SSE	4.935E-08	2.653E-08	1.704E-08	9.120E-09	5.840E-09	4.120E-09	3.091E-09	2.419E-09	1.952E-09	1.613E-09	1.358E-09

Table 4.6-3D Annual Average Atmospheric Dispersion And Deposition Factors From NWS (1987-1991) Data

*************************** RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS ********************

DIRECTION FROM SITE	DISTANCES IN MILES										
	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	3.280E-08	1.109E-08	5.695E-09	3.497E-09	1.743E-09	1.057E-09	7.149E-10	5.180E-10	3.939E-10	3.103E-10	2.512E-10
SSW	2.303E-08	7.787E-09	3.998E-09	2.455E-09	1.224E-09	7.424E-10	5.019E-10	3.637E-10	2.766E-10	2.179E-10	1.764E-10
SW	2.839E-08	9.601E-09	4.930E-09	3.027E-09	1.509E-09	9.152E-10	6.188E-10	4.484E-10	3.410E-10	2.686E-10	2.175E-10
WSW	2.815E-08	9.519E-09	4.887E-09	3.001E-09	1.496E-09	9.074E-10	6.135E-10	4.446E-10	3.381E-10	2.663E-10	2.156E-10
W	3.633E-08	1.229E-08	6.309E-09	3.874E-09	1.931E-09	1.171E-09	7.919E-10	5.739E-10	4.364E-10	3.438E-10	2.783E-10
WNW	3.195E-08	1.080E-08	5.547E-09	3.406E-09	1.698E-09	1.030E-09	6.963E-10	5.046E-10	3.837E-10	3.023E-10	2.447E-10
NW	4.353E-08	1.472E-08	7.558E-09	4.641E-09	2.314E-09	1.403E-09	9.488E-10	6.875E-10	5.228E-10	4.119E-10	3.334E-10
NNW	6.280E-08	2.124E-08	1.090E-08	6.696E-09	3.338E-09	2.025E-09	1.369E-09	9.919E-10	7.542E-10	5.942E-10	4.810E-10
N	1.179E-07	3.985E-08	2.046E-08	1.256E-08	6.264E-09	3.799E-09	2.569E-09	1.861E-09	1.415E-09	1.115E-09	9.027E-10
NNE	4.254E-08	1.439E-08	7.387E-09	4.536E-09	2.261E-09	1.371E-09	9.273E-10	6.719E-10	5.109E-10	4.025E-10	3.259E-10
NE	3.160E-08	1.068E-08	5.486E-09	3.369E-09	1.679E-09	1.019E-09	6.887E-10	4.990E-10	3.795E-10	2.990E-10	2.420E-10
ENE	2.710E-08	9.165E-09	4.706E-09	2.889E-09	1.441E-09	8.737E-10	5.907E-10	4.280E-10	3.255E-10	2.564E-10	2.076E-10
E	2.580E-08	8.723E-09	4.479E-09	2.750E-09	1.371E-09	8.316E-10	5.622E-10	4.074E-10	3.098E-10	2.441E-10	1.976E-10
ESE	1.400E-08	4.733E-09	2.430E-09	1.492E-09	7.440E-10	4.512E-10	3.051E-10	2.211E-10	1.681E-10	1.324E-10	1.072E-10
SE	1.552E-08	5.248E-09	2.695E-09	1.655E-09	8.249E-10	5.003E-10	3.383E-10	2.451E-10	1.864E-10	1.468E-10	1.189E-10
SSE	1.761E-08	5.955E-09	3.058E-09	1.877E-09	9.360E-10	5.677E-10	3.838E-10	2.781E-10	2.115E-10	1.666E-10	1.349E-10

Table 4.6-3D Annual Average Atmspheric Dispersion And Deposition Factos From NWS (1987-1991) Data (Continued)

DIRECTION FROM SITE	DISTANCES IN MILES										
	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	2.078E-10	1.018E-10	6.390E-11	3.230E-11	1.955E-11	1.311E-11	9.391E-12	7.052E-12	5.483E-12	4.380E-12	3.575E-12
SSW	1.459E-10	7.150E-11	4.486E-11	2.268E-11	1.372E-11	9.202E-12	6.594E-12	4.951E-12	3.850E-12	3.075E-12	2.510E-12
SW	1.799E-10	8.815E-11	5.531E-11	2.796E-11	1.692E-11	1.135E-11	8.129E-12	6.104E-12	4.746E-12	3.791E-12	3.095E-12
WSW	1.783E-10	8.740E-11	5.484E-11	2.772E-11	1.678E-11	1.125E-11	8.060E-12	6.052E-12	4.706E-12	3.759E-12	3.068E-12
W	2.302E-10	1.128E-10	7.079E-11	3.578E-11	2.166E-11	1.452E-11	1.040E-11	7.812E-12	6.074E-12	4.852E-12	3.960E-12
WNW	2.024E-10	9.919E-11	6.224E-11	3.146E-11	1.904E-11	1.277E-11	9.148E-12	6.869E-12	5.341E-12	4.266E-12	3.482E-12
NW	2.758E-10	1.352E-10	8.481E-11	4.287E-11	2.595E-11	1.740E-11	1.246E-11	9.360E-12	7.277E-12	5.813E-12	4.745E-12
NNW	3.979E-10	1.950E-10	1.223E-10	6.184E-11	3.743E-11	2.510E-11	1.798E-11	1.350E-11	1.050E-11	8.386E-12	6.845E-12
N	7.467E-10	3.659E-10	2.296E-10	1.160E-10	7.024E-11	4.709E-11	3.374E-11	2.534E-11	1.970E-11	1.574E-11	1.285E-11
NNE	2.696E-10	1.321E-10	8.288E-11	4.189E-11	2.536E-11	1.700E-11	1.218E-11	9.147E-12	7.112E-12	5.681E-12	4.637E-12
NE	2.002E-10	9.811E-11	6.156E-11	3.111E-11	1.883E-11	1.263E-11	9.047E-12	6.794E-12	5.282E-12	4.219E-12	3.444E-12
ENE	1.717E-10	8.415E-11	5.280E-11	2.669E-11	1.615E-11	1.083E-11	7.760E-12	5.827E-12	4.531E-12	3.619E-12	2.954E-12
E	1.634E-10	8.009E-11	5.025E-11	2.540E-11	1.537E-11	1.031E-11	7.386E-12	5.546E-12	4.312E-12	3.445E-12	2.812E-12
ESE	8.869E-11	4.346E-11	2.727E-11	1.378E-11	8.342E-12	5.593E-12	4.008E-12	3.009E-12	2.340E-12	1.869E-12	1.526E-12
SE	9.834E-11	4.819E-11	3.024E-11	1.528E-11	9.250E-12	6.202E-12	4.444E-12	3.337E-12	2.595E-12	2.073E-12	1.692E-12
SSE	1.116E-10	5.468E-11	3.431E-11	1.734E-11	1.050E-11	7.037E-12	5.042E-12	3.786E-12	2.944E-12	2.352E-12	1.919E-12

Table 4.6-4 Construction Emission Types

Emission Type	Source Location	Quantity
Fugitive Dust	On site	2.4 g/s (19.1 lb/hr)
Vehicle Exhaust	On site	4,535 kg/yr (5 tons/yr)
Portable Generator Exhaust	NA[1]	NA[1]
Paint Fumes	On site buildings	NA[1]
Welding Torch Fumes	On site buildings	NA[1]
Solvent Fumes	NA[1]	NA[1]
Boiler Exhaust	Central Utilities Building	5,008 kg/yr (5.52 ton/yr) of NO_x, 499 kg/yr (0.55 ton/yr) of CO, 798 kg/yr (0.88 ton/yr) of VOC
Emergency Diesel Generator Exhaust	Central Utilities Building	100 kg/yr (0.11 ton/yr) of PM_{10}, 11,095 kg/yr (12.23 ton/yr) of NO_x, 853 kg/yr (0.94 ton/yr) of CO, 263 kg/yr (0.29 ton/yr) of VOC
Air Compressors	NA[1]	NA[1]

[1]Information is not available at this time.

Table 4.6-5 Offsite Vehicle Air Emissions During Construction

Estimated Vehicle Type	Emission Factor (g/mi)	Estimated Daily Number of Vehicles	Estimated Daily Mileage km (mi)	Daily Work Day Emissions (g)
NONMETHANE HYDROCARBONS				
Light Duty Vehicles (Gasoline)	1.2	800	64.4 (40)	38,400
Heavy Duty Truck (Diesel)	2.1	14	322 (200)	5,880
Total				44,280
Daily Emissions				**4.4E-02 metric tons (4.9E-02 tons)**
CARBON MONOXIDE				
Light Duty Vehicles (Gasoline)	4.6	800	64.4 (40)	147,200
Heavy Duty Truck (Diesel)	10.2	14	322 (200)	28,560
Total				175,760
Daily Emissions				**1.8E-01 metric tons (2.0E-01 tons)**
NITROGEN OXIDES				
Light Duty Vehicles (Gasoline)	0.7	800	64.4 (40)	22,400
Heavy Duty Truck (Diesel)	8.0	14	322 (200)	22,400
Total				44,800
Daily Emissions				**4.5E-02 metric tons (5.0E-02 tons)**

Table 4.6-6 Air Emissions During Operations

Boiler Exhaust	Central Utilities Building	5,008 kg/yr (5.52 ton/yr) of NO_x, 499 kg/yr (0.55 ton/yr) of CO, 798 kg/yr (0.88 ton/yr) of VOC
Emergency Diesel Generator Exhaust	Central Utilities Building	100 kg/yr (0.11 ton/yr) of PM_{10}, 11,095 kg/yr (12.23 ton/yr) of NO_x, 853 kg/yr (0.94 ton/yr) of CO, 263 kg/yr (0.29 ton/yr) of VOC

Table 4.6-7 Offsite Vehicle Air Emissions During Operations

Estimated Vehicle Type	Emission Factor (g/mi)	Estimated Daily Number of Vehicles	Estimated Daily Mileage km (mi)	Daily Work Day Emissions (g)
NONMETHANE HYDROCARBONS				
Light Duty Vehicles (Gasoline)	1.2	210	64.4 (40)	10,080
Heavy Duty Truck (Diesel)	2.1	18	805 (500)	18,900
Total				28,980
Daily Emissions				**2.9E-02 metric tons (3.2E-02 tons)**
CARBON MONOXIDE				
Light Duty Vehicles (Gasoline)	4.6	210	64.4 (40)	38,640
Heavy Duty Truck (Diesel)	10.2	18	805 (500)	91,800
Total				130,400
Daily Emissions				**1.3E-01 metric tons (1.4E-01 tons)**
NITROGEN OXIDES				
Light Duty Vehicles (Gasoline)	0.7	210	64.4 (40)	5,880
Heavy Duty Truck (Diesel)	8.0	18	805 (500)	72,000
Total				77,880
Daily Emissions				**7.8E-02 metric tons (8.6E-02 tons)**

Table 4.6-8 Decommissioning Emission Types

Emission Type[1]	Source Location	Quantity
Fugitive Dust	On site	2.4 g/s (19.1 lb/hr)
Vehicle Exhaust	On site	4,535 kg/yr (5 tons/yr)
Portable Generator Exhaust	NA[2]	NA[2]
Cutting Torch Fumes	On site buildings	NA[2]
Solvent Fumes	NA[2]	NA[2]
Boiler Exhaust	Central Utilities Building	5,008 kg/yr (5.52 ton/yr of NO_x, 499 kg/yr (0.55 ton/yr) of CO, 798 kg/yr (0.88 ton/yr) of VOC
Emergency Diesel Generator Exhaust	Central Utilities Building	100 kg/yr (0.11 ton/yr) of PM_{10}, 11,095 kg/yr (12.23 ton/yr) of NO_x, 853 kg/yr (0.94 ton/yr) of CO, 263 kg/yr (0.29 ton/yr) of VOC
Air Compressors	NA[2]	NA[2]

1 Fugitive dust and vehicle exhaust during decommissioning are assumed to be bounded by the emissions during construction.

2 Information is not available at this time.

4.7 NOISE IMPACTS

Noise is defined as "unwanted sound". At high levels noise can damage hearing, cause sleep deprivation, interfere with communication, and disrupt concentration. Even at low levels, noise can be a source of irritation, annoyance, and disturbance to people and communities when it significantly exceeds normal background sound levels. In the context of protecting the public health and welfare, noise implies adverse effects on people and the environment. A quantifiable demonstration of the range of noise levels and how they are subjectively perceived by humans is presented in Figure 3.7-2, Sound Level Range Examples.

4.7.1 Predicted Noise Levels

4.7.1.1 Construction Impacts

The construction of the NEF would require equipment for excavation, such as backhoes, front loaders, bulldozers, and dump trucks; materials-handling equipment, such as cement mixers and cranes; and compressors, generators, and pumps. Noise generated from this type of equipment would range from 87 to 99 dBA at approximately 9.1 m (30 ft) (Cowan, 1994), which would be equivalent of 57 to 69 dBA at approximately 305 m (1,000 ft). Most of the construction activities would occur during weekday, daylight hours; however, construction could occur during nights and weekends, if necessary. Large trucks would produce noise levels around 89 dBA at approximately 9.1 m (30 ft) (Cowan, 1994), which is equivalent of 77 dBA approximately 37m (120 ft).

As shown on Figures 1.2-4, NEF Buildings, and 6.1-2, Modified Site Features with Proposed Sampling Stations and Monitoring Locations, the nearest manmade structures to NEF boundaries, excluding the two driveways, are the Site Stormwater Detention Basin and the Visitor Center at the southeast corner of the site. The southern edge of the Site Stormwater Detention Basin is approximately 15.2 meters (50 feet) from the south perimeter fence and approximately 53.3 meters (175 feet) from New Mexico Highway 234. The eastern edge of the Visitor Center is approximately 68.6 meters (225 feet) from the east perimeter fence. As stated in ER Sections 3.7, Noise, and 4.7.5, Mitigation, considering that the sound pressure level from an outdoor noise source decreases 6 decibel units (dB) per doubling of distance, the highest noise levels are predicted to be within the range of 84 to 96 dBA at the south fence line during construction of the Site Stormwater Detention Basin and between 72 to 84 dBA at the east fence line when the Visitor Center is built. As shown in Table 3.7-2, U.S. Department of Housing and Urban Development Land Use Compatibility Guidelines, these predicted noise level ranges fall within unacceptable sound pressure levels as determined by the U.S. Department of Housing and Urban Development. ER Section 4.2.3, Traffic Pattern Impacts, states that New Mexico Highway 234 is a main trucking thoroughfare for local industry and ER Section 3.1, Land Use, states that a landfill is south/southeast of the NEF across New Mexico Highway 234 and that the adjacent property to the east of the NEF is vacant land. Therefore, there are no sensitive receptors at the NEF south and east boundaries. In addition, noise levels in the predicted ranges at the south and east fence lines would only be for a short duration and only during construction of the portions of both structures closest to the fences.

Noise levels generated during construction of the driveways would be comparable to traffic noise along the highway and would only be for a short period of time. Noise levels at other NEF boundaries during construction should be less since other construction activities will typically be further from the property lines.

The highest noise levels during construction are predicted to be within the range of 84 to 96 dBA at the south fence line during construction of the Site Stormwater Detention Basin and between 72 to 84 dBA at the east fence line when the Visitor Center is built. Noise levels in the predicted ranges at the south and east fence lines would only be for a short duration and only during construction of the portions of both structures closest to the fences. The south fence line is about 38.1 meters (125 feet) from New Mexico Highway 234 and the east fence line is adjacent to vacant land.

Since there is already substantial truck traffic using New Mexico Highway 234 and New Mexico Highway 18, the temporarily increased noise levels due to construction activities are not expected to adversely affect nearby residents. ER Section 4.2, Transportation Impacts, includes further discussion of vehicular traffic.

Due to the temporary and episodic nature of construction, and because of the significant distance to the nearest residence 4.3 km (2.63 mi), and since construction activities largely would be during weekday daylight hours, actual construction noise at the site is not expected to have a significant effect on nearby residents. Vehicle traffic will be the most noticeable cause of construction noise. Receptors located closest to the intersection of New Mexico Highway 18 and New Mexico Highway 234 will be the most aware of the increase in traffic due to proximity to the source.

4.7.1.2 Operational Impacts

The development of the NEF would generally increase noise levels, although the amount of the increase would depend on many factors, including the number of employees, and the amount of increased vehicular traffic. Vehicular traffic will be increased on New Mexico Highway 234 and New Mexico Highway 18 during operation, but due to the considerable truck traffic already present, noise levels should not increase significantly.

An operational noise survey was performed at the Almelo Enrichment Plant in Almelo, Netherlands, at the border of the site boundary during a 24-hour period. The noise results obtained during the survey ranged from 30 to 47 dBA, with an average of 39.7 dBA. The main sources of operational noise are from the cascade halls, the cooling fans, and the cooling towers. The Almelo Enrichment Plant design is comparable to the design of the NEF and sound level intensities outside both facilities are expected to vary no more than □4 dB based on the Almelo Enrichment Plant operating experience. The Almelo survey indicates that the majority of the noise sources were vehicle traffic from adjacent roadways, rather than operational noise from the plant itself. Sound contour maps for the Almelo facility are not available because they were not developed as part of the study. Furthermore, the contours would not be applicable to the NEF because the site building layouts are different. These results were expected and strongly suggest that NEF will be in complete compliance with the U.S. Department of Housing and Urban Development (HUD) guidelines and the Environmental Protection Agency (EPA) criteria (65 dBA and 55 dBA, respectively). Although the noise from the plant and the additional traffic would generally be noticeable, the operational noise from the plant is not expected to have significant impact on nearby residents (HUD-953-CPD; EPA 550/9). For this particular application (land use), the HUD guidelines are more appropriate since the NEF site is industrial with no nearby residents. LBDCR-07-0022

If the highest sound level reading (47 dBA) from the operational survey performed at the Almelo Enrichment Plant is used to calculate the effective exposure to the nearest residence located west of the NEF site at a distance of approximately 4.3 km (2.63 mi), the resultant sound level exposure would be below the perception of the human ear. This is because a source of 47 dBA over such a great distance will be dispersed in air and absorbed by natural landscape, vegetation, and buildings to the point of being masked by background ambient noise at the receptor. This is not meant to be a blanket statement to imply that residents will never be able to distinguish any operational noise emanating from the NEF. Certain phases of operation, weather, time of day, wind direction, traffic patterns, season, and the location of the receptor will all impact perceived operational noise levels. It should be noted that the Almelo survey data support previous assumptions that traffic noise will be the main noise contributor to nearby residences. Although the noise from the plant and the additional traffic would generally be noticeable, the operational noise from the plant is not expected to have a significant impact on nearby residents.

4.7.2 Noise Sources

Noise point sources for the plant during operation will include: cascade halls, boilers, coolers, rooftop fans, air conditioners, transformers, and traffic from delivery trucks, employee and site vehicles. Noise line sources for the plant during operation will consist only of site vehicular traffic entering and leaving the site. Ambient background noise sources in the area include vehicular traffic along New Mexico Highway 234, the concrete quarry to the north of the site, the landfill to the south of the site, the waste facility to the east of the site, train traffic along the tracks located on the north border, low flying aircraft traffic from Eunice Airport, birds, cattle and wind gusts.

4.7.3 Sound Level Standards

HUD guidelines, as detailed in Table 3.7-2, set the acceptable Day-Night Average Sound Level (Ldn) for areas of industrial, manufacturing, and utilities at 80 dBA as acceptable. Additionally, under these guidelines, construction and operation of the facility should not cause the Ldn at a nearby residence to exceed 65 dBA (HUD-953-CPD). The EPA has set a goal of 55 dBA for Ldn in outdoor spaces, as detailed in the EPA Levels Document (EPA 550/9). Background measurements and those performed at the Almelo facility were consistent with the guidance in American Society of Testing and Materials (ASTM) Standard Guide E-1686. As indicated in ER Section 4.7.1, Predicted Noise Levels, background noise levels, calculated construction noise levels, and operational noise levels should typically be well below both the HUD and EPA guidelines. Both the Eunice City Manager and Lea County Manager have informed LES that there are no city, county or New Mexico state ordinances or regulations governing environmental noise. Thus, the NEF site is not subject either to local or state noise regulation. Nonetheless, anticipated NEF noise levels are expected to typically be below the applicable HUD guidelines and EPA guidelines and are not expected to be harmful to the public's life and health, nor a disturbance of public peace and welfare.

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4.7.4 Potential Impacts to Sensitive Receptors

Potential impacts to local schools, churches, hospitals, and residences are not expected to be significant, as supported by the information presented in ER Section 4.7.1. The nearest home is located west of the site at a distance of approximately 4.3 km (2.63 mi) and due to its proximity is not expected to perceive an increase in noise levels due to operational noise levels. The nearest school, hospital, church and other sensitive noise receptors are beyond this distance, thereby allowing the noise to dissipate and be absorbed, helping decrease the sound levels even further. Homes located near the construction traffic at the intersection of New Mexico Highway 234 and New Mexico Highway 18 will be affected by the vehicle noise, but due to existing heavy tractor trailer vehicle traffic, the change should be minimal. No schools or hospitals are located at this intersection.

4.7.5 Mitigation

Mitigation of operational noise sources will occur primarily from the plant design, as cooling systems, valves, transformers, pumps, generators, and other facility equipment, will generally be located inside plant structures. The buildings themselves will absorb the majority of the noise generated within. Natural land contours, vegetation (such as scrub brush and trees), and site buildings and structures will mitigate noise from other equipment located outside of site structures. Distance from the noise source is also a key factor in the control of noise levels to area receptors. It is generally true that the sound pressure level from an outdoor noise source decreases 6 dB per doubling of distance (Cowan, 1994). Thus, a noise that measures 80 dB at 15.2 m (50 ft) away from the source will measure 74 dB at 30.5 m (100 ft), 68 dB at 61 m (200 ft), and 62 dB at 122 m (400 ft). Noise from construction activities will have the highest sound levels, occasionally peaking at 99 dBA at 9.1 m (30 ft) from the source, which would be equivalent to 69 dBA at 305 m (1,000 ft) (Cowan, 1994). As noted above, the nearest home is located west of the site at a distance of approximately 4.3 km (2.63 miles).However, heavy truck and earth moving equipment usage will be restricted after twilight and during early morning hours. All noise suppression systems on construction vehicles shall be kept in proper operation.

4.7.6 Cumulative Impacts

Cumulative impacts from all site noise sources should typically remain at or below HUD guidelines of 65 dBA Ldn and the EPA guidelines of 55 dBA Ldn (EPA 550/9) during NEF construction and operation. Residences closest to the site boundary will experience only minor impacts from construction noise, with the majority of the noise sources being from additional construction vehicle traffic. Since phases of construction include a variety of activities, there may be short-term occasions when higher noise levels will be present; examples include the use of backhoes and large generators.

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The level of noise anticipated offsite is comparable to noise levels near a busy road and less than noise levels found in most city neighborhoods. Expected noise levels will mostly affect a 1.6-km (1-mi) radius. The cumulative noise of all site activities should have a minor impact and only those receptors closest to the site boundary.

4.7.7 Comparative Noise Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The noise impact would be greater because of electric generation to support the GDP.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The noise impact would be greater in the short term due to operation of electric generation to support GDP and concentration in one location. In the long term, the noise impact would be the same or greater due to concentration of activity at a single location.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The noise impact for continued operation of the USEC GDP would be significantly greater because of increased electric energy demand to support increased GDP capacity.

4.8 HISTORIC AND CULTURAL RESOURCE IMPACTS

4.8.1 Direct Impacts

A pedestrian cultural resource survey of the 220-ha (543-acre) parcel of land where the NEF is to be located was conducted from September 10 through 12, 2003. Seven potential prehistoric archaeological sites (LA 140701 through LA 140707) were recorded during the survey of the study area; three of these (LA 140701, LA 140702, and LA 140705) are located in the Area of Potential Effect (APE). The APE consists of the site and area that includes the building(s) footprints and temporary lay-down areas. Two sites that are considered not to be eligible for the National Register of Historic Places (NRHP) (LA 140701 and LA 140702) will be impacted by the facility. Four of the recorded sites (LA 140704 through LA 140707) are considered potentially eligible to the NRHP. One potentially eligible archaeological site (LA 140705) will be affected by the proposed location of the access road to the facility. Based on surface findings, this site does contain the potential to contribute significant data to the prehistory of the region. The initial approach was that any potentially eligible archaeological site will either be avoided or a mitigation plan will be developed and implemented if required. (See ER Section 4.8.6, Minimizing Adverse Impacts on mitigative actions.)

Based on recommendation for the New Mexico State Historic Preservation Officer (SHPO) and standard practice, LES has not identified the locations of the seven potential prehistoric archaeological sites on a map so that the sites would not be disturbed by curiosity seekers or vandals.

The results of the survey were submitted to the New Mexico SHPO in March 2004. The SHPO review of the survey has resulted in their conclusion that all seven sites (LA 140701 through LA 140707) are eligible for listing on the NRHP. Three of these sites (LA 140701, LA 140702 and LA 140705) are within the proposed plant footprint. A treatment/mitigation plan is being developed by LES to recover any significant information from all sites.

4.8.2 Indirect Impacts

Based on the survey results and SHPO review as stated in ER Section 4.8.1, three eligible archaeological sites are known to exist within the APE of the proposed NEF. A treatment/mitigation plan is being developed by LES to recover any significant information from the seven eligible archaeological sites identified on the NEF site.

LES has no knowledge of any acts of vandalism on historical and cultural artifacts near the NEF site. LES provided the New Mexico SHPO with the survey report in March 2004 in lieu of providing the locations in the ER to further preclude potential for vandalism. (See ER Section 4.8.6 on mitigative actions.)

4.8.3 Agency Consultation

Consultation has been initiated with all appropriate state agencies and affected Native American Tribes. Letters of response are included in ER Appendix A.

4.8.4 Historic Preservation

The results of the survey were submitted to the New Mexico SHPO in March 2004 for a determination of eligibility. The SHPO review of the survey has resulted in their conclusion that all seven sites (LA 140701 through LA 140707) are eligible for listing on the NRHP. Three of these sites (LA 140701, LA 140702 and LA 140705) are within the proposed plant footprint. A treatment/mitigation plan is being developed by LES to recover any significant information from all sites. New Mexico's implementation of the Federal National Historic Preservation Act is contained in NMAC 4.10.2 (NMAC, 2001b). (See ER Section 4.8.6 on mitigative actions.)

4.8.5 Potential For Human Remains

There is low potential for human remains to be present on the NEF site. Based on previous work in the region, burials tend to occur in rockshelters and on sites with structures. Should an inadvertent discovery of such remains be made during construction, LES will stop construction activities immediately in the area of discovery and notify the New Mexico State Historic Preservation Officer (SHPO). The SHPO will determine the appropriate measures to identify, evaluate, and treat these discoveries. If the remains are potentially from Native American sites, LES will, in addition to the above actions, contact the Federal Agency that has primary management authority and the appropriate Native American tribe, if know or readily ascertainable. LES will also make reasonable effort to protect the items discovered before resuming the construction activities in the vicinity at the discovery. The construction activity will resume only after the appropriate consultations and notifications have occurred and guidance received.

4.8.6 Minimizing Adverse Impacts

Three eligible historic properties (LA 140701, LA 140702 and LA 140705) are located within the APE of the proposed location of the NEF. A treatment/mitigation plan is being developed by LES to recover any significant information from the seven eligible archaeological sites identified on the NEF site. Mitigation measures will be in place to minimize any potential impact on historical and cultural resources. In the event that any inadvertent discovery of human remains or other item of archeological significance is made during construction, the facility will cease construction activities immediately in the area of discovery and notify the New Mexico State Historic Preservation Officer to make the determination of appropriate measures to identify, evaluate and treat these discoveries.

Mitigation of the impact to eligible sites within the NEF project boundary can take a variety of forms. Avoidance and data collection are the two most common forms for sites considered eligible based on NRHP criterion (d), their data content, which is the basis for the eligibility of these particular sites (USC, 2003c). When possible, avoidance is the preferred alternative because the site is preserved in place and mitigation costs are minimized. When avoidance is not possible, data collection becomes the preferred alternative. Data collection proceeds after the sites have been determined eligible. A treatment plan is submitted to the appropriate regulatory agencies. The plan describes the expected data content of the sites and how data will be collected, analyzed, and reported. A treatment/mitigation plan is being developed by LES to recover any significant information from the seven eligible archaeological sites identified on the NEF site.

Options to deal with unexpected discoveries are defined. In the case of these sites, a phased approach may be appropriate. This type of approach would define a process of data recovery that begins with the recovery of the significant information present in the site features and the surface artifact assemblage combined with some level of subsurface exploration to identify the presence of other significant data to be present.

The next phase is predicated upon the results of the subsurface exploration. If other significant remains are located, additional excavation is used to extract this information. Generally, some maximum amount of excavation is specified and the additional excavation does not exceed that amount unless unexpected discoveries are made.

Alternatively, a testing phase can be inserted into the process prior to data collection. In this approach, a testing plan is prepared and submitted for regulatory review. Once approved, the site (in this case, either eligible or potentially eligible) testing plan is implemented. Recovered materials and spatial data are analyzed, and a testing report and treatment plan are prepared and submitted for regulatory review. Upon approval, the treatment plan is then implemented.

The recovered materials include artifacts and samples that include bone, charcoal, sediments, etc. Samples are usually submitted to outside analytical laboratories, these include radiocarbon dates. Artifacts, bones and perhaps some of the remaining samples are then curated. Curation is usually at the Museum of New Mexico. The museum charges a fee for curation in perpetuity.

Given the small number of potential archaeological sites and isolated occurrences located on the site, and LES's ability to avoid or mitigate impacts to those sites, the NEF project will not have a significant impact on historic and cultural resources.

4.8.7 Cumulative Impacts

Given the small number of archaeological sites located in the study area, there will be no cumulatively significant impacts to cultural resources.

4.8.8 Comparative Historical and Cultural Resource Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The historical and cultural impacts would be the same or less because of similar capacity of the new plant.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The historical and cultural impacts would be the same or less because only one plant site would be disturbed.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The historical and cultural impacts are less since no new facility is constructed.

4.9 VISUAL/SCENIC RESOURCES IMPACTS

4.9.1 Photos

Refer to ER Section 3.9.2, Site Photographs. As shown on the photographs, there are no existing structures on the NEF site.

4.9.2 Aesthetic and Scenic Quality Rating

The visual resource inventory process provides a means for determining visual values (BLM, 1984). The inventory consists of a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. Based on these three factors, lands are placed into one of four visual resource inventory classes. These inventory classes represent the relative value of the visual resources as follows: Classes I and II are considered to have the highest value, Class III represents a moderate value, and Class IV ranked is of least value. The inventory classes provide the basis for considering visual values in the resource management planning (RMP) process. Visual resource management classes are established through the RMP process. The NEF site, as evaluated based on the scenic quality of the site receives a "C" rating and falls into Class IV. Seismic quality is a measure of the visual appeal of a tract of land which is given an A, B or C rating (A-highest, C-lowest) based on the apparent scenic quality. Refer to ER Table 3.9-1, Scenic Quality Inventory and Evaluation Chart. This class is of the least value and allows for manipulation or disturbance. The proposed use of the NEF site is not outside the objectives for Class IV, which is to provide for management activities that require major modifications of the existing character of the landscape. Therefore, land management activities may dominate the view and be the major focus of viewer attention. The level of change to the characteristics of the landscape can be high (BLM,1984; BLM, 1986).

4.9.3 Significant Visual Impacts

Figure 4.9-1, Aerial View, is an artistic aerial view of the NEF and surrounding area. The quarry and "produced water" lagoons to the north, the existing Waste Control Specialists (WCS) waste facility to the east, the county landfill to the southeast and New Mexico Highway 234 to the south are shown in relation to the NEF site. Land to the west, occupied by a petroleum contaminated soil treatment facility, is undeveloped. Viewing the surrounding area from the NEF site, and looking northward, the quarry and "produced water" lagoons are at a higher elevation. To the east, several low-rise buildings associated with the WCS waste facility are apparent at a distance. Earthern mounds at the county landfill are apparent to the southeast, across New Mexico Highway 234. No structures are visible on the adjacent property to the west.

4.9.3.1 Physical Facilities Out Of Character With Existing Features

Given that the site is undeveloped, the proposed NEF is out of character with current, onsite conditions. However, considering the neighboring properties have been developed for industrial purposes (WCS facility, county landfill and quarry), the proposed plant structures are similar to existing, architectural features on surrounding land. Overall, the visual impact of the NEF will be minimal.

4.9.3.2 Structures Obstructing Existing Views

None of the proposed onsite structures will be taller than 40 m (131 ft). Due to the relative flatness of the site and vicinity, the structures will be observable from New Mexico Highway 234 and from nearby properties, partially obstructing views of existing landscape. However, considering that there are no high quality viewing areas (see ER Section 3.9.7, High Quality View Areas) and the many existing, manmade structures (pump jacks, high power lines, industrial buildings, above-ground tanks) near the NEF, the obstruction of existing views due to proposed structures will be comparable to current conditions. Refer to ER Figures 3.9-1A through 3.9-1H.)

4.9.3.3 Structures Creating Visual Intrusions

Although most proposed NEF structures will be set back a substantial distance from New Mexico Highway 234, due to the relative flatness of the area, taller plant structures will likely be visible from the highway and adjacent properties, creating a visual intrusion. However, considering the existing structures associated with neighboring industrial properties to the north, east and south (quarry, WCS facility and county landfill, respectively) the nearby utility poles along New Mexico Highway 234, the high power utility line to the east that runs parallel to the New Mexico/Texas state line, and the numerous pump jacks dotting the landscape to the north, south and west, the proposed onsite structures will be no more intrusive.

4.9.3.4 Structures Requiring The Removal Of Barriers, Screens Or Buffers

As noted in ER Section 3.9.1, Viewshed Boundaries, a series of small sand dunes on the western portion of the site provide natural screening from areas to the west. Except possibly for a section of the proposed, westernmost, access road, none of the onsite structures will require removal of natural barriers, screens or buffers. Any removal of natural barriers, screens or buffers associated with road construction will be minimized. Additionally natural landscape, using vegetation indigenous to the area, is planned to provide additional aesthetically pleasing screening measures.

4.9.3.5 Altered Historical, Archaeological Or Cultural Properties

Based on discussion with a county historian and as stated in ER Section 3.8, Historic and Cultural Resources, all cultural or archaeological sites that were found within the proposed NEF site can either be avoided or successfully mitigated, if required. The results of the LES surveys of the site were submitted to the New Mexico State Historic Preservation Officer (SHPO) in March 2004. The SHPO review of the survey has resulted in their conclusion that all seven sites (LA140701 through LA140707) are eligible for listing on the NRHP. A treatment/mitigation plan is being developed by LES to recover any significant information from all sites. As a result, no historical, archaeological or cultural properties will be affected by development of the NEF.

4.9.3.6 Structures That Create Visual, Audible Or Atmospheric Elements Out Of Character With The Site

Although the proposed onsite structures are out of character with the natural setting of the site, they are comparable to those existing on the surrounding industrial properties. None of the NEF structures or associated activities will typically produce significant noise levels audible from offsite (see ER Section 4.7.1, Predicted Noise Levels) or create significant atmospheric elements (such as a large emission plumes) visible from offsite.

4.9.4 Visual Compatibility And Compliance

As noted in ER Section 3.9.9, Regulatory Information, discussions were held between LES and the city of Eunice, New Mexico, and Lea County officials, to coordinate and discuss local area community planning issues. No local or county zoning, land use planning or associated review process requirements were identified. All applicable local ordinances and regulations will be followed during the construction and operation of the NEF. However, development of the site will meet federal and state requirements for nuclear and radioactive material sites regarding design, siting, construction materials, and monitoring.

4.9.5 Potential Mitigation Measures

Mitigation measures will be in place to minimize the impact to visual and scenic resources. These include the following items:

- The use of accepted natural, low-water consumption landscaping techniques to limit any potential visual impacts. These techniques will incorporate, but not be limited to, the use of landscape plantings. As for aesthetically pleasing screening measures, planned landscape plantings will include indigenous vegetation.
- Prompt re-vegetation or covering of bare areas will be used to mitigate visual impacts due to construction activities.

4.9.6 Cumulative Impacts To Visual/Scenic Quality

The cumulative impacts to the visual/scenic quality of the NEF site can be assessed by examining proposed actions associated with construction of the NEF and development of surrounding properties.

Proposed site development potentially impacting the visual/scenic quality of the NEF site includes:

- Several buildings surrounded by chain link fencing;
- Proposed power lines; and
- New access roads

Existing development on surrounding properties impacting the visual/scenic quality of the site and vicinity includes:

- A railroad spur;
- Industrial structures (buildings, aboveground tanks);
- Man-made earthen structures (industrial lagoons, stockpiled soil, landfill cavities);
- Dirt and gravel covered roadways;
- Power poles and a high-voltage utility line;
- Pump jacks; and
- Barbed wire fencing along property perimeters

By considering both proposed onsite and nearby existing developments, modification to the subject site will not add significantly to its visual degradation. Therefore, there will be little cumulative impact on the visual/scenic quality of the NEF site.

4.9.7 Comparative Visual/Scenic Resources Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The visual/scenic resources impact would be less because only one of two centrifuge plants would be built.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The visual/scenic resources impact would be the same or less because although only one plant is to be constructed, the capacity would be larger.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The visual/scenic resources impact would be less since no new facility is constructed.

4.9.8 Section 4.9 Figures

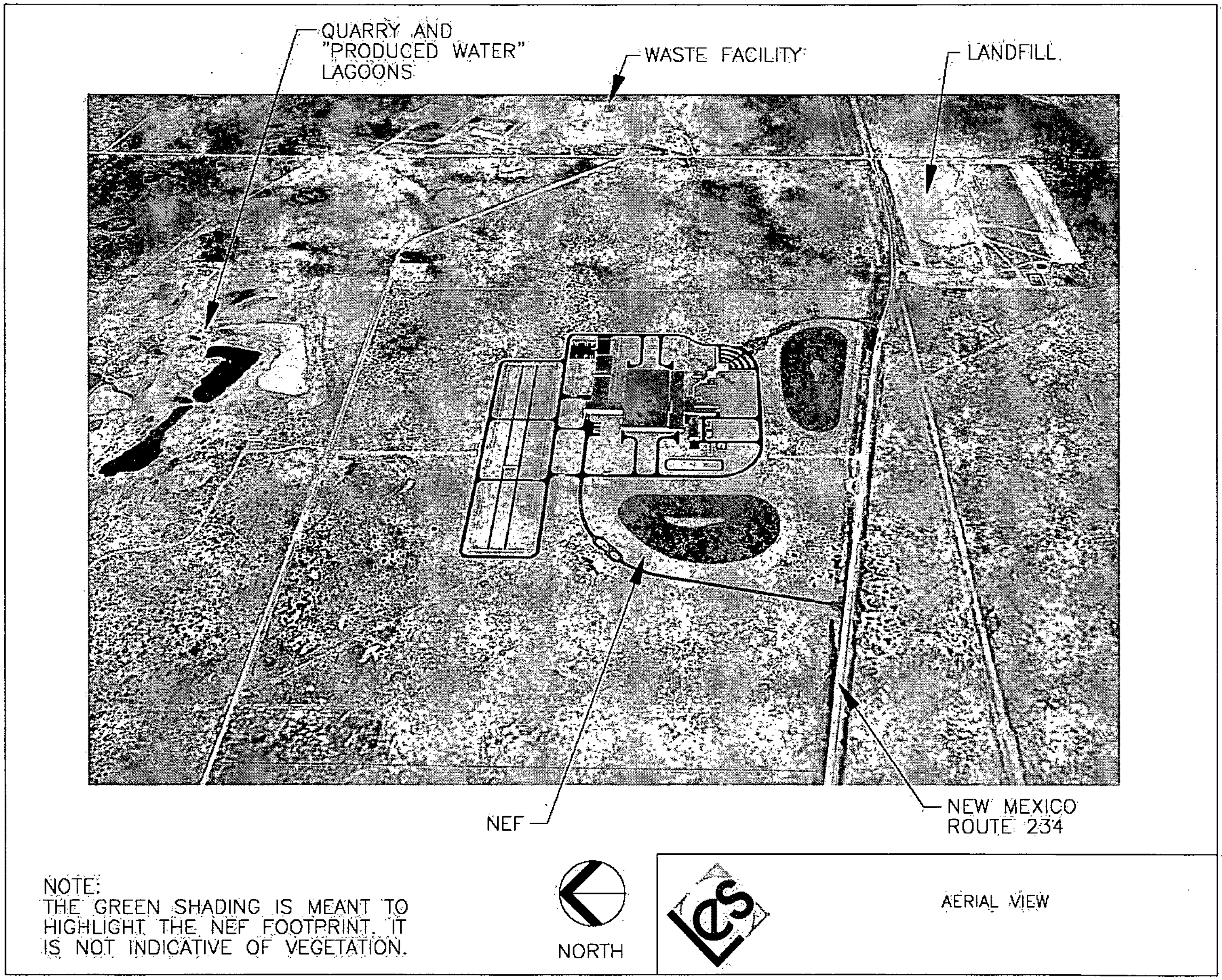

Figure 4.9-1 Aerial View

4.10 SOCIOECONOMIC IMPACTS

This section describes the socioeconomic impacts to the community surrounding the NEF, including the impacts from the influx of the construction and operation work force to schools and housing as well as on social services. Transportation impacts are described in ER Section 4.2, Transportation Impacts.

4.10.1 Facility Construction

4.10.1.1 Worker Population

Groundbreaking at the NEF site is scheduled for 2006, with construction continuing for eight years through 2013. Table 4.10-1, Estimated Number of Construction Workers by Annual Pay, lists the estimated average annual number of construction employees working on the NEF during construction and the estimated salary range. As shown in that table, a peak construction force of about 800 workers is anticipated during the period 2008-2009.

During early construction stages of the project, the work force is expected to consist primarily of structural crafts, which should benefit the local area since this workforce is expected to come from the local area. As construction progresses, there will be a transition to predominantly mechanical and electrical crafts in the later stages. The bulk of this labor force is expected to come from the surrounding 120-km (75-mi) region due to the relatively low population of the local site area (Table 3.10-3, Civilian Employment Data, 2000). The available labor pool is expected to correlate with the required education and skill levels for the construction work force.

The southeast New Mexico area's ability to supply ample labor is enhanced by an excellent rural road system and warm climate. These factors allow an employer to draw from a wide geographic area labor force, which is characterized by an eagerness to learn, willingness to work, and a high level of productivity.

4.10.1.2 Impacts on Human Activities

The major impact of facility construction on human activities is expected to be a result of the influx of labor into the area on a daily or semi-permanent basis. LES estimates approximately 15% of the construction work force (120 workers) is expected to move into the vicinity as new residents. Previous experience regarding construction for the nuclear industry projects suggests that of those who move, approximately 65% will bring their families, which on average consist of the worker, a spouse, and one school-aged child (NRC, 1994a). The likely increase in area population during peak construction, therefore, will total 360. This is less than 1% of the total Lea, New Mexico-Andrews, Texas Counties' 2000 population (Table 3.10-1, Population and Population Projections).

The increase in jobs and population would lead to a need for additional housing and an increased level of community services, such as schools, fire and police protection, and medical services. However, since the growth in jobs and population would occur over a period of several years, providers of these services should be able to accommodate the growth. For example, the estimated peak increase in school-age children is 120, or less than 1% of the total Lea, New Mexico-Andrews, Texas Counties' 2000 enrollment (Table 3.10-7, Educational Information in the Lea, New Mexico-Andrews, Texas County Vicinity). Based on the local area teacher-student ratio of approximately 1:17 (Table 3.10-6, Educational Facilities Near the NEF), and assuming an even distribution of students among all grade levels, the increase in students represents seven classrooms. This impact should be manageable, however, considering that Lea County, New Mexico has experienced a far greater temporary population growth due to petroleum industry work in the mid-1980s (Table 3.10-1). The overall change in population density and population characteristics in Lea County, New Mexico and Andrews County, Texas, due to construction of the NEF, will be insignificant.

Similarly, LES has estimated 120 housing units would be needed to accommodate the new NEF construction workforce. The percentage of vacant housing units in the Lea, New Mexico-Andrews, Texas County area in 2000 was about 16% and 15%, respectively, meaning that more than 4,000 housing units were available (Table 3.10-5, Housing Information in the Lea, New Mexico – Andrews, Texas County Vicinity). Accordingly, there should be no measurable impact related to the need for additional housing.

While some additional investment in facilities and equipment may be necessary, local government revenues would also increase (see ER Section 7.1, Cost Benefits Analysis, and discussion in ER Section 4.10.2.2, Community Characteristic Impacts, concerning LES' anticipated payments to the State of New Mexico and to Lea County, New Mexico, under the Lea County Industrial Revenue Bond business incentive program during the construction and operation of the facility). These benefits and payments will provide the source for additional government investment in facilities and equipment. That revenue increase may lag somewhat behind the need for new investment more easily, but the incremental nature of the growth should allow local governments to more easily accommodate the increase. Consequently, insignificant negative impacts on community services would be expected.

4.10.2 Facility Operation

4.10.2.1 Jobs, Income, and Population

Operation of the proposed NEF would lead to a permanent increase in employment, income, and population in the area. Employment at the NEF during operation will be 210 workers. This is a 0.7% increase in total employment in Lea and Andrews Counties and a 18% increase in manufacturing employment in the two counties, as compared to the 2000 estimate of jobs (Table 3.10-3). A significant number of operational jobs are likely to be filled by residents in the region since most of its populace has completed school attainment at or below the high school grade level (Table 3.10-7, Educational Information in the Lea, New Mexico – Andrews, Texas County Vicinity).

The NEF annual operating payroll will be approximately $10.5 million for a workforce of 210. The resultant average salary is approximately three times the individual per capita income in the Lea New Mexico-Andrews, Texas County area and approximately 60% and 40% above the median household income for those counties, respectively (Table 3.10-4, Area Income Data).

An increase in the number of jobs would also lead to a population increase in the surrounding areas. Lea and Andrews Counties probably would experience the most noticeable population increases. However, these increases would be less than during facility construction and,

accordingly, have commensurate lesser impacts. In particular, the region would avoid a boomtown effect, which generally describes the consequence of rapid increases in population (at least 5 to 10% per year) in small (populations of a few thousand to a few tens of thousands), rural 48 to 80 km (30 to 50 mi) or more from a major city communities undergoing rapid increases in economic activity (NRC, 1994a). The overall change in population density and population characteristics in Lea County, New Mexico and Andrews County, Texas due to operation of the NEF will be insignificant.

4.10.2.2 Community Characteristic Impacts

The increase in population due to NEF operation, as stated above, will be less than during construction. Based on the housing vacancy rate in the area, which is about 3% to 6% higher than the respective states in general (Table 3.10-5, Housing Information in the Lea, New Mexico – Andrews, Texas County Vicinity), the relatively small need for housing units is not anticipated to burden or raise prices within the local real estate market.

Similarly, a smaller increase in local elementary and secondary school enrollment will be expected as compared to than during construction. Area medical, fire, and law enforcement services should be minimally affected as well. Agreements exist among the cities in Lea County, New Mexico, for emergency services if personnel in Eunice, New Mexico are not available. Otherwise, available services should be able to absorb the needs of new workers and residents. To allow provision of services, the development of new fire departments or police departments, for example, should not be necessary because the NEF will be equipped with its own Fire Protection System and Security Force.

4.10.3 Regional Impact Due to Construction and Operation

The impact estimates provided in ER Sections 4.10.1 and 4.10.2 are based on the combined population of Lea and Andrew counties. The population in New Mexico and Texas within about 120 km (75 mi) of the site is larger than the combined population of Lea and Andrews counties. Therefore, the projected increase in population reported in ER Sections 4.10.1 and 4.10.2 would be reduced if spread over the area within 120 km (75 mi) of the site due to the higher population. This is the case for both the construction and operation periods. This minor increase in population would produce a minor impact on population characteristics, economic trends, housing, community services (health, social and educational resources), and the tax structure and distribution within 120 km (75 mi) of the site during both the construction and operation period.

As shown in Table 3.10-1, the population of Lea County, New Mexico was approximately 55,511 in 2000. The three closest population centers to the site in Lea County are Eunice at 8 km (5 mi), Hobbs at 32 km (20 mi), and Jal at 37 km (23 mi). The populations of these three areas in 2000 were approximately 2,562, 28,657, and 1,996, respectively, providing a combined total population of approximately 33,215. If the entire construction phase population increase of 360, reported in ER Section 4.10.1.2, is assumed to relocate to these three areas, a total construction phase population increase of approximately 1.1 percent would result.

As shown in Table 3.10-I, the population of Andrews County, Texas, was approximately 13,004 in 2000. The two closest population centers in Texas to the site are Andrews and Seminole at 51 km (32 mi) each. The populations of these two areas in 2000 were 9,652 and 5,910, respectively. It is reasonable to assume that the population increase due to the NEF construction and operation would mostly relocate to this representative set of nearby population centers: Eunice, Hobbs and Jal, New Mexico, and Andrews and Seminole, Texas. All five locations are within 51 km (32 mi) of the site and are reasonable commuting distances for this region of the country. These five areas have a combined population of 48,777. If the construction phase population increase of 360 is assumed to relocate to all five of the nearby locations (Eunice, Hobbs, Jal, Andrews, and Seminole), a total construction phase population increase of approximately 0.7 percent would result.

A significant number of operational jobs are likely to be filled by residents already living in the region, Therefore, the population increase during operation of the proposed NEF would be less than during facility construction since fewer workers are expected to relocate to the area. The small population increase of approximately 360 during the construction phase is not expected to have a significant impact on the area. Because the population increase during operation is expected to be smaller than the expected population increase during construction, a similar conclusion applies concerning the impact on the area during the operational period of the NEF.

The minor increase in population would produce a minor impact on population characteristics, economic trends, housing, community services (health, social and educational resources), and the tax structure and distribution within Eunice, Hobbs and Jal, New Mexico, and Andrews and Seminole, Texas, during both the construction and operation periods of the NEF.

The estimated tax revenue and estimated allocations to the State of New Mexico and Lea County resulting from the construction and operation of the NEF are provided in Tables 4.10-2, Estimated Tax Revenue, and 4.10-3, Estimated Tax Revenue Allocations. Total tax revenue is estimated to range from $177 million up to $212 million.

4.10.4 Comparative Socioeconomic Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The socioeconomic impact would be less positive since only one centrifuge plant would be built versus two.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The socioeconomic impact would be the same or less positive because of building only one centrifuge plant, but increasing the capacity.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The socioeconomic impact would be less positive since no new plants would be built.

4.10.5 Section 4.10 Tables

Table 4.10-1 Estimated Number Of Construction Workers By Annual Pay

		Annual Worker Salary			Workers
Year	$0-16,000	$17,000-33,000	$34,000-49,000	$50,000-82,000	Average No./Yr.
2006	100	100	50	5	255
2007	50	75	350	45	520
2008	50	100	500	50	700
2009	50	100	600	50	800
2010	50	25	300	50	425
2011	10	25	100	60	195
2012	10	15	75	40	140
2013	10	15	75	40	140

Table 4.10-2 Estimated Tax Revenue

Tax	Estimated Payments Over the Life of the Plant	
	Low Estimate	High Estimate
Gross Receipts	$23,000,000	$34,000,000
NM Corporate Income Tax(1)	$120,000,000	$140,000,000
Corporate Franchise Tax	$1,000	$1,000
NM Withholding Tax	$15,000,000	$15,000,000
NM Unemployment Insurance	$9,000,000	$9,000,000
NM Property Tax(2)	$10,000,000	$14,000,000
Total	$177,001,000	$212,001,000

(1) Based on average income

(2) Average

Table 4.10-3 Estimated Tax Revenue Allocations [1][2]

Tax	State of New Mexico	Lea County	Eunice, NM	Total
Estimated Gross Receipts Tax				
High	$32,300,000	$1,700,000	NA[3]	$34,000,000
Low	$21,850,000	$1,150,000	NA[3]	$23,000,000
NM Corporate Income Tax[4]				
Estimated total payments over the life of the plant				
High	$140,000,000	NA[5]	NA[5]	$140,000,000
Low	$120,000,000	NA[5]	NA[5]	$120,000,000
NM Corporate Franchise Tax[6]				
Estimated total payments over the life of the plant	$1,000	--	--	$1,000
NM Withholding Tax				
Estimated total payments over the life of the plant	$15,000,000	NA[5]	NA[5]	$15,000,000
NM Unemployment Insurance				
Estimated total payments over the life of the plant	$9,000,000	NA[5]	NA[5]	$9,000,000
NM Property Tax[7]				
High (Estimated total payments over the life of the plant)	--	$14,000,000	NA[3]	$14,000,000
Low (Estimated total payments over the life of the plant)	--	$10,000,000	NA[3]	$10,000,000

(1) Inflation is not included in any estimate.
(2) Tax rates are based on tax rates as of April 2004.
(3) Allocation to Eunice, NM will be performed by Lea County. Allocation estimate is not available.
(4) Based on average earnings over the life of the plant.
(5) Allocation will be made by the State of New Mexico. Allocation estimate is not available.
(6) Based on $50 per year flat rate.
(7) Property tax is dependent on sustaining investment in the plant.

4.11 ENVIRONMENTAL JUSTICE

This section examines whether there are disproportionately high minority or low-income populations residing within a 6.4-km (4-mi) radius of the NEF for which further examination of environmental impacts, to determine the potential for environmental justice concerns, is warranted. The evaluation was performed using the most recent population and economic data available from the U. S. Census Bureau for that area, and was done in accordance with the procedures contained in NUREG-1748. This guidance was endorsed by the NRC's recently issued draft Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (FR, 2003). As discussed below, no minority or low-income populations were identified that would require further analysis of environmental justice concerns under the criteria established by the NRC. LBDCR-07-0022

4.11.1 Procedure and Evaluation Criteria

The determination of whether the potential for environmental justice concerns exists was made in accordance with the detailed procedures set forth in Appendix C to NUREG-1748. Census data from the 2000 decennial census were obtained from the U. S. Census Bureau on the minority and low-income populations residing within a 6.4-km (4-mi) radius (i.e., 130 km^2 or 50 mi^2) of the center of the NEF site. These data were obtained by census block group (CBG), and include (for minority populations) percentage totals within each census block group for both each individual minority population group (i.e., African-American, Hispanic, Native American) and for the aggregate minority population. For low-income households (defined in NUREG-1748 as those households falling below the U.S. Census Bureau-specified poverty level), only the total percentage of such households within each CBG was obtained. The low income household data used in the evaluation was for 1999. In examining alternative sites for the NEF, LES considered environmental justice as part of the overall site selection process. However, it did not conduct as detailed an analyses for those sites not selected as that performed for the Lea County site. LBDCR-07-0022

Once collected, the above-described minority and low-income population percentage data were then compared to their counterparts for their respective county and state. These comparisons were made pursuant to the "20%" and "50%" criteria contained in Appendix C to NUREG-1748, to determine (1) if any individual CBG contained a minority population group, aggregate minority population, or low-income household percentage that exceeded its county or state counterparts by more than 20 percentage points; and (2) if any CBG was comprised of more than 50% minorities (either by individual group or in the aggregate) or low-income households.

Based on its comparison of the relevant CBG data to their county and state counterparts, as discussed below, LES determined that no further evaluation of potential environmental justice concerns is necessary, as no CBG within the 6.4-km (4-mi) radius of the NEF site contained a minority or low-income population exceeding the NUREG-1748 "20%" or "50%" criteria. LBDCR-07-0022

4.11.2 Results

The 130-km^2 (50-mi^2) area around the proposed NEF site includes parts of both Lea County, New Mexico and Andrews County, Texas (Figure 4.11-1, 130-km^2 (50-mi^2) Area Around Proposed NEF). Within that area, there are two census tracts (one in each county and one census block group (CBG) in each census tract).

The minority population for each of the individual CBGs, as well as the total corresponding minority population for Lea and Andrews Counties, the states of New Mexico and Texas and the 130 km^2 (50 mi^2) area around the proposed NEF site are enumerated in Table 4.11-1, Minority Population, 2000. The table also lists the percent make up of each minority and the percentage difference between the CBG and the 130-km^2 (50-mi^2) area around the NEF with the parent state and county. Since the 130-km^2 (50-mi^2) area around the NEF covers both states, the comparisons were made to each state and the two counties (Lea County, New Mexico and Andrews County, Texas). A positive difference value means the CBG has a higher percentage of the minority population; a negative difference value means the CBG or the 130-km^2 (50-mi^2) area around the NEF has a lower percentage of the minority population.

As shown in Table 4.11-1, the largest minority group is Hispanic or Latino, accounting for 42.1% of the total population in New Mexico and 32.0% in Texas. In Lea County, New Mexico, the highest percentage of a minority population, at 39.6%, is also Hispanic or Latino. In Andrews County, Texas, Hispanic or Latino is the largest minority group as well at 40.0%..

Table 4.11-1 demonstrates that no individual CBG and the 130-km^2 (50-mi^2) area around the NEF are comprised of more than 50% of any minority population. With respect to the Hispanic or Latino population, the largest minority population in both census tracts, the percentages are as follows: Census Tract 8, CGB 2 – 24.8%; Census Tract 9501, CBG 4 – 19.8%. The largest minority group in the 130-km^2 (50-mi^2) area around the NEF is Hispanic or Latino, accounting for 11.7%. Moreover, none of these percentages exceeds the applicable State or County percentages for this minority population by more than 20 percentage points.

Table 4.11-2, Low Income (Poverty) Population, 1999, demonstrates that no individual CBG is comprised of more than 50% of low-income households. The percentages are as follows: Tract 8, CBG 2 –3.6%; Tract 9501, CBG 4- 9.9%. Neither of these percentages exceeds 50 percent; moreover, neither of these populations significantly exceeds the percentage of low-income households in the applicable State or County. Low income (poverty) data is only compiled down to the CBG level and, therefore, data is not available for only the 130-km^2 (50-mi^2) area around the NEF.

Based on this analysis of the above-described data, performed in accordance with the criteria, guidelines and procedures set forth in NUREG-1748, LES has concluded that no disproportionately high minority or low-income populations exist that would warrant further examination of environmental impacts upon such populations. LBDCR-07-0022

4.11.3 Comparative Environmental Justice Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The environmental justice impact is the same since it is assumed there are no disproportionate impacts associated with the alternative scenario.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The environmental justice impact would be the same since it is assumed there are no disproportionate impacts associated with the alternative scenario.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The environmental justice impact would be the same since it is assumed that there are no disproportionate impacts associated with the alternative scenario.

4.11.4 Section 4.11 Tables

Table 4.11-1 Minority Population, 2000

Geographic Area	New Mexico	Lea County	NM Census Tract 8, Blk Grp 2	Within 130 km^2 (50 mi^2) Compared to NM and Lea County	Texas	Andrews County	TX Census Tract 9501, Blk Grp 4	Within 130 km^2 (50 mi^2) Compared to TX and Andrews County
Total:	1,819,046	55,511	618	60	20,851,820	13,004	591	60
Not Hispanic or Latino	1,053,660	33,501	465	53	14,182,154	7,802	474	53
Percent	57.9%	60.4%	75.2%	88.3%	68.0%	60.0%	80.2%	88.3%
White alone	813,495	29,977	452	48	10,933,313	7,322	438	48
Percent	44.7%	54.0%	73.1%	80.0%	52.4%	56.3%	74.1%	80.0%
Black or African American alone	30,654	2,340	3	3	2,364,255	195	3	3
Percent	1.7%	4.2%	.5%	5.0%	11.3%	1.5%	0.5%	5.0%
State percentage difference	0.0%	2.5%	-1.2%	3.3%	0.0%	-9.8%	-10.8%	6.3%
County percentage difference	N/A	0.0%	-3.7%	0.8%	N/A	0.0%	-1.0%	3.5%
American Indian and Alaska Native alone	161,460	356	2	1	68,859	64	2	1
Percent	8.9%	0.6%	0.3%	1.7%	0.3%	0.5%	0.3%	1.7%
State percentage difference	0.0%	-8.2%	-8.6%	-7.2%	0.0%	0.2%	0.0%	1.3%
County percentage difference	N/A	0.0%	-0.3%	1.0%	N/A	0.0%	-0.2%	1.2%

Table 4.11-1 Minority Population, 2000

Geographic Area	New Mexico	Lea County	NM Census Tract 8, Blk Grp 2	Within 130 km² (50 mi²) Compared to NM and Lea County	Texas	Andrews County	TX Census Tract 9501, Blk Grp 4	Within 130 km² (50 mi²) Compared to TX and Andrews County
Asian alone	18,257	198	0	0	554,445	88	17	0
Percent	1.0%	0.4%	0.0%	0.0%	2.7%	0.7%	2.9%	0.0%
State percentage difference	0.0%	-0.6%	-1.0%	-1.0%	0.0%	-2.0%	0.2%	-2.7%
County percentage difference	N/A	-0.0%	-0.4%	-0.4%	N/A	0.0%	2.2%	-0.7%
Native Hawaiian and Other Pacific Islander alone	992	11	0	0	10,757	2	0	0
Percent	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
State percentage difference	0.0%	0.0%	-0.1%	-0.1%	0.0%	0.0%	-0.1%	-0.1%
County percentage difference	N/A	0.0%	0.0%	0.0%	N/A	0.0%	0.0%	0.0%
Some other race alone	3,009	34	0	0	19,958	13	0	0
Percent	0.2%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%
State percentage difference	0.0%	-0.1%	-0.2%	-0.2%	0.0%	0.0%	-0.1%	-0.1%
County percentage difference	N/A	0.0%	-0.1%	-0.1%	N/A	0.0%	-0.1%	-0.1%

Table 4.11-1 Minority Population, 2000

Geographic Area	New Mexico	Lea County	NM Census Tract 8, Blk Grp 2	Within 130 km^2 (50 mi^2) Compared to NM and Lea County	Texas	Andrews County	TX Census Tract 9501, Blk Grp 4	Within 130 km^2 (50 mi^2) Compared to TX and Andrews County
Two or more races	25,793	585	8	1	230,567	118	14	1
Percent	1.4%	1.1%	1.3%	1.7%	1.1%	0.2%	2.4%	1.7%
State percentage difference	0.0%	-0.4%	-0.1%	-0.2%	0.0%	-0.9%	1.3%	0.6%
County percentage difference	N/A	0.0%	0.2%	-0.6%	N/A	0.0%	2.2%	1.5%
Hispanic or Latino:	765,386	22,010	153	7	6,669,666	5,202	117	7
Percent	42.1%	39.6%	24.8%	11.7%	32.0%	40.0%	19.8%	11.7%
State percentage difference	0.0%	-2.4%	-17.3%	-30.4%`	0.0%	8.0%	-12.2%	-20.3%
County percentage difference	N/A	0.0%	-14.9%	-28%	N/A	0.0%	-20.2%	-28.3%
Total Minority	979,758	24,949	158	11	687,940	564	139	11
Percent	53.9%	44.9%	25.6%	18.3%	46.5%	42.8%	23.5%	18.3%
State percentage difference	0.0%	-8.9%	-28.3%	-35.5%	0.0%	-3.7%	-22.9%	-28.1%
County percentage difference	N/A	0.0%	-19.4%	-26.0%	N/A	0.0%	-19.3%	-24.5%

Table 4.11-2 Low Income (Poverty) Population, 1999

Geographic Area	New Mexico	Lea County	NM Census Tract 8, Blk Grp 2	Texas	Andrews County	TX Census Tract 9501, Blk Grp 4
Total:	1,783,907	53,682	581	20,287,300	12,892	568
Income in 1999 below poverty level:	328,933	11,317	21	3,117,609	2,117	56
Percent below poverty level:	18.4%	21.1%	3.6%	15.4%	16.4%	9.9%
State percentage difference	0.0%	2.6%	-14.8%	0.0%	1.1%	-5.5%
County percentage difference	NA	0.0%	-17.5%	NA	0.0%	-6.6%

4.11.5 Section 4.11 Figures

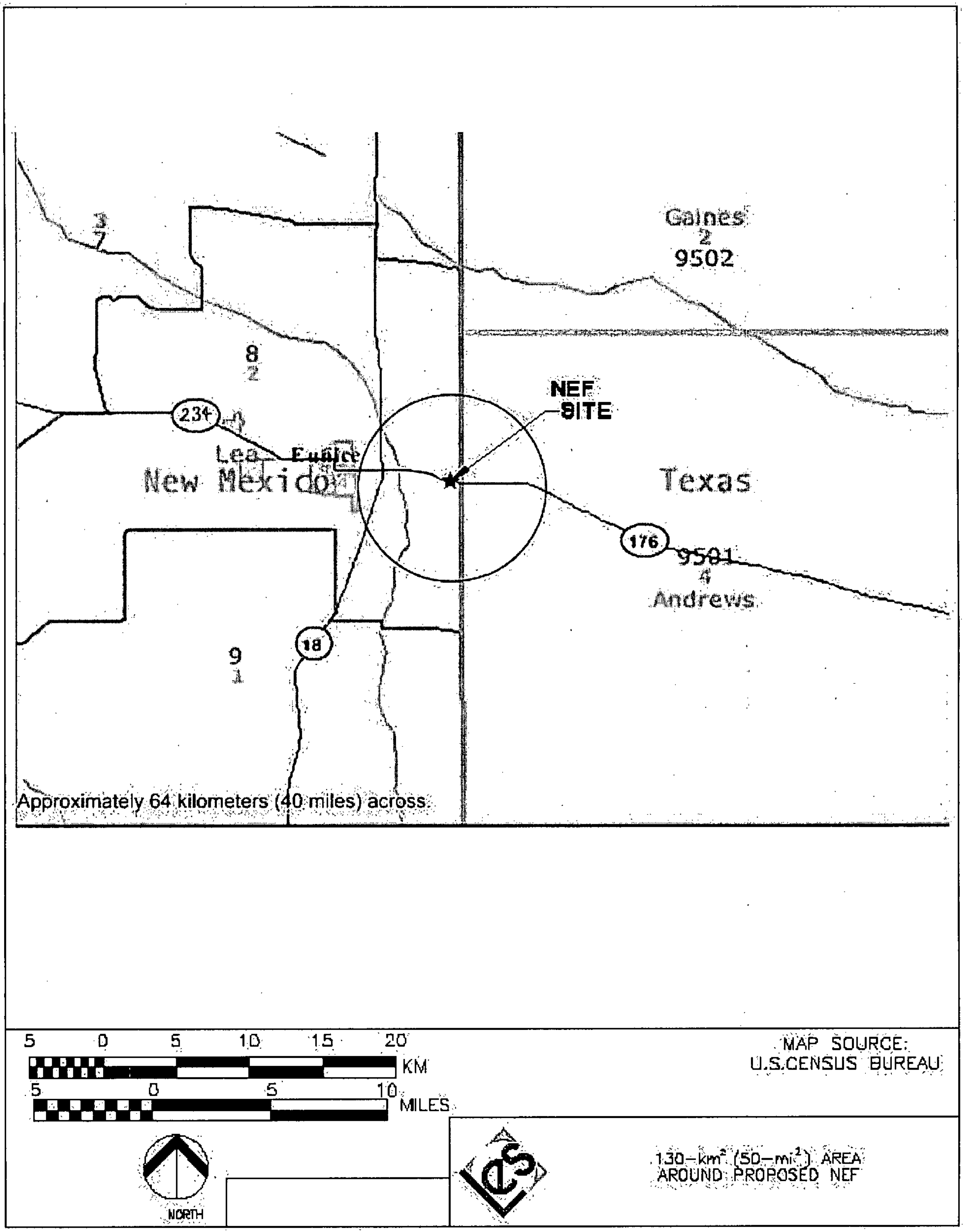

Figure 4.11-1 130-km² (50-mi²) Area Around Proposed NEF

4.12 PUBLIC AND OCCUPATIONAL HEALTH IMPACTS

4.12.1 Nonradiological Impacts

Sources of nonradiological exposure to the public and to facility workers are characterized below. Nonradiological effluents have been evaluated and do not exceed criteria in 40 CFR 50, 59, 60, 61, 122, 129, or 141 (CFR, 2003w; CFR, 2003x; CFR, 2003y; CFR, 2003g; CFR, 2003z; CFR, 2003s; CFR, 2003h). Radionuclides, hydrogen fluoride, and methylene chloride are governed as a National Emission Standards Hazardous Air Pollutants (NESHAP) (EPA, 2003g). Details of radiological gaseous and liquid effluent impacts and controls are listed in ER Section 4.12.2, Radiological Impacts. A detailed list of the chemicals that will be used at the NEF, by building, is contained in ER Tables 2.1-2 through 2.1-4. ER Figure 2.1-4 indicates where these buildings are located on the NEF site.

4.12.1.1 Routine Gaseous Effluent

Routine gaseous effluents from the plant are listed in Table 3.12-3, Estimated Annual Gaseous Effluent. The primary material in use at the facility is uranium hexafluoride (UF_6). UF_6 is hygroscopic (moisture absorbing) and, in contact with water, will chemically break down into uranyl fluoride (UO_2F_2) and hydrogen fluoride (HF). When released to the atmosphere, gaseous UF_6 combines with humidity to form a cloud of particulate UO_2F_2 and HF fumes. Inhalation of UF_6 typically results in internal exposure to UO_2F_2 and HF. In addition to a potential radiation dose, a worker would be subjected to two other primary toxic effects: (1) the uranium in the uranyl complex acts as a heavy metal poison that can affect the kidneys, and (2) the HF can cause severe irritation to the skin and lungs at high concentrations.

Of primary importance to the NEF is the control of UF_6. The UF_6 readily reacts with air, moisture, and some other materials. The most significant reaction products in this plant are HF, UO_2F_2, and small amounts of uranium tetrafluoride (UF_4). Of these, HF is the most significant hazard, being toxic to humans. Refer to ER Section 3.11.2.2, Public and Occupational Exposure Limits, for public and occupational exposure limits.

It should be noted that the public exposure limits proposed by the State of California (30 $\mu g/m^3$) and the Occupational Safety and Health Administration (OSHA) Permissible Exposure Level (PEL) (2.0 mg/m^3) vastly differ, with the California (CA) value being significantly more conservative. The proposed CA limit is by far the most stringent of all state or federal agencies, yet both are based on allowable exposure for an 8-hr workday. NEF is not obligated to follow California proposed standards; however, for comparative reasons, LES points out that the annual average gaseous effluent release concentration from a 3 million SWU Urenco Centrifuge Enrichment Plant is 3.9 $\mu g/m^3$ at the point of discharge (rooftop). This comparison demonstrates the HF emissions from the plant do not exceed the strictest of regulatory limits at the point of discharge. If standard dispersion modeling techniques are used to estimate the exposure to the nearest residents under normal operating conditions, the concentration at the nearest fence boundary is calculated to be 3.2×10^{-4} $\mu g/m^3$ and the concentration at the nearest residence located west of the site at a distance greater than 4.3 km (2.63 mi) is 6.4×10^{-6} $\mu g/m^3$. The nearest resident to the site is shown in Figure 4.12-1, Nearest Resident. Other sensitive receptors (e.g., schools and hospitals), as well as the nearest drinking water source, are located further away.

Methylene chloride is used in small bench-top quantities to clean certain components. All chemicals at NEF will be used in accordance with the manufacturers recommendations, health and safety regulations and under formal procedures. LES will investigate the use of alternate solvents and/or apply control technologies as required. The remaining effluents listed in Table 3.12-4, Estimated Annual Liquid Effluent will have no significant impact on the public since they are used in deminimus levels or are nonhazardous by nature. All regulated gaseous effluents will be below regulatory limits as specified by the New Mexico Air Quality Bureau.

Worker exposure to in-plant gaseous effluents listed in Table 3.12-3, Estimated Annual Gaseous Effluent, will be minimal. No exposures exceeding 29 CFR 1910, Subpart Z are anticipated (CFR, 2003o). Leaks in UF_6 components and piping would cause air to leak into the system and would not release effluent. All maintenance activities utilize mitigative features including local flexible exhaust hoses connected to the Gaseous Effluent Vent System, thereby minimizing any potential for occupational exposure. Laboratory and maintenance operations activities involving hazardous gaseous or respirable effluents will be conducted with ventilation control (i.e., fume hoods, local exhaust or similar) and/or with the use of respiratory protection as required.

4.12.1.2 Routine Liquid Effluent

Routine liquid effluents are listed in Table 3.12-4, Estimated Annual Liquid Effluent. The facility does not directly discharge any industrial effluents to natural surface waters or grounds onsite, and there is no plant tie-in to a Publicly Owned Treatment Works (POTW). All effluents are contained on the NEF site via collection tanks and retention/detention basins. See ER Section 2.1.2.3.4 for further discussion of the Liquid Effluent Collection and Treatment System. There is no water intake for surface water systems in the region. Water supplies in the region are from distant groundwater sources and are thus protected from any immediate impact due to potential releases. ER Section 3.4 provides further information about water wells in the site area. No public impact is expected from routine liquid effluent discharge.

Worker exposure to liquid in-plant effluents shown in Tables 3,12-2 and 3.12-4 will be minimal. No exposures exceeding 29 CFR 1910 (CFR, 2003o), Subpart Z are anticipated. Additionally, handling of all chemicals and wastes will be conducted in accordance with the site Environment, Health, and Safety Program which will conform to 29 CFR 1910 (CFR, 2003o) and specify the use of appropriate engineered controls, as well as personnel protective equipment, to minimize potential chemical exposures.

4.12.2 Radiological Impacts

Sources of radiation exposure incurred by the public generally fall into one of two major groupings, naturally-occurring radioactivity and man-made radioactivity. Naturally-occurring radioactivity includes primordial radionuclides (nuclides that existed or were created during the formation of the earth and have a sufficiently long half-life to be detected today) and their progeny nuclides, and nuclides that are continually produced by natural processes other than the decay of the primordial nuclides. These nuclides are ubiquitous in nature, and are responsible for a large fraction of radiation exposure referred to as background exposure. Uranium (U), the material used in the NEF operations, is included in this group. Man-made radioactivity, which includes radioactivity generated by human activities (e.g., fallout from weapons testing, medical treatments, and x-rays), also contributes to background radiation exposure. The combined relative concentrations of naturally-occurring radioactivity and man-made radioactivity in the environment vary extensively around the world, with variations seen between areas in close proximity. The concentration of radionuclides and radiation levels in an area are influenced by such factors as geology, precipitation, runoff, topsoil disturbances, solar activity, barometric pressure, and a host of other variables. The annual total effective dose equivalent from background radiation in the United States varies from 2.0 to 3.0 mSv (200 to 300 mrem) depending on the geographic region or locale and the prevalence of radon and its daughters.

Workers at the NEF are subject to higher potential exposures than members of the public because they are involved directly with handling uranium cylinders, processes for the enrichment of uranium, and decontamination and maintenance of equipment. During routine operations, workers at the plant may potentially be exposed to radiation from uranium via inhalation of airborne particles and direct exposure to equipment and components containing uranic materials. The radiation protection program at the NEF requires routine radiation surveys and air sampling to assure that worker exposures are maintained as low as reasonably achievable (ALARA). In addition, exposure-monitoring techniques at the plant include use of personal dosimeters by workers, personnel breathing zone air sampling, and annual whole-body counting.

In addition to the radiological hazards associated with uranium, workers may be potentially exposed to the chemical hazards associated with uranium. The material, UF_6, is hygroscopic (moisture absorbing) and, in contact with water, will chemically breakdown into UO_2F_2 and HF. When released to the atmosphere, gaseous UF_6 combines with humidity to form a cloud of particulate UO_2F_2 and HF fumes. The reaction is very fast and is dependent on the availability of water vapor. Consequently, an inhalation to UF_6 is typically an internal exposure to HF and UO_2F_2. In addition to the radiation dose, a worker would be subjected to two other primary toxic effects: (1) the uranium in the uranyl complex acts as a heavy metal poison that can affect the kidneys, and (2) the HF can cause acid burns to the skin and lungs if concentrated. Because of low specific activity values, the radiotoxicity of UF_6 and its products are smaller than their chemical toxicity.

Both a radiation protection program and a health and safety program will protect workers at the NEF. The Radiation Protection Program will comply with all applicable NRC requirements established in 10 CFR 20 (CFR, 2003q), Subpart B. Similarly, the Health and Safety Program at the NEF will comply with all applicable OSHA requirements established in 29 CFR 1910 (CFR, 2003o).

The general public and the environment may be impacted by radiation and radioactive material from the NEF in two primary ways. Potential radiological impacts may occur from (1) gaseous and liquid effluent discharges associated with controlled releases from the uranium enrichment process lines during routine operations and from decontamination and maintenance of equipment, and (2) direct radiation exposure associated with transportation and storage of UF_6 feed cylinders, product cylinders, and Uranium Byproduct Cylinders (UBCs).

The potential radiological impacts to the public from operations at the NEF are those associated with chronic exposure to low levels of radiation, not the immediate health effects associated with acute radiation exposure. The major sources of potential radiation exposure are the effluent from the Separations Building, Technical Services Building (TSB) and direct radiation from the UBC Storage Pad. The Centrifuge Assembly Building is a potential minor source of radiation exposure. It is anticipated that the total amount of uranium released to the environment via air effluent discharges from the NEF will be less than 10 g (0.35 ounces) per year (URENCO, 2000; URENCO, 2001, URENCO, 2002a). Due to the anticipated low volume of contaminated liquid waste and the effectiveness of treatment processes, liquid effluent discharges are not expected to have a significant radiological impact to the public or the environment. In addition, the radiological impacts associated with direct radiation from indoor operations are not expected to be a significant contributor because the low-energy gamma-rays associated with the uranium will be absorbed almost completely by the process lines, equipment, cylinders, and building structures at the NEF. However, the UBC Storage Pad may present the highest potential for direct radiation impact to the public at or beyond the plant fence line. The combined potential radiological impacts associated with the small quantity of uranium in effluent discharges and direct radiation exposure due to stored UBCs are expected to be a small fraction of the general public dose limits established in 10 CFR 20 (CFR, 2003q) and within the uranium fuel cycle standards established in 40 CFR 190 (CFR, 2003f). Figure 4.12-1, Nearest Resident and Figure 4.12-2, Site Layout for NEF, show the site layout for the NEF and its relation to the nearest residence.

The principle isotopes of uranium, ^{238}U, ^{236}U, ^{235}U, and ^{234}U, are expected to be the primary nuclides of concern in both gaseous effluent and liquid waste discharged from the plant. However, their concentrations in gaseous and liquid effluents are expected to be very low because of engineered controls and treatment processes prior to discharge. In addition, a combination of the effluent monitoring and environmental monitoring/sampling programs will provide data to identify and assess plant's contribution to environmental uranium at the NEF site. Both monitoring programs have been designed to provide comprehensive data to demonstrate that plant operations have no adverse impact on the environment. ER Section 6.1 provides detailed descriptions of the two monitoring programs.

The enrichment process system operates sub-atmospherically such that any air leaks are into the equipment and not into the building environment. In addition to building HVAC, the plant design includes two separate GEVS for treatment of potentially contaminated gas streams. The enrichment process in the main separations plant includes two parallel trains of exhaust filters (pre-filters, HEPA filters, and activated carbon filters) before gaseous effluent is discharged to the environment. The TSB also has a single train of similar filtration to treat gaseous effluent from laboratories containing process materials and from other rooms within the TSB where decontamination and maintenance works are performed. In addition, gaseous effluent from the GEVS is monitored continuously (refer to ER Section 6.1, Radiological Monitoring, for details regarding the effluent monitoring system).

The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System, similar to the TSB GEVS, performs a similar function except it has one set of filters, two fans, and exhausts on the roof of the CAB. Discharges of gaseous effluent from both GEVS and the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System result in ground-level plumes because the release point is at roof top level on the TSB or CAB, as applicable. Consequently, airborne concentrations of uranium present in gaseous effluent continually decrease with distance from the release point. Therefore, the greatest offsite radiological impact is expected at or near the site boundary locations in each sector. Site boundary distances have been determined for each sector (refer to ER Section 4.6 for details). The nearest resident has been identified at a distance of about 4.3 km (2.63 miles) in the west sector. Other important receptor locations, such as schools, have also been identified within an 8-km (5-mi) radius of the NEF site (refer to ER Section 3.10). With respect to ingestion pathways, there is little in the way of food crops grown within an 8-km (5-mi) radius due to semi-arid nature and minimal development of the local area for agriculture. Cattle grazing across the open range has been observed in the vicinity of the site (refer to ER Section 3.1). The radiological impacts on members of the public and the environment at these potential receptor locations are expected to be only small fractions of the radiological impacts that have been estimated for the site boundary locations because of the low initial concentrations in gaseous effluent and the high degree of dispersion that takes place as the gaseous effluent is transported.

The potential offsite radiological impacts to members of the general public from routine operations at the NEF were assessed through calculations designed to estimate the annual committed effective dose equivalent (CEDE) and annual committed dose equivalent to organs from effluent releases. The calculations also assessed impacts from direct radiation from stored uranium in feed, product and byproduct cylinders. The term "dose equivalent" as described throughout this section refers to a 50-year committed dose equivalent. The addition of the effluent related doses and direct dose equivalent from fixed sources provides an estimate of the total effective dose equivalent (TEDE) associated with plant operations. The calculated annual dose equivalents were then compared to regulatory (NRC and EPA) radiation exposure standards as a way of illustrating the magnitude of potential impacts.

4.12.2.1 Pathway Assessment

4.12.2.1.1 Routine Gaseous Effluent

Most of the airborne uranium is removed through filtration prior to the discharge of gaseous effluent to the atmosphere. However, the release of uranium in extremely low concentrations is expected and raises the potential for radiological impacts to the general public and the environment. The total annual discharge of uranium in routine gaseous effluent from a similar designed 1.5 million SWU uranium enrichment facility (half the size of the NEF) was estimated to be less than 30 g (1.1 oz) (NRC, 1994a). The uranium source term applied in the assessment of radiological impacts for routine gaseous effluent from that plant was $4.4x10^6$ Bq (120 µCi) per year. It was noted that actual uranium discharges in gaseous effluent for European facilities with similar design and throughput are significantly lower (i.e., < $1x10^6$ Bq (28 µCi) per year) (NRC, 1994a). In contrast, the NEF is a 3 million SWU facility. The annual discharge of uranium in routine gaseous effluent discharged from the NEF is expected to be less than 10 g (0.35 ounces) (URENCO, 2000; URENCO, 2001, URENCO, 2002a). As a conservative assumption for assessment of potential radiological impacts to the general public, the uranium source term used in the assessment of radiological impacts for routine gaseous effluent releases from the NEF was taken as 8.9 MBq (240 µCi) per year, which is equal to twice the source term applied to the 1.5 million SWU plant described in NUREG-1484 (NRC, 1994a). In comparison, the operating history of gaseous emissions from the Urenco Capenhurst facility in the United Kingdom averaged over a four-year period (1999 to 2002) indicates an average annual release to the atmosphere of uranium of about only 0.1 MBq (2.8 µCi) (URENCO, 2001; URENCO, 2002a). Since the Capenhurst facility is less than half the size of the NEF, scaling their annual release by a conservative factor of 3 suggests that the expected annual releases could be about 0.31 MBq (8.4 □Ci) of uranium, or about 28 times smaller than the 8.9 MBq (240 µCi) bounding condition that is used in this assessment.

There are three primary exposure pathways associated with plant effluent: (1) direct radiation due to deposited radioactivity on the ground surface (ground plane exposure), (2) inhalation of airborne radioactivity in a passing effluent plume, and (3) ingestion of food that was contaminated by plant effluent radioactivity. Of these three exposure pathways, inhalation exposures are expected to be the predominant pathways at site boundary locations and also at offsite locations that are relatively close to the site boundary. The reason for this is that the discharge point for gaseous effluent, roof-top stacks, result in ground level effluent plumes. For ground level plume, the airborne concentration(s) within the plume decrease with the distance from the discharge point. Consequently, for gaseous effluent from the NEF, the highest offsite airborne concentrations (and, hence, the greatest radiological impacts) are expected at locations close to the site boundary. Beyond those locations, the concentrations of airborne radioactive material decreases continually as it is transported because of dispersion and depletion processes. For example, based on a comparison of the atmospheric dispersion factors for a ground level effluent release from the NEF calculated for the site boundary, 769 m (2,522 ft), and for the 1.6-km (1-mi) distance in the west sector, the concentration at the 1.6 km (1.0-mi) distance is approximately 3.6 times lower than at the site boundary. Although radiological impacts via the ingestion exposure pathways come into play for distances beyond the site boundary, the concentrations of radioactive material will have been greatly reduced by the time effluent plumes reach those locations.

The radiological impacts from routine gaseous effluents were estimated for four exposure pathways which included inhalation and immersion in the effluent plume, direct dose from ground plane deposition, and ingestion of food products (stored and fresh vegetables, milk and meat) assumed to be grown or raised at the nearest resident location. For both the inhalation and ingestion exposure pathways, the Exposure-to-Dose conversion factors (DCF) were taken from Federal Guidance Report 11 (EPA 520/1-88-020) and were applied for both the committed LBDCR-07-0022 organ equivalent dose and the committed effective equivalent dose. No assumption on the chemical form of the uranic material deposited in the environment is made due to the extended time that effluents will persist in the open environment and the unknown change in chemical form that might take place over time. As a consequence, the most restrictive clearance class for inhalation and fractional uptake condition for ingestion is assumed (for conservatism) in the selection of dose factors from Federal Guidance Report 11 (EPA 520/1-88-020). For ingestion LBDCR-07-0022 and inhalation pathways, dose equivalent were calculated for seven organs (gonads, breast, lung, red bone marrow, bone surface, thyroid, and a remainder for all other organs) as well as effective dose equivalent.

For direct dose from material deposited on the ground plane or from the passing cloud, the DCF from Federal Guidance Report No. 12 (EPA, 1993a) have been applied. For ground plane exposures, it is assumed that the material deposited from the passing cloud remains on the ground surface as an infinite source plane (i.e., no mixing with any soil depth). This provides the most conservative assumption for direct ground plane exposure. The dose from ground plane deposition was evaluated after 30 years (end of expected license period) to account for the maximum buildup of released activity, including the in-growth of radionuclide progeny from the primary uranium isotopes that make up the expected release from the plant. This provides the upper bound on any single year of projected plant impacts. For external exposures from plume immersion and ground plane exposure, the skin is added to those organs that were evaluated for internal exposures (inhalation and ingestion).

The dose factors in the Federal Guidance Report (FGR)-11 (EPA 520/1-88-020) are derived for LBDCR-07-0022 adults. In order to estimate the impact to other age groups, the doses calculated to adults were adjusted for difference in food consumption or inhalation rates as taken from NRC Regulatory Guide 1.109 and then multiplied by the relative age dependent dose factor for the effective dose LBDCR-07-0022 equivalent as found for the different ages in the International Commission of Radiological Protection (ICRP) Report No. 72 (ICRP, 1995). With respect to the DCF's for adults, the relative ingestion dose commitment multiplier by age group for the four isotopes of uranium of concern averaged 1.0 (adults), 1.5 (teens), 1.8 (children) and 7.5 (infants). For the inhalation pathway, these relative dose commitment multipliers are 1.0 (adult), 1.2 (teens), 2.02 (children) and 4.25 (infants).

The ingestion pathway models for locally grown or raised food products were taken from NRC Regulatory Guide 1.109. The models projected isotopic concentrations in vegetation, milk and LBDCR-07-0022 meat products based on the annual quantity of uranium material assumed to be released to the air and the atmospheric dispersion and deposition factors at key receptor locations of interest. These food product concentrations were then used to determine the ingestion committed effective dose equivalent and organ doses by multiplying the individual organ and effective dose conversion factors by the food product concentrations and the annual individual usage factors from the NRC Regulatory Guide 1.109. LBDCR-07-0022

The key receptor locations (critical populations) for determining dose impacts included the nearest public access point to the site boundary with the most restrictive atmospheric dispersion factors as well as boundary locations where direct doses from fixed sources are predicted to be the highest. Also included as key locations of interest are nearby private businesses and the location of the nearest resident. Figure 4.12-1, Nearest Resident, indicates the location of the nearest resident.

The atmospheric dispersion factors used in the radiological impacts assessment were calculated as described in ER Section 4.6, Air Quality Impacts and are provided in Table 4.6-3A, Annual Average Atmospheric Dispersion and Deposition Factors from NWS (1987-1991) Data. The meteorological data was taken from the National Weather Service station for Midland – Odessa, Texas covering the years from 1987 through 1991.

Three groups of individuals (members of the public) or exposure scenarios were evaluated for both potential and real receptors located at or beyond the site boundary. For the first group, the dose impact to the nearest (and highest potentially impacted) residence was evaluated for all exposure pathways (inhalation and plume immersion, direct dose from ground plane deposition, and ingestion of food products which include fresh and stored vegetables, milk and meat postulated to be grown or raised at this location). The analysis included dose equivalent assessments for all four age groups (adults, teens, children and infants) for these pathways. The location of this residence is identified to be approximately 4.3 km (2.63 mi) west of the NEF site in the W sector as measured from the main plant vent systems situated on top of the TSB (see Figures 4.12-1 and 6.1-2). The occupancy time was assumed to be continuous for a full year, along with a residential shielding factor of 0.7 (Regulatory Guide 1.109). This location provides for an assessment of doses to real members of the public. LBDCR-07-0022

The second group of individuals (critical populations) are those associated with local businesses situated near the plant site in the SE and N-NNW sectors about the plant (see Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Locations). Two locations were evaluated for impact assessment based on the most limiting offsite atmospheric dispersion factors, or where the combination of direct dose from fixed sources and plant effluents would maximize the projected total dose. The location of most limiting dispersion is for a small landfill site situated 0.93 km (0.57 mile) from the TSB in the SE sector. The second business location is a quarry operation located approximately 1.8 km (1.1 mi) in the N-NNW sectors around the NEF. The combination of effluents and direct (including scatter) dose from fixed sources is potentially highest here for actually occupied locations. Since these two locations reflect outdoor businesses, the annual occupancy time is taken as the standard 2,000 hours for work environments. Also, the residential shielding factor of 0.7 was replaced with 1.0 (no shielding credit) since the nature of both operations is mainly outdoor work. In addition, only the inhalation and plume immersion pathways along with direct dose equivalent from ground plane deposition are applied since no food products (gardens or animals) are associated with these types of businesses. As these are work locations, the age group of interest, adults (>17 years), is the only significant group assumed to spend substantial time at these places.

The third group of postulated individuals (critical populations) is associated with transient populations who come right up to the site boundary, and for some reason, stay for the equivalent of a standard work year (2,000 hours). This high occupancy time maximizes the dose impacts for future activity that could be associated with such operations as oil well drilling or mineral extraction from land bordering the site boundary. This also provides an estimate for onsite dose equivalents (NEF occupational dose equivalents) for that portion of the NEF staff whose jobs take them in the general area of the plant property away from the buildings. As with the group of local area businesses noted above, the residential shielding factor is set at 1.0 (no shielding credit) since any activity is assumed to take place outdoors. In addition, only the inhalation and plume immersion pathways along with direct dose equivalent from ground plane deposition are applied (no food product ingestion pathways are expected to exist along the site boundary line). As assumed work locations,, the age group of interest is taken as adults.

Transit time for an accident gaseous release (involving uranic or HF concentrations) would be a few minutes (at boundary) to hours (nearest resident) for the critical populations discussed above. The nearest known location from which a member of the public can obtain aquatic food and/or drinking water is the Wallach Quarry, where transit times for gaseous releases are on the order of tens of minutes. The Wallach Quarry is located in the N-NNW sector approximately 1.8 km (1.1 mi) away. There are no recreational, schools or hospitals within 8 km (5 mi) of the NEF.

4.12.2.1.2 Routine Liquid Effluent

The design of the NEF includes liquid waste processing to concentrate and filter out the majority of uranic materials that are collected as part of liquid waste treatment of various process streams. ER Section 2.1.2, Proposed Action, provides an overview of the liquid waste treatment systems. From an effluent standpoint, the main feature of the liquid waste treatment is that there is no direct liquid effluents discharged offsite. The primary liquid waste effluents that could contain residual uranic waste include (1) decontamination, laboratory and miscellaneous waste streams, (2) hand wash and shower effluents, and (3) laundry effluents. Liquids discharged from these paths are collected and sent to an onsite basin (the Treated Effluent Evaporative Basin) that allows for natural evaporation of the liquid with the residual uranic material left

behind in the bottom of the basin. The waste treatment system's design annual liquid uranic waste discharge to the basin is estimated to be 570 g (1.3 lb) of uranium, or approximately 14.4 MBq (390 µCi) of radioactivity. As with the gaseous waste effluents, the major radionuclides in the liquid waste stream are the four isotopes of uranium, ^{238}U, ^{236}U, ^{235}U and ^{234}U. Of these, ^{238}U and ^{234}U account for about 97% of the total uranic radioactivity and dominate the dose contribution resulting from offsite releases. Similar to the treated liquid waste stream, water from other sources, such as site area rain runoff, are also collected on site in separate collection basins which allow for evaporation instead of liquid discharges across the site boundary.

The Treated Effluent Evaporative Basin employs a dual membrane system to prevent the intrusion of collected wastewater into the ground layers below the basin, thereby limiting the potential for soil and groundwater contamination. A leak detection system is also part of the basin design features to provide early indication of any failure of the basin barriers to restrict liquid effluent waste from entering the soil or groundwater regime below the site. ER Section 3.4.1, Surface Hydrology, also describes the site's groundwater investigations which indicates the depth to the nearest groundwater aquifer (Santa Rosa) is approximately 340 m (1,115 ft) which is separated from the surface by a thick Chinle clay unit. This aquifier is considered not potable. These site features negate any significant potential that the drinking water exposure pathway could be impacted by routine liquid waste releases.

Since there are no offsite releases to any surface waters or POTW, the remaining release pathway assumed for this evaluation is the airborne resuspension of particulate activity from the bottom of the basin after the waste water evaporates off.

As initial operating parameters, the Treated Effluent Evaporative Basin is assumed to be dry no more than 10% of the time. This assumption was made in order to estimate the duration of dust resuspension from the basin into the air. The actual duration that the basin remains dry over a year is dependent on the final design of the Treated Effluent Evaporative Basin. Final design considerations will take into account the As Low As Reasonably Achievable (ALARA) aspects of maximizing the duration that the basin remains wet in order to minimize, to the extent practicable, the potential resuspension of solids from the basin into the air, thereby minimizing the dose impact. The resuspension rate is taken as 4.0×10^{-6}/hr based on information from a Department of Energy handbook (DOE, 1994) on various release scenarios of radioactivity to the atmosphere. The selected resuspension rate was taken from a very similar set of conditions to the NEF evaporative basin that addressed large pools of liquids outdoors that deposited uranic waste content into a soil layer that subsequently evaporated with a resulting resuspension of contaminants into the atmosphere. This resuspension rate was applied as a constant over the entire 30-year operating period of liquid waste buildup in the basin. The use of the 4×10^{-6}/hr resuspension rate over this entire period is conservative according to a DOE handbook (DOE, 1994) on various release scenarios of radioactivity to the atmosphere, the resuspension rate was assessed only for freshly deposited contaminants that is not heavily intermingled with the overall soil or waste matrix. A review of resuspension literature (NRC, 1975a) also noted that resuspension factors for deposited material in soils reduces over time as the waste becomes fixed within the soil matrix. This reference (NRC, 1975a) provides an algorithm to correct for this time dependent reduction in the resuspension factor which would reduce the amount of resuspended material from the buildup of solid particles deposited over time. The end of plant license period release rates are thereby limited. For conservatism, no time-dependent reduction in the effective resuspension rate over the 30 years of waste deposits has been applied to the calculated offsite releases to the atmosphere. The actual long-term resuspension rate is a site-specific value that depends on environmental factors such as soil type, duration of dry conditions in the basin, and local weather conditions. The site's radiological monitoring program will include measurements of observed resuspension rates from the Treated Effluent Evaporative Basin over time in order to assess the site specific airborne releases from the basin for both the immediate onsite area around the basin and for offsite releases. This information will provide a basis to determine any specific control means needed to ensure that the buildup of radioactivity in the basin over time will not cause unexpected airborne levels of radioactive materials.

Since the liquid effluent scenario assumes airborne particle releases from the Treated Effluent Evaporative Basin as the offsite transport mode, the same exposure pathways and receptor locations as evaluated for the gaseous release pathways discussed above were also applied to resuspended particles from dried liquid waste. Dose equivalent impacts to the critical receptors are evaluated for the projected 30th year of operations, thereby evaluating the end buildup of uranic material in the basin. In the assessment of the overall radiological impact, the dose equivalent contribution from resuspended airborne material is added to the gas release assessments for the nearest resident location, nearby businesses and site boundary locations.

4.12.2.1.3 Direct Radiation Impacts

Storage of feed, product and UBCs at the NEF may have an impact due to direct and scatter (sky shine) radiation to the site boundary, and to lesser extents, offsite locations. The UBC Storage Pad is the most significant portion of the total direct dose equivalent.

The direct dose equivalent from the accumulation of 30 years of UBC generation (15,727 cylinders) was calculated with the MCNP4C2 computer code (ORNL, 2000a). The layout of the UBC Storage Pad is shown in Figure 4.12-3, UBC Pad Dose Equivalent Isopleths (2,000 Hours Per Year Occupancy). Included in the total was the expected number of empty feed cylinders (354). These cylinders were included because they contain decaying residual material and produce a higher dose equivalent than full UBCs due to the absence of self-shielding. Direct dose from cylinders stored in the Cylinder Receipt and Dispatch Building (CRDB) was also included in the calculations.

The photon source intensity and spectrum were calculated using the ORIGEN-2 computer code (ORNL, 2000b). The generation of photons in UF_6 from beta particles emitted by the decay of uranium (i.e., Bremsstrahlung) is estimated at 60% of that calculated by ORIGEN-2 for UO_2 due to the higher density of UF_6.

In addition to the photon source term, there is a two-component neutron source term. The first component of the neutron source term is due to spontaneous fission by uranium. For this component a Watt fission spectrum for ^{252}Cf, as taken from the Monte Carlo N-particle (MCNP) manual (Briesmeister, 2000), is assumed. The second component is due to neutron emission by fluorine after alpha particle capture. In these calculations, this neutron source is assigned the spectrum from an 241Am-fluoride neutron source since no information is available on the spectrum from UF_6. As a consequence, conservatism is added to the calculation since the neutrons from UF_6 have a lower maximum energy than those from ^{241}Am-fluoride.

The regulatory dose equivalent limit for areas beyond the NEF fence boundary is 0.25 mSv (25 mrem) per year (including direct and effluent contributions) (including the contribution from cylinders stored in the CRDB to a member of the public (CFR, 2003q; CFR, 2003f). The evaluation of the UBC Storage Pad contribution to the offsite dose equivalent was based on a site design criteria of 0.20 mSv (20 mrem) at the site boundary to account for uncertainties in the calculation and to provide conservatism.

The annual offsite dose equivalent was calculated at the NEF fence line assuming 2,000 hours per year occupancy. Implicit in the use of 2,000 hours is the assumption that the dose equivalent is to a non-resident (i.e., a worker at an unrelated business). The annual dose equivalents for the actual nearest worksite and at the nearest residence were also calculated.

The dose equivalent at the NEF fence line is 0.189 mSv/yr (18.9 mrem/yr) assuming 2,000 hours per year occupancy. The dose equivalent at the nearest actual worksite NNW, 1.9 km (1.17 mi) is 6.0×10^{-5} mSv/yr (0.006 mrem/yr). The dose equivalent at the nearest actual residence west, 4.3 km (2.63 mi) is 8×10^{-12} mSv/yr (8×10^{-10} mrem/yr). In the latter case, full-time occupancy (i.e., 8,760 hours per year) is assumed. Figure 4.12-3, UBC Pad Dose Equivalent Isopleths (2,000 Hours per Year Occupancy) shows the dose equivalent contours for the summed contributions from the UBC Storage Pad and the CRDB for 2,000 hours/year occupancy. Figure 4.12-4, UBC Pad Dose Equivalent Isopleths (8,760 Hours per Year Occupancy), indicates the dose equivalent contours assuming full-time occupancy.

Table 4.12-1, Direct Radiation Annual Dose Equivalent by Source, summarizes the annual dose equivalents by source (UBC Storage Pad and CRDB) at different locations.

4.12.2.1.4 Population Dose Equivalents

The local area population distribution was derived from U.S. Census Bureau 2000 data for counties in New Mexico and Texas (DOC, 2000a; DOC, 2000b; DOC, 2000c; DOC, 2000d) that fall all or in part of a 80-km (50-mi) radius of the NEF site. A standard 16-sector compass rose was centered on the NEF site and divided into annular rings at selected distances. Population counts from census data that located significant population groups for towns or cities within the 80-km (50-mi) area were then distributed into those sectors that covered the groupings. After accounting for these significant population locations, the balance of the population for the different counties persons per square kilometer (square mile) was distributed by equal area allocation based on the land area in the sector. For the first 8 km (5 mi), site area observations provided information on the nearest resident within 8 km (5 mi) in all sectors, which indicated that most of the 16 sectors had no resident population near the site. The resulting population for the 2000 is shown on Table 4.12-2, Population Data for the Year 2000. Census data for the year 2000 also provided information on the breakdown of the seven counties within 80 km (50 mi) by age (DOC, 2000d). From this data, age groups as a fraction of the total population were determined for infants under one year of age (1.54%), children ages 1-11 (17.90%), teens ages 12 –17 (10.93%) and adults ages greater than 17 (69.64%). This breakdown was applied to the total population distribution for all exposure pathways including the determination of annual committed dose equivalent from ingestion and inhalation where age also affects the amount of annual intake (air and food).

The collective dose equivalent from gaseous effluents from the Separations Building GEVS, the TSB GEVS and the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System, along with resuspended airborne particles from dried liquid waste deposits on the bottom of the Treated Effluent Evaporative Basin (assuming 30-years of buildup of waste inventory) are calculated for the 80-km (50-mi) population based on all pathways calculated for the nearest resident applying to the general population. For the ingestion of food products, it was assumed that the area produced sufficient volume to supply the entire population with their needs. Annual average usage factors for the general population (Regulatory Guide 1.109) were used as the individual consumption rates. Individual total effective dose equivalents were calculated for each age group by sector and then multiplied by the estimated age-dependent population for that sector to get the collective dose equivalent. The collective dose equivalents for each age group were then added to provide the total population collective dose equivalents. Table 4.12-3, Collective Dose Equivalents to All Ages Population (Person-Seiverts) and Table 4.12-4, Collective Dose Equivalents to All Ages Population (Person-rem) indicate the total collective dose for the entire population within the 80-km (50-mi) radius of the NEF site in units of Person-Sieverts and Person-rem, respectively.

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4.12.2.1.5 Mitigation Measures

Although routine operations at the NEF create the potential for radiological and nonradiological impacts on the environment and members of the public, plant design has incorporated features to minimize gaseous and liquid effluent releases and to keep them well below regulatory limits. These features include:

- Process systems that handle UF_6 operate at sub-atmospheric pressure, which minimizes outward leakage of UF_6.
- UF_6 cylinders are moved only when cool and when UF_6 is in solid form, which minimizes the risk of inadvertent release due to mishandling.
- Process off-gas from UF_6 purification and other operations passes through desublimers to solidify and reclaim as much UF_6 as possible. Remaining gases pass through high-efficiency filters and chemical absorbers, which remove HF and uranium compounds.
- Waste generated by decontamination of equipment and systems are subjected to processes that separate uranium compounds and various other heavy metals in the waste material.
- Liquid and solid waste handling systems and techniques are used to control wastes and effluent concentrations.
- Gaseous effluent passes through prefilters, HEPA filters, and activated carbon filters, all of which greatly reduce the radioactivity in the final discharged effluent to very low concentrations.
- Liquid waste is routed to collection tanks, and treated through a combination of precipitation, evaporation, and ion exchange to remove most of the radioactivity prior to release of the onsite Treated Effluent Evaporative Basin.
- Effluent paths are monitored and sampled to assure compliance with regulatory discharge limits.

Under routine operations, the potential that radioactivity from the UBC Storage Pad may impact the public is low because the UBCs are surveyed for external contamination before they are placed on the storage pad. Therefore, rainfall runoff from the pad is not expected to be a significant exposure pathway. Runoff water from the UBC Storage Pad is directed from the UBC Storage Pad to an onsite retention basin for evaporation of the collected water. Periodic sampling of the soil from the basin is performed to identify accumulation or buildup of any residual UBC surface contamination washed off by rainwater to the basin (see ER Section 6.1, Radiological Monitoring). No liquids from the retention basin are discharged directly offsite. In addition, direct radiation from the UBC Storage Pad is monitored on a quarterly basis using thermo-luminescent dosimeters (TLDs) and pressurized ion chamber measurements.

4.12.2.2 Public and Occupational Exposure Impacts

The assessment of the dose impacts resulting from the annual liquid and gaseous effluents for the NEF site indicate that the principal radionuclides with respect to the dose equivalent contribution to individuals are ^{234}U and ^{238}U. Each of these nuclides contributes about the same level of committed dose. The critical organ for all receptor locations was found to be the lung as a result of the pathway. This committed dose equivalent dominated all other exposure pathways by a few orders of magnitude.

For gaseous effluents, the location of highest calculated offsite dose is the South site boundary with an annual effective dose equivalent of 1.7×10^{-4} mSv (1.7×10^{-2} mrem), with a maximum annual organ (lung) committed dose of 1.4×10^{-3} mSv (1.5×10^{-2} mrem). The nearest resident location had maximum annual effective dose equivalents of (teenager) 1.7×10^{-5} mSv (1.7×10^{-3} mrem), or about a factor of 10 lower than the site boundary. The maximum annual organ (lung) at the nearest resident was estimated to be 1.3×10^{-4} mSv (1.2×10^{-2} mrem) and was to the teenager age group. The nearest business, which exhibited the highest calculated annual effective dose equivalent, was at a location southeast, approximately 925 m (0.57 mi) from the TSB release point. The annual effective dose equivalent for this location from liquid releases is 2.8×10^{-5} mSv (2.8×10^{-3} mrem). The maximum organ (lung) committed dose for this receptor was estimated at 2.3×10^{-4} mSv (2.3×10^{-2} mrem) from one year's exposure and intake. Tables 4.12-5 through 4.12-7 provide a breakdown of organ and effective doses by exposure pathway for gaseous effluents.

For liquid effluents which result in resuspended airborne particles from the dry out of the Treated Effluent Evaporative Basin, the location of highest calculated offsite dose is also the south site boundary with an annual effective dose equivalent of 1.7×10^{-5} mSv (1.7×10^{-3} mrem), with a maximum annual organ (lung) committed dose of 1.5×10^{-4} mSv (1.5×10^{-2} mrem). The nearest resident location had maximum annual effective dose equivalents of (teenager)

1.7×10^{-6} mSv (1.7×10^{-4} mrem), or about a factor of 10 lower that the site boundary liquid pathway doses, and about a factor of 10 below the equivalent gaseous dose impacts at the same local. The liquid impact assessments assumed that the evaporative basin was dry only 10% of the year, thereby limiting the dose impact. Even if the evaporative basin were assumed to be dry for a full year, the increase in the resuspended material into the air would increase the liquid pathway dose by a factor of 10, making it about the same impact as the gaseous pathway contribution to the total offsite dose. If it is assumed that the basin is dry almost an entire year allowing for a ten-fold increase in the projected dose, the resulting maximum dose equivalent (south site boundary) of 1.7E-04 mSv/yr (1.7E-02 mrem/yr) is still a small fraction of the 10 CFR 20.1301 (CFR, 2003q) dose limits for members of the public. Similarly, the maximum organ committed dose equivalent from liquid releases would increase from 1.5E-04 mSv/yr (1.5E-02 mrem/yr) to 1.5E-03 mSv/yr (1.5E-01 mrem/yr), which is below the 40 CFR 190 (CFR, 2003f) dose limits for members of the public.

The maximum annual organ (lung) dose equivalent at the nearest resident from liquid effluents was estimated to be 1.3×10^{-5} mSv (1.3×10^{-3} mrem) and was to the teenager age group. The nearest business, which exhibited the highest calculated annual effective dose equivalent, was also the southeast location, approximately 925 m (0.57 mi) from the TSB release point. The estimated annual effective dose equivalent for this location from liquid releases is 2.9×10^{-6} mSv (2.9×10^{-4} mrem). The maximum organ (lung) committed dose for this receptor was estimated at 2.4×10^{-5} mSv (2.4×10^{-3} mrem) from one year's exposure and intake. Tables 4.12-8 through 4.12-10 provide a breakdown of organ and effective doses by exposure pathway for the liquid effluent contribution to the offsite dose.

The combination of both liquid and gaseous related annual effluent dose impacts are summarized in Table 4.12-11, Maximum Annual Liquid and Gas Radiological Impacts.

As can be seen on Table 4.12-12, Annual Effective Total Dose Equivalent (All Sources), the dominant source of offsite radiation exposure is from direct (and scatter) radiation from the UBC Storage Pad (fixed source). The maximum annual dose equivalent was found along the north site boundary with an estimated impact of 0.188 mSv /year (18.8 mrem/year). Table 4.12-12 provides the combined impact from liquid, gases and fixed radiation sources and illustrates that the annual total effective dose equivalent (TEDE) at the maximum exposure point is estimated to be 0.19 mSv (19 mrem) assuming a full UBC Storage Pad. The calculated dose equivalents are all below the 1 mSv (100 mrem/yr) TEDE requirement per 10 CFR 20.1301 (CFR, 2003q), and also within the 0.25 mSv (25 mrem/yr) dose equivalent to the whole body and any organ as indicated in 40 CFR 190 (CFR, 2003f). It is therefore concluded that the operation of the NEF will not exceed the dose equivalent criteria for members of the public as stipulated in Federal regulations.

Table 4.12-3, Collective Dose Equivalents to All Ages Population (Person-Sieverts) and Table 4.12-4, Collective Dose Equivalents to All Ages Population (Person-rem) provide the estimated collective effective dose equivalent to the 80-km (50-mi) population (all age and exposure pathways). The estimated dose is $5.2x10^{-5}$ Person-Sv ($5.2x10^{-3}$ Person-rem). This is a small fraction of the collective dose from natural background for the same population.

In addition to members of the public along the site boundary and beyond, estimates of annual facility area radiation dose rates have been made along with projections of occupational (NEF worker) personnel exposures during normal operations. Table 4.12-13, Estimated NEF Occupational Dose Equivalent Rates and Table 4.12-14, Estimated NEF Occupational (Individual) Exposures summarize the annual dose equivalent rates and projected dose impact for different areas and compounds (i.e., cylinders) of the plant, and for different work functions for employees. Section 4.1 of the NEF Safety Analysis Report (SAR) provides a detailed description of the NEF radiation protection program for controlling and limiting occupational exposures for plant workers.

4.12.3 Environmental Effects of Accidents

4.12.3.1 Accident Scenarios

All credible accident sequences were considered during the Integrated Safety Analysis (ISA) performed for the facility. Accidents evaluated fell into two general types: criticality events and UF_6 releases. Criticality events and some UF_6 release scenarios were shown to result in potential radiological and HF chemical exposures, respectively, to the public. Gaseous releases of UF_6 react quickly with moisture in the air to form HF and UO_2F_2. Consequence analyses showed that HF was the bounding consequence for all gaseous UF_6 releases to the environment. For some fire cases, uranic material in waste form or in chemical traps provided the bounding case. Accidents that produced unacceptable consequences to the public resulted in the identification of various design bases, design features and administrative controls.

During the ISA process, evaluation of most accident sequences resulted in identification of design bases and design features that prevent a criticality event or chemical release to the environment. Table 4.12-15, Accident Criteria Chemical Exposure Limits by Category lists the accident criteria chemical exposure limits by category for an immediate consequence and high consequence categories. Examples of preventative controls for criticality events include limits on UF_6 quantities or equipment geometry for UF_6 vessels that eliminate the potential for a criticality event. Examples of preventative controls for UF_6 releases include highly reliable protection features to prevent overheating of UF_6 cylinders and explicit design basis such as that for tornadoes.

These preventive controls reduce the likelihood of the accident (criticality events and HF release scenarios) such that the risk is reduced to acceptable levels as defined in 10 CFR 70.61 (CFR, 2003b). All HF release scenarios with the exception of those caused by seismic and for some fire cases are controlled through design features or by administrative procedural control measures.

Several accident sequences involving HF releases to the environment due to seismic or fire events were mitigated using design features to delay and reduce the UF_6 releases inside the buildings from reaching the outside environment. The seismic accident scenario considers an earthquake event of sufficient magnitude to fail the UF_6 process piping and some UF_6 components resulting in a large gaseous UF_6 release inside the buildings housing UF_6 process systems. The fire accident scenario considers a fire within the TSB that causes the release of uranic material from open waste containers and chemical traps during waste drum filling operations. These mitigation features include automatic shutoff of building HVAC systems following a seismic event or during a fire event along with building features to limit building air leakage to the outside environment. With mitigation, the dose equivalent consequences to the public for these accident sequences have been reduced to below an intermediate consequence as defined in 10 CFR 70.61 (CFR, 2003b).

Without mitigation, the bounding seismic scenario results in a 30-minute radiological dose equivalent of 0.18 mSv (18 mrem) TEDE, a 30-minute uranium inhalation intake of 2.9 mg, a 30-minute uranium chemical exposure to 4.7 mg U/m^3, a 24-hour airborne uranium concentration of 0.10 mg U/m^3, and a 30-minute HF chemical exposure to 32 mg HF/m^3. The controlling dose is for the HF chemical exposure, which is a high consequence as defined in 10 CFR 70.61 (CFR, 2003b).

With mitigation, the bounding seismic scenario results in a 30-minute radiological dose equivalent of 8μSv (0.8 mrem) TEDE, a 30-minute uranium inhalation intake of 0.13 mg, a 30-minute uranium chemical exposure to 0.213 mg U/m^3, a 24-hour airborne uranium concentration of 0.004 mg U/m^3, and a 30-minute HF chemical exposure to 1.4 mg HF/m^3. The controlling dose is for the HF chemical exposure, which is a below an intermediate consequence as defined in 10 CFR 70.61 (CFR, 2003b).

Without mitigation, the bounding fire scenario results in a 30-minute radiological dose equivalent of 0.055 mSv (5.5 mrem) TEDE, a 30-minute uranium inhalation intake of 0.92 mg, a 30-minute uranium chemical exposure to 1.5 mg U/m^3, a 24-hour airborne uranium concentration of 0.03 mg U/m^3, and a 30-minute HF chemical exposure to 5 mg HF/m^3. The controlling dose is for the HF chemical exposure, which is an intermediate consequence as defined in 10 CFR 70.61 (CFR, 2003b).

With mitigation, the bounding fire scenario results in a 30-minute radiological dose equivalent of 16 μSv (1.6 mrem) TEDE, a 30-minute uranium inhalation intake of 0.265 mg, a 30-minute uranium chemical exposure to 0.425 mg U/m^3, a 24-hour airborne uranium concentration of 0.0089 mg U/m^3, and a 30-minute HF chemical exposure to 1.44 mg HF/m^3. The controlling dose is for the HF chemical exposure, which is a below an intermediate consequence as defined in 10 CFR 70.61 (CFR, 2002b).

4.12.3.2 Accident Mitigation Measures

Potential adverse impacts for accident conditions are described in ER Section 4.12.3.1 above. Several accident sequences involving HF releases to the environment due to seismic or fire events were mitigated using design features to delay and reduce the UF_6 releases inside the buildings from reaching the outside environment. These mitigative features include automatic shutoff of building HVAC systems following a seismic event or during a fire event along with building features to limit building air leakage to the outside environment. With mitigation, the dose equivalent consequences to the public for these accident sequences have been reduced to below an intermediate consequence as defined in 10 CFR 70.61 (CFR, 2003b).

4.12.3.3 Non-Radiological Accidents

A review of non-radiological accident injury reports for the Capenhurst facility was conducted for the period 1999-2003. No injuries involving the public were reported. Injuries to workers occurred due to accidents in parking lots and offices as well as in the plant. The typical causes of injuries sustained at the Capenhurst facility are summarized in Table 4.12-16, Causes of Injuries at Capenhurst (1999-2003). Non-radiological accidents to equipment that did not result in injury to workers are not reported by Capenhurst.

4.12.4 Comparative Public and Occupational Exposure Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action" i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The public and occupational exposure impact would be greater because of greater effluents and operational exposure associated with GDP operation.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The public and occupational exposure impact would be greater in the short term due to more effluents and operational exposure associated with GDP operation. In the long term, the public and occupational exposure would be the same or greater.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The public and occupational exposure impact would be significantly greater since a significant amount of additional effluent and exposure results from operation of the GDP at the increased capacity.

4.12.4 Section 4.12 Tables

Table 4.12-1 Direct Radiation Annual Dose Equivalent by Source

Location	Annual Occupancy (hours/year)	UBC Storage Pad mSv/yr (mrem/yr)	CRDB mSv/yr (mrem/yr)	Total mSv/yr (mrem/yr)
Site Fence, North* 435 m (1,427 ft)	2,000	0.188 (18.8)	0.001 (0.1)	0.19 (19.0)
Site Fence East* 376 m (1,235 ft)	2,000	0.188 (11.8)	0.003 (0.3)	0.121 (12.1)
Nearest Actual Business, NNW 1.9 km (1.17 mi)**	2,000	$6.0x10^{-5}$ ($6.0x10^{-3}$)	$2.0x10^{-10}$ ($2.0x10^{-8}$)	$6.0x10^{-5}$ ($6.0x10^{-3}$)
Nearest Actual Residence, West 4.3 km (2.63 mi)**	8,760	$8.0x10^{-12}$ ($8.0x10^{-10}$)	$9.0x10^{-20}$ ($9.0x10^{-18}$)	$8.0x10^{-12}$ ($8.0x10^{-10}$)

* Distance from the closest edge of the pad.

**Distance from the center of the site.

Table 4.12-2 Population Data for the Year 2000											
Population (All Ages) Distribution (2000 Census) Within 80 km (50 mi)											
Sector	0-1.6 km (0-1 mi)	1.6-3.2 km (1-2 mi)	3.2-4.8 km (2-3 mi)	4.8-6.4 km (3-4 mi)	6.4-8.0 km (4-5 mi)	8.0-16 km (5-10 mi)	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)	Totals
N	0	0	0	0	0	43	171	275	370	476	1,336
NNE	0	0	0	0	0	61	243	405	568	4,404	5,681
NE	0	0	0	0	0	61	243	405	3,523	3,064	7,296
ENE	0	0	0	0	0	61	188	405	3,523	730	4,906
E	0	0	0	0	0	33	132	220	308	396	1,089
ESE	0	0	0	0	0	33	132	220	9,960	396	10,741
SE	0	0	0	0	0	33	132	220	1,937	7,084	9,406
SSE	0	0	0	0	0	33	132	157	1,321	2,836	4,479
S	0	0	0	0	0	43	171	286	88	6,746	7,334
SSW	0	0	0	0	0	43	171	2,282	167	56	2,719
SW	0	0	0	0	0	43	171	286	400	266	1,166
WSW	0	0	11	6	0	43	171	286	400	537	1,454
W	0	0	11	52	1,286	1,324	171	286	400	537	4,067
WNW	0	0	0	0	0	43	171	286	400	520	1,420
NW	0	0	0	0	0	43	171	286	400	514	1,414
NNW	0	0	0	0	0	43	7,335	7,450	9,871	514	25,213
Ring Totals=	0	0	22	58	1,286	1,981	9,909	13,754	33,635	29,075	89,720
Cum. Totals =	0	0	22	80	1,366	3,347	13,256	27,009	60,644	89,720	

Table 4.12-3 Collective Dose Equivalents to All Ages Population (Person-Sieverts)

(liquid and gas release pathways)

Population Dose Equivalent (All Ages - All Pathways) Within 80 km (50 mi) (Person-Sievert)

Sector	0-1.6 km (0-1 mi)	1.6-3.2 km (1-2 mi)	3.2-4.8 km (2-3 mi)	4.8-6.4 km (3-4 mi)	6.4-8.0 km (4-5 mi)	8.0-16 km (5-10 mi)	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)	Totals
N	0.0	0.0	0.0	0.0	0.0	3.3E-07	4.4E-07	3.1E-07	2.5E-07	2.1E-07	1.5E-06
NNE	0.0	0.0	0.0	0.0	0.0	2.3E-07	3.1E-07	2.3E-07	1.9E-07	9.9E-07	2.0E-06
NE	0.0	0.0	0.0	0.0	0.0	1.4E-07	1.8E-07	1.4E-07	7.0E-07	4.0E-07	1.6E-06
ENE	0.0	0.0	0.0	0.0	0.0	1.3E-07	1.3E-07	1.3E-07	6.6E-07	9.1E-08	1.1E-06
E	0.0	0.0	0.0	0.0	0.0	7.5E-08	1.0E-07	7.7E-08	6.3E-08	5.4E-08	3.7E-07
ESE	0.0	0.0	0.0	0.0	0.0	6.3E-08	8.7E-08	6.6E-08	1.7E-06	4.6E-08	2.0E-06
SE	0.0	0.0	0.0	0.0	0.0	7.4E-08	1.0E-07	7.7E-08	4.0E-07	9.7E-07	1.6E-06
SSE	0.0	0.0	0.0	0.0	0.0	7.6E-08	1.0E-07	5.6E-08	2.8E-07	3.9E-07	9.0E-07
S	0.0	0.0	0.0	0.0	0.0	1.5E-07	2.0E-07	1.5E-07	2.7E-08	1.4E-06	1.9E-06
SSW	0.0	0.0	0.0	0.0	0.0	6.9E-08	9.3E-08	5.5E-07	2.3E-08	5.1E-09	7.4E-07
SW	0.0	0.0	0.0	0.0	0.0	7.3E-08	9.7E-08	7.1E-08	5.8E-08	2.5E-08	3.2E-07
WSW	0.0	0.0	1.0E-07	3.2E-08	0.0	6.9E-08	9.1E-08	6.7E-08	5.4E-08	4.8E-08	4.6E-07
W	0.0	0.0	1.7E-07	4.6E-07	7.7E-06	3.5E-06	1.5E-07	1.1E-07	9.3E-08	8.3E-08	1.2E-05
WNW	0.0	0.0	0.0	0.0	0.0	9.8E-08	1.3E-07	9.8E-08	7.9E-08	6.8E-08	4.8E-07
NW	0.0	0.0	0.0	0.0	0.0	1.4E-07	2.0E-07	1.5E-07	1.2E-07	1.0E-07	7.1E-07
NNW	0.0	0.0	0.0	0.0	0.0	2.2E-07	1.3E-05	5.9E-06	4.6E-06	1.6E-07	2.4E-05
Ring Totals=	0	0	2.7E-07	5.0E-07	7.7E-06	5.5E-06	1.5E-05	8.2E-06	9.3E-06	5.0E-06	5.2E-05
Cum. Totals =	0	0	2.7E-07	7.6E-07	8.4E-06	1.4E-05	2.9E-05	3.8E-05	4.7E-05	5.2E-05	

Table 4.12-4 Collective Dose Equivalents to All Ages Population (Person-rem)

(liquid and gas release pathways)

Population Dose Equivalent (All Ages - All Pathways) Within 80 km (50 mi) (Person-rem)

Sector	0-1.6 km (0-1 mi)	1.6-3.2 km (1-2 mi)	3.2-4.8 km (2-3 mi)	4.8-6.4 km (3-4 mi)	6.4-8.0 km (4-5 mi)	8.0-16 km (5-10 mi)	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)	Totals
N	0.0	0.0	0.0	0.0	0.0	3.3E-05	4.4E-05	3.1E-05	2.5E-05	2.1E-05	1.5E-04
NNE	0.0	0.0	0.0	0.0	0.0	2.3E-05	3.1E-05	2.3E-05	1.9E-05	9.9E-05	2.0E-04
NE	0.0	0.0	0.0	0.0	0.0	1.4E-05	1.8E-05	1.4E-05	7.0E-05	4.0E-05	1.6E-04
ENE	0.0	0.0	0.0	0.0	0.0	1.3E-05	1.3E-05	1.3E-05	6.6E-05	9.1E-06	1.1E-04
E	0.0	0.0	0.0	0.0	0.0	7.5E-06	1.0E-05	7.7E-06	6.3E-06	5.4E-06	3.7E-05
ESE	0.0	0.0	0.0	0.0	0.0	6.3E-06	8.7E-06	6.6E-06	1.7E-04	4.6E-06	2.0E-04
SE	0.0	0.0	0.0	0.0	0.0	7.4E-06	1.0E-05	7.7E-06	4.0E-05	9.7E-05	1.6E-04
SSE	0.0	0.0	0.0	0.0	0.0	7.6E-06	1.0E-05	5.6E-06	2.8E-05	3.9E-05	9.0E-05
S	0.0	0.0	0.0	0.0	0.0	1.5E-05	2.0E-05	1.5E-05	2.7E-06	1.4E-04	1.9E-04
SSW	0.0	0.0	0.0	0.0	0.0	6.9E-06	9.3E-06	5.5E-05	2.3E-06	5.1E-07	7.4E-05
SW	0.0	0.0	0.0	0.0	0.0	7.3E-06	9.7E-06	7.1E-06	5.8E-06	2.5E-06	3.2E-05
WSW	0.0	0.0	1.0E-05	3.2E-06	0.0	6.9E-06	9.1E-06	6.7E-06	5.4E-06	4.8E-06	4.6E-05
W	0.0	0.0	1.7E-05	4.6E-05	7.7E-04	3.5E-04	1.5E-05	1.1E-05	9.3E-06	8.3E-06	1.2E-03
WNW	0.0	0.0	0.0	0.0	0.0	9.8E-06	1.3E-05	9.8E-06	7.9E-06	6.8E-06	4.8E-05
NW	0.0	0.0	0.0	0.0	0.0	1.4E-05	2.0E-05	1.5E-05	1.2E-05	1.0E-05	7.1E-05
NNW	0.0	0.0	0.0	0.0	0.0	2.2E-05	1.3E-03	5.9E-04	4.6E-04	1.6E-05	2.4E-03
Ring Totals=	0	0	2.7E-05	5.0E-05	7.7E-04	5.5E-04	1.5E-03	8.2E-04	9.3E-04	5.0E-04	5.2E-03
Cum. Totals =	0	0	2.7E-05	7.6E-05	8.4E-04	1.4E-03	2.9E-03	3.8E-03	4.7E-03	5.2E-03	

Table 4.12-5A Annual and Committed Dose Equivalents for Exposures in Year 30 to an Adult from Gaseous Effluent (Nearest Resident)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.3E-13	1.6E-13	1.9E-13	1.5E-13	1.4E-13	4.2E-13	1.6E-13	1.5E-13	1.7E-13
	(mrem)	2.3E-11	1.6E-11	1.9E-11	1.5E-11	1.4E-11	4.2E-11	1.6E-11	1.5E-11	1.7E-11
Inhalation	(mSv)	0.0E+00	9.2E-10	1.0E-09	1.0E-04	2.5E-08	3.9E-07	9.8E-10	3.7E-08	1.2E-05
	(mrem)	0.0E+00	9.2E-08	1.0E-07	1.0E-02	2.5E-06	3.9E-05	9.8E-08	3.7E-06	1.2E-03
Grd. Plane direct	(mSv)	1.9E-05	7.7E-08	7.8E-08	6.2E-08	6.1E-08	1.5E-07	6.5E-08	6.2E-08	7.1E-08
	(mrem)	1.9E-03	7.7E-06	7.8E-06	6.2E-06	6.1E-06	1.5E-05	6.5E-06	6.2E-06	7.1E-06
Ingestion	(mSv)	0.0E+00	4.1E-08	4.1E-08	4.1E-08	1.2E-06	1.8E-05	4.1E-08	1.7E-06	1.2E-06
	(mrem)	0.0E+00	4.1E-06	4.1E-06	4.1E-06	1.2E-04	1.8E-03	4.1E-06	1.7E-04	1.2E-04
Sum Total	(mSv)	1.9E-05	1.2E-07	1.2E-07	1.0E-04	1.3E-06	1.9E-05	1.1E-07	1.8E-06	1.4E-05
	(mrem)	1.9E-03	1.2E-05	1.2E-05	1.0E-02	1.3E-04	1.9E-03	1.1E-05	1.8E-04	1.4E-03

Table 4.12-5B Annual and Committed Dose Equivalents for Exposures in Year 30 to an Teen from Gaseous Effluents (Nearest Resident)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.3E-13	1.6E-13	1.9E-13	1.5E-13	1.4E-13	4.2E-13	1.6E-13	1.5E-13	1.7E-13
	(mrem)	2.3E-11	1.6E-11	1.9E-11	1.5E-11	1.4E-11	4.2E-11	1.6E-11	1.5E-11	1.7E-11
Inhalation	(mSv)	0.0E+00	1.1E-09	1.2E-09	1.2E-04	3.1E-08	4.6E-07	1.2E-09	4.4E-08	1.5E-05
	(mrem)	0.0E+00	1.1E-07	1.2E-07	1.2E-02	3.1E-06	4.6E-05	1.2E-07	4.4E-06	1.5E-03
Grd. Plane direct	(mSv)	1.9E-05	7.7E-08	7.8E-08	6.2E-08	6.1E-08	1.5E-07	6.5E-08	6.2E-08	7.1E-08
	(mrem)	1.9E-03	7.7E-06	7.8E-06	6.2E-06	6.1E-06	1.5E-05	6.5E-06	6.2E-06	7.1E-06
Ingestion	(mSv)	0.0E+00	7.1E-08	7.0E-08	7.0E-08	2.0E-06	3.1E-05	7.0E-08	3.0E-06	2.1E-06
	(mrem)	0.0E+00	7.1E-06	7.0E-06	7.0E-06	2.0E-04	3.1E-03	7.0E-06	3.0E-04	2.1E-04
Sum Total	(mSv)	1.9E-05	1.5E-07	1.5E-07	1.2E-04	2.1E-06	3.1E-05	1.4E-07	3.1E-06	1.7E-05
	(mrem)	1.9E-03	1.5E-05	1.5E-05	1.2E-02	2.1E-04	3.1E-03	1.4E-05	3.1E-04	1.7E-03

Table 4.12-5C Annual and Committed Dose Equivalents for Exposures in Year 30 to an Child from Gaseous Effluent (Nearest Resident)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.3E-13	1.6E-13	1.9E-13	1.5E-13	1.4E-13	4.2E-13	1.6E-13	1.5E-13	1.7E-13
	(mrem)	2.3E-11	1.6E-11	1.9E-11	1.5E-11	1.4E-11	4.2E-11	1.6E-11	1.5E-11	1.7E-11
Inhalation	(mSv)	0.0E+00	8.6E-10	9.6E-10	9.5E-05	2.4E-08	3.6E-07	9.2E-10	3.4E-08	1.1E-05
	(mrem)	0.0E+00	8.6E-08	9.6E-08	9.5E-03	2.4E-06	3.6E-05	9.2E-08	3.4E-06	1.1E-03
Grd. Plane direct	(mSv)	1.9E-05	7.7E-08	7.8E-08	6.2E-08	6.1E-08	1.5E-07	6.5E-08	6.2E-08	7.1E-08
	(mrem)	1.9E-03	7.7E-06	7.8E-06	6.2E-06	6.1E-06	1.5E-05	6.5E-06	6.2E-06	7.1E-06
Ingestion	(mSv)	0.0E+00	6.8E-08	6.8E-08	6.8E-08	1.9E-06	3.0E-05	6.8E-08	2.9E-06	2.0E-06
	(mrem)	0.0E+00	6.8E-06	6.8E-06	6.8E-06	1.9E-04	3.0E-03	6.8E-06	2.9E-04	2.0E-04
Sum Total	(mSv)	1.9E-05	1.5E-07	1.5E-07	9.5E-05	2.0E-06	3.0E-05	1.3E-07	2.9E-06	1.4E-05
	(mrem)	1.9E-03	1.5E-05	1.5E-05	9.5E-03	2.0E-04	3.0E-03	1.3E-05	2.9E-04	1.4E-03

Table 4.12-5D Annual and Committed Dose Equivalents for Exposures in Year 30 to an Infant from Gaseous Effluent (Nearest Resident)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.3E-13	1.6E-13	1.9E-13	1.5E-13	1.4E-13	4.2E-13	1.6E-13	1.5E-13	1.7E-13
	(mrem)	2.3E-11	1.6E-11	1.9E-11	1.5E-11	1.4E-11	4.2E-11	1.6E-11	1.5E-11	1.7E-11
Inhalation	(mSv)	0.0E+00	6.8E-10	7.7E-10	7.6E-05	1.9E-08	2.9E-07	7.3E-10	2.7E-08	9.1E-06
	(mrem)	0.0E+00	6.8E-08	7.7E-08	7.6E-03	1.9E-06	2.9E-05	7.3E-08	2.7E-06	9.1E-04
Grd. Plane direct	(mSv)	1.9E-05	7.7E-08	7.8E-08	6.2E-08	6.1E-08	1.5E-07	6.5E-08	6.2E-08	7.1E-08
	(mrem)	1.9E-03	7.7E-06	7.8E-06	6.2E-06	6.1E-06	1.5E-05	6.5E-06	6.2E-06	7.1E-06
Ingestion	(mSv)	0.0E+00	1.2E-08	1.2E-08	1.2E-08	3.5E-07	5.3E-06	1.2E-08	5.1E-07	3.6E-07
	(mrem)	0.0E+00	1.2E-06	1.2E-06	1.2E-06	3.5E-05	5.3E-04	1.2E-06	5.1E-05	3.6E-05
Sum Total	(mSv)	1.9E-05	9.0E-08	9.1E-08	7.6E-05	4.3E-07	5.7E-06	7.8E-08	6.0E-07	9.5E-06
	(mrem)	1.9E-03	9.0E-06	9.1E-06	7.6E-03	4.3E-05	5.7E-04	7.8E-06	6.0E-05	9.5E-04

Table 4.12-6A Annual and Committed Dose Equivalents for Exposures in Year 30 to an Adult From Gaseous Effluent (Nearby Businesses)

Location: Nearby Business – SE, 925 m (3,035 ft)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	7.4E-13	5.3E-13	6.3E-13	5.0E-13	4.6E-13	1.4E-12	5.3E-13	4.7E-13	5.4E-13
	(mrem)	7.4E-11	5.3E-11	6.3E-11	5.0E-11	4.6E-11	1.4E-10	5.3E-11	4.7E-11	5.4E-11
Inhalation	(mSv)	0.0E+00	2.1E-09	2.4E-09	2.3E-04	5.8E-08	8.8E-07	2.2E-09	8.3E-08	2.8E-05
	(mrem)	0.0E+00	2.1E-07	2.4E-07	2.3E-02	5.8E-06	8.8E-05	2.2E-07	8.3E-06	2.8E-03
Grd. Plane direct	(mSv)	3.6E-05	1.5E-07	1.5E-07	1.2E-07	1.2E-07	2.8E-07	1.2E-07	1.2E-07	1.3E-07
	(mrem)	3.6E-03	1.5E-05	1.5E-05	1.2E-05	1.2E-05	2.8E-05	1.2E-05	1.2E-05	1.3E-05
Ingestion	(mSv)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	(mrem)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Total	(mSv)	3.6E-05	1.5E-07	1.5E-07	2.3E-04	1.7E-07	1.2E-06	1.3E-07	2.0E-07	2.8E-05
	(mrem)	3.6E-03	1.5E-05	1.5E-05	2.3E-02	1.7E-05	1.2E-04	1.3E-05	2.0E-05	2.8E-03

Table 4.12-6B Annual and Committed Dose Equivalents for Exposures in Year 30 to an Adult From Gaseous Effluent (Nearby Businesses)

Location: Nearby Business – NNW, 1,712 m (5,617 ft)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	6.0E-13	4.3E-13	5.1E-13	4.1E-13	3.7E-13	1.1E-12	4.3E-13	3.9E-13	4.4E-13
	(mrem)	6.0E-11	4.3E-11	5.1E-11	4.1E-11	3.7E-11	1.1E-10	4.3E-11	3.9E-11	4.4E-11
Inhalation	(mSv)	0.0E+00	1.7E-09	1.9E-09	1.9E-04	4.7E-08	7.2E-07	1.8E-09	6.8E-08	2.3E-05
	(mrem)	0.0E+00	1.7E-07	1.9E-07	1.9E-02	4.7E-06	7.2E-05	1.8E-07	6.8E-06	2.3E-03
Grd. Plane direct	(mSv)	5.2E-05	2.1E-07	2.1E-07	1.7E-07	1.7E-07	4.1E-07	1.8E-07	1.7E-07	1.9E-07
	(mrem)	5.2E-03	2.1E-05	2.1E-05	1.7E-05	1.7E-05	4.1E-05	1.8E-05	1.7E-05	1.9E-05
Ingestion	(mSv)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	(mrem)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Total	(mSv)	5.2E-05	2.1E-07	2.1E-07	1.9E-04	2.1E-07	1.1E-06	1.8E-07	2.4E-07	2.3E-05
	(mrem)	5.2E-03	2.1E-05	2.1E-05	1.9E-02	2.1E-05	1.1E-04	1.8E-05	2.4E-05	2.3E-03

Table 4.12-7A Annual and Committed Dose Equivalents for Exposure in Year 30 to an Adult From Gaseous Effluent (Site Boundary)

Location: Maximum Site Boundary – South, 417 m (1,368 ft)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	4.5E-12	3.2E-12	3.8E-12	3.0E-12	2.7E-12	8.3E-12	3.2E-12	2.8E-12	3.3E-12
	(mrem)	4.5E-10	3.2E-10	3.8E-10	3.0E-10	2.7E-10	8.3E-10	3.2E-10	2.8E-10	3.3E-10
Inhalation	(mSv)	0.0E+00	1.3E-08	1.4E-08	1.4E-03	3.5E-07	5.3E-06	1.3E-08	5.0E-07	1.7E-04
	(mrem)	0.0E+00	1.3E-06	1.4E-06	1.4E-01	3.5E-05	5.3E-04	1.3E-06	5.0E-05	1.7E-02
Grd. Plane direct	(mSv)	2.7E-04	1.1E-06	1.1E-06	8.8E-07	8.6E-07	2.1E-06	9.1E-07	8.7E-07	1.0E-06
	(mrem)	2.7E-02	1.1E-04	1.1E-04	8.8E-05	8.6E-05	2.1E-04	9.1E-05	8.7E-05	1.0E-04
Ingestion	(mSv)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	(mrem)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Total	(mSv)	2.7E-04	1.1E-06	1.1E-06	1.4E-03	1.2E-06	7.4E-06	9.2E-07	1.4E-06	1.7E-04
	(mrem)	2.7E-02	1.1E-04	1.1E-04	1.4E-01	1.2E-04	7.4E-04	9.2E-05	1.4E-04	1.7E-02

Table 4.12-7B Annual and Committed Dose Equivalents for Exposure in Year 30 to an Adult From Gaseous Effluent (Site Boundary)

Location: Maximum Site Boundary – North, 995 m (3,265 ft) Side Next to UBC Storage Pad)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.3E-12	1.7E-12	2.0E-12	1.6E-12	1.4E-12	4.3E-12	1.7E-12	1.5E-12	1.7E-12
	(mrem)	2.3E-10	1.7E-10	2.0E-10	1.6E-10	1.4E-10	4.3E-10	1.7E-10	1.5E-10	1.7E-10
Inhalation	(mSv)	0.0E+00	6.5E-09	7.4E-09	7.3E-04	1.8E-07	2.8E-06	7.0E-09	2.6E-07	8.7E-05
	(mrem)	0.0E+00	6.5E-07	7.4E-07	7.3E-02	1.8E-05	2.8E-04	7.0E-07	2.6E-05	8.7E-03
Grd. Plane direct	(mSv)	2.4E-04	9.7E-07	9.8E-07	7.9E-07	7.8E-07	1.9E-06	8.2E-07	7.9E-07	9.0E-07
	(mrem)	2.4E-02	9.7E-05	9.8E-05	7.9E-05	7.8E-05	1.9E-04	8.2E-05	7.9E-05	9.0E-05
Ingestion	(mSv)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	(mrem)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Total	(mSv)	2.4E-04	9.8E-07	9.9E-07	7.3E-04	9.6E-07	4.6E-06	8.3E-07	1.0E-06	8.8E-05
	(mrem)	2.4E-02	9.8E-05	9.9E-05	7.3E-02	9.6E-05	4.6E-04	8.3E-05	1.0E-04	8.8E-03

Table 4.12-8A Annual and Committed Dose Equivalents for Exposures in Year 30 to an Adult From Liquid Effluent (Nearest Resident)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.8E-12	7.7E-14	8.9E-14	7.3E-14	6.7E-14	1.8E-13	7.6E-14	6.9E-14	7.8E-14
	(mrem)	2.8E-10	7.7E-12	8.9E-12	7.3E-12	6.7E-12	1.8E-11	7.6E-12	6.9E-12	7.8E-12
Inhalation	(mSv)	0.0E+00	9.6E-11	1.1E-10	1.1E-05	2.7E-09	4.0E-08	1.0E-10	3.9E-12	1.3E-06
	(mrem)	0.0E+00	9.6E-09	1.1E-08	1.1E-03	2.7E-07	4.0E-06	1.0E-08	3.9E-10	1.3E-04
Grd. Plane direct	(mSv)	1.2E-06	4.7E-09	4.7E-09	3.8E-09	3.7E-09	9.1E-09	3.9E-09	3.8E-12	4.3E-09
	(mrem)	1.2E-04	4.7E-07	4.7E-07	3.8E-07	3.7E-07	9.1E-07	3.9E-07	3.8E-10	4.3E-07
Ingestion	(mSv)	0.0E+00	4.2E-09	4.2E-09	4.2E-09	1.2E-07	1.8E-06	4.2E-09	1.8E-07	1.3E-07
	(mrem)	0.0E+00	4.2E-07	4.2E-07	4.2E-07	1.2E-05	1.8E-04	4.2E-07	1.8E-05	1.3E-05
Sum Total	(mSv)	1.2E-06	9.0E-09	9.0E-09	1.1E-05	1.3E-07	1.9E-06	8.2E-09	1.8E-07	1.4E-06
	(mrem)	1.2E-04	9.0E-07	9.0E-07	1.1E-03	1.3E-05	1.9E-04	8.2E-07	1.8E-05	1.4E-04

Table 4.12-8B Annual and Committed Dose Equivalents for Exposures in Year 30 to a Teen From Liquid Effluent (Nearest Resident)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.8E-12	7.7E-14	8.9E-14	7.3E-14	6.7E-14	1.8E-13	7.6E-14	6.9E-14	7.8E-14
	(mrem)	2.8E-10	7.7E-12	8.9E-12	7.3E-12	6.7E-12	1.8E-11	7.6E-12	6.9E-12	7.8E-12
Inhalation	(mSv)	0.0E+00	1.2E-10	1.3E-10	1.3E-05	3.2E-09	4.8E-08	1.2E-10	4.7E-12	1.5E-06
	(mrem)	0.0E+00	1.2E-08	1.3E-08	1.3E-03	3.2E-07	4.8E-06	1.2E-08	4.7E-10	1.5E-04
Grd. Plane direct	(mSv)	1.2E-06	4.7E-09	4.7E-09	3.8E-09	3.7E-09	9.1E-09	3.9E-09	3.8E-12	4.3E-09
	(mrem)	1.2E-04	4.7E-07	4.7E-07	3.8E-07	3.7E-07	9.1E-07	3.9E-07	3.8E-10	4.3E-07
Ingestion	(mSv)	0.0E+00	7.2E-09	7.2E-09	7.2E-09	2.1E-07	3.1E-06	7.2E-09	3.0E-07	2.1E-07
	(mrem)	0.0E+00	7.2E-07	7.2E-07	7.2E-07	2.1E-05	3.1E-04	7.2E-07	3.0E-05	2.1E-05
Sum Total	(mSv)	1.2E-06	1.2E-08	1.2E-08	1.3E-05	2.1E-07	3.2E-06	1.1E-08	3.0E-07	1.7E-06
	(mrem)	1.2E-04	1.2E-06	1.2E-06	1.3E-03	2.1E-05	3.2E-04	1.1E-06	3.0E-05	1.7E-04

Table 4.12-8C Annual and Committed Dose Equivalents for Exposures in Year 30 to a Child From Liquid Effluent (Nearest Resident)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.8E-12	7.7E-14	8.9E-14	7.3E-14	6.7E-14	1.8E-13	7.6E-14	6.9E-14	7.8E-14
	(mrem)	2.8E-10	7.7E-12	8.9E-12	7.3E-12	6.7E-12	1.8E-11	7.6E-12	6.9E-12	7.8E-12
Inhalation	(mSv)	0.0E+00	9.0E-11	1.0E-10	9.9E-06	2.5E-09	3.8E-08	9.6E-11	3.6E-12	1.2E-06
	(mrem)	0.0E+00	9.0E-09	1.0E-08	9.9E-04	2.5E-07	3.8E-06	9.6E-09	3.6E-10	1.2E-04
Grd. Plane direct	(mSv)	1.2E-06	4.7E-09	4.7E-09	3.8E-09	3.7E-09	9.1E-09	3.9E-09	3.8E-12	4.3E-09
	(mrem)	1.2E-04	4.7E-07	4.7E-07	3.8E-07	3.7E-07	9.1E-07	3.9E-07	3.8E-10	4.3E-07
Ingestion	(mSv)	0.0E+00	6.9E-09	6.9E-09	6.9E-09	2.0E-07	3.0E-06	6.9E-09	2.9E-07	2.1E-07
	(mrem)	0.0E+00	6.9E-07	6.9E-07	6.9E-07	2.0E-05	3.0E-04	6.9E-07	2.9E-05	2.1E-05
Sum Total	(mSv)	1.2E-06	1.2E-08	1.2E-08	9.9E-06	2.0E-07	3.1E-06	1.1E-08	2.9E-07	1.4E-06
	(mrem)	1.2E-04	1.2E-06	1.2E-06	9.9E-04	2.0E-05	3.1E-04	1.1E-06	2.9E-05	1.4E-04

Table 4.12-8D Annual and Committed Dose Equivalents for Exposures in Year 30 to an Infant From Liquid Effluent (Nearest Resident)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.8E-12	7.7E-14	8.9E-14	7.3E-14	6.7E-14	1.8E-13	7.6E-14	6.9E-14	7.8E-14
	(mrem)	2.8E-10	7.7E-12	8.9E-12	7.3E-12	6.7E-12	1.8E-11	7.6E-12	6.9E-12	7.8E-12
Inhalation	(mSv)	0.0E+00	7.1E-11	8.0E-11	7.9E-06	2.0E-09	3.0E-08	7.6E-11	2.9E-12	9.5E-07
	(mrem)	0.0E+00	7.1E-09	8.0E-09	7.9E-04	2.0E-07	3.0E-06	7.6E-09	2.9E-10	9.5E-05
Grd. Plane direct	(mSv)	1.2E-06	4.7E-09	4.7E-09	3.8E-09	3.7E-09	9.1E-09	3.9E-09	3.8E-12	4.3E-09
	(mrem)	1.2E-04	4.7E-07	4.7E-07	3.8E-07	3.7E-07	9.1E-07	3.9E-07	3.8E-10	4.3E-07
Ingestion	(mSv)	0.0E+00	1.3E-09	1.2E-09	1.2E-09	3.6E-08	5.5E-07	1.2E-09	5.3E-08	3.7E-08
	(mrem)	0.0E+00	1.3E-07	1.2E-07	1.2E-07	3.6E-06	5.5E-05	1.2E-07	5.3E-06	3.7E-06
Sum Total	(mSv)	1.2E-06	6.0E-09	6.1E-09	7.9E-06	4.1E-08	5.9E-07	5.3E-09	5.3E-08	9.9E-07
	(mrem)	1.2E-04	6.0E-07	6.1E-07	7.9E-04	4.1E-06	5.9E-05	5.3E-07	5.3E-06	9.9E-05

Table 4.12-9b Annual and Committed Dose Equivalents for Exposures in Year 30 to an Adult from Liquid Effluent (Nearby Businesses)

Location: Nearby Business – SE, 925 m (3,035 ft)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	9.2E-12	2.5E-13	2.9E-13	2.4E-13	2.2E-13	5.7E-13	2.5E-13	2.3E-13	2.5E-13
	(mrem)	9.2E-10	2.5E-11	2.9E-11	2.4E-11	2.2E-11	5.7E-11	2.5E-11	2.3E-11	2.5E-11
Inhalation	(mSv)	0.0E+00	2.2E-10	2.5E-10	2.4E-05	6.1E-09	9.2E-08	2.3E-10	8.9E-12	2.9E-06
	(mrem)	0.0E+00	2.2E-08	2.5E-08	2.4E-03	6.1E-07	9.2E-06	2.3E-08	8.9E-10	2.9E-04
Grd. Plane direct	(mSv)	2.2E-06	8.9E-09	9.0E-09	7.2E-09	7.1E-09	1.7E-08	7.5E-09	7.2E-12	8.2E-09
	(mrem)	2.2E-04	8.9E-07	9.0E-07	7.2E-07	7.1E-07	1.7E-06	7.5E-07	7.2E-10	8.2E-07
Ingestion	(mSv)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	(mrem)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Total	(mSv)	2.2E-06	9.1E-09	9.2E-09	2.4E-05	1.3E-08	1.1E-07	7.7E-09	1.6E-11	2.9E-06
	(mrem)	2.2E-04	9.1E-07	9.2E-07	2.4E-03	1.3E-06	1.1E-05	7.7E-07	1.6E-09	2.9E-04

Table 4.12-9B Annual and Committed Dose Equivalents for Exposures in Year 30 to an Adult from Liquid Effluent (Nearby Businesses)

Location: Nearby Business – NNW, 1,712 m (5,617 ft)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	7.5E-12	2.0E-13	2.4E-13	1.9E-13	1.8E-13	4.7E-13	2.0E-13	1.8E-13	2.1E-13
	(mrem)	7.5E-10	2.0E-11	2.4E-11	1.9E-11	1.8E-11	4.7E-11	2.0E-11	1.8E-11	2.1E-11
Inhalation	(mSv)	0.0E+00	1.8E-10	2.0E-10	2.0E-05	4.9E-09	7.5E-08	1.9E-10	7.2E-12	2.4E-06
	(mrem)	0.0E+00	1.8E-08	2.0E-08	2.0E-03	4.9E-07	7.5E-06	1.9E-08	7.2E-10	2.4E-04
Grd. Plane direct	(mSv)	3.2E-06	1.3E-08	1.3E-08	1.0E-08	1.0E-08	2.5E-08	1.1E-08	1.0E-11	1.2E-08
	(mrem)	3.2E-04	1.3E-06	1.3E-06	1.0E-06	1.0E-06	2.5E-06	1.1E-06	1.0E-09	1.2E-06
Ingestion	(mSv)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	(mrem)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Total	(mSv)	3.2E-06	1.3E-08	1.3E-08	2.0E-05	1.5E-08	9.9E-08	1.1E-08	1.8E-11	2.4E-06
	(mrem)	3.2E-04	1.3E-06	1.3E-06	2.0E-03	1.5E-06	9.9E-06	1.1E-06	1.8E-09	2.4E-04

Table 4.12-10A Annual and Committed Dose Equivalents for Exposure in Year 30 to an Adult From Liquid Effluent (Site Boundary)

Location: Maximum Site Boundary – South, 417 m (1,368 ft)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	5.5E-11	1.5E-12	1.7E-12	1.4E-12	1.3E-12	3.4E-12	1.5E-12	1.4E-12	1.5E-12
	(mrem)	5.5E-09	1.5E-10	1.7E-10	1.4E-10	1.3E-10	3.4E-10	1.5E-10	1.4E-10	1.5E-10
Inhalation	(mSv)	0.0E+00	1.3E-09	1.5E-09	1.4E-04	3.6E-08	5.5E-07	1.4E-09	5.3E-11	1.7E-05
	(mrem)	0.0E+00	1.3E-07	1.5E-07	1.4E-02	3.6E-06	5.5E-05	1.4E-07	5.3E-09	1.7E-03
Grd. Plane direct	(mSv)	1.6E-05	6.6E-08	6.6E-08	5.3E-08	5.2E-08	1.3E-07	5.5E-08	5.3E-11	6.1E-08
	(mrem)	1.6E-03	6.6E-06	6.6E-06	5.3E-06	5.2E-06	1.3E-05	5.5E-06	5.3E-09	6.1E-06
Ingestion	(mSv)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	(mrem)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Total	(mSv)	1.6E-05	6.7E-08	6.8E-08	1.5E-04	8.9E-08	6.8E-07	5.7E-08	1.1E-10	1.7E-05
	(mrem)	1.6E-03	6.7E-06	6.8E-06	1.5E-02	8.9E-06	6.8E-05	5.7E-06	1.1E-08	1.7E-03

Table 4.12-10B Annual and Committed Dose Equivalents for Exposure in Year 30 to an Adult From Liquid Effluent (Site Boundary)

Location: Maximum Site Boundary – North, 995 m (3,264 ft) (Side Next to UBC Storage Pad)

Source		Skin	Gonads	Breast	Lung	Red Bone Marrow	Bone Surface	Thyroid	Remainder	Effective Dose Equivalent
Cloud Immersion	(mSv)	2.9E-11	7.8E-13	9.1E-13	7.4E-13	6.9E-13	1.8E-12	7.8E-13	7.0E-13	7.9E-13
	(mrem)	2.9E-09	7.8E-11	9.1E-11	7.4E-11	6.9E-11	1.8E-10	7.8E-11	7.0E-11	7.9E-11
Inhalation	(mSv)	0.0E+00	6.8E-10	7.7E-10	7.6E-05	1.9E-08	2.9E-07	7.3E-10	2.8E-11	9.1E-06
	(mrem)	0.0E+00	6.8E-08	7.7E-08	7.6E-03	1.9E-06	2.9E-05	7.3E-08	2.8E-09	9.1E-04
Grd. Plane direct	(mSv)	1.5E-05	5.9E-08	6.0E-08	4.8E-08	4.7E-08	1.2E-07	5.0E-08	4.8E-11	5.5E-08
	(mrem)	1.5E-03	5.9E-06	6.0E-06	4.8E-06	4.7E-06	1.2E-05	5.0E-06	4.8E-09	5.5E-06
Ingestion	(mSv)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	(mrem)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Total	(mSv)	1.5E-05	6.0E-08	6.1E-08	7.6E-05	6.6E-08	4.0E-07	5.1E-08	7.6E-11	9.1E-06
	(mrem)	1.5E-03	6.0E-06	6.1E-06	7.6E-03	6.6E-06	4.0E-05	5.1E-06	7.6E-09	9.1E-04

Table 4.12-11 Maximum Annual Liquid and Gas Radiological Impacts

Category	Dose Equivalent	Location
Maximum Effective Dose Equivalent	(mSv) 1.9E-04 (mrem) 1.9E-02	Site Boundary (South, 417 m (1,368 ft))
Maximum Thyroid Committed Dose Equivalent	(mSv) 9.8E-07 (mrem) 9.8E-05	Site Boundary (South, 417 m (1,368 ft))
Maximum Organ Committed Dose Equivalent	(mSv) 1.5E-03 (mrem) 1.5E-01	Site Boundary (South 417 m (1,368 ft))

Table 4.12-12 Annual Total Effective Dose Equivalent (All Sources)

Location		Fixed Sources	Gas & Liquid Effluents	TEDE
Site Boundary (North)	(mSv)	1.9E-01	9.7E-05	1.9E-01
	(mrem)	1.9E+01	9.7E-03	1.9E+01
Nearest Business (mSv) (NNW, 1.7 km (1.1 mi))		6.0E-05	2.5E-05	8.5E-05
	(mrem)	6.0E-03	2.5E-03	8.5E-03
Nearest Resident (W, 4.3 km (2.63 mi))	(mSv)	8.0E-12	1.9E-05	1.9E-05
	(mrem)	8.0E-10	1.9E-03	1.9E-03

Table 4.12-13 Estimated NEF Occupational Dose Equivalent Rates

Area or Component	Dose Rate, mSv/hr (mrem/hr)
Plant general area (excluding Separations Building Modules)	< 0.0001 (< 0.01)
Separations Building Module – Cascade Halls	0.0005 (0.05)
Separations Building Module – UF_6 Handling Area and Process Services Area	0.001 (0.1)
Empty used UF_6 shipping cylinder	0.1 on contact (10.0) 0.010 at 1 m (3.3 ft) (1.0)
Full UF_6 Shipping cylinder	0.05 on contact (5.0) 0.002 at 1 m (3.3 ft) (0.2)

Table 4.12-14 Estimated NEF Occupational (Individual) Exposures

Position	Annual Dose Equivalent*
General Office Staff	< 0.05 mSv (< 5.0 mrem)
Typical Operations & Maintenance Technician	1 mSv (100 mrem)
Typical Cylinder Handler	3 mSv (300 mrem)

*The average worker exposure at the Urenco Capenhurst facility during the years 1998 through 2002 was approximately 0.2 mSv (20 mrem) (URENCO, 2000; URENCO, 2001; URENCO, 2002a).

Table 4.12-15 Accident Criteria Chemical Exposure Limits by Category

	High Consequence (Category 3)	Intermediate Consequence (Category 2)
Worker (local)	> 40 mg U intake > 139 mg HF/m^3	> 10 mg U intake > 78 mg HF/m^3
Worker (elsewhere in room)	> 146 mg U/m^3 > 139 mg HF/m^3	> 19 mg U/m^3 > 78 mg HF/m^3
Outside Controlled Area (30-min exposure)	> 13 mg U/m^3 > 28 mg HF/m^3	> 2.4 mg U/m^3 > 0.8 mg HF/m^3

Table 4.12-16 Causes of Injuries at Capenhurst (1999-2003)

Main Causes of Injury at UCL 1999-2003	Number	Percent of Total
Handling tools, equipment or other items	10	40%
Impact (striking objects or objects falling)	3	12%
Slips, trips or falls on the same level	8	32%
Chemical contact	2	8%
Welding	2	8%
Total	**25**	**100%**

4.12.5 Section 4.12 Figures

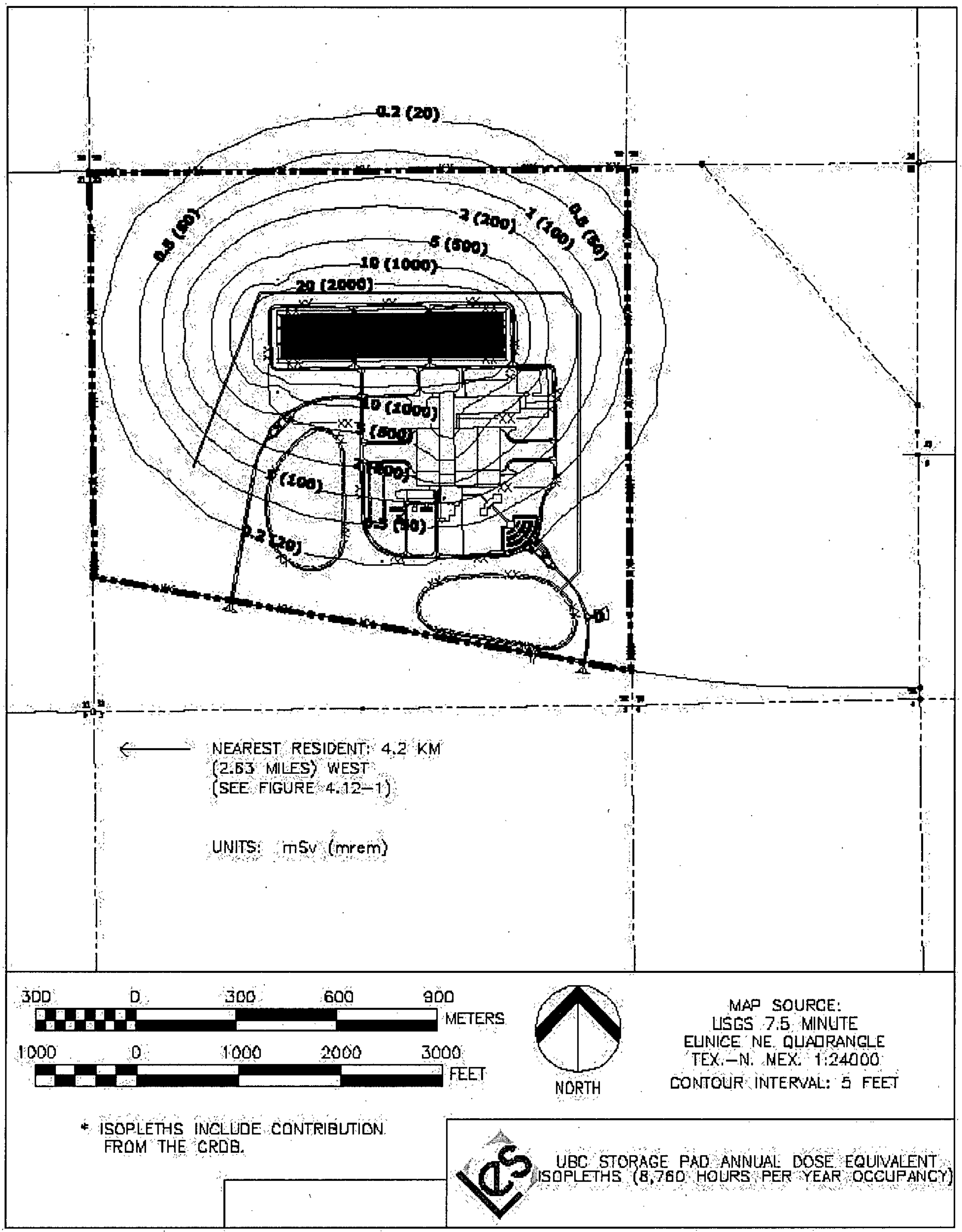

Figure 4.12-1 Nearest Resident

Security-Related Information
Figure Withheld Under 10 CFR 2.390

CONSTRUCTED FEATURES (SITE PLAN)

Figure 4.12-2 Site Layout for NEF

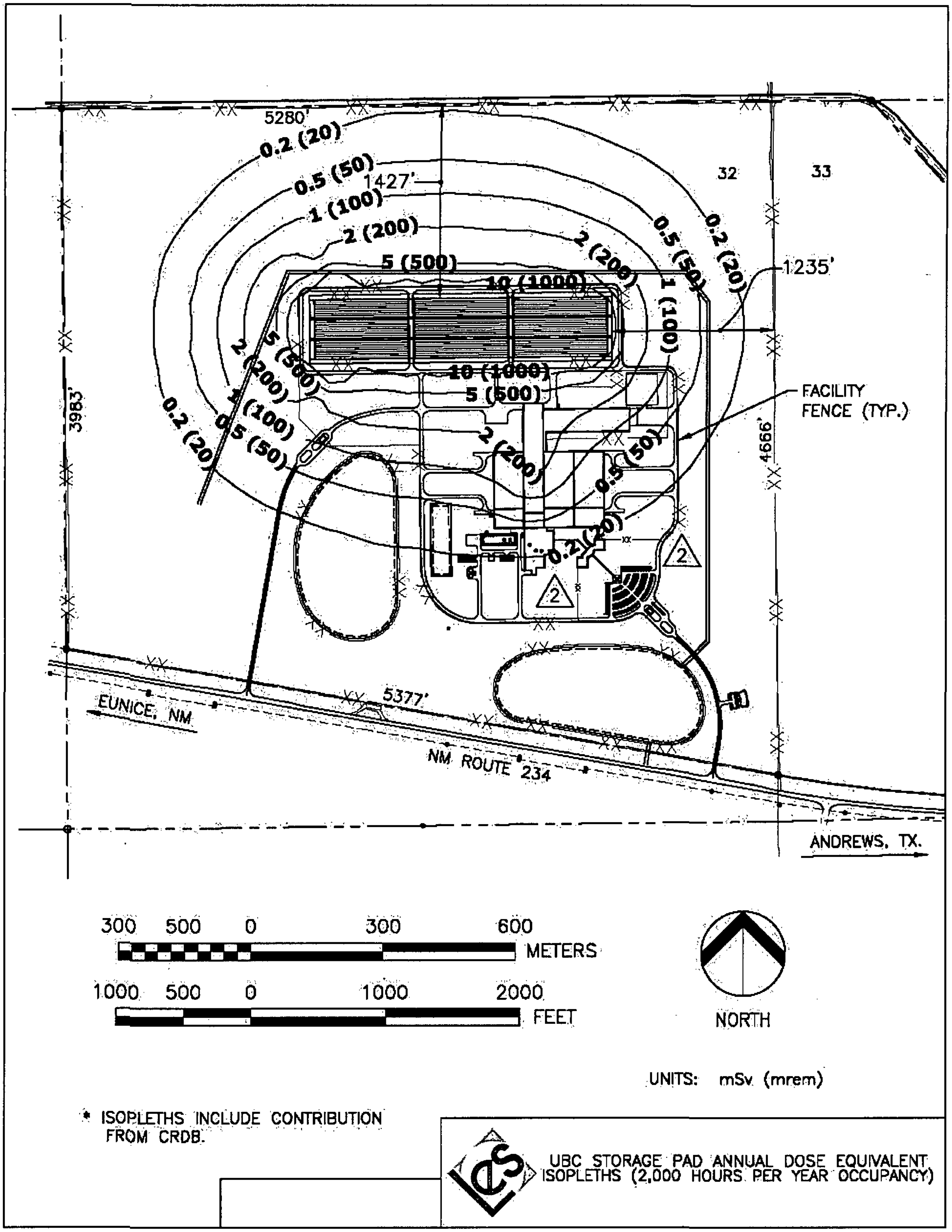

Figure 4.12-3 UBC Storage Pad Annual Dose Equivalent Isopleths (2,000 Hours per Year Occupancy)

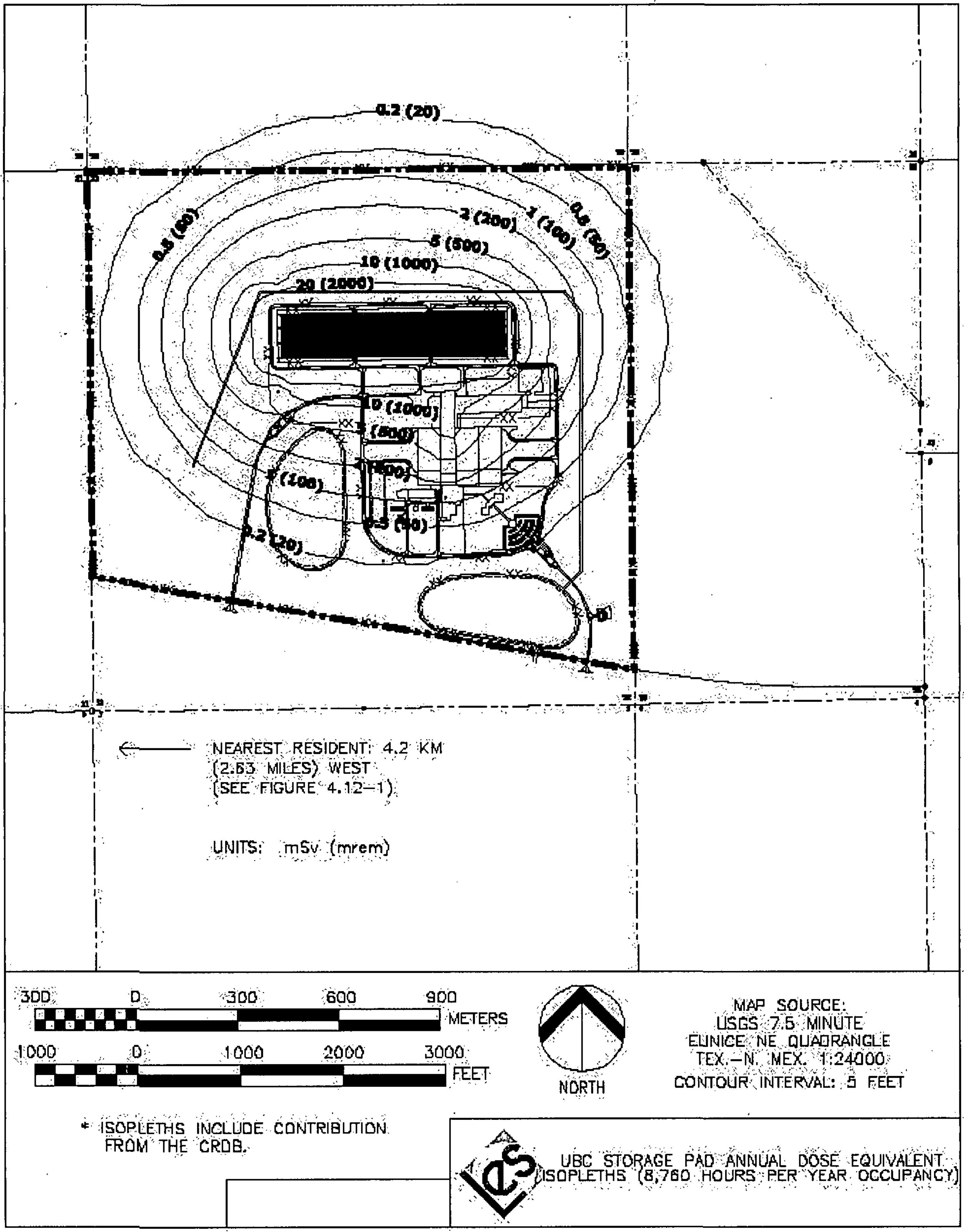

Figure 4.12-4 UBC Storage Pad Annual Dose Equivalent Isopleths (8,760 Hours per Year Occupancy)

4.13 WASTE MANAGEMENT IMPACTS

Solid waste generated at the NEF will be disposed of at licensed facilities designed to accept the various waste types. Industrial waste, including miscellaneous trash, filters, resins and paper will be shipped offsite for compaction and then sent to a licensed waste landfill. Radioactive waste will be collected in labeled containers in each Restricted Area and transferred to the Solid Waste Collection Room for inspection. Suitable waste will be volume-reduced and all radioactive waste disposed of at a licensed LLW disposal facility. Hazardous and some mixed wastes will be collected at the point of generation, transferred to the Solid Waste Collection Room, inspected, and classified. Any mixed waste that may be processed to meet land disposal requirements may be treated in its original collection container and shipped as LLW for disposal. There will be no onsite disposal of solid waste at the NEF. Waste Management Impacts for onsite disposal, therefore, need not be evaluated. Onsite storage of UBCs will minimally impact the environment. A detailed pathway assessment for the UBC Storage Pad is provided in ER Section 4.13.3.1.1, UBC Storage.

NEF will generate approximately 1,770 kg (3,932 lbs) of Resource Conservation and Recovery Act (RCRA) hazardous wastes per year and 50 kg (110 lbs) of mixed waste. This is an average of 147 kg (325 lbs) per month. Under New Mexico regulations, a facility that generates less than 100 kg (220 lbs) per month is conditionally exempt. In New Mexico, hazardous waste generators are classified by the actual monthly generation rate, not the annual average. Given that the average is over 100 kg/mo (220 lbs/mo), NEF would be considered a small quantity generator and would not be conditionally exempt from the New Mexico Hazardous Waste Bureau (NMHWB) hazardous waste regulations. Within 90 days after the generation of any new waste stream, NEF will need to determine if it is classified as a hazardous waste. If so, the NEF will need to notify the NMHWB within that time period. As a small quantity generator, the NEF will be required to file an annual report to the NMHWB and to pay an annual fee The NEF plans to ship all hazardous wastes offsite within the allowed timeframe, therefore, no further permitting should be necessary. Without the appropriate RCRA permit, NEF will not treat, store or dispose of hazardous wastes onsite; therefore the impacts for such systems need not be evaluated.

4.13.1 Waste Descriptions

Descriptions of the sources, types and quantities of solid, hazardous, radioactive and mixed wastes generated by NEF construction and operation are provided in ER Section 3.12, Waste Management.

4.13.2 Waste Management System Description

Descriptions of the proposed NEF waste management systems are provided in ER Section 3.12.

4.13.3 Waste Disposal Plans

4.13.3.1 Radioactive and Mixed Waste Disposal Plans

Solid radioactive wastes are produced in a number of plant activities and require a variety of methods for treatment and disposal. These wastes, as well as the generation and handling systems, are described in detail in ER Section 3.12, Waste Management.

All radioactive and mixed wastes will be disposed of at offsite, licensed facilities. The impacts on the environment due to these offsite facilities are not addressed in this report. Table 4.13-1, Possible Radioactive Waste Processing/Disposal Facilities, summarizes the facilities that may be used to process or dispose of NEF radioactive or mixed waste.

Radioactive waste will be shipped to any of the three listed radioactive waste processing / disposal sites. Other offsite processing or disposal facilities may be used if appropriately licensed to accept NEF waste types. Depleted UF_6 will most likely be shipped to one of the UF_6 Conversion Facilities subsequent to temporary onsite storage. The remaining mixed waste will either be pretreated in its collection container onsite prior to offsite disposal, or shipped directly to a mixed waste processor for ultimate disposal.

The Barnwell site, located in Barnwell, South Carolina, is a low-level radioactive waste disposal facility licensed in an agreement state in association with 10 CFR 61, (CFR, 2003r). This facility is licensed to accept NEF low-level waste either directly from the NEF site or as processed waste from offsite waste processing vendors. The disposal site is approximately 2,320 km (1,441 mi) from the NEF.

The Clive site, located in South Clive, Utah, is owned and operated privately by Envirocare of Utah. This low-level waste disposal site is also licensed in an agreement state in association with 10 CFR 61 (CFR, 2003r), and 40 CFR 264 (CFR, 2003v). Currently, the license allows acceptance of Class A waste only. In addition to accepting radioactive waste, the Clive facility may accept some mixed wastes. This facility is licensed to accept NEF low-level waste either directly from the NEF site or as processed waste from offsite waste processing vendors. The disposal site is approximately 1,636 km (1,016 mi) from the NEF.

Waste processors such as GTS Duratek, primarily located in Oak Ridge, Tennessee, have the ability to volume reduce most Class A low level wastes. GTS Duratek also has the capability to process contaminated oils and some mixed wastes. The NEF may send wastes that are candidates for volume reduction, recycling, or treatment to the GTS Duratek facilities. Other processing vendors may be used to process NEF waste depending on future availability. The processing facilities are approximately 1,993 km (1,238 mi).

With regard to depleted UF_6 disposal, DOE has recently contracted for the construction and operation of depleted UF_6 conversion facilities in Paducah, Kentucky, and Portsmouth, Ohio. This action was taken following the earlier enactment of Section 3113 of the USEC Privatization Act, which requires the Secretary of Energy to "accept" for disposal depleted UF_6 generated by an NRC-licensed facility such as the NEF, and related subsequent legislation. DOE facilities for conversion and ultimate offsite disposal of LES generated depleted UF_6 is one of the options available for the disposition of depleted UF_6. Such disposal will be accomplished either by sale of converted depleted UF_6 for reuse or by shipment of the depleted UF_6 to a licensed disposal facility for burial. As described later in this chapter, other options are available for depleted UF_6 disposal. The environmental impact of a UF_6 conversion facility was previously evaluated generically for the Claiborne Enrichment Center (CEC) and is documented in Section 4.2.2.8 of the NRC Final Environmental Impact Statement (FEIS) (NRC, 1994a). After scaling to account for the increased capacity of the NEF compared to the CEC, this evaluation remains valid for NEF. In addition, the Department of Energy has recently issued FEISs (DOE, 2004a; DOE, 2004b) for the UF_6 conversion facilities to be constructed and operated at Paducah, KY and Portsmouth, OH. These FEISs consider the construction, operation, maintenance, and decontamination and decommissioning of the conversion facilities and are also valid evaluations for the NEF.

4.13.3.1.1 Uranium Byproduct Cylinder (UBC) Storage

The NEF yields a depleted UF_6 stream that will be temporarily stored onsite in containers before transfer to the conversion facility and subsequent reuse or disposal. The storage containers are referred to as Uranium Byproduct Cylinders (UBC). The storage location is designated the UBC Storage Pad. The UBC Storage Pad will have minimal environmental impacts.

The NEF's preferred option for disposition of the UBCs includes temporary onsite storage of cylinders. See ER Section 4.13.3.1.3. There will be no disposal onsite. The NEF will pursue economically viable disposal paths for the UBCs as soon as they become available. In addition, the NEF will look to private deconversion facilities to render the UF_6 into U_3O_8.

LES is committed to the following storage and disposition of UBCs on the NEF site (LES, 2003b):

- Only temporary onsite storage will be utilized.
- No long-term storage beyond the life of the plant.
- Aggressively pursue economically viable disposal paths.
- Setting up a financial surety bonding mechanism to assure adequate funding is in place to dispose of all UBCs.

Since UBCs will be stored for a time on the pad, the potential impact of this preferred option is the remote possibility of stormwater runoff from the UBC Storage Pad becoming contaminated with UF_6 or its derivatives. Cylinders placed on the UBC Storage Pad normally have no surface contamination due to restrictions placed on surface contamination levels by plant operating procedures . Because of the remote possibility of contamination, the runoff water will be directed to an onsite lined retention basin, designed to minimize ground infiltration. The site soil characteristics greatly minimize the migration of materials into the soil over the life of the plant. However, the basin is sampled under the site's environmental monitoring plan. The sources of the potential water runoff contamination (albeit unlikely) would be either residual contamination on the cylinders from routine handling, or accidental releases of UF_6 and its derivatives resulting from a leaking cylinder or cylinder valve (caused by corrosion, transportation or handling accidents, or other factors). Operational evidence suggests that breaches in cylinders and the resulting leaks are "self-sealing." (See ER Section 4.13.3.1.2.)

The chemical and physical properties of UF_6 can pose potential health risks, and the material is handled accordingly. Uranium and its decay products emit low-levels of alpha, beta, gamma and neutron radiation. If UF_6 is released to the atmosphere, it reacts with water vapor in the air to form hydrogen fluoride (HF) and the uranium oxyfluoride compound called uranyl fluoride (UO_2F_2). These products are chemically toxic. Uranium is a heavy metal that, in addition to being radioactive, can have toxic chemical effects (primarily on the kidneys) if it enters the bloodstream by means of ingestion or inhalation. HF is an extremely corrosive gas that can damage the lungs and cause death if inhaled in high concentrations.

The NEA/IAEA (NEA, 2002) reports that there is widespread experience with the storage of UF_6 in steel cylinders in open-air storage yards. It is reported that even without routine treatment of localized corrosion, containers have maintained structural integrity for more than 50 years. The most extreme conditions experienced were in Russian Siberia where temperatures ranged from +40°C to -40°C (+104°F to –40°F), and from deep snow to full sun.

Depleted UF_6 can be safely stored for decades in painted steel cylinders in open-air storage yards. Internal corrosion does not represent a problem. A reaction between the UF_6 and inner surface of the cylinder forms a complex uranium oxifluoride layer between the UF_6 and cylinder wall that limits access of water moisture to the inside of the cylinder, thus further inhibiting internal corrosion. Moreover, while limiting factors are the external corrosion of the steel containers and the integrity of the "connection" seals, their impact can be minimized with an adequate preventive maintenance program. The three primary causes of external corrosion, all of which are preventable, are: (1) standing water on metal surfaces, (2) handling damaged cylinders and (3) the aging of cylinder paint.

Standing water problems can be minimized through proper yard drainage, use of support saddles, and periodic inspection. Handling damage can be minimized by appropriate labor training and yard access design. Aging can be minimized through the use of periodic inspection and repainting and the use of quality paint. At the NEF UBCs are placed on an outdoor storage pad of reinforced concrete. The pad is provided with a UBC Storage Pad Stormwater Retention Basin, concrete saddles on which the cylinders rest, and a mobile cylinder transporter. The stormwater collection system has sampling capabilities. The mobile transporter transfers cylinders from the UF_6 Handling Area of the Separations Building to the UBC Storage Pad where they rest on concrete saddles for storage. UBC transport between the Separations Building and the storage area is discussed in greater detail in the Safety Analysis Report Section 3.4.11, Material Handling Processes.

The Depleted Uranium Hexafluoride Management Study (LES, 1991b) provides a plan for the storage of UBCs in a safe and cost-effective manner in accordance with all applicable regulations to protect the environment. The NEF will maintain an active cylinder management program to improve storage conditions in the cylinder yard, to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs to cylinders and the Storage Pad, as needed. The UBC Storage Pad has been sited to minimize the potential environmental impact from external radiation exposure to the public at the site boundary. The concrete pad to be initially constructed onsite for the storage of UBCs will only be of a size necessary to hold a few years worth of UBCs. It will be expanded, only if necessary. The dose equivalent rate from the UBC Storage Pad at the site boundary will be below the regulatory limits of 10 CFR 20 (CFR 2003q) and 40 CFR 190 (CFR, 2003f). The direct dose equivalent comes from the gamma-emitting progeny within the uranium decay chain. In addition, neutrons are produced by spontaneous fission in uranium and by the ${}^{19}_{9}F$ (alpha, n) ${}^{22}_{11}Na$ reaction. Thermoluminescent Dosimeters (TLDs) will be distributed along the site boundary fence line to monitor this impact due to photons (see ER Section 6.1), and ensure that the estimated dose equivalent is not exceeded. See ER Section 4.12.2.1.3 for more detailed information on the impact of external dose equivalents from UBC Storage Pad.

The overall impact of the preferred UBC Storage Pad option is believed to be small given the comprehensive cylinder maintenance and inspection programs that have been instituted in Europe over the past 30 years. This experience has shown that outdoor UF_6 cylinder storage will have little or no adverse environmental impact when it is coupled with an effective and protective cylinder management program. In more than 30 years of operation at three different enrichment plants, the European cylinder management program has not resulted in any significant releases of UF_6 to the environment (see ER Section 3.11.2.2, Public and Occupational Exposure Limits, for information of the types of releases that have occurred at Urenco plants).

4.13.3.1.2 Mitigation for Depleted UF_6 Storage

Since UF_6 is a solid at ambient temperatures and pressures, it is not readily released from a cylinder following a leak or breach. When a cylinder is breached, moist air reacts with the exposed UF_6 solid and iron, resulting in the formation of a dense plug of solid uranium and iron compounds and a small amount of HF gas. This "self-healing" plug limits the amount of material released from a breached cylinder. When a cylinder breach is identified, the cylinder is typically repaired or its contents are transferred to a new cylinder.

LES will maintain an active cylinder management program to maintain optimum storage conditions in the cylinder yard, to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs to cylinders and the storage yard, as needed. The following handling and storage procedures and practices shall be adopted at the NEF to mitigate adverse events, by either reducing the probability of an adverse event or reducing the consequence should an adverse event occur (LES, 1991b).

- All filled UBCs will be stored in designated areas of the storage yard on concrete saddles (or saddles comprised of other material) that do not cause cylinder corrosion. These saddles shall be placed on a stable concrete surface.
- The storage array shall permit easy visual inspection of all cylinders.
- The UBCs shall be surveyed for external contamination (wipe tested) prior to being placed on the UBC Storage Pad or transported offsite. The maximum level of removable surface contamination allowed on the external surface of the cylinder shall be no greater than 0.4 Bq/cm^2 (22 dpm/cm2) (beta, gamma, alpha) on accessible surfaces averaged over 300 cm^2.
- UBC valves shall be fitted with valve guards to protect the cylinder valve during transfer and storage.
- Provisions are in place to ensure that UBCs do not have the defective valves (identified in NRC Bulletin 2003-03, "Potentially Defective 1-Inch Valves for Uranium Hexafluoride Cylinders" installed. LBDCR-07-0022
- All UBCs shall be abrasive-blasted and coated with a minimum of one coat of zinc chromate primer plus one zinc-rich topcoat or equivalent anti-corrosion treatment.
- Only designated vehicles with less than 280 L (74 gal) of fuel shall be allowed in the UBC Storage Pad area.
- Only trained and qualified personnel shall be allowed to operate vehicles on the UBC Storage Pad area.
- UBCs shall be inspected for damage prior to placing a filled cylinder on the Storage Pad.
- UBCs shall be re-inspected annually for damage or surface coating defects. These inspections shall verify that:
  - Lifting points are free from distortion and cracking.
  - Cylinder skirts and stiffener rings are free from distortion and cracking.
  - Cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion.

- Cylinder valves are fitted with the correct protector and cap, the valve is straight and not distorted, 2 to 6 threads are visible, and the square head of the valve stem is undamaged.
- Cylinder plugs are undamaged and not leaking.
- If inspection of a UBC reveals significant deterioration (i.e., leakage, cracks, excessive, distortion, bent or broken valves or plugs, broken or torn stiffening rings or skirts, or other conditions that may affect the safe use of the cylinder), the contents of the affected cylinder shall be transferred to another undamaged cylinder and the defective cylinder shall be discarded. The root cause of any significant deterioration shall be determined and, if necessary, additional inspections of cylinders shall be made.
- Proper documentation on the status of each UBC shall be available on site, including content and inspection dates.
- Cylinders containing liquid depleted UF_6 shall not be transported.

* Site stormwater runoff from the UBC Storage Pad is directed to a lined retention basin, which will be included in the site environmental monitoring plan. (See ER Section 6.1.)

4.13.3.1.3 Depleted UF_6 Disposition Alternatives

LES is committed to the temporary storage of UBCs on the NEF site as described in ER Section 4.13.3.1.1, Uranium Byproduct Cylinder (UBC) Storage. The preferred option and a "plausible strategy" for disposition of the UBCs is private sector conversion and disposal as described below. The disposition of UBCs by DOE conversion and disposal is described below since it is also a "plausible strategy," but is not considered the preferred option.

On April 24, 2002, LES submitted to the NRC information addressing depleted uranium disposition (LES, 2002). LES recommended that the NRC consider that the Section 3113 requirements of the U.S. Enrichment Corporation Privatization Act mandate, in LES's view, that DOE dispose of depleted uranium from a uranium enrichment facility licensed by the NRC. LES's position is that this approach constitutes a "plausible strategy" for dispositioning these materials. Subsequently, the NRC in its response to the LES submittal (NRC, 2003b) dated March 24, 2003, stated that the NRC "[c]onsiders that Section 3113 would be a "plausible strategy" for dispositioning depleted uranium tails if the NRC staff determines the depleted uranium is a low-level radioactive waste."

The NRC March 24, 2003 letter (NRC, 2003b) stated that the NRC expects LES to indicate in its NEF license application whether the depleted uranium tails will be treated as a waste or a resource. LES will make a determination as to whether the depleted uranium is a resource or a waste and notify the NRC.

The NRC also noted in its letter to LES (NRC, 2003b), that the NEF license application should demonstrate that, given the expected constituents of the LES depleted uranium, the material meets the definition of low-level radioactive waste given in 10 CFR Part 61 (CFR, 2003r). The definition of low-level waste in 10 CFR 61 (CFR, 2003r) is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste), 10 CFR 30 (CFR, 2003c), and 10 CFR 40 (CFR, 2003d). High-level radioactive waste (HLW) is primarily in the form of spent fuel discharged from commercial nuclear power reactors. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride. No spent fuel is used in the NEF. Therefore, the LES depleted uranium is not high-level waste nor does it contain any high-level waste.

A transuranic element is an artificially made, radioactive element that has an atomic number higher than uranium in the Periodic Table of Elements such as neptunium, plutonium, americium, and others. Transuranic waste is material contaminated with transuranic elements. It is produced primarily from reprocessing spent fuel and from the use of plutonium in the fabrication of nuclear weapons. Since the LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride, it contains no transuranic waste.

Spent nuclear fuel is fuel that has been removed from a nuclear reactor because it can no longer sustain power production for economic or other reasons. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride. Therefore, the LES depleted uranium is not nuclear fuel.

Section 11e.(2) of the Atomic Energy Act classifies tailings produced from uranium ore as byproduct material. Tailings are the waste left after ore has been extracted from rock. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride, not from uranium ore or rock tailings. Therefore, the NEF depleted uranium is not byproduct material per section 11e.(2) of the Atomic Energy Act.

10 CFR 30 (CFR, 2003c) states that byproduct material is any radioactive material, except special nuclear material, yielded in or made radioactive by exposure to the process of producing or utilizing special nuclear material. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride and is not made radioactive by exposure to radiation incident to the process of producing or utilizing special nuclear material.

10 CFR 40 (CFR, 2003c) states that byproduct material is the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride and is not produced by extraction or concentration of uranium or thorium from ore.

The NEF depleted uranium is not high-level radioactive waste, contains no transuranic waste, spent nuclear fuel, or byproduct material as defined in Section 11e.(2) of the Atomic Energy Act, 10 CFR 30 (CFR, 2003c) and 10 CFR 40 (CFR, 2003d); therefore, once NEF depleted uranium is determined by LES to be a waste and not a resource, it meets the 10 CFR 61 definition of low-level radioactive waste.

Disposition of the UBCs has several potential impacts that depend on the particular approach taken. Currently, the preferred options are short-term onsite storage followed by conversion and underground burial (Option 1 below) or transportation of the UBCs to a DOE conversion facility (Option 2 below). LES considered several other options in addition to the preferred options that could have implications on the number of UBCs stored at the NEF and the length of storage for the cylinders. All of these options are discussed below along with some of their impacts. However, at this time, LES considers only Options 1 and 2 below to represent plausible strategies for the disposition of its UBCs.

Option 1 –U.S. Private Sector Conversion and Disposal (Preferred Plausible Strategy)

Transporting depleted UF_6 from the NEF to a private sector conversion facility and depleted U_3O_8 permanent disposal in a western U.S. exhausted underground uranium mine is the preferred "plausible strategy" disposition option. The NRC repeatedly affirmed its acceptance of this option during its licensing review of the previous LES license application. In Section 4.2.2.8 of its final environmental impact statement (FEIS) for that application, the NRC staff noted that "it is plausible to assume that depleted UF_6 converted into U_3O_8 may be disposed by emplacement in near surface or deep geological disposal units" (NRC, 1994a). And during the subsequent adjudicatory hearing on that application, an NRC Atomic Safety and Licensing Board held that "[LES] has presented a plausible disposal strategy. [Its] plan to convert depleted UF_6 to U_3O_8 at an offsite facility in the United States and then ship that material as waste to a final site for deeper than surface burial is a reasonable and credible plan for depleted UF_6 disposal (NRC, 1997).

LES has committed to the Governor of New Mexico (LES, 2003b) that: (1) there will be no long-term disposal or long-term storage (beyond the life of the plant) of UBCs in the State of New Mexico; (2) a disposal path outside the State of New Mexico is utilized as soon as possible; (3) LES will aggressively pursue economically viable paths for UBCs as soon as they become available; (4) LES will work with qualified vendors pursuing construction of private deconversion facilities by entering in good faith discussions to provide such vendor long-term UBC contracts to assist them in their financing efforts; and (5) LES will put in place as part of the NRC license a financial surety bonding mechanism that assures funding will be available in the event of any default by LES.

ConverDyn, a company that is engaged in converting U_3O_8 material to UF_6 for enrichment, has the technical capability to construct and operate a depleted UF_6 to depleted U_3O_8 facility at its facility in Metropolis, Illinois in the future if there is an assured market. One of the two ConverDyn partners, General Atomics, may have access to an exhausted uranium mine (the Cotter Mines in Colorado) where depleted U_3O_8 could be disposed. Furthermore, discussions have recently been held with Cogema concerning a private conversion facility. Cogema has experience with such a facility currently processing depleted UF_6 in France. These factors support LES's position that this option is the preferred "plausible strategy" option.

Any deconversion facility used by NEF will not be located in the State of New Mexico.

Option 2 – DOE Conversion and Disposal (Plausible Strategy)

Transporting depleted UF_6 from the NEF to DOE conversion facilities for ultimate disposition is a plausible disposition option. Pursuant to Section 3113 of the USEC Privatization Act, DOE is instructed to "accept for disposal" depleted UF_6, such as those that will be generated by the NRC-licensed NEF. To that end, DOE has recently contracted for the construction and operation of two UF_6 conversion facilities to be located in Paducah, Kentucky and Portsmouth, Ohio.

DOE has recently reaffirmed the plausibility of this option. In a July 25, 2002 letter to Martin Virgilio, Director of the NRC Office of Nuclear Material Safety and Safeguards, William Magwood IV, Director of DOE's Office of Nuclear Energy, Science and Technology, unequivocally stated that "in view of [DOE's] plans to build depleted uranium disposition facilities and the critical importance [DOE] places on maintaining a viable domestic uranium enrichment industry, [DOE] acknowledges that Section 3113 may constitute a "plausible strategy" for the disposal of depleted uranium from the private sector domestic uranium enrichment plant license applicants and operators." (DOE, 2002a)

Moreover, this plausible strategy is virtually identical to one considered by LES during its earlier licensing efforts before the NRC. During the adjudicatory hearing on LES's application, an NRC Atomic Safety and Licensing Board noted that "all parties apparently agree that LES's actual disposal method will be to transfer the tails to DOE and pay DOE's disposal charges" (footnote omitted) (NRC, 1997). LES considers that given the NRC's earlier acceptance of this option, DOE's current acceptance, and DOE's existing contractual commitment to ensure construction and operation of two depleted UF_6 conversion plants, this option to disposition its depleted UF_6 by way of DOE conversion and disposal remains plausible.

Option 3 - Foreign Re-Enrichment or Conversion and Disposal

The shipment of depleted UF_6 to either Canada, Europe or the Confederation of Independent States (CIS) (the former Soviet Union) for either re-enrichment or conversion and disposal would require that a bilateral agreement for cooperation exist between the U.S. and the subject foreign country so long as the depleted UF_6 continues to be classified as source material.

Option 3A – Russian Re-Enrichment

Because the U.S. does not yet have a bilateral agreement for cooperation with Russia, U.S. depleted UF_6, as source material, cannot be shipped to Russia for re-enrichment. However, once there is a bilateral agreement in effect, source material could be re-enriched in Russia to about 0.7 $^{w}/_{o}$ and returned to the U.S. or elsewhere, with the re-enrichment depleted UF_6 remaining in Russia.

Option 3B – French Conversion or Re-Enrichment

The shipment of depleted UF_6 to France for conversion to depleted U_3O_8 by Cogema and its return to the U.S. for disposal is a possible, though unlikely, option. However, the viability of this option would depend on Cogema's available capacity, the economics of transportation back and forward across the Atlantic, and the willingness of Areva, Cogema's parent company, to participate in a Urenco-sponsored venture.

There may be a French interest in re-enriching depleted UF_6, for a price, and keeping the depleted UF_6 just as it would for a regular utility customer. Though Eurodif has excess capacity, its use would be electricity cost-dependent. This option is less likely to be implemented than either Option 1 or Option 2 above.

Option 3C – Kazakhstan Conversion and Disposal

While there may be an interest in Kazakhstan in converting depleted UF_6 to depleted U_3O_8 and disposing of it there, such interest is only speculative at this time. One way transportation economics costs could be a factor weighing against this option's employment.

4.13.3.1.4 Converted Depleted UF_6 Disposal Options

The following provides a brief summary of the different disposal options considered in the Programmatic Environmental Impact Statement (PEIS) for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (DOE, 1999). Appendix I of the PEIS assessed disposal impacts of converted depleted UF_6. The information is based on pre-conceptual design data provided in the engineering analysis report (LLNL, 1997a). The PEIS was completed in April 1999 and identified conversion of depleted UF_6 to another chemical form for use or long-term storage as part of a preferred management alternative. In the corresponding Record of Decision (ROD) for the Long-Term Management and Use of Depleted Uranium Hexafluoride (FR, 1999), DOE decided to promptly convert the depleted UF_6 inventory to depleted uranium oxide, depleted uranium metal, or a combination of both.

Under the uranium oxide disposal alternative, depleted UF_6 would be chemically converted to a stable oxide form and disposed of below ground as LLW. The ROD further explained that depleted uranium oxide will be used as much as possible, and the remaining depleted uranium oxide will be stored for potential future uses or disposal, as necessary. In addition, according to the ROD, conversion to depleted uranium metal will occur only if uses for such metal are available. Disposal is defined as the emplacement of material in a manner designed to ensure isolation for the foreseeable future. Compared with long-term storage, disposal is considered to be permanent, with no intent to retrieve the material for future use. In fact, considerable and deliberate effort would be required to regain access to the material following disposal.

The PEIS considered several disposal options, including disposal in shallow earthen structures, below-ground vaults, and an underground mine. In addition, two physical waste forms were considered in the PEIS: ungrouted waste and grouted waste. Ungrouted waste refers to U_3O_8 or UO_2 in the powder or pellet form produced during the deconversion process. This bulk material would be disposed of in drums. Grouted waste refers to the solid material obtained by mixing the uranium oxide with cement and repackaging it in drums. Grouting is intended to increase structural strength and stability of the waste and to reduce the solubility of the waste in water. However, because cement would be added to the uranium oxide, grouting would increase the total volume of material requiring disposal. Grouting of waste was assumed to occur at the disposal facility. For each option, the U_3O_8 and UO_2 would be packaged for disposal as follows:

- U_3O_8 would be disposed of in 208 L (55-gal) drums. If ungrouted, approximately 714,000 drums would be required; if grouted, approximately 1,500,000 drums would be required.

- UO_2 would be disposed of in 110 L (30-gal) drums. These small drums would be used because of the greater density of UO_2, a filled 110-L (30-gal) drum would weigh about 605 kg (1,330 lbs). If ungrouted, approximately 740,000 drums would be required; if grouted, approximately 1,110,000 drums would be required.

All disposal options would include a central waste-form facility where drums of uranium oxide would be received from the deconversion facility and prepared for disposal. The waste-form facility would include an administration building, a receiving warehouse, and cementing/curing/ short-term storage buildings (if necessary). Grouting of waste would be performed by mechanically mixing the uranium oxide with cement in large tanks and then pouring the mixture into drums. Once prepared for disposal (if necessary), drums would be moved into disposal units. For the grouted U_3O_8 option, the area of the waste-form facility would be approximately 3.6 ha (9 acres); for the grouted UO_2 option, the area would be about 4.5 ha (11 acres). For ungrouted disposal options, only about 3 ha (7 acres) would be required because the facilities for grouting, curing, and additional short-term storage would not be needed. The unique features of each disposal option are described below.

4.13.3.1.4.1 Disposal in Shallow Earthen Structures

Shallow earthen structures, commonly referred to as engineered trenches, are among the most commonly used forms of low-level waste disposal, especially in dry climates. Shallow earthen structures would be excavated to a depth of about 8 m (26 ft), with the length and width determined by site conditions and the annual volume of waste to be disposed of. Disposal in shallow earthen structures would consist of placing waste on a stable structural pad with barrier walls constructed of compacted clay. Clay would be used because it prevents the walls from collapsing or caving in, and it presents a relatively impermeable barrier to waste migration. The waste containers (i.e., drums) would be tightly stacked three pallets high in the bottom of the structure with forklifts. Any open space between containers would be filled with earth, sand, gravel, or other similar material as each layer of drums was placed. After the structure was filled, a 2-m (6-ft) thick cap composed of engineered fill dirt and clay would be placed on top and compacted. The cap would be mounded at least 1 m (3 ft) above the local grade and sloped to minimize the potential for water infiltration. Disposal would require about 30 ha (74 acres).

4.13.3.1.4.2 Disposal in Vaults

Concrete vaults for disposal would be divided into five sections, each section approximately 20 m (66 ft) long by 8 m (26 ft) wide and 4 m (13 ft) tall. As opposed to shallow earthen structures, the walls and floor of a vault would be constructed of reinforced concrete. A crane would be used to place the depleted U_3O_8 within each section. Once a vault was full, any open space between containers would be filled with earth, sand, gravel, or other similar material. A permanent roof slab of reinforced concrete that completely covers the vault would be installed after all five sections were filled. A cap of engineered fill dirt and clay would be placed on top of the concrete cover and compacted. The cap would be mounded above the local grade and sloped to minimize the potential for water infiltration. Disposal would require about 51 ha (125 acres).

4.13.3.1.4.3 Disposal in a Mine

An underground mine disposal facility would be a repository for permanent deep geological disposal. A mined disposal facility could possibly use a previously existing mine, or be constructed for the sole purpose of waste disposal. For purposes of comparing alternatives, the conservative assumption of constructing a new mine was assessed in the PEIS. A mine disposal facility would consist of surface facilities that provide space for waste receiving and inspection (the waste-form facility), and shafts and ramps for access to and ventilation of the underground portion of the repository. The underground portion would consist of tunnels (called "drifts") for the transport and disposal of waste underground. The dimensions of the drifts would be similar to those described previously for the storage options, except that each drift would have a width of 6.5 m (21 ft). Waste containers would be placed in drifts and back-filled. Disposal of ungrouted and grouted U_3O_8 would require about 91 ha (228 acres) and 185 ha (462 acres) of underground disposal space, respectively. Disposal of ungrouted and grouted UO_2 would require about 70 ha (172 acres) and 102 ha (252 acres), respectively.

4.13.3.1.5 Potential Impacts of Each Disposal Option

This section provides a summary of the potential environmental impacts associated with the disposal of depleted uranium oxides in shallow earthen structures, vaults, and a mine during two distinct phases: (1) the operational phase and (2) the post-closure phase. Analysis of the operational phase included facility construction and the time during which waste would be actively placed in disposal units. Analysis of the post-closure phase considered potential impacts 1,000 years after the disposal units fail (i.e., release uranium material to the environment). For each phase, impacts were estimated for both generic wet and dry environmental settings. The following is presented as a general summary of potential environmental impacts during the operational phase:

- ***Potential Adverse Impacts.*** Potential adverse impacts during the operational phase would be small and generally similar for all options. Minor to moderate impacts would occur during construction activities, although these impacts would be temporary and easily mitigated by common engineering and good construction practices. Impacts during waste emplacement activities also would be small and limited to workers.
- ***Wet or Dry Environmental Setting.*** In general, potential impacts would be similar for generic wet and dry environmental settings during the operational phase.
- ***U_3O_8 or UO_2.*** The potential disposal impacts tend to be slightly larger for U_3O_8 than for UO_2 because the volume of U_3O_8 would be greater and most environmental impacts tend to be proportional to the volume.
- ***Grouted or Ungrouted Waste.*** For both U_3O_8 and UO_2, the disposal of grouted waste would result in larger impacts than disposal of ungrouted waste during the operational phase for two reasons: (1) grouting increases the volume of waste requiring disposal (by about 50%) and (2) grouting operations result in small emissions of uranium material to the air and water.
- ***Shallow Earthen Structure, Vault, or Mine.*** The potential impacts are essentially similar for disposal in a shallow earthen structure, vault, or mine. However, disposal in a mine could create slightly larger potential impacts if excavation of the mine was required (use of an existing mine would minimize impacts).

For the post-closure phase, impacts from disposal of U_3O_8 and UO_2, were calculated for a post-failure time of 1,000 years. The potential impacts estimated for the post-closure phase are subject to a great deal of uncertainty because of the extremely long time period considered and the dependence of predictions on the behavior of the waste material as it interacts with soil and water in a distant future environment. The post-closure impacts would depend greatly on the specific disposal facility design and site-specific characteristics. Because of these uncertainties, the assessment assumptions are generally selected to produce conservative estimates of impact, i.e., they tend to overestimate the expected impact. Changes in key disposal assumptions could yield significantly different results.

The following is presented as a general summary of potential environmental impacts during the post-closure phase:

- ***Potential Adverse Impacts.*** For all disposal options, potentially large impacts to human health and groundwater quality could occur within 1,000 years after failure of a facility in a wet setting, whereas essentially no impacts would occur from a dry setting in the same time frame. Potential impacts would result primarily from the contamination of groundwater. The maximum dose to an individual assumed to live at the edge of the disposal site and use the contaminated water was estimated to be about 1.1 mSv/yr (110 mrem/yr), which would exceed the 0.25 mSv/yr (25-mrem/yr) limit specified in 10 CFR 61 (CFR, 2003r) and DOE Order 5820.2A (DOE, 1988). (For comparison, the average dose equivalent to an individual from background radiation is about 2 to 3 mSv/yr (200 to 300 mrem/yr). Possible exposures (on the order of 0.1 Sv/yr (10 rem/yr) could occur for shallow earthen structures and vaults if the cover material were to erode and expose the uranium material; however, this would not arise until several thousand years later, and such exposure could be eliminated by adding new cover material to the top of the waste area.
- ***Wet or Dry Environmental Setting.*** The potential impacts would be significantly greater in a wet setting than in a dry setting. Specifically virtually no impacts would be expected in a dry setting for more than 1,000 years due to the low water infiltration rate and greater depth to the water table.
- ***U_3O_8 or UO_2.*** Overall, the potential environmental impacts tend to be slightly larger for U_3O_8 than for UO_2 because the volume of U_3O_8 requiring disposal would be greater than that of UO_2. A larger volume of waste essentially exposes a greater area of it to infiltrating water.
- ***Grouted or Ungrouted Waste.*** For both U_3O_8 and UO_2, the disposal of grouted waste would have larger environmental impacts than disposal of ungrouted waste, once the waste was exposed to the environment, because grouting would increase the waste volume. However, further studies using site-specific soil characteristics are necessary to determine the effect of grouting on long-term waste mobility. Grouting might reduce the dissolution rate of the waste and subsequent leaching of uranium into the groundwater in the first several hundred years after failure. However, over longer periods the grouted form would be expected to deteriorate and, because of the long half-life of uranium, the performance of grouted and ungrouted waste would be essentially the same. Depending on soil properties and characteristics of the grout material, it is also possible that grouting could increase the solubility of the uranium material by providing a carbonate-rich environment.

- ***Shallow Earthen Structure, Vault, or Mine.*** Because of the long time periods considered and the fact that the calculations were performed to characterize a time of 1,000 years after each facility was assumed to fail, the potential impacts are very similar among the options of for disposal in a shallow earthen structure, vault, or mine. However, shallow earthen structures would be expected to contain the waste material for a period of at least several hundred years before failure, whereas vaults and a mine would be expected to last even longer — from several hundred years to a thousand years or more. Therefore, vault and mine disposal would provide greater protection of waste in a wet environment. In addition, both vault and a mine would be expected to provide additional protection against erosion of the cover material (and possible resultant surface exposure of the waste material) as compared to shallow earthen structures. The exact time that any disposal facility would perform as designed would depend on the specific facility design and site characteristics.

In NUREG-1484 (NRC, 1994a), Section 4.2.2.8, the NRC provided a generic evaluation of the impacts of disposal of depleted uranium oxides. This generic evaluation was done since there are no actual disposal facilities for large quantities of depleted UF_6. The depleted UF_6 disposal impact analysis method included selection of assumed generic disposal sites, development of undisturbed performance and deep well water use exposure scenarios, and estimation of potential doses.

Exposure pathways used for the near-surface disposal case included drinking shallow well water and consuming crops irrigated with shallow well water. Evaluation of the deep disposal case included undisturbed performance and deep well water exposure scenarios. In the undisturbed performance scenario, groundwater flows into a river that serves as a source of drinking water and fish. For the well water use exposure scenario, an individual drills a well into an aquifer down gradient from the disposal facility and uses groundwater for drinking and irrigation.

The release of uranium isotopes and their daughter nuclides from the disposal facility is limited by their solubility in water. Using the environmental characteristics of a humid southeastern U.S. site and the methods of the EIS, drinking water and agricultural doses were conservatively estimated, for a near surface disposal facility, to exceed 10 CFR 61 limits (CFR, 2003r).

In order to compensate for the lack of knowledge of a specific deep disposal site, two representative sites whose geological structures have previously been characterized were selected for the NRC analysis. Potential consequences of emplacement of U_3O_8 in a geological disposal unit include intake of radionuclides from drinking water, irrigated crops, and fish. Under the assumed conditions for the undisturbed performance scenario, groundwater would be discharged to a river. Under conditions not expected to occur, an individual would obtain groundwater by drilling a well down gradient from the disposal unit.

The estimated impacts for a deep disposal facility were less than the 0.25 mSv/yr (25 mrem/yr) level adopted from 10 CFR 61 (CFR, 2003r) as a basis for comparison. The assumptions used in the analysis, included neglect of potential engineered barriers, mass transfer limitations in releases, and decay and retardation during vertical transfer contribute to a conservative analysis.

The evaluation also concluded that UBCs can be stored indefinitely in a retrievable surface facility with minimal environmental impacts. The environmental impacts associated with such storage would be commitment of the land for a storage area, and a small offsite radiation dose.

4.13.3.1.6 Costs Associated with Depleted UF_6 Conversion and Disposal

This section presents cost estimates for the conversion of depleted uranium hexafluoride (depleted UF_6) and the disposal of the depleted triuranium octoxide (depleted U_3O_8) produced during deconversion. It also presents cost estimates for the associated transportation of depleted UF_6 to the conversion plant and the transportation of depleted U_3O_8 to the disposal site. The cost estimates were obtained from analyses of four sources: a 1997 study by the Lawrence Livermore National Laboratory (LLNL), the Uranium Disposition Services, LLC (UDS) contract with the Department of Energy (DOE) dated August 29, 2002, information from Urenco related to depleted UF_6 disposition costs including conversion, and the costs submitted to the Nuclear Regulatory Commission (NRC) by LES as part of the Claiborne Energy Center (CEC) license application in the early 1990s (LES, 1993). The estimated cost to dispose of depleted U_3O_8 in an exhausted uranium mine was also assessed.

This section reviews cost estimates developed by LLNL for the interim storage of the current very large United States (U.S.) inventory of depleted UF_6 at DOE conversion facilities, the DOE preferred option of conversion of depleted UF_6 to depleted U_3O_8 at DOE facilities, the ultimate disposal of depleted U_3O_8 at DOE sites, and the transportation of depleted UF_6 and depleted U_3O_8 (LLNL, 1997a). While cost estimates for other disposition alternatives (e.g. conversion to uranium oxide (UO_2)) were reviewed they are not addressed in this section since they were not considered as being applicable to LES. It is noted that the LLNL study estimates are reported in 1996 discounted dollars.

This section reviews the UDS-DOE contract since it is regarded as being more credible than an estimate because it represents actual U.S. cost data (DOE, 2002b). Unfortunately the UDS contract does not provide a breakdown of the conversion and disposal cost components.

This section also reflects information on depleted UF_6 disposition cost by European fuel cycle supplier, Urenco. The disposal costs submitted to the NRC in support of the Claiborne Energy Center license application to the NRC in the early 1990s were also reviewed (LES, 1993).

This section is based on an analysis of reports and literature in the public domain as well as information provided by Urenco and the experience of expert consultants.

In August 2001 the DOE reported that it had an inventory of depleted UF_6 enrichment tails material amounting to 55,000 (60,627), 193,000 (212,746) and 449,000 (494,938) metric tons (tons) stored at its enrichment sites at Oak Ridge in Tennessee, at Portsmouth in Ohio, and at Paducah in Kentucky, respectively (DOE, 2001d). This total of approximately 700,000 MT (771,617 tons) of depleted UF_6 corresponds to about 470,000 MT (518,086 tons) of uranium (MTU) as UF_6, a figure that is obtained by multiplying the mass of depleted UF_6 by the mass fraction of U to UF_6; i.e., 0.676. The depleted UF_6 is stored in approximately 60,000 steel cylinders, some dating back to about 1947 (DOE, 2001e). On October 31, 2000, the DOE issued a Request for Proposal (RFP) to construct depleted UF_6 to depleted U_3O_8 conversion facilities at the Portsmouth and Paducah sites in order to begin management and disposition of the UBCs accumulated at its three sites (DOE, 2000a). The DOE plans to ship the depleted UF_6 stored at the East Tennessee Technology Park (ETTP) at Oak Ridge to Portsmouth for conversion.

Since the 1950s, the government has stored depleted UF_6 in an array of large steel cylinders at Oak Ridge, Paducah, and Portsmouth. Several different cylinder types, including 137 nominal 19-ton cylinders (Paducah) made of former UF_6 gaseous diffusion conversion shells, are in use, although the vast majority of cylinders have a 12 MT (14 ton) capacity. The cylinders are typically 3.7 m (12 ft) long by 1.2 m (4 ft) in diameter, with most having a thin wall thickness of 0.79 cm (5/16 in) of steel. Similar but smaller cylinders are also in use. Thick-walled cylinders, 48Ys that have a 1.6 cm (5/8 in) wall thickness, will be used by LES for storage and transport. The cylinders managed by DOE at the three sites are typically stacked two cylinders high in large areas called yards.

The DOE and USEC Inc. cylinders considered acceptable for UF_6 handling and shipping are referred to as conforming cylinders in the LLNL study. LLNL notes that the old or corroded cylinders that will not meet the American National Standards Institute (ANSI) specifications (ANSI N14.1), non-conforming cylinders, will require either special handling and special over-packs or transfer of contents to approved cylinders, and approval by regulatory agencies such as the Department of Transportation (DOE, 2001d). The LLNL report estimated high costs for the management and transporting of 29,083 non-conforming cylinders in the study's reference case, approximately 63% of the total of 46,422 cylinders in the study. There are approximately 4,683 cylinders at the Oak Ridge ETTP that the DOE has determined should be transported to the Portsmouth site for disposition. The LLNL report estimated that the life-cycle cost of developing special over-packs and constructing and operating a transfer facility for the DOE's non-conforming cylinders could be as much as $604 million, in discounted 1996 dollars (LLNL, 1997a). LBDCR-07-0022

On August 29, 2002, the DOE announced the competitive selection of UDS to design, construct, and operate conversion facilities near the Paducah and Portsmouth gaseous diffusion plants. UDS will operate these facilities for the first five years, beginning in 2005. The UDS contract runs from August 29, 2002 to August 3, 2010. UDS will also be responsible for maintaining the depleted uranium and product inventories and transporting depleted uranium from ETTP to the Portsmouth for conversion. The DOE-UDS contract scope includes packaging, transporting and disposing of the conversion product depleted U_3O_8 at a government waste disposal site such as the Nevada Test Site (NTS) (DOE, 2002b).

UDS is a consortium formed by Framatome ANP, Inc., Duratek Federal Services, Inc., and Burns and Roe Enterprises, Inc. The estimated value of the cost reimbursement contract is $558 million (DOE, 2002c). Design, construction and operation of the facilities will be subject to appropriations of funds from Congress. On December 19, 2002, the White House confirmed that funding for both conversion facilities will be included in President Bush's 2004 budget. President Bush signed the Energy and Water Appropriations Bill on December 1, 2003 which included funding for both conversion facilities.

The NEF UBCs will all be thick-walled conforming 48Y cylinders. The 48Y cylinders have a gross weight of about 14.9 MT (16.4 tons), and when filled, will normally contain 12.5 MT (13.8 tons) of UF_6 or about 8.5 MTU (9.4 tons). The management and transporting of the LES UBCs will not involve unusual costs such as those that will be required for the majority of the DOE-managed cylinders currently stored at the three government sites.

In May 1997, LLNL published a cost analysis report for the long-term management of depleted uranium hexafluoride (LLNL, 1997a). The report was prepared to provide comparative life-cycle cost data for the Department of Energy's (DOE) Draft 1997 Programmatic Environmental Impact Statement (PEIS) on alternative strategies for management and disposition of depleted UF_6 (DOE, 1997a). The LLNL report appears to be the most comprehensive recent assessment of depleted UF_6 disposition costs available in the public domain. The technical data on which the LLNL cost analysis report is based, is principally the May 1997 Engineering Analysis Report, also by LLNL (LLNL, 1997b). The April 1999 Final PEIS identified as soon as practicable conversion of DUF6 to another stable chemical form, uranium oxide (or metal if there is a use for it), the DOE-preferred management alternative (DOE, 1999).

The LLNL costs, which are reported in discounted 1996 dollars (first quarter), were undiscounted and adjusted upward by 11% to 2002 dollars using the U.S. Gross Domestic Product (GDP) Implicit Price Deflator (IPD).

When the LLNL report was prepared in 1997, more than five years ago, the cost estimates in it were based on an inventory of 560,000 MT (617,294 tons) of depleted UF_6 , or 378,600 MTU (417,335 tons uranium) after applying the 0.676 mass fraction multiplier. This inventory equates over the 20 years of the study to an annual throughput rate of 28,000 MT (30,865 tons) of UF_6 or about 19,000 MT (20,943 tons) of depleted uranium, which is approximately 3.6 times the expected annual UBC output of the proposed NEF. The costs in the LLNL report are based on the life-cycle quantity of 378,600 MTU (417,335 tons uranium), beginning in 2009.

The LLNL cost analyses assumed that the depleted UF_6 would be converted to depleted U_3O_8, the DOE's preferred disposal form, using one of two dry process conversion alternatives. The first alternative, the AHF option, upgrades the hydrogen fluoride (HF) product to anhydrous HF (<1.0% water). In the second option, the HF neutralization alternative, the HF would be neutralized with lime to produce calcium fluoride (CaF2). The LLNL cost analyses assumed that the AHF and CaF2 conversion products' would have negligible uranium contamination and could be sold for unrestricted use. LES will not use a deconversion facility that employs a process that results in the production of anhydrous HF.

Table 4.13-2, LLNL Estimated Life-Cycle Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion, presents the LLNL-estimated life-cycle capital, operating, and regulatory discounted costs in 1996 dollars, for conversion of 378,600 MTU (417,335 tons uranium) over 20 years, of depleted UF_6 to depleted U_3O_8 by anhydrous hydrogen fluoride (AHF) and HF neutralization processing. The costs were extracted from Table 4.8 in the LLNL report. The discounted LLNL life-cycle costs in 1996 dollars were undiscounted and converted to per kg unit costs and adjusted to 2002 dollars using the Gross Domestic Product (GDP) Implicit Price Deflator (IPD), as shown in the table. The escalation adjustment resulted in the 1996 costs being increased by 11%.

The anhydrous hydrogen fluoride (AHF) conversion option for which LLNL provides a cost estimate assumes that the AHF by-product is saleable, and that total sales revenues over the 20 years of operation would amount to $77.32 million, in discounted dollars. LLNL also assumed that the life-cycle sale of CaF2 obtained from neutralizing HF with lime would result in discounted revenues of $11.02 million.

The cost estimates for the conversion facility assumed that all major buildings are to be structural steel frame construction, except for the process building which is a two story reinforced concrete structure. Most of this building is assumed to be "special construction" with 0.3-m (1-ft) thick concrete perimeter walls and ceilings, 8-in concrete interior walls, and 0.6-m (2-ft) thick concrete floor mat. The "standard construction" area walls were taken to be 8-in thick concrete with 15-cm (6-in) elevated floors and 20 cm (8-in) concrete floors slabs on grade.

Table 4.13-3, Summary of LLNL Estimated Capital, Operating and Regulatory Unit Costs for DOE depleted UF_6 to Depleted U_3O_8 Conversion, presents a summary of estimated capital, operating and regulatory costs for depleted UF_6 to depleted U_3O_8 conversion on a dollars per kgU basis, in both 1996 and 2002 dollars, undiscounted. It can be seen that in either case the conversion process is operations and maintenance intensive.

Table 4.13-4, LLNL Estimated Life Cycle Costs for DOE Depleted UF_6 Disposal Alternatives, presents LLNL-estimated life-cycle costs for the waste form preparation and disposal of DOE depleted U_3O_8 produced by conversion of depleted UF_6. The table presents estimated costs for two depleted U_3O_8 disposal alternatives: shallow earthen structures (engineered "trenches") and concrete vaults. The waste form preparation for each alternative consists primarily of loading, compacting, and sealing the depleted U_3O_8 into 208-L (55-gal) steel drums.

The LLNL-estimated life-cycle costs for depleted U_3O_8 disposal range from $86 million, in discounted 1996 dollars, for the engineered trench alternative to $180 million for depleted U_3O_8 disposal in a concrete vault. The disposal unit costs range from $1.46 per kgU to $2.17 per kgU, in 2002 dollars. As discussed later in this section, the LLNL-estimated concrete vault costs are higher than those that would be required to either sink a new underground mine or to refurbish and operate an existing exhausted mine, an alternative that the NRC has indicated to be acceptable (ORNL, 1995). For example, the capital cost for the concrete vault alternative of

$130.75 million in discounted 1996 dollars or $349.7 million in undiscounted 2002 dollars is far greater than the $12.4 million cost of a new 200 MT (220 tons) per day underground mine, as shown later in this section.

Table 4.13-5, Summary of Total Estimated Conversion and Disposal Costs presents the depleted UF_6 conversion and depleted U_3O_8 disposal costs already discussed on a dollar per kgU basis, in undiscounted 2002 dollars. In addition it also includes the LLNL-estimated cost to DOE of rail transportation (including loading and unloading) of conforming depleted UF_6 cylinders to the conversion facility site and drummed depleted U_3O_8 to the disposal sites. It does not include interim storage costs since it may reasonably be assumed that LES UBCs may be shipped directly to the deconversion facility. The table indicates that the total costs for depleted UF_6 disposal in, in 2002 dollars, based on the LLNL study estimates, is likely to range from about $5.06 to $5.81 per kgU.

On August 29, 2002, the DOE announced the competitive selection of UDS to design and construct conversion facilities near the DOE enrichment plants at Paducah, Kentucky and Portsmouth, Ohio, and to operate these facilities from 2006 to 2010. UDS will also be responsible for maintaining the depleted uranium and conversion product inventories and transporting depleted uranium from Oak Ridge East Tennessee Technology Park (ETTP) to the Portsmouth site for conversion. The contract scope includes packaging, transporting and disposing of the conversion product depleted U_3O_8. Table 4.13-6, DOE UDS August 29, 2002 Contract Quantities and Costs presents a summary of the UDS contract quantities and costs.

The DOE-estimated value of the cost reimbursement incentive fee contract, which runs from August 29, 2002 to August 3, 2010, is $558 million (DOE, 2002c). Design, construction and operation of the facilities will be subject to appropriations of funds from Congress. On December 19, 2002, the White House confirmed that funding for both conversion facilities will be included in President Bush's 2004 budget. However, the Office of Management and Budget has not yet indicated how much funding will be allocated. Framatome is a subsidiary of Areva, the French company whose subsidiary Cogema has operated the world's only existing commercial depleted UF_6 conversion plant since 1984.

The table shows the target deconversion quantities and the estimated fee. The contract calls for the construction of a 12,200 MTU (13,448 tons uranium) per year conversion plant at Paducah and a 9,100 MTU (10,031 tons uranium) per year conversion plant at Portsmouth, for an annual nominal total capacity of 21.3 million kgU (23,479 tons uranium), which is also the target conversion rate per year. Based on the target conversion rate the UDS contract total unit capital cost is estimated to be $0.77 per kgU ($0.35 per lb U). This unit cost is based on plant operation over 25 years and 6% government cost of money. The conversion, disposal and material management total operating cost during the first five years of operation corresponds to $3.15 per kgU. The total unit capital and operating cost is $3.92 per kgU. As noted earlier in this section, the DOE has indicated that the disposal of the depleted U_3O_8 may take place at the Nevada Test Site. The cost to DOE of depleted U_3O_8 disposal at NTS is currently estimated at $7.50 per ft3 or about $0.11 per kgU ($.0.05 per lb U). In 1994 it was reported that the NTS charge to the DOE of $10 per ft3 ($0.15 per kgU) was not a full cost recovery rate (EGG, 1994).

It is of interest to note that USEC entered into an agreement with the DOE on June 30, 1998, wherein it agreed to pay the DOE $50,021,940 immediately prior to privatization for a commitment by the DOE "for storage, management and disposition of the transferred depleted uranium..." generated by USEC during the FY 1999 to FY 2004 time period (DOE, 1998).

Under the terms of the agreement, the DOE also committed to perform "...research and development into the beneficial use of depleted uranium, and related activities and support services for depleted uranium-related activities". The agreement specifies that USEC will transfer to the DOE title to and possession of 2,026 48G cylinders containing approximately 16,673,980 kgU (18,380 tons of uranium). Under this agreement, DOE effectively committed to dispose of the USEC DUF6 at an average rate of approximately 3.0 million kgU per year between the middle of calendar 1998 and the end of 2003 at a cost of exactly $3.00 per kgU ($1.36 per lb U), in 1998 dollars.

According to Urenco its depleted UF_6 disposal will be similar to those that will be generated by LES at the NEF. Urenco contracts with a supplier for depleted UF_6 to depleted U_3O_8 conversion. The supplier has been converting depleted UF_6 to depleted U_3O_8 on an industrial scale since 1984.

The Claiborne Energy Center costs given in Table 4.13-7, Summary of Depleted UF_6 Disposal Costs from Four Sources are based upon those presented to John Hickey of the NRC in the LES letter of June 30, 1993 (LES, 1993) as adjusted for changes in units and escalated to 2002. A conversion cost of $4.00 per kgU was provided to LES by Cogema at that time. A value of $1.00 per kgU U_3O_8 ($0.45 lb U_3O_8) depleted U_3O_8 disposal cost was based on information provided by Urenco at the time.

As indicated earlier in this section, the NRC has noted that an existing exhausted underground uranium mine would be a suitable repository for depleted U_3O_8 (NRC, 1995). For purposes of comparing alternatives, the conservative assumption of constructing a new mine was assessed. A mine disposal facility would consist of surface facilities for waste receiving and inspection (the waste-form facility), and shafts and ramps for access to and ventilation of the underground portion of the repository, and appropriate underground transport and handling equipment. The mine underground would consist of tunnels (called “drifts”) and cross-cuts for the transport and storage of stacked 208-L (55-gal) steel drums which are then back-filled. A great many features of a typical underground mine would be applicable to this disposal alternative.

The NEF, when operating at its nominal full capacity of 3.0 million Separative Work Units (SWUs) per year will produce 7,800 MT (8.598 tons) of depleted UF_6 . A typical U.S. underground mine, operating for five days per week over fifty weeks of the year, excepting ten holiday days per year, would operate for 240 days per year. Thus, if LES UBCs were disposed uniformly over the year, the average disposal rate would be 32.5 MT (35.8 tons) of depleted UF_6 per day. This is much less than the rate of ore production in even a typical small under ground mine. However, it may reasonably assumed that the rate of emplacement of the drummed depleted U_3O_8 would be less than the rate of ore removal from a typical underground mine.

The estimated capital and operating costs for a 200 MT per day underground metal mine in a U.S. setting was provided by a U.S. mining engineering company, Western Mine Engineering, Inc. The costs are for a vein type mine accessed by a 160-m (524-ft) deep vertical shaft with rail type underground haulage transport. The operating costs for the 200 MT per day mine is estimated to be $0.07 per kg ($0.03 per lb) of ore and the capital cost is estimated to be approximately $0.04 per kg ($0.02 per lb) of ore, for a total cost of $0.11 per kg ($0.05 per lb) of ore. The capital cost of the mine is $12.4 million 2002 dollars. In the case of an existing exhausted mine the capital costs could be much less.

The mine cost estimates presented indicate that the assumption of the much higher costs presented in Table 4.13-4, LLNL Estimated Life Cycle Costs for DOE Depleted UF_6 Disposal

Alternatives for the concrete vault alternative, represents an upper bound cost estimate for depleted U_3O_8 disposal. For example, the capital cost of the concrete vault alternative, which may be obtained by undiscounting the LLNL estimate costs presented in Table 4.13-4, is $350 million in 2002 dollars, or 28 times the capital cost of the 200 MT (220 tons) mine discussed above.

The four sets of cost estimates obtained are presented in Table 4.13-7 in 2002 dollars per kgU. Note that the Claiborne Enrichment Center cost had a greater uncertainty associated with it. The UDS contract does not allow the component costs for conversion, disposal and transportation to be estimated. The costs in the table indicate that $5.50 per kgU ($2.50 per lb U) is a conservative and, therefore, prudent estimate of total depleted UF_6 disposition cost for the LES NEF. That is, the historical estimates from LLNL and CEC and the more recent actual costs from the UDS contract were used to inform the LES cost estimate. Urenco has reviewed this estimate and, based on its current cost for UBC disposal, finds this figure to be prudent.

Based on information from corresponding vendors, the value of $5.50 per kgU (2002 dollars), which is equal to $5.70 per kgU when escalated to 2004 dollars, was revised in December 2004 to $4.68 per kgU (2004 dollars). The value of $4.68 per kgU was derived from the estimates of costs from the three components that make up the total disposition cost of DUF6 (i.e., deconversion, disposal, and transportation). The estimate of $4.68 per kgU supports the Preferred Plausible Strategy of U.S. Private Sector Conversion and Disposal identified in section 4.13.3.1.3 of the ER as Option 1. In addition, $0.60 per kgU has been added to this estimate to cover the cost of managing the empty UBCs once the DUF6 has been removed for conversion.

In support of the Option 2 Plausible Strategy identified in Section 4.13.3.1.3 of the ER, "DOE Conversion and Disposal," considered the backup option, LES requested a cost estimate from the Department of Energy (DOE). On March 1, 2005, DOE provided a cost estimate to LES for the components that make up the total disposition cost (i.e., deconversion, disposal, and transportation, excluding the cost of loading the UBCs at the NEF site) (DOE, 2005). This estimate, which was based upon an independent analysis undertaken by DOE's consultant, LMI Government Consulting, estimated the cost of disposition to total approximately $4.91 per kgU (2004 dollars). This estimate was subsequently corrected to $4.68 per kgU (2004 dollars) and no additional amounts were added to account for UBC loading at the NEF site since this cost is minimal and the DOE transportation estimate is highly conservative. The Department's cost estimate for deconversion, storage, and disposal of the DU is consistent with the contract between UDS and DOE. The cost estimate does not assume any resale or reuse of any products resulting from the conversion process.

For purposes of determining the total tails disposition funding requirement and the amount of financial assurance required for this purpose, the value of $5.28 per kgU (based upon the cost estimate for the Preferred Plausible Strategy) was selected. Furthermore, this financial assurance will always cover the backup DOE option cost estimate, plus a 25% contingency, via the periodic update mechanism. See Safety Analysis Report Table 10.1-14, Total Decommissioning Costs, for the total tails disposition funding cost.

4.13.3.2 Water Quality Limits

All plant effluents are contained on the NEF site. A series of evaporation retention/detention basins, and septic systems are used to contain the plant effluents. There will be no discharges to a Publicly Owned Treatment Works (POTW). Contaminated water is treated to the limits in 10 CFR 20, Appendix B, Table 2 and to administrative levels recommended by Regulatory Guide 8.37 (CFR, 2003q). Refer to ER Section 4.4, Water Resource Impacts, for additional water quality standards and permits for the NEF. ER Section 3.12, Waste Management, also contains information on the NEF systems and procedures to ensure water quality. LBDCR-07-0022

4.13.4 Waste Minimization

The highest priority has been assigned to minimizing the generation of waste through reduction, reuse or recycling. The NEF incorporates several waste minimization systems in its operational procedures that aim at conserving materials and recycling important compounds. For example, all Fomblin Oil will be recovered where practical. Fomblin Oil is an expensive, highly fluorinated, inert oil selected specifically for use in UF_6 systems to avoid reactions with UF_6. The NEF will also have in place a Decontamination Workshop designed to remove radioactive contamination from equipment and allow some equipment to be reused rather than treated as waste.

In addition, the NEF process systems that handle UF_6, other than the Product Liquid Sampling System, will operate entirely at subatmospheric pressure to prevent outward leakage of UF_6. Cylinders, initially containing liquid UF_6, will be transported only after being cooled, so that the UF_6 is in solid form, to minimize the potential risk of accidental releases due to mishandling.

The NEF is designed to minimize the usage of natural and depletable resources. Closed-loop cooling systems have been incorporated in the designs to reduce water usage. Power usage will be minimized by efficient design of lighting systems, selection of high-efficiency motors, and use of proper insulation materials.

ALARA controls will be maintained during facility operation to account for standard waste minimization practices as directed in 10 CFR 20 (CFR, 2003q). The outer packaging associated with consumables will be removed prior to use in a contaminated area. The use of glove boxes will minimize the spread of contamination and waste generation.

Collected waste such as trash, compressible dry waste, scrap metals, and other candidate wastes will be volume reduced at a centralized waste processing facility. This facility could be operated by a commercial vendor such as GTS Duratek. This facility would further reduce generated waste to a minimum quantity prior to final disposal at a land disposal facility or potential reuse.

4.13.4.1 Control and Conservation

The features and systems described below serve to limit, collect, confine, and treat wastes and effluents that result from the UF_6 enrichment process. A number of chemicals and processes are used in fulfilling these functions. As with any chemical/industrial facility, a wide variety of waste types will be produced. Waste and effluent control is addressed below as well as the features and systems used to conserve resources.

4.13.4.1.1 Mitigating Effluent Releases

The equipment and design features incorporated in the NEF are selected to keep the release of gaseous and liquid effluent contaminants as low as practicable, and within regulatory limits. They are also selected to minimize the use of depletable resources. Equipment and design features for limiting effluent releases during normal operation are described below:

The process systems that handle UF_6 operate almost entirely at sub-atmospheric pressures. Such operation results in no outward leakage of UF_6 to any effluent stream.

- The one location where UF_6 pressure is raised above atmospheric pressure is in the piping and cylinders inside the sampling autoclave. The piping and cylinders inside the autoclave confine the UF_6. In the event of leakage, the sampling autoclave provides secondary containment of UF_6.
- Cylinders of UF_6 are transported only when cool and when the UF_6 is in solid form. This minimizes risk of inadvertent releases due to mishandling.
- Process off-gas, from UF_6 purification and other operations, is discharged through desublimers to solidify and reclaim as much UF_6 as possible. Remaining gases are discharged through high-efficiency filters and chemical adsorbent beds. The filters and adsorbents remove HF and uranium compounds left in the gaseous effluent stream.

- Liquids and solids in the process systems collect uranium compounds. When these liquids and solids (e.g., oils, damaged piping, or equipment) are removed for cleaning or maintenance, portions end up in wastes and effluent. Different processes are employed to separate uranium compounds and other materials (such as various heavy metals) from the resulting wastes and effluent. These processes are described in ER Section 4.13.4.2 below.
- Processes used to clean up wastes and effluent create their own wastes and effluent as well. Control of these is also accomplished by liquid and solid waste handling systems and techniques, which are described in detail in the Sections below. In general, careful applications of basic principles for waste handling are followed in all of the systems and processes. Different waste types are collected in separate containers to minimize contamination of one waste type with another. Materials that can cause airborne contamination are carefully packaged; ventilation and filtration of the air in the area is provided as necessary. Liquid wastes are confined to piping, tanks, and other containers; curbing, pits, and sumps are used to collect and contain leaks and spills. Hazardous wastes are stored in designated areas in carefully labeled containers; mixed wastes are also contained and stored separately. Strong acids and caustics are neutralized before entering an effluent stream. Radioactively contaminated wastes are decontaminated insofar as possible to reduce waste volume.
- Following handling and treatment processes to limit wastes and effluent, sampling and monitoring is performed to assure regulatory and administrative limits are met. Gaseous effluent is monitored for HF and is sampled for radioactive contamination before release; liquid effluent is sampled and/or monitored in liquid waste systems; solid wastes are sampled and/or monitored prior to offsite treatment and disposal. Samples are returned to their source where feasible to minimize input to waste streams.

4.13.4.1.2 Conserving Depletable Resources

The NEF design serves to minimize the use of depletable resources. Water is the primary depletable resource used at the facility. Electric power usage also depletes fuel sources used in the production of the power. Other depletable resources are used only in small quantities. Chemical usage is minimized not only to conserve resources, but also to preclude excessive waste production. Recyclable materials are used and recycled wherever practicable.

The main feature incorporated in the NEF to limit water consumption is the use of closed-loop cooling systems.

The NEF is designed to minimize the usage of natural and depletable resources as shown by the following measures:

- The use of low-water consumption landscaping versus conventional landscaping reduces water usage.
- The installation of low flow toilets, sinks and showers reduces water usage when compared to standard flow fixtures.
- Localized floor washing using mops and self-contained cleaning machines reduces water usage compared to conventional washing with a hose twice per week.
- The use of high efficiency washing machines compared to standard machines reduces water usage.

- The use of high efficiency closed cell cooling towers (water/air cooling) versus open cell design reduces water usage.
- Closed-loop cooling systems have been incorporated to reduce water usage.

Power usage is minimized by efficient design of lighting systems, selection of high-efficiency motors, use of appropriate building insulation materials, and other good engineering practices. The demand for power in the process systems is a major portion of plant operating cost; efficient design of components is incorporated throughout process systems.

4.13.4.1.3 Prevention and Control of Oil Spills

The NEF will implement a spill control program for accidental oil spills. The purpose of the spill control program will be to reduce the potential for the occurrence of spills, reduce the risk of injury in case of a spill occurs, minimize the impact of a spill, and provide a procedure for the cleanup and reporting of spills. The oil spill control program will be established to comply with the requirements of 40 CFR 112 (CFR, 2003aa), Oil Pollution Prevention. As required by Part 112 , a Spill Prevention, Control, and Countermeasure (SPCC) plan will be prepared prior to either the start of facility operation of the facility or prior to the storage of oil onsite in excess of the de minimis quantities established in 40 CFR 112.1(d) (CFR, 2003aa). The SPCC Plan will be reviewed and certified by a Professional Engineer and will be maintained onsite.

As a minimum the SPCC Plan will contain the following information:

- Identification of potential significant sources of spills and a prediction of the direction and quantity of flow that would result from a spill from each such source;
- Identification the use of containment or diversionary structures such as dikes, berms, culverts, booms, sumps, and diversion ponds to be used at the facility where appropriate to prevent discharged oil from reaching navigable waters;
- Procedures for inspection of potential sources of spills and spill containment/diversion structures; and
- Assigned responsibilities for implementing the plan, inspections, and reporting.

In addition to preparation and implementation of the SPCC Plan, the facility will comply with the specific spill prevention and control guidelines contained in 40 CFR 112.7(e) (CFR, 2003aa), such as drainage of rain water from diked areas, containment of oil in bulk storage tanks, above ground tank integrity testing, and oil transfer operational safeguards.

4.13.4.2 Reprocessing and Recovery Systems

Systems used to allow recovery or reuse of materials are described below.

4.13.4.2.1 Fomblin Oil Recovery System

Fomblin oil is an expensive, highly fluorinated, inert oil selected specifically for use in UF_6 systems to avoid reaction with UF_6. The Fomblin Oil Recovery System recovers used Fomblin oil from pumps used in UF_6 systems. All Fomblin oil is recovered; none is normally released as waste or effluent.

Used Fomblin oil is recovered by removing impurities that inhibit the oil's lubrication properties. The impurities collected are primarily uranyl fluoride (UO_2F_2) and uranium tetrafluoride (UF4) particles. The recovery process also removes trace amounts of hydrocarbons, which if left in the oil would react with UF_6. The Fomblin Oil Recovery System components are located in the Decontaminated Workshop in the Technical Services Building (TSB). The total annual volume of oil to be processed in this system is approximately 535 L (141 gal).

The Fomblin oil recovery process consists of oil collection, uranium precipitation, trace hydrocarbon removal, oil sampling, and storage of cleaned oil for reuse. Each step is performed manually.

Fomblin oil is collected in the Vacuum Pump Rebuild Workshop as part of the pump disassembly process. The oil is the transferred for processing to the Decontamination Workshop in plastic containers. The containers are labeled so each can be tracked through the process. Used oil awaiting processing is stored in the used oil storage receipt array to eliminate the possibility of accidental criticality.

Uranium compounds are removed from the Fomblin oil in the Fomblin oil fume hood to minimize personnel exposure to airborne contamination. Dissolved uranium compounds are removed by the addition of anhydrous sodium carbonate (Na_2CO_3) to the oil container which causes the uranium compounds to precipitate into sodium uranyl carbonate $Na_4UO_2(CO_3)_3$. The mixture is agitated and then filtered through a coarse screen to remove metal particles and small parts such as screws and nuts. These are transferred to the Solid Waste Collection System. The oil is then heated to 90°C (194°F) and stirred for 90 minutes to speed the reaction. The oil is then centrifuged to remove UF_4, sodium uranyl carbonate, and various metallic fluorides. The particulate removed from the oil is collected and transferred to the Solid Waste Collection Room for disposal.

Trace amounts of hydrocarbons are next removed in the Fomblin oil fume hood next by adding activated carbon to the Fomblin oil and heating the mixture at 100°C (212°F) for two hours. The activated carbon absorbs the hydrocarbons, and the carbon in turn is removed by filtration through a bed celite. The resulting sludge is transferred to the Solid Waste Disposal Collection Room for disposal.

Recovered Fomblin oil is sampled. Oil that meets the criteria can be reused in the system while oil that does not meet the criteria will be reprocessed. The following limits have been set for evaluating recovered Fomblin oil purity for reuse in the plant:

- Uranium - 50 ppm by volume
- Hydrocarbons - 3 ppm by volume

Recovered Fomblin oil is stored in plastic containers in the Chemical Storage Area.

Failure of this system will not endanger the health and safety of the public. Nevertheless, design and operating features are included that contribute to the safety of plant workers. Containment of waste is provided by components, designated containers, and air filtration systems. Criticality is precluded through the control of geometry, mass, and the selection of appropriate storage containers. To minimize worker exposure, airborne radiological contamination resulting from dismantling is extracted. Where necessary, air suits and portable ventilation units are available for further worker protection.

4.13.4.2.2 Decontamination System

The Contaminated Workshop and Decontamination System are located in the same room in the TSB. This room is called the Decontamination Workshop. The Decontamination Workshop in the TSB will contain the area to break down and strip contaminated equipment and to decontaminate that equipment and its components. The decontamination systems in the workshop are designed to remove radioactive contamination from contaminated materials and equipment. The only significant forms of radioactive contamination found in the plant are uranium hexafluoride (UF_6), uranium tetrafluoride (UF_4) and uranyl fluoride (UO_2F_2).

One of the functions of the Decontamination Workshop is to provide a maintenance facility for both UF_6 pumps and vacuum pumps. The workshop will be used for the temporary storage and subsequent dismantling of failed pumps. The dismantling area will be in physical proximity to the decontamination train, in which the dismantled pump components will be processed. Full maintenance records for each pump will be kept.

The process carried out within the Decontamination Workshop begins with receipt and storage of contaminated pumps, out-gassing, Fomblin oil removal and storage, and pump stripping. Activities for the dismantling and maintenance of other plant components are also carried out. Other components commonly decontaminated besides pumps include valves, piping, instruments, sample bottles, tools, and scrap metal. Personnel entry into the facility will be via a sub-change facility. This area has the required contamination controls, washing and monitoring facilities.

The decontamination part of the process consists of a series of steps following equipment disassembly including degreasing, decontamination, drying, and inspection. Items from uranium hexafluoride systems, waste handling systems, and miscellaneous other items are decontaminated in this system. The decontamination process for most plant components is described below, with a typical cycle time of one hour. For smaller components the decontamination process time is slightly less, about 50 minutes. Sample bottles and flexible hoses are handled under special procedures due to the difficulty of handling the specific shapes. Sample bottle decontamination and decontamination of flexible hoses are addressed separately below.

Criticality is precluded through the control of geometry, mass, and the selection of appropriate storage containers. Administrative measures are applied to uranium concentrations in the Citric Acid Tank and Degreaser Tank to maintain these controls. To minimize worker exposure, airborne radiological contamination resulting from dismantling is extracted. Air suits and portable ventilation units are available for further worker protection.

Containment of chemicals and wastes is provided by components, designated containers, and air filtration systems. All pipe work and vessels in the Decontamination Workshop are provided with design measures to protect against spillage or leakage. Hazardous wastes and materials are contained in tanks and other appropriate containers, and are strictly controlled by administrative procedures. Chemical reaction accidents are prevented by strict control on chemical handling.

4.13.4.2.3 General Decontamination

Prior to removal from the plant, the pump goes through an isolation and de-gas process. This removes the majority of UF_6 from the pump. The pump flanges are then sealed prior to movement to the Decontamination Workshop. The pumps are labeled so each can be tracked through the process. Pumps enter the Decontamination Workshop through airlock doors. The internal and external doors are electrically interlocked such that only one door can be opened at a given time. Pumps may enter the workshop individually or in pairs. Valves, pipework, flexible hoses, and general plant components are accepted into the room either within plastic bags or with the ends blinded.

Pumps waiting to be processed are stored in the pump storage array to eliminate the possibility of accidental criticality. The array maintains a minimum edge spacing of 600 mm (2 ft). Pumps are not accepted if there are no vacancies in the array.

Before being broken down and stripped, all pumps are placed in the Outgas Area and the local ventilation hose is positioned close to the pump flange. The flange cover is then removed. HF and UF_6 fumes from the pump are extracted via the exhaust hose, typically over a period of several hours. While in the Outgas Area, the oil will be drained from the pumps and the first stage roots pumps will be separated from the second stage roots pumps. The oil is drained into 5-L (1.3 gal) plastic containers that are labeled so each can be tracked through the process.

Prior to transfer from the Outgas Area, the outside of the bins, the pump frames, and the oil bottles are all monitored for radiological contamination. The various items will then be taken to the decontamination system or Fomblin oil storage array as appropriate.

Oil waiting to be processed is stored in the Fomblin oil storage array to eliminate the possibility of accidental criticality. The array maintains a minimum edge spacing of about 600 mm (2 ft) between containers. When ready for processing, the oil is transferred to the Fomblin Oil Recovery System where the uranics and hydrocarbon contaminants can be separated prior to reuse of the oil.

After out-gassing, individual pumps are removed from the Outgas Area and placed on either of the two hydraulic stripping tables. An overhead crane is utilized to aid the movement of pumps and tools over the stripping table. The tables can be height-adjusted and the pump can be moved and positioned on the table. Hydraulic stripping tools are then placed on the stripping tables using the overhead crane or mobile jig truck. The pump and motor are stripped to component level using various hydraulic and hand tools. Using the overhead crane or mobile jig truck, the components are placed in bins ready for transportation to the General Decontamination Cabinet.

Degreasing is performed following disassembly of equipment. Degreasing takes place in the hot water Degreaser Tank of the decontamination facility system. The degreased components are inspected and then transferred to the next decontamination tank.

Following disassembly and degreasing, decontamination is accomplished by immersing the contaminated component in a citric acid bath with ultrasonic agitation. After 15 minutes, the component is removed, and is rinsed with water to remove the citric acid.

The tanks are sampled periodically to determine the condition of the solution and any sludge present. The Citric Acid Tank contents are analyzed for uranium concentration and citric acid concentration. A limit on ^{235}U of 0.2 g/L (0.02 ounces/gal) of bath has been established to prevent criticality. Additional citric acid is added as necessary to keep the citric acid concentration between 5% and 7%. Spent solutions, consisting of citric acid and various uranyl and metallic citrates, are transferred to a citric acid collection tank. The Rinse Water Tanks are checked for satisfactory pH levels; unusable water is transferred to an effluent collection tank.

All components are dried after decontamination. This is performed manually using compressed air.

The decontaminated components are inspected prior to release. The quantity of contamination remaining shall be "as-low-as-reasonably practicable." Components released for unrestricted use do not have contamination exceeding 83.3 Bq/100 cm^2 (5,000 dpm/100 cm^2) for average fixed alpha or beta/gamma contamination and 16 Bq/100 cm^2 (1,000 dpm/100 cm^2) removable alpha or beta/gamma contamination. However, if all the component surfaces cannot be monitored then the consignment will be disposed of as a low-level waste.

4.13.4.2.4 Sample Bottle Decontamination

Sample bottle decontamination is handled somewhat differently than the general decontamination process. The Decontamination Workshop has a separate area dedicated to sample bottle storage, disassembly, and decontamination. Used sample bottles are weighed to confirm the bottles are empty. The valves are loosened, and the remainder of the decontamination process is performed in the sample bottle decontamination hood. The valves are removed inside the fume hood. Any loose material inside the bottle or valve is dissolved in a citric acid solution. Spent citric acid is transferred to the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment System.

Initially, sample bottles and valves are flushed with a 10% citric acid solution and then rinsed with deionized water. In the case of sample bottles, these are filled with deionized water and left to stand for an hour, while the valves are grouped together and citric acid is recirculated in a closed loop for an hour. These used solutions are collected and taken to the Citric Acid Collection Tank in the General Decontamination Cabinet. Any liquid spillages / drips are soaked away with paper tissues that are disposed of in the Solid Waste Collection Room. Bottles and valves are then rinsed again with deionized water. This used solution is collected in a small plastic beaker, and then poured into the Citric Acid Tank in the decontamination train. Both the bottles and valves are dried manually, using compressed air, and inspected for contamination and rust. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. The bottles are then put into an electric oven to ensure total dryness, and on removal are ready for reuse. The cleaned components are transferred to the clean workshop for reassembly and pressure and vacuum testing.

4.13.4.2.5 Flexible Hose Decontamination

The decontamination of flexible hoses is handled somewhat differently than the general process and has a separate area. The decontamination process is performed in a Flexible Hose Decontamination Cabinet. This decontamination cabinet is designed to process only one flexible hose at a time and is comprised of a supply of citric acid, deionized water and compressed air.

Initially, the flexible hose is flushed with a 10% citric acid solution at 60°C (140°F) and then rinsed with deionized water (also at 60°C) (140°F) in a closed loop recirculation system. The used solutions (citric acid and deionized water) are transferred into the contaminated Citric Acid Tank for disposal. Interlocks are provided in the recirculation loop to prevent such that the recirculation pumps from starting if the flexible hose has not been connected correctly at both ends. Both the citric acid and deionized water recirculation pumps are equipped with a 15-minute timer device. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. Spill from the drip tray are routed to either the Citric Acid Tank or the hot water recirculation tank, depending upon the decontamination cycle. Each flexible hose is then dried in the decontamination cupboard using hot compressed air at 60°C (140°F). to ensure complete dryness. The cleaned dry flexible hose is then transferred to the Vacuum Pump Rebuild Workshop for reassembly and pressure testing prior to reuse in the plant.

4.13.4.2.6 Decontamination Equipment

The following major components are included in the Decontamination System:

- Citric Acid Baths: An open top Citric Acid Tank with a sloping bottom in hastelloy is provided for the primary means of removing radioactive contamination. The sloping-bottom construction is provided for ease of emptying and draining the tank completely. The tank has a liquid capacity of 800 L (211 gal). The tank is located in a cabinet and is furnished with ultrasonic agitation, a thermostatically controlled electric heater to maintain the content's temperature at 60°C (140°F), and a recirculation pump. Mixing is provided to accommodate sampling for criticality prevention. Level control with a local alarm is provided to maintain the acid level. The tank has a ring header and a manual hose to rinse out residual solids/sludge with deionized water after the batch has been pumped to the Liquid Effluent Collection and Treatment System. In order to minimize uranium concentration, the rinse water from the Rinse Water Tank that receives deionized water directly is pumped into the other Rinse Water Tank, which in turn is pumped into the Citric Acid Tank. The counter-current system eliminates a waste product stream by concentrating the uranics only in the Citric Acid Tank. The rinse water transfer pump is linked with the level controller of the Citric Acid Tank, which prevents overfilling of this tank during transfer of the rinse water. During transfer, the rinse water transfer pump trips at a high tank level resulting in a local alarm. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to assure airborne contamination is controlled. The Citric Acid Tank contents are monitored and then emptied by an air-driven double diaphragm pump into the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment System.

- Rinse Water Baths: Two open top Rinse Water Tanks with stainless steel sloping bottoms are provided to rinse excess citric acid from decontaminated components. Each of the tanks has a liquid capacity of 800 L (211 gal). Both tanks are located in an enclosure, and each tank is furnished with ultrasonic agitation, a thermostatically controlled electric heater to maintain the contents temperature at 60°C (140°F), and a recirculation pump to accommodate sampling for criticality prevention. The sloping-bottom is provided of emptying and draining the tank completely. Fresh deionized water is added to the tank. In order to minimize uranium concentration, the rinse water from the tank that receives deionized water directly is pumped into the other Rinse Water Tank, which in turn is pumped into the Citric Acid Tank. Level control is provided to maintain the deionized (rinse) water level. During transfer, the rinse water transfer pump trips at tank high level resulting in a local alarm. The Rinse Water Tank that directly receives deionized water is topped up manually with the water as necessary. The extracted air exhausts to the GEVS to assure airborne contamination is controlled. A manual spray hose is available for rinsing the tank after it has been emptied.
- Decontamination Degreasing Unit: An open top Degreaser Tank with a sloping bottom in hastelloy is provided for the primary means of removing the Fomblin oil and greases that may inhibit the decontamination process. Components requiring degreasing are cleaned manually and then immersed into the Degreaser Tank. The sloping-bottom construction is provided for ease of emptying and draining the tank completely. During the decontamination process, the tank contents are continuously recirculated using a pump. Recirculation is provided to accommodate sampling for criticality prevention. The tank has a capacity of 800 L (211 gal) and is located in a cabinet. It is furnished with an ultrasonic agitation facility, and a thermostatically-controlled electric heater to maintain the temperature at 60°C (140°F). The tank has a ring header and a manual hose to rinse out residual solids/sludge with deionized water after the batch has been pumped to the Liquid Effluent Collection and Treatment System. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. Level control with a local alarm is provided to maintain the liquid level. The Degreaser Tank contents are monitored and then emptied by an air-driven double diaphragm pump into the Degreaser Water Collection Tank in the Liquid Effluent Collection and Treatment System.
- The activities carried out in the Decontamination Workshop may create potentially contaminated gaseous streams, which would require treatment before discharging to the atmosphere. These streams consist of air with traces of UF_6, HF, and uranium particulates (mainly UO_2F_2). The Gaseous Effluent Vent System is designed to route these streams to a filter system and to monitor, on a continuous basis, the resultant exhaust stream discharged to the atmosphere. Air exhausted from the General Decontamination Cabinet, the Sample Bottle Decontamination Cabinet, and the Flexible Hose Decontamination Cabinet is vented to the GEVS. There will be local ventilation ports in the stripping area and Outgas Area that operate under vacuum with all air discharging through the GEVS. The room itself will have other HVAC ventilation.
- Vapor Recovery Unit and distillation still.
- Drying Cabinet: One drying cabinet is provided to dry components after decontamination.
- Decontamination System for Sample Bottles (in a cabinet) - a small, fresh citric acid tank; a small, deionized water tank; and 5 L (1.3 gal) containers for citric acid/uranic waste
- Decontamination System for Flexible Hoses (in a cabinet) - a small citric acid tank for fresh and waste citric acid, an air diaphragm pump and associated equipment

- Various tools for moving equipment (e.g., cranes)
- Various tools for stripping equipment
- An integral monorail hoist with a lifting capacity of one ton, located within the decontamination enclosure, is provided to lift the basket and its components into and out of the Degreaser Tank, Citric Acid Tank, and the two Rinse Water Tanks as part of the decontamination activity sequence.
- Citric Acid Tank and Degreaser Tank clean-up ancillary items, comprised for each tank, a portable air driven transfer pump and associated equipment
- Radiation monitors.

4.13.4.2.7 Laundry System

The Laundry System cleans contaminated and soiled clothing and other articles which have been used throughout the plant. It contains the resulting solid and liquid wastes for transfer to appropriate treatment and disposal facilities. The Laundry System receives the clothing and articles from the plant in plastic bin bags, taken from containers strategically positioned within the plant. Clean clothing and articles are delivered to storage areas located within the plant. The Contaminated Laundry System components are located in the Laundry room of the TSB.

The Laundry System collects, sorts, cleans, dries, and inspects clothing and articles used throughout the plant in the various Restricted Areas. The laundry system does not handle any articles from outside the radiological zones. Laundry collection is divided into two main groups: articles with a low probability of contamination and articles with a high probability of contamination. Those articles unlikely to have been contaminated are further sorted into lightly soiled and heavily soiled groups. The sorting is done on a table underneath a vent hood that is connected to the TSB Gaseous Effluent Vent System (GEVS). All lightly soiled articles are cleaned in the laundry. Heavily soiled articles are inspected and any considered to be difficult to clean (i.e., those with significant amounts of grease or oil on them) are transferred to the Solid Waste Collection Room without cleaning. Special containers and procedures are used for collection, storage, and transfer of these items as described in the Solid Waste Disposal System section. Articles from one plant department are not cleaned with articles from another plant department.

Special water-absorbent bags are used to collect the articles that are more likely to be contaminated. These articles may include pressure suits and items worn when, for example, it is required to disconnect or "open up" an existing plant system. These articles that are more likely to be contaminated are cleaned separately. Expected contaminants on the laundry include slight amounts of uranyl fluoride (UO_2F_2) and uranium tetrafluoride (UF_4).

Clothing processed by this system normally includes overalls, laboratory coats, shirts, towels and miscellaneous items. Approximately 113 kg (248 lbs) of clothing is washed each day. Upon completion of a cycle, the washer discharges to one of three Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment System.

The washed laundry is dried in the hot air dryers. The exhaust air passes through a lint drawer to the atmosphere. Upon completion of a drying cycle, the dried laundry is inspected for excessive wear. Usable laundry is folded and returned to storage for reuse. Unusable laundry is handled as solid waste as described in the Solid Waste Disposal System section.

When sorting is completed, the articles are placed into the front-loading washing machine in batches. The cleaning process uses 80°C (176°F) minimum water, detergents, and non-chlorine bleach for dirt and odor removal, and disinfection of the laundry. Detergents and non-chlorine bleach are added by vendor-supplied automatic dispensing systems. No "dry cleaning" solvents are used. Wastewater from the washing machine is discharged to one of three Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment System. The laundry effluent is then sampled, analyzed, and transferred to the double-lined Treated Effluent Evaporative Basin with leak detection for disposal (if uncontaminated) or to the Precipitation Treatment Tank for treatment as necessary.

When the washing cycle is complete, the wet laundry is placed in a front-loading, electrically heated dryer. The dryer has variable temperature settings, and the hot wet air is exhausted to the atmosphere through a lint drawer that is built into the dryer. The lint from the drawer is then sent to the Solid Waste Disposal System as combustible waste.

Dry laundry is removed from the dryer and placed on the laundry inspection table for inspection and folding. Folded laundry is returned to storage areas in the plant.

The following major components are included in this system:

- Washers: Two industrial quality washing machines are provided to clean contaminated and soiled laundry. One machine is operating and one is a spare for standby. Each machine has an equal capacity that is capable of washing the daily batches.
- Dryers: Two industrial quality dryers are provided to dry the laundry cleaned in the washing machine. One dryer is operating and one is a spare for standby. Each machine has an equal capacity that is capable of drying the daily batches. The dryer has a lint drawer that filters out the majority of the lint.
- Air Hood: One exhaust hood mounted over the sorting table and connected to the TSB GEVS. The hood is to draw potentially contaminated air away as laundry is sorted prior to washing.
- Sorting Table: One table to sort laundry prior to washing.
- Laundry Inspection Table: One table to inspect laundry for excessive wear after washing and drying.
- The Laundry System interfaces with the following other plant systems:
- Liquid Effluent Collection and Treatment System: The wastewater generated during the laundry process is pumped to one of three Laundry Effluent Monitor Tanks.
- Solid Waste Disposal System: The Solid Waste Disposal System receives clothing that has been laundered but is not acceptable for further use. It also receives clothing rejected from the laundry system due to excess quantities of oil or hazardous liquids.
- TSB GEVS: Air from the sorting hood is sent to the TSB GEVS.
- Process Water System: The Process Water System supplies hot and cold water to the washer.
- Compressed Air System: Compressed air will be supplied as required to support options selected for the Laundry washers and dryers.
- Electrical System: The washing machines and dryers consume power.

Piping, piping components, and a laundry room sump provide containment of any liquid radiological waste. Small leaks and spills from the washer are mopped up and sent to the Liquid Effluent Collection and Treatment System. A rarely occurring large leak is captured in the laundry room sump. Any effluent captured in the sump is transferred to the Liquid Effluent Collection and Treatment System by a portable pump.

Liquid effluents from the washers are collected in the Liquid Effluent Collection and Treatment System and monitored prior to discharge to the Treated Effluent Evaporative Basin. Clothing containing hazardous wastes is segregated prior to washing to avoid introduction into this system. The exhaust air blows to atmosphere because there is little chance of any contaminant being in it.

The washer and dryer are equipped with electronic controls to monitor the operation. The dryer has a fire protection system that initiates an isolated sprinkler inside the dryer basket if a fire is detected in the dryer.

4.13.5 Comparative Waste Management Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action" i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action," alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The waste management impact would be greater since a greater amount of waste results from GDP operation.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The waste management impact would be greater in the short term because the GDP produces a larger waste stream. In the long term, the waste management impact would be the same once the GDP production is terminated.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The waste management impact would be significantly greater because a significant amount of additional waste results from GDP operation at the increased capacity.

4.13.6 Section 4.13 Tables

Table 4.13-1 Possible Radioactive Waste Processing / Disposal Facilities

Radioactive Waste Processing / Disposal Facility	Acceptable Wastes	Approximate Distance km (miles)
Barnwell Disposal Site Barnwell, SC	Radioactive Class A, B, C Processed Mixed	2,320 (1,441)
Envirocare of Utah South Clive, UT	Radioactive Class A Mixed	1,636 (1016)
GTS Duratek[1] Oak Ridge, TN	Radioactive Class A Some Mixed	1,993 (1,238)
Depleted UF_6 Conversion Facility[2] Paducah, Kentucky	Depleted UF_6	1,670 (1037)
Depleted UF_6 Conversion Facility[2] Portsmouth, Ohio	Depleted UF_6	2,243 (1,393)

[1]Other offsite waste processors may also be used.
[2]Per DOE-UDS contract, to begin operation in 2005.

Table 4.13-2 LLNL-Estimated Life-Cycle Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion

LLNL-ESTIMATED LIFE-CYCLE COSTS FOR DOE DEPLETED UF_6 TO DEPLETED U_3O_8 CONVERSION (A) (MILLION DOLLARS FOR 378,600 MTU OF DEPLETED UF_6 OVER 20 YEARS; DISCOUNTED 1996 DOLLARS)		
Conversion Capital & Operating Activities	AHF Conversion Alternative	HF Neutralization Conversion Alternative
Technology Department	9.84	5.74
Process Equipment	22.36	20.88
Process Facilities	46.33	45.53
Balance of Plant	29.20	30.25
Regulatory Compliance	22.70	22.70
Operations & Maintenance	134.76	198.40
Decontamination & Decommissioning	1.76	1.73
Total Discounted Costs (1996 Dollars):	266.95	325.23
Total Undiscounted Costs (1996 Dollars):	902.6	1,160.1
Undiscounted Unit Costs ($/kgU):		
TOTAL (1996 Dollars)	2.38	3.05
TOTAL (2002 Dollars per GDP IPD)	2.64	3.39
(a) Source: (LLNL, 1997a)		
AHF: Assumes sale of anhydrous hydrogen fluoride; $77.32 million credit assumed. HF: Assumes sale of calcium fluoride (CAF_2) produced from hydrogen fluoride (HF); $11.02 million credit assumed.		

Table 4.13-3 Summary of LLNL-Estimated Capital, Operating and Regulatory Unit Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion

SUMMARY OF LLNL-ESTIMATED CAPITAL, OPERATING, AND REGULATORY UNIT COSTS FOR DOE DEPLETED UF_6 TO DEPLETED U_3O_8 CONVERSION (A) (UNDISCOUNTED DOLLARS PER KILOGRAMS OF U AS DEPLETED UF_6)				
Cost Breakdown	AHF Alternative		HF Neutralization Alternative	
	1996$	2002$	1996$	2002$
Capital (b)	0.72	0.80	0.69	0.76
Operating & Maintenance	1.51	1.67	2.22	2.46
Regulatory Compliance	0.14	0.16	0.14	0.16
Total:	2.38	2.64	3.05	3.39

(a) Unit costs based on Table 4.13-2 costs.

(b) Technology development, process equipment, process facilities, balance of plant and decontamination and decommissioning.

Source: (LLNL, 1997a)

Note: Summation may be affected by rounding.

Table 4.13-4 LLNL-Estimated Life-Cycle Costs for DOE Depleted UF_6 Disposal Alternatives

LLNL-ESTIMATED LIFE-CYCLE COSTS FOR DOE DEPLETED U_3O_8 DISPOSAL ALTERNATIVES (MILLION DOLLARS FOR 378,600 MTU OF DEPLETED UF_6 OVER 20 YEARS; UNDISCOUNTED 1996 DOLLARS)		
	Depleted U_3O_8 Disposal Alternatives	
Depleted U_3O_8 Disposal Capital & Operating Activities	Engineered Trench	Concrete Vault
Waste Form Preparation:		
Technology Development		
Balance of Plant	6.56	6.56
Regulatory Compliance	26.43	26.43
Operations & Maintenance	2.02	2.02
Decontamination & Decommissioning	33.23	33.23
	0.60	0.60
Subtotal (1996 Discounted Dollars)		
Waste Disposal:	68.84	68.84
Facility Engineering & Construction		
Site Preparation & Restoration		
Emplacement & Closure		
Regulatory Compliance	12.22	96.08
Surveillance & Maintenance	0.89	1.68
	30.61	39.2
	40.35	40.35
Subtotal (1996 Discounted Dollars)	2.29	2.86
Preparation & Disposal Discounted Total Costs (1996 Dollars):		
	86.36	180.17
	155.20	249.01
Preparation & Disposal Undiscounted Total Costs (1996 Dollars):	499.60	742.50
Undiscounted Unit Costs ($/kgU):		
TOTAL (1996 Dollars)		
TOTAL (2002 Dollars per GDP IPD)	1.31	1.95
	1.46	2.17
Source: (LLNL, 1997a)		

Table 4.13-5 Summary of Total Estimated Conversion and Disposal Costs

SUMMARY OF TOTAL ESTIMATED CONVERSION AND DISPOSAL COSTS (UNDISCOUNTED 2002 DOLLARS PER KGU OF DEPLETED UF_6)				
Cost Items	AHF Alternative		HF Neutralization Alternative	
	Engineered Trench	Concrete Vault	Engineered Trench	Concrete Vault
Depleted UF_6 Conversion to Depleted U_3O_8	2.64	2.64	3.39	3.39
Waste Preparation & Disposal	1.46	2.17	1.46	2.17
Depleted UF_6 & Depleted U_3O_8 Transportation	0.25	0.25	0.25	0.25
Total Cost:	4.35	5.06	5.1	5.81

Table 4.13-6 DOE-UDS August 29, 2002 Contract Quantities and Costs

DOE-UDS AUGUST 29, 2002, CONTRACT QUANTITIES & COSTS		
	Target Million kgU	
UDS Conversion & Disposal Quantities:	Depleted UF_6 (a)	U (b)
FY 2005 (Aug. – Sept.)	1.050	0.710
FY 2006	27.825	18.8
FY 2007	31.500	21.294
FY 2008	31.500	21.294
FY 2009	31.500	21.294
FY 2010 (Oct.-July)	26.250	17.745
Total:	149.625	101.147
Nominal Conversion Capacity (c) and Target Conversion Rate (Million kgU/yr)		21.3
UDS Contract Workscope Costs (d):		Million $
Design, Permitting, Project Management, etc.		27.99
Construct Paducah Conversion Facility		93.96
Construct Portsmouth Conversion Facility		90.40
Operations for First 5 Years Depleted UF_6 & Depleted U_3O_8 (e)		283.23
Contract Estimated Total Cost w/o Fee		495.58
Contract Estimated Value per DOE PR, August 29, 2003		558.00
Difference Between Cost & Value is the Estimated Fee of 12.6%		62.42
Capital Cost without Fee		212.35
Capital Cost with Fee		239.10
First 5 Years Operating Cost with Fee		318.92
Estimated Unit Conversion & Disposal Costs:		
Unit Capital Cost (f)		$0.77/kgU
2005-2010 Unit Operating Costs in 2002$		$3.15/kgU
Total Estimated Unit Cost		$3.92kgU

(a) As on page B-10 of the UDS contract.
(b) Depleted UF_6 weight multiplied by the uranium atomic mass fraction, 0.676.
(c) Based on page H-34 of the UDS contract.
(d) Workscope costs on an UDS contract pages B-2 and B-3.
(e) Does not include any potential off-set credit for HF sales.
(f) Assumed operation over 25 years, 6% government cost of money, and no taxes.

Table 4.13-7 Summary of Depleted UF_6 Disposal Costs From Four Sources

SUMMARY OF Depleted UF_6 DISPOSAL COSTS FROM FOUR SOURCES				
Source	Costs in 2002 Dollars per kgU			
	Conversion	Disposal	Transportation	Total
LLNL (UCRL-AR-127650 (a)	2.64	2.17	0.25	5.06
UDS Contract (b)	(d)	(d)	(d)	3.92
URENCO (e)	(d)	(d)	(d)	(d)
CEC Cost Estimate (c)	4.93	1.47	0.34	6.74

(a) 1997 Lawrence Livermore National Laboratory cost estimate study for DOE; discounted costs in 1996 dollars were undiscounted and escalated to 2002 by ERI.

(b) Uranium Disposition Services (UDS) contract with DOE for capital and operating costs for first five years of Depleted UF_6 conversion and Depleted U_3O_8 conversion product disposition.

(c) Based upon depleted UF_6 and depleted U_3O_8 disposition costs provided to the NRC during Claiborne Energy Center license application in 1993.

(d) Cost component proprietary or not made available.

(e) The average of the three costs is $5.24/kg U. LES has selected $5.50/kgU as the disposal cost for the National Enrichment Facility. Urenco has reviewed this cost estimate, and based on its current experience with UF_6 disposal, finds this figure to be prudent.

5.0 MITIGATION MEASURES

This chapter summarizes the mitigation measures that will be in place to reduce adverse impacts that occur during construction, routine and non-routine operation of the National Enrichment Facility (NEF).

5.1 IMPACT SUMMARY

This section summarizes the environmental impacts that may result from the construction and operation of the NEF. Complete details of these potential impacts are provided in Chapter 4 of this Environmental Report.

5.1.1 Land Use

Land use impact has been characterized in ER Section 4.1, Land Use Impacts. No substantive impacts exists as related to the following:

- Land-use impact, and impact of any related Federal action that may have cumulatively significant impacts
- Area and location of land that will be disturbed on either a long-term or short-term basis.

Minor impacts related to erosion control on the site may occur, but are short-term and limited. Mitigation measures associated with these impacts are listed in ER Section 5.2.1, Land Use.

5.1.2 Transportation

Transportation impact has been characterized in ER Section 4.2, Transportation Impacts.

With respect to construction-related transportation, no substantive impacts exist as related to the following:

- Construction of the access roads to the facility. Two construction access roads will be constructed from New Mexico Highway 234. Both roads will be converted to permanent site access roads upon completion of construction.
- Transportation route and mode for conveying construction material to the facility
- Traffic pattern impacts (e.g., from any increase in traffic from heavy haul vehicles and construction worker commuting)
- Impacts of construction transportation such as fugitive dust, scenic quality, and noise.

Minor impacts related to construction traffic such as fugitive dust, noise, and emissions are discussed in ER Section 4.2.4, Construction Transportation Impacts. Additional information on noise impacts is contained in ER Section 4.7.1, Predicted Noise Levels. Mitigation measures associated with transportation impacts are listed in ER Section 5.2.2, Transportation.

With respect to the transport of radioactive materials, no substantive impacts exist as related to the following activities:

- Transportation mode (i.e., truck), and routes from originating site to the destination
- Estimated transportation distance from the originating site to the destination
- Treatment and packaging procedure for radioactive wastes
- Radiological dose equivalents for incident-free scenarios to public and workers
- Impacts of operating transportation vehicles on the environment (e.g., fire from equipment sparking).

Impacts related to the transport of radioactive material are addressed in ER Section 4.2.7, Radioactive Material Transportation. The materials that will be transported to and from the NEF

are well within the scope of the environmental impacts previously evaluated by the Nuclear Regulatory Commission (NRC). Because these impacts have been addressed in a previous NRC environmental impact statement (NUREG/CR-0170) (NRC, 1977a), no additional mitigation measures are proposed in ER Section 5.2.2, Transportation.

5.1.3 Geology and Soils

The potential impacts to the geology and soils have been characterized in ER Section 4.3, Geology and Soils Impact. No substantive impacts exist as related to the following activities:

- Soil resuspension, erosion, and disruption of natural drainage
- Excavations to be conducted during construction.

Impacts to geology and soils will be limited to surface runoff due to routine operation. Construction activities may cause some short-term increases in soil erosion at the site. Mitigation measures associated with these impacts are listed in ER Section 5.2.3, Geology and Soils.

5.1.4 Water Resources

The potential impacts to the water resources have been characterized in ER Section 4.4, Water Resources Impacts. No substantive impacts exists as related to the following:

- Impacts on surface water and groundwater quality

- Impacts of consumptive water uses (e.g., groundwater depletion) on other water users and adverse impacts on surface-oriented water users resulting from facility activities. Site groundwater will not be utilized for any reason, and therefore, should not be impacted by routine NEF operations. The NEF water supply will be obtained from the town of Eunice, New Mexico. Current capacity for the Eunice municipal water supply system is 16,350 m^3/day (4.32 million gpd), respectively and current usage is 5,600 m^3/day (1.48 million gpd). Average and peak potable water requirements for operation of the NEF are expected to be approximately 240 m^3/day (63,423 gpd) and 85 m^3/hour (378 gpm), respectively. These usage rates are well within the capacity of the water system. For both peak and the normal usage rates, the needs of the NEF facility should readily be met by the municipal water system. Impacts to water resources on site and in the vicinity of NEF are expected to be negligible. LBDCR-07-0005 LBDCR-07-0005 LBDCR-07-0005
- Hydrological system alterations or impacts
- Withdrawals and returns of ground and surface water
- Cumulative effects on water resources.

The NEF will not obtain any water from onsite surface or groundwater resources. Process effluents will be discharged to the double-lined Treated Effluent Evaporative Basin with leak detection. Sanitary waste water discharges will be made through site septic systems. Stormwater from developed portions of the site will be collected in retention/detention basins, as described in ER Section 3.4, Water Resources. These include the Site Stormwater Detention Basin and the UBC Storage Pad Stormwater Retention Basin. Minor impacts to water resources are discussed in ER Section 4.4. Mitigation measures associated with these impacts are listed in ER Section 5.2.4, Water Resources.

5.1.5 Ecological Resources

The potential impacts to the ecological resources have been characterized in ER Section 4.5, Ecological Resources Impacts. No substantive impacts exists as related to the following:

- Total area of land to be disturbed
- Area of disturbance for each habitat type
- Use of chemical herbicides, roadway maintenance, and mechanical clearing
- Areas to be used on a short-term basis during construction
- Communities or habitats that have been defined as rare or unique or that support threatened and endangered species
- Impacts of elevated construction equipment or structures on species (e.g., bird collisions, nesting areas)
- Impact on important biota.

Impacts to ecological resources will be minimal. Mitigation measures associated with these impacts are listed in ER Section 5.2.5, Ecological Resources.

5.1.6 Air Quality

The potential impacts to the air quality have been characterized in ER Section 4.6, Air Quality Impacts. No substantive impacts exist as related to the following activities:

- Gaseous effluents
- Visibility impacts.

Impacts to air quality will be minimal. Construction activities will result in interim increases in hydrocarbons and particulate matter due to vehicle emissions and dust. Impacts due to plant operation consist of cooling tower plumes, small quantities of volatile organic components (VOC) emissions and trace amounts of HF, UO_2F_2, and other uranic compound effluents remaining in treated air emissions from plant ventilation systems. These effluents are significantly below regulatory limits. Mitigation measures associated with air quality impacts are listed in ER Section 5.2.6, Air Quality.

5.1.7 Noise

The potential impacts related to noise generated by the facility have been characterized in ER Section 4.7, Noise Impacts. No substantive impacts exists as related to the following activities:

- Predicted typical noise levels at facility perimeter
- Impacts to sensitive receptors (i.e., hospitals, schools, residences, wildlife).

Noise levels will increase during construction and due to operation of the NEF, but not to a level that will cause significant impact to nearby residents. The nearest residence is 4.3 km (2.63 mi) from the site. Mitigation measures associated with noise impacts are listed in ER Section 5.2.7, Noise.

5.1.8 Historical and Cultural Resources

The potential impacts to historical and cultural resources have been characterized in ER Section 4.8, Historical and Cultural Resources Impacts. Only minor impacts exists as related to the following activities:

- Construction, operation, or decommissioning
- Impact on historic properties
- Potential for human remains to be present in the project area
- Impact on archeological resources.

Impacts to Historical and Cultural Resources will be minimal. Mitigation measures associated with these impacts, if required, are listed in ER Section 5.2.8, Historical and Cultural Resources.

5.1.9 Visual/Scenic Resources

The potential impacts to visual/scenic resources have been characterized in ER Section 4.9, Visual/Scenic Resources Impacts. No substantive negative impacts exists as related to the following:

- The aesthetic and scenic quality of the site
- Impacts from physical structures
- Impacts on historical, archaeological or cultural properties of the site
- Impacts on the character of the site setting.

Visual/scenic impacts due to the development of the NEF result from visual intrusions in the existing landscape character. Except possibly for a section of the proposed, westernmost access road, no structures are proposed that may require the removal of natural or built barriers, screens or buffers. Mitigation measures associated with these impacts are listed in ER Section 5.2.9, Visual/Scenic Resources.

5.1.10 Socioeconomic

The potential socioeconomic impacts to the community have been characterized in ER Section 4.10, Socioeconomic Impacts. No substantive negative impacts exist as related to the following:

- Impacts to population characteristics (e.g., ethnic groups, and population density)
- Impacts to housing, health and social services, or educational and transportation resources
- Impacts to area's tax structure and distribution.

The anticipated cumulative socioeconomic negative impacts of the proposed operation of NEF are expected to be insignificant. The positive socioeconomic impacts are substantial (see ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation). See ER Section 4.10, Socioeconomic Impacts, for a detailed discussion on socioeconomic impacts.

5.1.11 Environmental Justice

The potential impacts with respect to environmental justice have been characterized in ER Section 4.11, Environmental Justice. No substantive impacts exist as related to the following:

- Disproportionate impact to minority or low-income population.

Based on the data analyzed and the NUREG-1748 guidance by which that analysis was conducted, LES determined that no further evaluation of potential Environmental Justice concerns was necessary, as no Census Block Group within the 6.4-km (4-mi) radius, i.e., 128 km^2 (50 mi^2), of the NEF site contained a minority or low-income population exceeding the NUREG-1748 "20%" or "50%" criteria. See ER Section 4.11, Environmental Justice. LBDCR-07-0022

5.1.12 Public and Occupational Health

This section describes public and occupational health impacts from both nonradiological and radiological sources.

5.1.12.1 Nonradiological – Normal Operations

The potential impacts to public and occupational health for nonradiological sources have been characterized in ER Section 4.12.1, Nonradiological Impacts. No substantive impacts exist as related to the following:

- Impact to members of the public from nonradiological discharge of liquid or gaseous effluents to water or air
- Impact to facility workers as a result of occupational exposure to nonradiological chemicals, effluents, and wastes
- Cumulative impacts to public and occupational health.

Impacts to the public and workers from nonradiological gaseous and liquid effluents will be minimal. Mitigation measures associated with these impacts are listed in ER Section 5.2.12.1, Nonradiological – Normal Operations.

5.1.12.2 Radiological – Normal Operations

This subsection describes public and occupational health impacts from radiological sources. It provides a brief description of the methods used to assess the pathways for exposure and the potential impacts.

5.1.12.2.1 Pathway Assessment

The potential for exposure to radiological sources included an assessment of pathways that could convey radioactive material to members of the public. These are briefly summarized below.

Potential points or areas were characterized to identify:

- Nearest site boundary
- Nearest full time resident
- Location of average member of the critical group
- In addition, important ingestion pathways such as stored and fresh vegetables, milk and meat, assumed to be grown or raised at the nearest resident location have been analyzed. There are no offsite releases to any surface waters or Publicly Owned Treatment Works (POTW).

5.1.12.2.2 Public and Occupational Exposure

The potential impacts to public and occupational health for radiological sources have been characterized in ER Section 4.12, Public and Occupational Health Impacts. No substantive impacts exists as related to the following:

- Impacts based on the average annual concentration of radioactive and hazardous materials in gaseous and liquid effluents
- Impacts to the public (as determined by the critical group)

- Impacts to the workforce based on radiological and chemical exposures
- Impacts based on reasonably foreseeable (i.e., credible) accidents with the potential to result in environmental releases.

Routine operations at the NEF create the potential for radiological and nonradiological public and occupational exposure. Radiation exposure is due to the plant's use of the isotopes or uranium and the presence of associated decay products. Chemical and radiological exposures are primarily from byproducts of UF_6;UO_2F_2, hydrogen fluoride and related uranic compounds, that will form inside plant equipment and from reaction with components. These are the primary products of concern in gaseous effluents that will be released from the plant and liquid effluents that will be released to the onsite retention basin. Mitigation measures associated with these impacts are listed in ER Section 5.2.12, Public and Occupational Health.

5.1.12.3 Accidental Releases

All credible accident sequences were considered during the Integrated Safety Analysis (ISA) performed for the facility. Accidents evaluated fell into two general types: criticality events and UF_6 releases. Criticality events and some UF_6 release scenarios were shown to result in potential radiological and HF chemical exposures, respectively, to the public. Gaseous releases of UF_6 react quickly with moisture in the air to form HF and UO_2F_2. Consequence analyses showed that HF was the bounding consequence for all gaseous UF_6 releases to the environment. For some fire cases, uranic material in waste form or in chemical traps provided the bounding case. Accidents that produced unacceptable consequences to the public resulted in the identification of various design bases, design features, and administrative controls.

During the ISA process, evaluation of most accident sequences resulted in identification of design bases and design features that prevent a criticality event or HF release to the environment. Table 4.12-15, Accident Criteria Chemical Exposure Limits by Category, lists the accident criteria chemical exposure limits (HF) by category for an immediate consequence and high consequence categories.

Several accident sequences involving HF releases to the environment due to seismic or fire events were mitigated using design features to delay and reduce the UF_6 releases inside the buildings from reaching the outside environment. The seismic accident scenario considers an earthquake event of sufficient magnitude to fail the UF_6 process piping and some UF_6 components resulting in a large gaseous UF_6 release inside the buildings housing UF_6 process systems. The fire accident scenario considers a fire within the Technical Services Building (TSB) that causes the release of uranic material from open waste containers and chemical traps during waste drum filling operations.

Potential adverse impacts for accident conditions are described in ER Section 4.12.3, Environmental Effects of Accidents. Mitigation measures associated with these impacts are listed in ER Section 5.2.12.3, Accidental Releases.

5.1.13 Waste Management

The potential impacts of waste generation and waste management have been characterized in ER Section 4.13, Waste Management Impacts. No substantive impacts exist as related to the following:

- Impact to the public due to the composition and disposal of solid, hazardous, radioactive and mixed wastes
- Impact to facility workers due to storage, processing, handling, and disposal of solid, hazardous, radioactive and mixed wastes
- Cumulative impacts of waste management.

Waste generated at the NEF will be comprised of industrial (nonhazardous), radioactive and mixed, and hazardous waste categories. In addition, radioactive and mixed waste will be further segregated according to the quantity of liquid that is not readily separable from the solid material. Gaseous and liquid effluent impacts are discussed in ER Section 5.1.12.2, Radiological – Normal Operations. Uranium Byproduct Cylinders (UBCs) are stored onsite at an outdoor storage area and will minimally impact the environment. (See ER Section 5.2.13, Waste Management.)

Mitigation measures associated with waste management are listed in ER Section 5.2.13, Waste Management.

5.2 MITIGATIONS

This section summarizes the mitigation measures that are in place to reduce adverse impacts that may result from the construction and operation of the NEF. The residual and unavoidable adverse impacts, which will remain after application of the mitigation measures, are of such a small magnitude that LES considers that additional analysis is not necessary.

5.2.1 Land Use

The anticipated effects on the soil during construction activities are limited to a potential short-term increase in soil erosion. However, this impact will be mitigated by following proper construction best management practices (BMPs) including:

- Minimizing the construction footprint to the extent possible
- Limiting site slopes to a horizontal-vertical ratio of three to one or less
- Use of a sedimentation detention basin
- Protection of undisturbed areas with silt fencing and straw bales as appropriate
- Site stabilization practices such as placing crushed stone on top of disturbed soil in areas of concentrated runoff

Site stabilization practices to reduce the potential for erosion and sedimentation. Additional discussion is provided in ER Section 5.2.3, Geology and Soils.

After construction is complete, the site will be stabilized with natural, low-water maintenance landscaping and pavement.

5.2.2 Transportation

Mitigation measures will be in place to minimize potential impact of construction-related transportation activities. To control fugitive dust production, all reasonable precautions will be taken to prevent particulate matter from becoming airborne including the following actions:

- The use of water (controlled to minimize use) in the control of dust on dirt roads, in clearing and grading operations and construction activities.
- The use of adequate containment methods during excavation and/or other similar operations.
- Open bodied trucks transporting materials likely to give rise to airborne dust, shall be covered at all times when in motion.
- The prompt removal of earthen materials from paved roads, onto which, earth or other material has been transported by trucking or earth moving equipment, erosion by water, wind, or other means.
- Prompt stabilization or covering of bare areas once earth moving activities are completed.
- The operation of construction equipment and related vehicles with standard pollution control devices maintained in good working order.
- Washing of construction trucks with water only (controlled to minimize use) when required.

- Personnel will be designated to monitor dust emissions and to direct increased surface watering where necessary.
- If during the course of construction short duration activities (e.g., concrete trucks, multiple deliveries) with traffic impact are required, these will be scheduled to minimize traffic impacts.
- Work shifts will be implemented throughout the construction period to minimize impacts to traffic in the site vicinity. Car pooling will also be encouraged.

5.2.3 Geology and Soils

Mitigation measures will be in place to minimize potential impact on geology and soils. These include the following items:

- Erosional impacts due to site clearing and grading will be mitigated by utilization of construction and erosion control BMPs, some of which are further described below.
- Disturbed soils will be stabilized by acceptable means as part of construction work.
- Earthen berms, dikes and sediment fences will be utilized as necessary during all phases of construction to limit suspended solids in runoff.
- Cleared areas not covered by structures or pavement will be stabilized by acceptable means as soon as practical.
- Watering (controlled to minimize use) will be used to control fugitive construction dust.
- Surface runoff will be collected in temporary (during construction) and permanent retention/detention basins.
- Standard drilling and blasting techniques, if required, will be used to minimize impact to bedrock; reducing the potential for over-excavation thereby minimizing damage to the surrounding rock; and protecting adjacent surfaces that are intended to remain intact.
- Drainage culverts and ditches will be stabilized and lined with rock aggregate/rip-rap to reduce flow velocity and prohibit scouring.
- Soil stockpiles generated during construction will be placed in a manner to reduce erosion.
- Excavated materials will be reused when ever possible.

5.2.4 Water Resources

Mitigation measures will be in place to minimize potential impact on water resources. As discussed in ER Section 4.4.7, Control of Impacts to Water Quality, there is little potential to impact any groundwater or surface water resources. These mitigation measures also prevent soil contamination. These include employing BMPs and the control of hazardous materials and fuels. In addition, the following controls are also implemented:

- Construction equipment will be in good repair without visible leaks of oil, greases, or hydraulic fluids.
- The control of spills during construction will be in conformance with Spill Prevention Control and Countermeasures (SPCC) plan procedures.

- Use of the BMPs will assure stormwater runoff related to these activities will not release runoff into nearby sensitive areas.
- BMPs will also be used for dust control associated with excavation and fill operations during construction.
- Silt fencing and/or sediment traps.
- External vehicle washing (water only and controlled to minimize use).
- Stone construction pads will be placed at entrance/exits if unpaved construction access adjoins a state road.
- All basins are arranged to provide for the prompt, systematic sampling of runoff in the event of any special needs.
- Water quality impacts will be controlled during construction by compliance with the National Pollution Discharge Elimination System – Construction General Permit requirements and by applying BMPs as detailed in the site Stormwater Pollution Prevention Plan (SWPPP).
- A Spill Prevention Control and Countermeasure (SPCC) plan, will be implemented for the facility to identify potential spill substances, sources and responsibilities.
- All above ground diesel storage tanks will be bermed.
- Any hazardous materials will be handled by approved methods and shipped offsite to approved disposal sites. Sanitary wastes generated during site construction will be handled by portable systems, until such time that plant sanitary facilities are available for site use. An adequate number of these portables systems will be provided.
- The facility's Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant including the collection, analysis, and processing of liquid wastes for disposal.
- Liquid effluent concentration releases to the Treated Effluent Evaporative Basin and the UBC Storage Pad Stormwater Retention Basin will both be below the 10 CFR 20 (CFR, 2003q) uncontrolled release limits. Both basins are included in the site environmental monitoring plan.
- Periodic visual inspections of the NEF basins for high level will be performed to verify proper functioning. The visual inspections will be performed on a frequency that is sufficient to allow for identification of basin high water level conditions and implementation of corrective actions to restore water level of the associated basin(s) prior to overflowing.
- Control of surface water runoff will be required for activities as covered by the National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As a result, no impacts are expected to surface or groundwater bodies.

The NEF is designed to minimize the usage of natural and depletable resources as shown by the following measures:

- The use of low-water consumption landscaping versus conventional landscaping reduces water usage.
- The installation of low flow toilets, sinks and showers reduces water usage when compared to standard flow fixtures.

- Localized floor washing using mops and self-contained cleaning machines reduces water usage compared to conventional washing with a hose twice per week.
- The use of high efficiency washing machines compared to standard machines reduces water usage.
- The use of high efficiency closed cell cooling towers (water/air cooling) versus open cell design reduces water usage.
- Closed-loop cooling systems have been incorporated to reduce water usage.

The UBC Storage Pad Stormwater Retention Basin, which exclusively serves the UBC Storage Pad and cooling tower blowdown water and heating boiler blowdown water discharges, is lined to prevent infiltration. It is designed to retain a volume slightly more than twice that for the 24-hour, 100-year frequency storm and an allowance for the cooling tower blowdown water and heating boiler blowdown water. Designed for sampling and radiological testing of the contained water and sediment, this basin has no flow outlet. All discharge is through evaporation.

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin.

Discharge of operations-generated potentially contaminated waste water is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on prescribed standards) and discharged to this basin. The basin is double-lined, open to allow evaporation, has no flow outlet and has leak detection.

5.2.5 5.2.5 Ecological Resources

Mitigation measures will be in place to minimize potential impact on ecological resources. These include the following items:

- Use of BMPs recommended by the State of New Mexico to minimize the construction footprint to the extent possible
- The use of detention and retention ponds
- Site stabilization practices to reduce the potential for erosion and sedimentation.
- Proposed wildlife management practices include:
- The placement of a raptor perch in an unused open area.
- The use of bird feeders at the visitor's center.
- The placement of quail feeders in the unused open areas away from the NEF buildings.
- The management of unused open areas (i.e. leave undisturbed), including areas of native grasses and shrubs for the benefit of wildlife.
- The use of native plant species (i.e., low-water consuming plants) to revegetate disturbed areas to enhance wildlife habitat.
- The use of netting, or other suitable material, to ensure migratory birds are excluded from evaporative ponds that do not meet New Mexico Water Quality Control Commission (NMAC 20.6.4) surface water standards for wildlife usage. LBDCR-07-0022

- The use of animal-friendly fencing around ponds or basins which may contain contaminated process water so that wildlife cannot be injured or entangled. LBDCR-08-0009
- Minimize the amount of open trenches at any given time and keep trenching and backfilling crews close together.
- Trench during the cooler months (when possible).
- Avoid leaving trenches open overnight. Escape ramps will be constructed at least every 90 m (295 ft). The slope of the ramps will be less than 45 degrees. Trenches that are left open overnight will be inspected and animals removed prior to backfilling.

In addition to proposed wildlife management practices above, LES will consider all recommendations of appropriate state and federal agencies, including the United States Fish and Wildlife Service and the New Mexico Department of Game and Fish.

5.2.6 Air Quality

Mitigation measures will be in place to minimize potential impact on air quality. These include the following items:

- The design of the NEF cooling towers combines adiabatic and evaporative heat transfer processes to significantly reduce visible plumes.
- The TSB and Separations Building Gaseous Effluent Vent Systems (GEVS) are designed to collect and clean potentially hazardous gases from the plant prior to release into the atmosphere. Instrumentation is provided to detect and signal via alarm, all non-routine process conditions, including the presence of radionuclides or hydrogen fluoride in the exhaust stream, that will trip the system to a safe condition, in the event of effluent detection beyond routine operational limits.
- The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is designed to collect and clean all potentially hazardous gases from the serviced areas in the CAB prior to release into the atmosphere. Instrumentation is provided to detect and signal the Control Room via alarm, all non-routine process conditions, including the presence of radionuclides or hydrogen fluoride in the exhaust stream. Operators will then take appropriate actions to mitigate the release.
- Construction BMPs will be applied as described previously to minimize fugitive dusts.
- Air concentrations of the Criteria Pollutants for vehicle emissions and fugitive dust will be below the National Ambient Air Quality Standards (NAAQS) (CFR, 2003w) and thus will not require further mitigation measures.

5.2.7 Noise

Mitigation of the operational noise sources will occur primarily from the plant design, whereby cooling systems, valves, transformers, pumps, generators, and other facility equipment, will mostly reside inside plant structures. The buildings themselves will absorb the majority of the noise located within. Natural land contours, vegetation (such as scrub brush), and site buildings and structures will mitigate the impact of other equipment located outside of structures that contribute to site noise levels.

Noise from construction activities will have the highest sound levels, but the nearest home is located 4.3 km (2.63 mi) from the site and due to distance, it is not expected that residents will perceive an increase in noise levels. However, heavy truck and earth moving equipment usage will be restricted after twilight and during early morning hours. All noise suppression systems on construction vehicles shall be kept in proper operation.

5.2.8 Historical and Cultural Resources

Mitigation measures will be in place to minimize any potential impact on historical and cultural resources. In the event that any inadvertent discovery of human remains or other item of archeological significance is made during construction, the facility will cease construction activities in the area around the discovery and notify the New Mexico State Historic Preservation Officer, to make the determination of appropriate measures to identify, evaluate, and treat these discoveries.

Mitigation of the impact to historical and cultural sites within the NEF project boundary can take a variety of forms. Avoidance and data collection are the two most common forms for sites considered eligible based on National Register of Historic Places (NRHP) (USC, 2003c) criterion (d), their data content, which is the basis for the recommended eligibility of these particular sites (USC, 2003c). When possible, avoidance is the preferred alternative because the site is preserved in place and mitigation costs are minimized. When avoidance is not possible, data collection becomes the preferred alternative. Data collection proceeds after the sites have been determined eligible. A treatment plan is submitted to the appropriate regulatory agencies. The plan describes the expected data content of the sites and how data will be collected, analyzed, and reported. A treatment/mitigation plan is being developed by LES to recover any significant information from the seven eligible archaeological sites identified on the NEF site.

Options to deal with unexpected discoveries are defined. In the case of these sites, a phased approach may be appropriate. This type of approach would define a process of data recovery that begins with the recovery of the significant information present in the site features and the surface artifact assemblage combined with some level of subsurface exploration to identify the presence of other significant data thought to be present.

The next phase is predicated upon the results of the subsurface exploration. If other significant remains are located, additional excavation is used to extract this information. Generally, some maximum amount of excavation is specified and the additional excavation does not exceed that amount unless unexpected discoveries are made.

Alternatively, a testing phase can be inserted into the process prior to data collection. In this approach, a testing plan is prepared and submitted for regulatory review. Once approved, the site (in this case, either eligible or potentially eligible) testing plan is implemented. Recovered materials and spatial data are analyzed, and a testing report and treatment plan are prepared and submitted for regulatory review. Upon approval, the treatment plan is then implemented.

The recovered materials include artifacts and samples that include bone, charcoal, sediments, etc. Samples are usually submitted to outside analytical laboratories, these include radiocarbon dates. Artifacts, bones, and perhaps some of the remaining samples are then curated. Curation is usually at the Museum of New Mexico. The museum charges a fee for curation in perpetuity.

5.2.9 Visual/Scenic Resources

Mitigation measures will be in place to minimize the impact to visual and scenic resources. These include the following items:

- The use of accepted natural, low-water consumption landscaping techniques to limit any potential visual impacts. These techniques will incorporate, but not be limited to the use of landscape plantings. As for aesthetically pleasing screening measures, planned landscape plantings will include indigenous vegetation.
- Prompt natural re-vegetation or covering of bare areas, will be used to mitigate visual impacts due to construction activities.
- Any removal of natural barriers, screens or buffers will be minimized.

5.2.10 Socioeconomic

No socioeconomic mitigation measures are anticipated.

5.2.11 Environmental Justice

No environmental justice mitigation measures are anticipated.

5.2.12 Public and Occupational Health

This section describes the mitigation measures to minimize public and occupational health impacts, from both nonradiological and radiological sources.

5.2.12.1 Nonradiological – Normal Operations

Mitigation measures will be in place to minimize the impact of nonradiological gaseous and liquid effluents to well below regulatory limits. The plant design incorporates numerous features to minimize potential gaseous and liquid effluent impacts including:

- Process systems that handle UF_6 operate at sub-atmospheric pressure minimizes outward leakage of UF_6.
- UF_6 cylinders are moved only when cool and when UF_6 is in solid form minimizing the risk of inadvertent release due to mishandling.
- Process off-gas from UF_6 purification and other operations passes through cold traps to solidify and reclaim as much UF_6 as possible. Remaining gases pass through high-efficiency filters and chemical absorbers removing HF and uranic compounds.
- Waste generated by decontamination of equipment and systems are subjected to processes that separate uranic compounds and various other heavy metals in the waste material.
- Liquid and solid waste handling systems and techniques are used to control wastes and effluent concentrations.
- Gaseous effluent passes through pre-filters, high efficiency particulate air (HEPA) filters, and activated carbon filters, all of which reduce the radioactivity in the final discharged effluent to very low concentrations.

- Liquid waste is routed to collection tanks, and treated through a combination of precipitation, evaporation, and ion exchange to remove most of the radioactive material prior to release of waste water to the onsite Treated Effluent Evaporative Basin (double-lined with leak detection).
- Liquid effluent pathways are monitored and sampled to assure compliance with regulatory discharge limits.
- All UF_6 process systems are monitored by instrumentation, which will activate alarms in the Control Room and will either automatically shut down the plant to a safe condition or alert operators to take the appropriate action (i.e., to prevent release) in the event of operational problems.
- LES will investigate alternative solvents or will apply control technologies for methylene chloride solvent use.

Administrative controls, practices, and procedures are used to assure compliance with the NEFs' Health, Safety, and Environmental Program. This program is designed to ensure safe storage, use, and handling of chemicals to minimize the potential for worker exposure.

5.2.12.2 Radiological – Normal Operations

Mitigation measures to minimize the impact of radiological gaseous and liquid effluents are the same as those listed in ER Section 5.2.12.1, Nonradiological – Normal Operations. Additional measures to minimize radiological exposure and release are listed below.

Radiological practices and procedures are in place to ensure compliance with the NEFs' Radiation Protection Program. This program is designed to achieve and maintain radiological exposure to levels that are "As Low as Reasonably Achievable" (ALARA). These measures include:

- Routine plant radiation and radiological surveys to characterize and minimize potential radiological dose/exposure.
- Monitoring of all radiation workers via the use of dosimeters and area air sampling to ensure that radiological doses remain within regulatory limits and are ALARA.
- Radiation monitors are provided in the gaseous effluent stacks to detect and alarm, and affect the automatic safe shutdown of process equipment in the event contaminants are detected in the system exhaust. Systems will either automatically shut down, switch trains or rely on operator actions to mitigate the potential release.

5.2.12.3 Accidental Releases

Mitigation measures will be in place to minimize the impact of a potential accidental release of radiological and/or nonradiological effluents. For example, several accident sequences involving UF_6 releases to the environment due to seismic or fire events were mitigated using design features to delay and reduce the UF_6 releases inside the buildings from reaching the outside environment. These measures include:

- Automatic shutoff of building heating, ventilation and air conditioning (HVAC) systems following a seismic event or during certain fire events
- Building features designed to limit building air leakage to the outside environment.

With mitigation, the dose consequences to the public for these accident sequences, have been reduced to a level below that considered "intermediate consequences", as that term is defined in (10 CFR 70.61(c)) (CFR, 2003b). See ER Section 4.12.3, Environmental Effects of Accidents.

5.2.13 Waste Management

Mitigation measures will be in place to minimize both the generation and impact of facility wastes. Solid and liquid wastes and liquid and gaseous effluents will be controlled in accordance with regulatory limits. Mitigation measures include:

- System design features are in place to minimize the generation of solid waste, liquid waste, liquid effluents, and gaseous effluent. Liquid and gaseous effluent design features were previously described in ER Section 5.2.12, Public and Occupational Health.
- There will be no onsite disposal of waste at the NEF. Waste will be stored in designated areas of the plant, until an administrative limit is reached. When the administrative limit is reached, the waste will then be shipped offsite to a licensed disposal facility.
- All radioactive and mixed wastes will be disposed of at offsite, licensed facilities.
- Mitigation measures associated with UBC storage are as follows:
- LES will maintain a cylinder management program to monitor storage conditions on the UBC Storage Pad to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs as needed.
- All UBCs filled with depleted uranium hexafluoride (UF_6) will be stored on concrete (or other material) saddles that do not cause corrosion of the cylinders. These saddles shall be placed on a concrete pad.
- The storage pad areas shall be segregated from the rest of the enrichment facility by barriers (e.g., vehicle guard rails).
- UBCs shall be double stacked on the storage pad. The storage array shall permit easy visual inspection of all cylinders.
- UBCs shall be surveyed for external contamination (wipe tested), prior to being placed on the UBC Storage Pad or transported offsite.
- UBC valves shall be fitted with valve guards to protect the cylinder valve during transfer and storage.
- Provisions are in place to ensure that UBCs do not have the defective valves (identified in NRC Bulletin 2003-03, "Potentially Defective 1-Inch Valves for Uranium Hexafluoride Cylinders") installed. LBDCR-07-0022
- All UF_6 cylinders are abrasive blasted and coated with anti-corrosion primer/paint when manufactured (as required by specification). Touch-up application of coating will be performed on UBCs if coating damage is discovered during inspection.
- Only designated vehicles with less than 0.3 m^3 (74 gal) of fuel shall be allowed on the UBC Storage Pad.

UBCs shall be inspected for damage prior to placing a filled cylinder on the storage pad. UBCs shall be re-inspected annually for damage or surface coating defects. These inspections shall verify that:

- Lifting points are free from distortion and cracking.
- Cylinder skirts and stiffener rings are free from distortion and cracking.
- Cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion.
- Cylinder valves are fitted with the correct protector and cap.
- Cylinders are inspected to confirm that the valve is straight and not distorted, two to six threads are visible, and the square head of the valve stem is undamaged.
- Cylinder plugs are undamaged and not leaking.
- If inspection of a UBC reveals significant deterioration or other conditions that may affect the safe use of the cylinder, the contents of the affected cylinder shall be transferred to another good condition cylinder and the defective cylinder shall be discarded. The root cause of any significant deterioration shall be determined, and if necessary, additional inspections of cylinders shall be made.
- Proper documentation on the status of each UBC shall be available onsite, including content and inspection dates.
- The UBC Storage Pad Stormwater Retention Basin is used to capture stormwater runoff from the UBC Storage Pad.

Other waste mitigation measures will include:

- Power usage will be minimized by efficient design of lighting systems, selection of high-efficiency motors, and use of proper insulation materials.
- Processes used to clean up wastes and effluent create their own wastes and effluent as well. Control of these process effluents is accomplished by liquid and solid waste handling systems and techniques as described below.
- Careful applications of basic principles for waste handling are followed in all of the systems and processes.
- Different waste types are collected in separate containers to minimize contamination of one waste type with another. Materials that can cause airborne contamination are carefully packaged, and; ventilation and filtration of the air in the area are provided as necessary. Liquid wastes are confined to piping, tanks, and other containers; curbing, pits, and sumps are used to collect and contain leaks and spills.
- Hazardous wastes are stored in designated areas in carefully labeled containers. Mixed wastes are also contained and stored separately.
- Strong acids and caustics are neutralized before entering an effluent stream.
- Radioactively contaminated wastes, are decontaminated and/or re-used in so far as possible to reduce waste volume.
- Fomblin Oil will be recovered and none will be routinely released as waste or effluent.
- Collected waste such as trash, compressible dry waste, scrap metals, and other candidate wastes, will be volume reduced at a centralized waste processing facility.

- Waste management systems will include administrative procedures, and practices that provide for the collection, temporary storage, processing, and disposal of categorized solid waste in accordance with regulatory requirements.
- Handling and treatment process are designed to limit wastes and effluent. Sampling and monitoring is performed to assure plant administrative and regulatory limits, are not exceeded in discharges to the Treated Effluent Evaporative Basin.
- Gaseous effluent is monitored for HF and for radioactive contamination before release.
- Liquid effluent is sampled and/or monitored in liquid waste treatment systems.
- Solid wastes are sampled and/or monitored prior to offsite treatment and disposal.
- Process system samples are returned to their source, where feasible, to minimize input to waste streams.

The NEF will implement a spill control program for accidental oil spills. A Spill Prevention Control and Countermeasure (SPCC) Plan will be prepared prior to the start of operation of the facility or prior to the storage of oil onsite in excess of de minimis quantities and will contain the following information:

- Identification of potential significant sources of spills and a prediction of the direction and quantity of flow that would result from a spill from each source.
- Identification of the use of containment or diversionary structures such as dikes, berms, culverts, booms, sumps, and diversion ponds used at the facility to prevent discharged oil from reaching the surrounding environment.
- Procedures for inspection of potential sources of spills and spill containment/diversion structures.
- Assigned responsibilities for implementing the plan, inspections, and reporting.
- As part of the SPCC Plan, other measures will include control of drainage of rain water from diked areas, containment of oil and diesel fuel in bulk storage tanks, above ground tank integrity testing, and oil and diesel fuel transfer operational safeguards.

Currently, the NEF construction plan has not been developed enough to determine how much of the construction debris would be recycled. As such, there is no plan in place at this time to recycle construction materials. A construction phase recycling program will be developed as the construction plan progresses to final design.

The NEF will implement a non-hazardous materials waste recycling plan during operation. The recycling effort will start with the performance of a waste assessment to identify waste reduction opportunities and to determine which materials will be recycled. Once the decision has been made of which waste materials to recycle, brokers and haulers will be contacted to find an end-market for the materials. Employee training on the recycling program will be performed so that employees will know which materials are to be recycled. Recycling bins and containers will be purchased and shall be clearly labeled. Periodically, the recycling program will be evaluated (i.e., waste management expenses and savings, recycling and disposal quantities) and the results reported to the employees.

6.0 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 RADIOLOGICAL MONITORING

6.1.1 Effluent Monitoring Program

The Nuclear Regulatory Commission (NRC) requires, pursuant to 10 CFR 20 (CFR, 2003q) that licensees conduct surveys necessary to demonstrate compliance with these regulations and to demonstrate that the amount of radioactive material present in effluent from the facility has been kept as low as reasonably achievable (ALARA). In addition, the NRC requires pursuant to 10 CFR 70 (CFR, 2003b), that licensees submit semiannual reports, specifying the quantities of the principal radionuclides released to unrestricted areas and other information needed to estimate the annual radiation dose to the public from effluent discharges. The NRC has also issued Regulatory Guide 4.15 – Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment and Regulatory Guide 4.16 – Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluent from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants that reiterate that concentrations of hazardous materials in effluent must be controlled and that licensees must adhere to the ALARA principal such that there is no undue risk to the public health and safety at or beyond the site boundary.

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Refer to Figure 6.1-1, Effluent Release Points and Meteorological Tower, and Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Locations. Effluents are sampled as shown in Table 6.1-1, Effluent Sampling Program. For gaseous effluents, continuous air sampler filters are analyzed for gross alpha and beta each week. The filters are composited quarterly and an isotopic analysis is performed. For liquids, a grab sample is taken for isotopic analysis post-treatment prior to discharge to the Treated Effluent Evaporative Basin.

Public exposure to radiation from routine operations at the National Enrichment Facility (NEF) may occur as the result of discharge of liquid and gaseous effluents, including controlled releases from the uranium enrichment process lines during decontamination and maintenance of equipment. In addition, radiation exposure to the public may result from the transportation and storage of uranium hexafluoride (UF_6) feed cylinders, product cylinders, and Uranium Byproduct Cylinders (UBCs). Of these potential pathways, discharge of gaseous effluent has the highest possibility of introducing facility-related uranium into the environment. The plant's procedures and facilities for solid waste and liquid effluent handling, storage and monitoring result in safe storage and timely disposition of the material. ER Section 1.3, Applicable Regulatory Requirements and Required Consultations, accurately describes all applicable Federal and New Mexico State standards for discharges, as well as required permits issued by local, New Mexico and Federal governments.

Compliance with 10 CFR 20.1301 (CFR, 2003q) is demonstrated using a calculation of the total effective dose equivalent (TEDE) to the individual who is likely to receive the highest dose in accordance with 10 CFR 20.1302(b)(1) (CFR, 2003q). The determination of the TEDE by pathway analysis is supported by appropriate models, codes, and assumptions that accurately represent the facility, site, and the surrounding area. The assumptions are reasonably conservative, input data is accurate, and all applicable pathways are considered. ER Section 4.12, Public and Occupational Health Impacts, presents the details of these determinations.

The computer codes used to calculate dose associated with potential gaseous and liquid effluent from the plant follow the methodology, for pathway modeling, described in Regulatory Guide 1.109, and have undergone validation and verification. The dose conversion factors used are those presented in Federal Guidance Reports Numbers 11 (EPA 520/1-88-020) and 12 (EPA, 1993a). LBDCR-07-0022

Administrative action levels are established for effluent samples and monitoring instrumentation as an additional step in the effluent control process. All action levels are sufficiently low so as to permit implementation of corrective actions before regulatory limits are exceeded. Effluent samples that exceed the action level are cause for an investigation into the source of elevated radioactivity. Radiological analyses will be performed more frequently on ventilation air filters if there is a significant increase in gross radioactivity or when a process change or other circumstances cause significant changes in radioactivity concentrations. Additional corrective actions will be implemented based on the level, automatic shutdown programming, and operating procedures to be developed in the detailed alarm design. Under routine operating conditions, radioactive material in effluent discharged from the facility complies with regulatory release criteria.

Compliance is demonstrated through effluent and environmental sampling data. If an accidental release of uranium should occur, then routine operational effluent data and environmental data will be used to assess the extent of the release. Processes are designed to include, when practical, provision for automatic shutdown in the event action levels are exceeded. Appropriate action levels and actions to be taken are specified for liquid effluents and gaseous releases. Data analysis methods and criteria used in evaluating and reporting environmental sample results are appropriate and will indicate when an action level is being approached in time to take corrective actions.

The effluent monitoring program falls under the oversight of the NEF Quality Assurance (QA) program. Therefore, it is subject to periodic audits conducted by the facility QA personnel. Written procedures will be in place to ensure the collection of representative samples, use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples. In addition, the plant's written procedures also ensure that sampling and measuring equipment, including ancillary equipment such as airflow meters, are properly maintained and calibrated at regular intervals. Moreover, the effluent monitoring program procedures include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition. Employees involved in implementation of this program are trained in the program procedures.

The NEF will ensure, when sampling particulate matter within ducts with moving air streams, that sampling conditions within the sample probe are maintained to simulate as closely as possible the conditions in the duct. This will be accomplished by implementing the following criteria: 1) calibrating air sampling equipment so that the sample is representative of the effluent being sampled in the duct; 2) maintaining the axis of the sampling probe head parallel to the air stream flow lines in the ductwork; 3) sampling (if possible) at least ten duct diameters downstream from a bend or obstruction in the duct; and 4) using shrouded-head air sampling probes when they are available in the size appropriate to the air sampling situation. Particle size distributions will be determined from process knowledge or measured to estimate and compensate for sample line losses and momentary conditions not reflective of airflow conditions in the duct.

The NEF will ensure that sampling equipment (pumps, pressure gages and air flow calibrators) are calibrated by qualified individuals. All air flow and pressure drop calibration devices (e.g., rotometers) will be calibrated periodically using primary or secondary air flow calibrators (wet test meters, dry gas meters or displacement bellows). Secondary air flow calibrators will be calibrated annually by the manufacturer(s). Air sampling train flow rates will be verified and/or calibrated each time a filter is replaced or a sampling train component is replaced or modified. Sampling equipment and lines will be inspected for defects, obstructions and cleanliness. Calibration intervals will be developed based on applicable industry standards.

6.1.1.1 Gaseous Effluent Monitoring

As a matter of compliance with regulatory requirements, all potentially radioactive effluent from the facility is discharged only through monitored pathways. See ER Section 4.12.2.1, Routine Gaseous Effluent, for a discussion of pathway assessment. The effluent sampling program for the NEF is designed to determine the quantities and concentrations of radionuclides discharged to the environment. The uranium isotopes ^{238}U, ^{236}U, ^{235}U and ^{234}U are expected to be the prominent radionuclides in the gaseous effluent. The annual uranium source term for routine gaseous effluent releases from the plant has been conservatively assumed to be 8.9 MBq (240 □Ci) per year, which is equal to twice the source term applied to the 1.5 million SWU plant described in NUREG-1484 (NRC, 1994a). This is a very conservative annual release estimate used for bounding analyses. Additional details regarding source term are provided in ER Section 4.12, Public and Occupational Health Impacts. Representative samples are collected from each release point of the facility. Because uranium in gaseous effluent may exist in a variety of compounds (e.g., depleted hexavalent uranium, triuranium octoxide, and uranyl fluoride), effluent data will be maintained, reviewed, and assessed by the facility's Radiation Protection Manager, to assure that gaseous effluent discharges comply with regulatory release criteria for uranium. Table 6.1-1, Effluent Sampling Program, presents an overview of the effluent sampling program.

The gaseous effluent monitoring program for the NEF is designed to determine the quantities and concentrations of gaseous discharges to the environment.

Gaseous effluent from the NEF, which has the potential for airborne radioactivity (albeit in very low concentrations) will be discharged through the Separations Building Gaseous Effluent Vent System (GEVS), the Technical Services Building (TSB) GEVS, the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System, and portions of the TSB Heating Ventilating and Air Conditioning (HVAC) System that provide the confinement ventilation function for areas of the TSB with the potential for contamination (Decontamination Workshop, Cylinder Preparation Room and the Ventilated Room). Monitoring for each of these systems is as follows:

- Separations Building GEVS: This system discharges to a stack on the TSB roof. The Separations Building GEVS provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16. The GEVS stack sampling system provides the required samples. The exhaust stack is equipped with monitors for alpha radiation and HF. LBDCR-07-0022
- TSB GEVS: This system discharges to an exhaust stack on the TSB roof. The TSB GEVS provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16. The TSB GEVS stack sampling system provides the required samples. The exhaust stack contains monitors for alpha radiation and HF. LBDCR-07-0022

- The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System: This system discharges through a stack on the Centrifuge Assembly Building (CAB). The Centrifuge Test and Post Mortem Facilities Exhaust Filtration stack sampling system provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16. The exhaust stack is provided with an alpha radiation monitor and an HF monitor. LBDCR-07-0022
- TSB HVAC System (confinement ventilation function portions): This system maintains the room temperature in various areas of the TSB, including some potentially contaminated areas. For the potentially contaminated areas (Ventilated Room, Decontamination Workshop and Cylinder Preparation Room), the confinement ventilation function of the TSB HVAC system maintains a negative pressure in these rooms and discharges the gaseous effluent to an exhaust stack on the TSB roof. The stack sampling system provides for continuous monitoring and periodic sampling of the gaseous effluent from the rooms served by the TSB HVAC confinement ventilation function in accordance with the guidance in NRC Regulatory Guide 4.16. LBDCR-07-0022

The gaseous effluent sampling program supports the determination of quantity and concentration of radionuclides discharged from the facility and supports the collection of other information required in reports to be submitted to the NRC. The MDCs for analyses of gaseous effluent are presented in Table 6.1-2, Required Lower Level of Detection for Effluent Sample Analyses.

6.1.1.2 Liquid Effluent Monitoring

Liquid effluents containing low concentrations of radioactive material, consisting mainly of spent decontamination solutions, floor washings, liquid from the laundry, and evaporator flushes, is expected to be generated by the NEF. Table 6.1-3, Estimated Uranium in Pre-Treated Liquid Waste from Various Sources, provides estimates of the annual volume and radioactive material content in liquid effluent by source prior to processing. Uranium is the only radioactive material expected in these wastes. Potentially contaminated liquid effluent is routed to the Liquid Effluent Collection and Treatment System for treatment. Most of the radioactive material is removed from waste water in the Liquid Effluent Collection and Treatment System through a combination of clean-up processes that includes precipitation, evaporation, and ion exchange. Post-treatment liquid waste water is sampled and undergoes isotopic analysis prior to discharge to assure that the released concentrations are below the concentration limits established in Table 2 of Appendix B to 10 CFR 20 (CFR, 2003q).

After treatment, the effluent is released to the double-lined Treated Effluent Evaporative Basin, which includes leak detection monitoring. Concentrated radioactive solids generated by the liquid treatment processes at the facility are handled and disposed of as low-level radioactive waste.

The design basis uranium source term for routine liquid effluent discharge to the Treated Effluent Evaporative Basin has been conservatively estimated to be 14.4 MBq (390 μCi) per year. There is no offsite release of liquid effluents to unrestricted areas. ER Section 4.12, Public and Occupational Health Impacts, provides additional details regarding effluent source terms.

Representative sampling is required for all batch liquid effluent releases. Liquid samples are collected from each liquid batch and analyzed prior to any transfer. Isotopic analysis is performed prior to discharge. The MDC for analysis of liquid effluent are presented in Table 6.1-2, Required Lower Level of Detection for Effluent Sample Analyses. The liquid effluent sampling program supports the determination of quantities and concentrations of radionuclides discharged to the Treated Effluent Evaporative Basin and supports the collection of other information required in reports submitted to the NRC.

Periodic sampling of liquid effluent is required since these effluents are treated in batches. Representative sampling is assured through the use of tank agitators and recirculation lines. All collection tanks are sampled before the contents are sent through any treatment process. Treated water is collected in Monitor Tanks, which are sampled before discharge to the Treated Effluent Evaporative Basin.

NRC Information Notice 94-07 (NRC, 1994b) describes the method for determining solubility of discharged radioactive materials. Note that liquid effluents at the NEF are treated such that insoluble uranium is removed as part of the treatment process. Releases are in accordance with the ALARA principle.

General site stormwater runoff is routed to the Site Stormwater Detention Basin. The UBC Storage Pad Stormwater Retention Basin collects rainwater from the UBC Storage Pad as well as cooling tower blowdown water and heating boiler blowdown water. Approximately 174,100 m^3 (46 million gal) of stormwater are expected to be collected each year by the two basins. Both of these basins will be included in the site Radiological Environmental Monitoring Program. See ER Section 6.1.2.

6.1.2 Radiological Environmental Monitoring Program

The Radiological Environmental Monitoring Program (REMP) at the NEF is a major part of the effluent compliance program. It provides a supplementary check of containment and effluent controls, establishes a process for collecting data for assessing radiological impacts on the environs and estimating the potential impacts on the public, and supports the demonstration of compliance with applicable radiation protection standards and guidelines.

The primary objective of the REMP is to provide verification that the operations at the facility do not result in detrimental radiological impacts on the environment. Through its implementation, the REMP provides data to confirm the effectiveness of effluent controls and the effluent monitoring program. In order to meet program objectives, representative samples from various

environmental media are collected and analyzed for the presence of plant-related radioactivity. The types and frequency of sampling and analyses are summarized in Table 6.1-4, Radiological Environmental Monitoring Program. Environmental media identified for sampling consist of ambient air, groundwater, soil/sediment, and vegetation. All environmental samples will be analyzed onsite. However, samples may also be shipped to a qualified independent laboratory for analyses. The MDCs for gross alpha (assumed to be uranium) in various environmental media are shown in Table 6.1-5, Required MDC for Environmental Sample Analyses. Monitoring and sampling activities, laboratory analyses, and reporting of facility-related radioactivity in the environment will be conducted in accordance with industry-accepted and regulatory-approved methodologies.

The Quality Control (QC) procedures used by the laboratories performing the plant's REMP will be adequate to validate the analytical results and will conform with the guidance in Regulatory Guide 4.15. These QC procedures include the use of established standards such as those provided by the National Institute of Standards and Technology (NIST), as well as standard analytical procedures such as those established by the National Environmental Laboratory Accreditation Conference (NELAC). LBDCR-07-0022

Monitoring procedures will employ well-known acceptable analytical methods and instrumentation. The instrument maintenance and calibration program will be appropriate to the given instrumentation, in accordance with manufacturers' recommendations.

The NEF will ensure that the onsite laboratory and any contractor laboratory used to analyze NEF samples participates in third-party laboratory intercomparison programs appropriate to the media and analytes being measured. Examples of these third-party programs are: 1) Mixed Analyte Performance Evaluation Program (MAPEP) and the DOE Quality Assurance Program (DOEQAP) that are administered by the Department of Energy; and 2) Analytics Inc, Environmental Radiochemistry Cross-Check Program. The NEF will require that all radiological and non-radiological laboratory vendors are certified by the National Environmental Laboratory Accreditation Program (NELAP) or an equivalent state laboratory accreditation agency for the analytes being tested.

Reporting procedures will comply with the requirements of 10 CFR 70.59 (CFR, 2003b) and the guidance specified in Regulatory Guide 4.16. Reports of the concentrations of principal radionuclides released to unrestricted areas in effluents will be provided and will include the Minimum Detectable Concentration (MDC) for the analysis and the error for each data point. LBDCR-07-0022

The REMP includes the collection of data during pre-operational years in order to establish baseline radiological information that will be used in determining and evaluating impacts from operations at the plant on the local environment. The REMP will be initiated at least 2 years prior to plant operations in order to develop a sufficient database. The early initiation of the REMP provides assurance that a sufficient environmental baseline has been established for the plant before the arrival of the first uranium hexafluoride shipment. Radionuclides in environmental media will be identified using technically appropriate, accurate, and sensitive analytical instruments. Data collected during the operational years will be compared to the baseline generated by the pre-operational data. Such comparisons provide a means of assessing the magnitude of potential radiological impacts on members of the public and in demonstrating compliance with applicable radiation protection standards.

During the course of facility operations, revisions to the REMP may be necessary and appropriate to assure reliable sampling and collection of environmental data. The rationale and actions behind such revisions to the program will be documented and reported to the appropriate regulatory agency, as required. REMP sampling focuses on locations within 4.8 km (3 mi) of the facility, but may also include distant locations as control sites. REMP sampling locations have been determined based on NRC guidance found in the document, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors" (NRC, 1991), meteorological information, and current land use. The sampling locations may be subject to change as determined from the results of periodic review of land use.

Atmospheric radioactivity monitoring is based on plant design data, demographic and geologic data, meteorological data, and land use data. Because operational releases are anticipated to be very low and subject to rapid dilution via dispersion, distinguishing plant-related uranium from background uranium already present in the site environment is a major challenge of the REMP. The gaseous effluent is released from roof-top discharge points, or resuspension of particles from the Treated Effluent Evaporative Basin, which will result in ground-level releases. A characteristic of ground-level plumes is that plume concentrations decrease continually as the distance from the release point increases. It logically follows that the impact at locations close to the release point is greater than at more distant locations. The concentrations of radioactive material in gaseous effluent from the NEF are expected to be very low concentrations of uranium because of process and effluent controls. Consequently, air samples collected at locations that are close to the plant would provide the best opportunity to detect and identify plant-related radioactivity in the ambient air. Therefore, air-monitoring activities will concentrate on collection of data from locations that are relatively close to the plant, such as the plant perimeter fence or the plant property line. Air monitoring stations will be situated along the site boundary locations of highest predicted atmospheric deposition, and at special interest locations, such as a nearby residential area and business. In addition, an air monitoring station will be located next to the Treated Effluent Evaporative Basin in order to measure for particulate radioactivity that may be being resuspended into the air from sediment layers when the basin is dry.

A control sample location will be established beyond 8 km (5 mi) in an upwind sector (the sector with least prevalent wind direction). Refer to ER Sections 3.6, Meteorology, Climatology and Air Quality and 4.6, Air Quality Impacts, for information on meteorology and atmospheric dispersion. All environmental air samplers operate on a continuous basis with sample retrieval for a gross alpha and beta analysis occurring on a biweekly basis (or as required by dust loads).

Vegetation and soil samples, both from on and offsite locations will be collected on a quarterly basis in each sector during the pre-operational REMP. This is to assure the development of a sound baseline. During the operational years, vegetation and soil sampling will be performed semiannually in eight sectors, including three with the highest predicted atmospheric deposition. Vegetation samples may include vegetables and grass, depending on availability. Soil samples will be collected in the same vicinity as the vegetation samples.

Groundwater samples from onsite monitoring well(s) will be collected semiannually for radiological analysis. The locations of the groundwater sampling (monitoring) wells are shown on Figure 6.1-2, Modified Site Features with Proposed Sampling Stations and Monitoring Locations. The rationale for the locations is based on the slope of the red bed surface at the base of the shallow sand and gravel layer and the groundwater gradient in the 70 m (230 ft) groundwater zone to the south under the NEF site and proximity to key site structures. Two monitoring wells will be located down-gradient of the site basins, two will be located down-gradient of the UBC Storage Pad and one will be located up-gradient of the UBC Storage Pad and all site facilities.

The background monitoring well, located in the NNW sector of the NEF site, is also shown on Figure 6.1-2. This background monitoring well is located up-gradient of the NEF and cross-gradient from the WCS facility. This location is intended to avoid potential contamination from both facilities, i.e., NEF and/or WCS. Monitoring at this location will occur in both the shallow sand and gravel layer on top of the red bed and in the 70-m (230-ft) groundwater zone. Groundwater in the sand and gravel layer was not encountered at the NEF site during groundwater investigations. Although not an aquifer, it will be monitored since it is the shallowest layer under the NEF site. The 70-m (230 ft) zone contains the first occurrence of groundwater beneath the NEF. Although not strictly meeting the definition of an aquifer, which requires that the unit be able to transit "significant quantities of water under ordinary hydraulic gradients," this layer will also be monitored.

Due to the potential interference with construction of the UBC Storage Page Storm Water Retention Basin and the UBC Storage Pad, the three monitoring wells located down-gradient of these structures will not be installed until after the structures are built. The monitor well located down-gradient of the Site Storm Water Detention Basin, the background monitoring well and at least three additional monitor wells will be installed during the pre-operational monitoring period. CC-EV-2006-0008

Other surrounding industrial activities, the Wallach Quarry and the Sundance Services "produced water" lagoons north of the NEF site have some potential to introduce contaminants that could reach the background monitoring well. The contaminants of concern for those facilities should be readily differentiated from potential contaminants from the NEF.

Sediment samples will be collected semiannually from both of the stormwater runoff retention/detention basins onsite to look for any buildup of uranic material being deposited. With respect to the Treated Effluent Evaporative Basin, measurements of the expected accumulation of uranic material into the sediment layer will be evaluated along with nearby air monitoring data to assess any observed resuspension of particles into the air.

The site septic systems will receive only typical sanitary wastes. No plant process related effluents will be introduced into the septic systems. Each septic tank will, however, be periodically sampled (prior to pumping) and analyzed for isotopic Uranium. The septic tanks are upstream of the leach fields. Any Uranium that is in the system that could reach the leach fields would be detected in the septic tanks. Therefore, no sampling will be performed at the leach fields.

Direct radiation in offsite areas from processes inside the facility building is expected to be minimal because the low-energy radiation associated with the uranium will be shielded by the process piping, equipment, and cylinders to be used at the NEF. However, the Uranium Byproduct Cylinders (UBCs) stored on the UBC Storage Pad may have an impact in some offsite locations due to direct and scatter (skyshine) radiation. The offsite impact from the UBC storage has been evaluated and is discussed in ER Section 4.12, Public and Occupational Health Impacts.

The conservative evaluation showed that an annual dose equivalent of < 0.2 mSv (20 mrem) is expected at the highest impacted area at the plant perimeter fence.

Because the offsite dose equivalent rate from stored UBCs is expected to be very low and difficult to distinguish from the variance in normal background radiation beyond the site boundary, demonstration of compliance will rely on a system that combines direct dose equivalent measurements and computer modeling to extrapolate the measurements. Environmental thermoluminescent dosimeters (TLDs) placed at the plant perimeter fence line or other location(s) close to the UBCs will provide quarterly direct dose equivalent information. The direct dose equivalent at offsite locations will be estimated through extrapolation of the quarterly TLD data using the Monte Carlo N-Particle (MCNP) computer program (ORNL, 2000a) or a similar computer program.

Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Stations, indicates the location of REMP sampling locations.

The REMP may be enhanced during the operation of the facility as necessary to maintain the collection and reliability of environmental data based on changes to regulatory requirements or facility operations. The REMP includes administrative action levels (requiring further analysis) and reporting levels for radioactivity in environmental samples.

The REMP falls under the oversight of the facility's Quality Assurance (QA) program. Therefore, written procedures to ensure representative sampling, proper use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples will be a key part of the program. In addition, written procedures ensure that sampling and measuring equipment, including ancillary equipment such as airflow meters, are properly maintained and calibrated at regular intervals. Moreover, the REMP implementing procedures will include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition.

The design status of leak detection (and mitigation procedures) for ponds and tanks has not yet progressed to final design. The NEF will conform with leak detection recommendations required in NUREG-1520. LBDCR-07-0022

Each year, the NEF will submit a summary report of the environmental sampling program to the NRC, including all associated data as required by 10 CFR 70 (CFR, 2003b). The report will include the types, numbers, and frequencies of environmental measurements and the identities and activity concentrations of facility-related nuclides found in environmental samples, in addition to the MDC for the analyses and the error associated with each data point. Significant positive trends in activities will also be noted in the report, along with any adjustment to the program, unavailable samples, and deviation to the sampling program.

6.1.3 Section 6.1 Tables

Table 6.1-1 Effluent Sampling Program

Effluent	Sample Location	Sample Type	Analysis-Frequency
Gaseous	Separative Building GEVS Stack TSB GEVS Stack TSB HVAC Stack Centrifuge Test and Post Mortem Facilities Exhaust Filtration System Stack	Continuous Air Particulate Filter	Gross Alpha/Beta-Weekly Isotopic Analysis[a] - Quarterly
	Process Areas	Continuous Air Particulate Filter*	Gross Alpha/Beta - Weekly Isotopic Analysis[a] - Quarterly
	Non-Process Areas	Continuous Air Particulate Filter*	Gross Alpha/Beta-Quarterly
Liquid	Monitor Tank	Representative Grab Sample	Isotopic Analysis[a] Post-Treatment - Prior to Discharge.

[a] Isotopic analysis for ^{234}U ,^{235}U, ^{236}U, and ^{238}U.

*As required to complement bioassay program.

Table 6.1-2 Required Lower Level Of Detection For Effluent Sample Analyses

Effluent Type	Nuclide	MDC[a] in Bq/ml (µCi/ml)
Gaseous	^{234}U	$9.3x10^{-11}$ ($2.5x10^{-15}$)
	^{235}U	$9.3x10^{-11}$ ($2.5x10^{-15}$)
	^{236}U	$9.3x10^{-11}$ ($2.5x10^{-15}$)
	^{238}U	$9.3x10^{-11}$ ($2.5x10^{-15}$)
	Gross Alpha	$9.3x10^{-11}$ ($2.5x10^{-15}$)
Liquid	^{234}U	$1.4x10^{-4}$ ($3.0x10^{-9}$)
	^{235}U	$1.4x10^{-4}$ ($3.0x10^{-9}$)
	^{236}U	$1.4x10^{-4}$ ($3.0x10^{-9}$)
	^{238}U	$1.4x10^{-4}$ ($3.0x10^{-9}$)

[a] These MDCs are less than 2% of the limits in 10 CFR 20 Appendix B, Table 2 Effluent Concentrations

Table 6.1-3 Estimated Uranium In Pre-Treated Liquid Waste From Various Sources

Source	Typical Annual Quantities, m^3 (gals)	Typical Annual Uranic Content, kg (lbs)*
Laboratory/floor washings/miscellaneous condensates	23.14 (6112)	16 (35)
Degreaser water	3.71 (980)	18.5 (41)
Citric acid	2.72 (719)	22 (49)
Laundry effluent water	405.80 (107,213)	0.2 (0.44)
Hand wash & shower water	2100 (554,820)	None
TOTAL	2,355 (669,844)	56.7 (125)

*Uranic quantity is before treatment. After treatment, approximately 1% of 0.57 kg (1.26 lb) of uranic material is expected to be discharged into the Treated Effluent Evaporative Basin.

Table 6.1-4 Radiological Environmental Monitoring Program

Sample Type	Minimum Number of Sample Locations	Sampling and Collection Frequency	Type of Analysis
Continuous Airborne Particulate	7	Continuous operation of air sampler with sample collection as required by dust loading but at least biweekly. Quarterly composite samples by location.	Gross beta/gross alpha analysis each filter change. Quarterly isotopic analysis on composite sample.
Vegetation	8	1 to 2-kg (2.2 to 4.4-lb) samples collected semiannually	Isotopic analysis[a]
Groundwater	5	4-L (1.06-gal) samples collected semiannually	Isotopic analysis[a]
Basins	1 from each of 3 basins[b]	4-L (1.06-gal) water sample/1 to 2-kg (2.2 to 4.4-lb) sediment sample collected quarterly	Isotopic analysis[a]
Soil	8	1 to 2-kg (2.2 to 4.4-lb) samples collected semiannually	Isotopic analysis[a]
Septic Tank(s)	1 from each affected tank	1 to 2-kg (2.2 to 4.4-lb) sludge sample from the affected tank(s) prior to pumping	Isotopic analysis[a]
TLD	16	Quarterly	Gamma and neutron dose equivalent

[a] Isotopic analysis for ^{234}U, ^{235}U, ^{236}U, and ^{238}U.

[b] Site Stormwater Detention Basin, UBC Storage Pad Stormwater Retention Basin and Treated Effluent Evaporative Basin.

Note:

Physiochemical monitoring parameters are addressed separately in ER Section 6.2, Physiochemical Monitoring.

Table 6.1-5 Required MDC For Environmental Sample Analyses

Medium	Analysis	MDC[a] in Bq/ml or g (μCi/ml or g)
Ambient Air	Gross Alpha	$9.3x10^{-11}$ ($2.5x10^{-15}$)
Vegetation	Isotopic U	$2.2x10^{-4}$ ($6.0x10^{-9}$)
Soil/Sediment	Isotopic U	$1.1x10^{-2}$ ($3.0x10^{-7}$)
Groundwater[b]	Isotopic U	$1.9x10^{-6}$ ($5.0x10^{-11}$)

[a] For analyses of groundwater samples, the MDC will be at least $1.9x10^{-6}$ Bq/ml ($5.0x10^{-11}$ μCi/ml), which represents <0.02% of the concentration limits listed in Table 2 of Appendix B to 10 CFR 20.

6.1.4 Section 6.1 Figures

Security-Related Information
Figure Withheld Under 10 CFR 2.390

EFFLUENT RELEASE POINTS AND METEOROLOGICAL TOWER

Figure 6.1-1 Effluent Release Points and Meteorological Tower

Security-Related Information
Figure Withheld Under 10 CFR 2.390

MODIFIED SITE FEATURES WITH PROPOSED SAMPLING STATIONS AND MONITORING LOCATIONS

Figure 6.1-2 Modified Site Features With Proposed Sampling Stations and Monitoring Locations

6.2 PHYSIOCHEMICAL MONITORING

6.2.1 Introduction

The primary objective of physiochemical monitoring is to provide verification that the operations at the NEF do not result in detrimental chemical impacts on the environment. Effluent controls which are discussed in ER Sections 3.12, Waste Management and 4.13, Waste Management Impacts, are in place to assure that chemical concentrations in gaseous and liquid effluents are maintained as low as reasonably achievable (ALARA). In addition, physiochemical monitoring provides data to confirm the effectiveness of effluent controls.

Administrative action levels will be implemented prior to facility operation to ensure that chemical discharges will remain below the limits specified in the facility discharge permits. The limits are specified in the EPA Region 6 NPDES General Discharge Permits as well as the New Mexico Water Quality Bureau (NMWQB) Groundwater Discharge Permit/Plan.

Specific information regarding the source and characteristics of all non-radiological plant effluents and wastes that will be collected and disposed of offsite, or discharged in various effluent streams is provided in ER Sections 3.12 and 4.13.

In conducting physiochemical monitoring, sampling protocols and emission/effluent monitoring will be performed for routine operations with provisions for additional evaluation in response to potential accidental release.

The facility will have an Environmental Monitoring Laboratory, which will be equipped with analytical instruments needed to ensure that the operation of the plant activities complies with federal, state and local environmental regulations and requirements. Compliance will be demonstrated by monitoring/sampling at various plant and process locations, analyzing the samples and reporting the results of these analyses to the appropriate agencies. The sampling/monitoring locations will be selected by the Health, Safety and Environmental (HS&E) organization staff in accordance with facility permits and good sampling practices.

The Environmental Monitoring Laboratory is located in the Technical Services Building (TSB) and is used to perform analyses that include the following:

- Hazardous material presence in waste samples
- pH, oil and other contaminants in liquid effluents

The Environmental Monitoring Laboratory will be available to perform analyses on air, water, soil, flora, and fauna samples obtained from designated areas around the plant. In addition to its environmental and radiological capabilities, the Environmental Monitoring Laboratory is also capable of performing bioassay analyses when necessary. Commercial, offsite laboratories may also be contracted to perform bioassay analyses.

All waste liquids, solids and gases from enrichment-related processes and decontamination operations will be analyzed and/or monitored for chemical and radiological contamination to determine safe disposal methods and/or further treatment requirements. A description of the radiological monitoring program at the NEF is provided in ER Section 6.1, Radiological Monitoring.

6.2.2 Evaluation and Analysis of Samples

Samples of liquid effluents, solids and gaseous effluents from plant processes will be analyzed in the Technical Services Building (TSB) Environmental Monitoring Laboratory. Results of process samples analyses are used to verify that process parameters are operating within expected performance ranges. Results of liquid effluent sample analyses will be characterized to determine if treatment is required prior to discharge to the Treated Effluent Evaporative Basin and to determine if corrective action is required in facility process and/or effluent collection and treatment systems.

6.2.3 Effluent Monitoring

Chemical constituents that may be discharged to the environment in facility effluents will be below concentrations that have been established by state and federal regulatory agencies as protective of the public health and the natural environment. Under routine operating conditions, no significant quantities of contaminants will be released from the facility as discussed in ER Sections 3.12 and 4.13. This will be confirmed through monitoring and collection and analysis of environmental data. Routine liquid effluents are listed in Table 3.12-4, Estimated Annual Liquid Effluent. The facility does not directly discharge any industrial effluents to surface waters or grounds offsite, and there is no plant tie-in to a Publicly Owned Treatment Works (POTW). Except for discharges from the Septic System, all liquid effluents are contained on the NEF site via collection tanks and retention basins. See ER Figure 6.1-1, Effluent Release Points and Meteorological Tower, Figure 6.1-2, Modified Site Features with Proposed Sampling Stations and Monitoring Locations, and Section 2.1.2, Proposed Action, for further discussion of the Liquid Effluent Treatment System.

Parameters for continuing environmental performance will be developed from the baseline data in this Environmental Report and additional preoperational sampling. Operational monitoring surveys will also be conducted using sampling sites and at frequencies established from baseline sampling data and as determined based on requirements. Operational monitoring surveys are determined based on requirements contained in EPA Region 6 NPDES General Discharge Permits as well as the NMWQB Groundwater Discharge Permit/Plan.

The frequency of some types of samples may be modified depending on baseline data for the parameters of concern. The monitoring program is designed to use the minimum percentage of allowable limits (lower limits of detection) broken down daily, quarterly, and semiannually. As construction and operation of the enrichment plant proceeds, changing conditions (e.g., regulations, site characteristics, and technology) and new knowledge may require that the monitoring program be reviewed and updated. The monitoring program will be enhanced as appropriate to maintain the collection and reliability of environmental data. The specific location of monitoring points will be determined in detailed design.

During implementation of the monitoring program, some samples may be collected in a different manner/method than specified herein. Examples of reasons for these deviations include severe weather events, changes in the length of the growing season, and changes in the number of plantings. Under these circumstances, documentation shall be prepared to describe how the samples were collected and the rationale for any deviations from normal monitoring program methods. If a sampling location has frequent unavailable samples or deviations from the schedule, then another location may be selected or other appropriate actions taken.

Each year, LES will submit a summary of the environmental sampling program and associated data to the proper regulatory authorities, as required. This summary will include the types, numbers and frequencies of samples collected.

Physiochemical monitoring will be conducted via sampling of stormwater, soil, sediment, vegetation, and groundwater as defined in Table 6.2-1, Physiochemical Sampling, to confirm that trace, incidental chemical discharges are below regulatory limits. There are no surface waters on the site, therefore no Surface Water Monitoring Program will be implemented; however soil sampling will include outfall areas such as the outfall at the Site Stormwater Detention Basin. In the event of any accidental release from the facility, these sampling protocols will be initiated immediately and on a continuing basis to document the extent/impact of the release until conditions have been abated and mitigated.

The site septic systems will receive only typical sanitary wastes. No chemical sampling is planned because no plant process related effluents will be introduced into the septic systems.

6.2.4 Stormwater Monitoring Program

A stormwater monitoring program will be initiated during construction of the facility. Data collected from the program will be used to evaluate the effectiveness of measures taken to prevent the contamination of stormwater and to retain sediments within property boundaries. A temporary detention basin will be used as a sediment control basin during construction as part of the overall sedimentation erosion control plan.

Stormwater monitoring will continue with the same monitoring frequency upon initiation of facility operation. During plant operation, samples will be collected from the Uranium Byproduct Cylinders (UBC) Storage Pad Stormwater Retention Basin and the Site Stormwater Detention Basin in order to demonstrate that runoff does not contain any contaminants. A list of parameters to be monitored and monitoring frequencies is presented in Table 6.2-1, Physiochemical Sampling. Table 6.2-2, Stormwater Monitoring Program shows the parameters to be monitored with respect to stormwater. This monitoring program will be refined to reflect applicable requirements as determined during the National Pollutant Discharge Elimination System (NPDES) process (see ER Section 4.4, Water Resources Impacts, for the construction and operational permits). Additionally, the Site Stormwater Detention Basin will adhere to the requirements of the Groundwater Discharge Permit/Plan from the NMWQB, as discussed in ER Sections 1.3, Applicable Regulatory Requirements, Permits and Required Consultations and Section 4.4, Water Resources Impacts.

6.2.5 Environmental Monitoring

The purpose of this section is to describe the surveillance-monitoring program, which will be implemented to measure non-radiological chemical impacts upon the natural environment.

The ability to detect and contain any potentially adverse chemical releases from the facility to the environment will depend on chemistry data to be collected as part of the effluent and stormwater monitoring programs described in the preceding sections. Data acquisition from these programs encompasses both onsite and offsite sample collection locations and chemical element/compound analyses. Final constituent analysis requirements will be in accordance with permit mandates.

Sampling locations will be determined based on meteorological information and current land use. The sampling locations may be subject to change as determined from the results of any observed changes in land use.

The range of chemical surveillance incorporated into all the planned effluent monitoring programs for the facility are designed to be sufficient to predict any relevant chemical interactions in the environment related to plant operations.

Vegetation and soil sampling will be conducted. Vegetation samples will include grasses, and if available, vegetables. Soil will be collected in the same vicinity as the vegetation sample. The samples are collected from both onsite and offsite locations in various sectors. Sectors are chosen based on air modeling. Sediment samples will be collected from discharge points to the different collection basins onsite. At this time, groundwater samples will be collected from a series of wells that will be installed around the plant. The locations of the groundwater sampling (monitoring) wells are as described in Section 6.1.2 and are shown in Figure 6.1-2.

Stormwater samples collected in the UBC Storage Pad Stormwater Retention Basin will be sampled to ensure no contaminants are present in the UBC Storage Pad runoff.

6.2.6 Meteorological Monitoring

In order to monitor and characterize meteorological phenomena (e.g., wind speed, direction, and temperature) during plant operation as well as consider interaction of meteorology and local terrain, conditions will be monitored with a 40-m (132-ft) tower located onsite. This data will assist in evaluating the potential locales on and off property that could be influenced by any emissions. The instrument tower will be located at a site approximately the same elevation as the finished facility grade and in an area where facility structures will have little or no influence on the meteorological measurements. An area approximately ten times the obstruction height around the tower towards the prevailing wind direction will be maintained in accordance with established standards for meteorological measurements. This practice will be used to avoid spurious measurements resulting from local building-caused turbulence. The program for instrument maintenance and servicing, combined with redundant data recorders, assures at least 90% data recovery.

The data this equipment provides is recorded in the Control Room and can be used for dispersion calculations. Equipment will also measure temperature and humidity, which will be recorded in the Control Room.

6.2.7 Biota

The monitoring of radiological and physiochemical impacts to biota are detailed in ER Section 6.3, Ecological Monitoring of this report.

6.2.8 Quality Assurance

Quality assurance will be achieved by following a set of formalized and controlled procedures that Louisiana Energy Services (LES) will create, implement and periodically review for sample collection, lab analysis, chain of custody, reporting of results, and corrective actions. Corrective actions will be instituted when an action level is exceeded for any of the measured parameters. Action levels will be divided into three priorities: 1) if the sample parameter is three times the normal background level; 2) if the sample parameter exceeds any existing administrative limits, or; 3) if the sample parameter exceeds any regulatory limit. The third scenario represents the worst case, which will be prepared for but is not expected. Corrective actions will be implemented to ensure that the cause for the action level exceedance can be identified and immediately corrected, applicable regulatory agencies are notified, if required, communications to address lessons learned are dispersed to appropriate personnel, and applicable procedures are revised accordingly if needed. All action plans will be commensurate to the severity of the exceedance.

The NEF will ensure that the onsite laboratory and any contractor laboratory used to analyze NEF samples participates in third-party laboratory intercomparison programs appropriate to the media and analytes being measured. Examples of these third-party programs are the Mixed Analyte Performance Evaluation Program (MAPEP) and the DOE Quality Assurance Program (DOEQAP) that are administered by the Department of Energy. The NEF will require all radiological and non-radiological laboratory vendors to be certified by the National Environmental Laboratory Accreditation Conference (NELAC) or an equivalent state laboratory accreditation agency for the analytes being tested.

6.2.9 Lower Limits of Detection

Lower limits of detection for the parameters sampled for in the Stormwater Monitoring Program are listed in Table 6.2-2, Stormwater Monitoring Program. Lower limits of detection (LLD) for the nonradiological parameters shown in Table 6.2-1, Physiochemical Sampling, will be based on the results of the baseline surveys and the type of matrix (sample type).

6.2.10 Section 6.2 Tables

Table 6.2-1 Physiochemical Sampling

Sample Type	Sample Location	Frequency	Sampling and Collections[2]
Stormwater	Site Stormwater Detention Basin UBC Storage Pad Stormwater Retention Basin	Quarterly	Analytes as determined by baseline program – see Table 6.2-2
Vegetation	4 minimum[1]	Quarterly (growing seasons)	Fluoride uptake
Soil/Sediment	4 minimum[1]	Quarterly	Metals, organics, pesticides, and fluoride uptake
Groundwater	All selected groundwater wells	Semiannually	Metals, organics and pesticides

1 Location to be established by Health, Safety and Environmental (HS&E) organization staff.

2 Analyses will meet EPA Lower Limits of Detection (LLD), as applicable, and will be based on the baseline surveys and the type of matrix (sample type).

Table 6.2-2 Stormwater Monitoring Program

Stormwater Monitoring Program for Detention and Retention Basins* (See Figure 4.4-1)

Monitored Parameter	Monitoring Frequency	Sample Type	LLD
Oil & Grease	Quarterly, if standing water exists	Grab	0.5 ppm
Total Suspended Solids	Quarterly, if standing water exists	Grab	0.5 ppm
5-Day Biological Oxygen Demand (BOD)	Quarterly, if standing water exists	Grab	2 ppm
Chemical Oxygen Demand (COD)	Quarterly, if standing water exists	Grab	1 ppm
Total Phosphorus	Quarterly, if standing water exists	Grab	0.1 ppm
Total Kjeldahl Nitrogen	Quarterly, if standing water exists	Grab	0.1 ppm
pH	Quarterly, if standing water exists	Grab	0.01 units
Nitrate plus Nitrite Nitrogen	Quarterly, if standing water exists	Grab	0.2 ppm
Metals	Quarterly, if standing water exists	Grab	Varies**

* Site Stormwater Detention Basin, UBC Storage Pad, Stormwater Detention Basin and any temporary basins used during construction.

** Analyses will meet EPA Lower Limits of Detection (LLD), as applicable, and will be based on the baseline surveys and the type of matrix (sample type).

Note:

Radiological monitoring parameters are addressed separately in ER Section 6.1, Radiological Monitoring.

6.3 ECOLOGICAL MONITORING

6.3.1 Maps

See Figure 6.1-2, Modified Site Features with Sampling Stations and Monitoring Locations.

6.3.2 Affected Important Ecological Resources

The existing natural habitats on the NEF site and the region surrounding the site have been impacted by domestic livestock grazing, oil/gas pipeline right-of-ways and access roads. These current and historic land uses have resulted in a dominant habitat type, the Plains Sand Scrub. Hundreds of square kilometers (miles) of this habitat type occur in the area of the NEF. The habitat type at the NEF site does not support any rare, threatened, or endangered animal or plant species. The Plains Sand Scrub vegetation type is characterized by shinnery oak shrub, mesquite shrub, and short to mid-grass prairie with little or no overhead cover.

Based on ecological surveys that have been performed onsite, LES has concluded that there are no important ecological systems onsite that are especially vulnerable to change or that contain important species habitats, such as breeding areas, nursery, feeding, resting, and wintering areas, or other areas of seasonally high concentrations of individuals of important species. The species selected as important (the mule deer and scaled quail) are both highly mobile, generalist species and can be found throughout the site area. Wildlife species on the site typically occur at average population concentrations for the Plains Sand Scrub habitat type.

The nearest suitable habitat for species of concern are several kilometers (miles) from the NEF site. The closest known populations of the Sand Dune Lizard occur approximately 4.8 km (3 mi) north of the site. A population of Lesser Prairie Chickens has been observed approximately 6.4 km (4 mi) north of the NEF site. No Black-Tailed Prairie Dogs are present at the NEF site.

6.3.3 Monitoring Program Elements

Several elements have been chosen for the ecological monitoring program. These elements include vegetation, birds, mammals, and reptiles/amphibians. Currently there is no action or reporting level for each specific element. However, additional consultation with all appropriate agencies (New Mexico Department of Game & Fish, US Fish & Wildlife Service USFWS) will continue. Agency recommendations, based on future consultation and monitoring program data, will be considered when developing action and/or reporting levels for each element. In addition, LES will periodically monitor the NEF site property and basin waters during construction and plant operations to ensure the risk to birds and wildlife is minimized. If needed measures will be taken to release entrapped wildlife. The monitoring program will assess the effectiveness of the entry barriers and release features to ensure risk to wildlife is minimized.

6.3.4 Observations and Sampling Design

The NEF site observations will include preconstruction, construction, and operations monitoring programs. The preconstruction monitoring program will establish the site baseline data. The procedures used to characterize the plant, bird, mammalian, and reptilian/amphibian communities at the NEF site during pre-construction monitoring are considered appropriate and will be used for both the construction and operations monitoring programs. Operational monitoring surveys will also be conducted annually (except semiannually for birds and reptiles/amphibians) using the same sampling sites established during the preconstruction monitoring program.

These surveys are intended to be sufficient to characterize gross changes in the composition of the vegetative, avian, mammalian, and reptilian/amphibian communities of the site associated with operation of the plant. Interpretation of operational monitoring results, however, must consider those changes that would be expected at the NEF site as a result of natural succession processes. Plant communities at the site will continue to change as the site begins to regenerate and mature. Changes in the bird, small mammal, and reptile/amphibian communities are likely to occur concomitantly in response to the changing habitat.

Vegetation

Collection of ground cover, frequency, woody plant density, and production data will be sampled from sixteen permanent sampling locations within the NEF Site. Sampling will occur annually in September or October. Annual sampling is scheduled to coincide with the mature flowering stage of the dominant perennial species.

The sampling locations are selected in areas outside of the proposed footprint of the NEF facility. The selected sampling locations will be marked physically onsite and the Global Positioning System (GPS) coordinates will be recorded. The expected positions of the sampling locations are plotted on a site schematic (See Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Locations). The establishment of permanent sampling locations will facilitate a long-term monitoring system to evaluate vegetation trends and characteristics.

Transects used for data collection will originate at the sampling location and radiate out 30 m (100 ft) in a specified compass direction. Ground cover and frequency will be determined utilizing the line intercept method. Each 0.3 m (1 ft) segment is considered a discrete sampling unit. Cover measurements will be read to the nearest 0.03 m (0.1 ft). Woody plant densities will be determined using the belt transect method. All shrub and tree species rooted within 2 m (6 ft) of the 30 m (100 ft) transect will be counted. Productivity will be determined using a double sampling technique. The double sampling technique consists of estimating the production within three 0.25 m2 (2.7 ft2) plots and harvesting one equal sized plot for each transect. Harvesting consists of clipping each species in a plot separately, oven drying, and weighing to the nearest 0.01 g. The weights will be converted to kg (lbs) of oven dry forage per ha (acre).

Birds

Site-specific avian surveys will be conducted in both the wintering and breeding seasons to verify the presence of particular bird species at the NEF site. The winter and spring surveys will be designed to identify the members of the avian community.

For the winter survey, the distinct habitats at the site will be identified and the bird species composition within each of the habitats described. Transects 100 m (328 ft) in length will be established within each distinct homogenous habitat and data will be collected along the transect. Species composition and relative abundance will be determined based on visual observations and call counts.

In addition to verifying species presence, the spring survey will be designed to determine the nesting and migratory status of the species observed and (as a measure of the nesting potential of the site) the occurrence and number of territories of singing males and/or exposed, visible posturing males. The area will be censused using the standard point count method (DOA, 1993; DOA, 1995). Standard point counts require a qualified observer to stand in a fixed position and record all the birds seen and heard over a time period of five minutes. Distances

and time are each subdivided. Distances are divided into less than 50 m (164 ft) and greater than 50 m (164 ft) categories (estimated by the observer), and the time is divided into two categories, 0-3 minute and 3-5 minute segments. All birds seen and heard at each station/point visited will be recorded on standard point count forms. All surveys will be conducted from 0615 to 1030 hours to coincide with the territorial males' peak singing times. The stations/points will be recorded using the GPS enabling the observer to make return visits. Surveys will only be conducted at time when fog, wind, or rain does not interfere with the observer's ability to accurately record data.

The avian communities are described in ER Section 3.5.2. All data collected will be recorded and compared to information listed in Table 3.5-2, Birds Potentially Using the NEF Site. The field data collections will be done semiannually. The initial monitoring will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

Mammals

The existing mammalian communities are described in ER Section 3.5.2. General observations will be compiled concurrently with other wildlife monitoring data and compared to information listed in Table 3.5 1, Mammals Potentially Using the NEF Site. The initial monitoring will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

Reptiles and Amphibians

There are several groups of reptile and amphibian species (lizards, snakes, amphibians) that provide the biological characteristics (demographics, life history characteristics, site specificity, environmental sensitivity) for an informative environmental monitoring program. Approximately 13 species of lizards, 13 species of snakes and 11 species of amphibians may occur on the site and in the area.

A combination of pitfall drift-fence trapping and walking transects (at trap sites) can provide data in sufficient quantity to allow statistical measurements of population trends, community composition, body size distributions and sex ratios that will reflect environmental conditions and changes at the site over time.

As practical, the monitoring program will include at least two other replicated sample sites beyond the primary location on the NEF property. Offsite, locations on Bureau of Land Management (BLM) or New Mexico state land to the south, west or north of NEF will be given preference for additional sampling sites. Each of these catch sites will have the same pitfall drift-fence arrays and standardized walking transects and will be operated simultaneously. Each sample site will be designed to maximize the total catch of reptiles and amphibians, rather than data on each individual caught. Each animal caught will be identified, sexed, snout-vent length measured, inspected for morphological anomalies and released (sample with replacement design). There will be two sample periods, at the same time each year, in May and late June/early July. These coincide with breeding activity for lizards, most snakes and depending on rainfall, amphibians.

Because reptiles and amphibians are sensitive to climatic conditions, and to account for the spotty effects of rainfall, each sampling event will also record rainfall, relative humidity and temperatures. The rainfall and temperature data will act as a covariate in the analysis.

Additionally, the offsite sample locations act to balance out climatic effects on populations of small animals. The comparison of NEF site data and offsite location data allows for monitoring to be a much more informative environmental indicator of conditions at the NEF site.

The reptile and amphibian communities are described in ER Section 3.5.2, General Ecological Conditions of the Site. In addition to the monitoring plan described above, general observations will be gathered and recorded concurrently with other wildlife monitoring. The data will be compared to information listed in Table 3.5-3, Amphibians/Reptiles Potentially Using the NEF Site. As with the programs for birds and mammals, the initial reptile and amphibian monitoring program will be effective for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

6.3.5 Statistical Validity of Sampling Program

The proposed sampling program will include descriptive statistics. These descriptive statistics will include the mean, standard deviation, standard error, and confidence interval for the mean. In each case the sampling size will be clearly indicated. The use of these standard descriptive statistics will be used to show the validity of the sampling program. A significance level of 5% will be used for the studies, which results in a 95% confidence level.

6.3.6 Sampling Equipment

Due to the type of ecological monitoring proposed for the NEF no specific sampling equipment is necessary.

6.3.7 Method of Chemical Analysis

Due to the type of monitoring proposed for the NEF, no chemical analysis is proposed for ecological monitoring.

6.3.8 Data Analysis And Reporting Procedures

LES or its contractor will analyze the ecological data collected on the NEF site. The Health, Safety & Environmental (HS&E) Director or a staff member reporting to the HS&E Director will be responsible for the data analysis.

A summary report will be prepared which will include the types, numbers and frequencies of samples collected.

6.3.9 Agency Consultation

Consultation was initiated with all appropriate federal and state agencies and affected Native American Tribes. Refer to Appendix A, Consultation Documents, for a complete list of consultation documents and comments.

6.3.10 Organizational Unit Responsible for Reviewing the Monitoring Program on an Ongoing Basis

As policy directives are developed, documentation of the environmental monitoring programs will occur. The person or organizational unit responsible for reviewing the program on an ongoing basis will be the HS&E Director.

6.3.11 Established Criteria

The ecological monitoring program is conducted in accordance with generally accepted practices and the requirements of the New Mexico Department of Game and Fish. Data will be collected, recorded, stored and analyzed. Actions will be taken as necessary to reconcile anomalous results.

6.3.11.1 Data Recording and Storage

Data relevant to the ecological monitoring program will be recorded in paper and/or electronic forms. These data will be kept on file for the life of the facility.

7.0 COST BENEFIT ANALYSIS

This chapter describes the costs and benefits for the proposed action, quantitatively and qualitatively. Environmental Report (ER) Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, describes the quantitative direct and indirect economic impacts from plant construction and operation. ER Section 7.2 describes the qualitative socioeconomic and environmental impacts from plant construction and operation. ER Section 7.3, No-Action Alternative Cost-Benefit, describes the impacts of the no-action alternative of not building the proposed NEF.

7.1 ECONOMIC COST-BENEFITS, PLANT CONSTRUCTION AND OPERATION

This analysis traces the economic impact of the proposed National Enrichment Facility (NEF) in Lea County, New Mexico, identifying the direct impacts of the plant on revenues of local businesses, on incomes accruing to households, on employment, and on the revenues of state and local government. Further, it explores the indirect impacts of the NEF on local entities using a model showing the interaction of economic sectors in Lea County.

7.1.1 Introduction

The purpose of ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, is to assess the economic impact that the construction and operation of the NEF would have on the surrounding area, including Lea and Eddy Counties in New Mexico. The analysis estimates the economic impact upon a contiguous eight-county region, comprised of the two previously identified New Mexico Counties, as well as six directly affected Texas Counties falling within a 80-km (50-mi) radius of the proposed site. These include Andrews, Ector, Gaines, Loving, Winkler, and Yoakum Counties. (See Figure 7.1-1, Eight-County Economic Impact Area.)

For the purpose of assessing the economic impact of the NEF, the analysis is divided into two distinct phases: Construction and Operations. For each of these two time periods, both the direct and indirect impacts are assessed.

ER Section 7.1.3, Regional Economic Outlook, discusses current economic conditions and existing economic structure of the eight-county region. ER Section 7.1.4, Direct Economic Impact, is a discussion of the direct impacts associated with the NEF, which includes earnings, employment, and tax-related revenues. ER Section 7.1.5, Total Economic Impact Using RIMS II, utilizes the Regional Input-Output Modeling System (RIMS) II framework to assess the total (both direct and indirect) economic impact of the NEF on the regional economy. The origin, general operation, and specific application of the RIMS II framework to the proposed action are discussed below.

7.1.2 The Economic Model

The RMIS II multipliers presented in this report reflect input-output (I-O) data for the 1999 annual I-O table for the nation and 2000 regional data, which shows the input and output structure for approximately 500 industries (BEA, 2003a).

The RIMS II method for estimating regional I-O multipliers can be viewed as a three-step process. In the first step, the producer portion of the national I-O table is made region-specific by using four-digit Standard Industrial Classification (SIC) location quotients (LQ's). The LQ's estimate the extent to which input requirements are supplied by firms within the region. RIMS II uses LQ's based on two types of data: The Bureau of Economic Analysis' (BEA's) personal income data (by place of residence) are used to calculate LQ's in the service industries; and BEA's wage-and-salary data (by place of work) are used to calculate LQ's in the nonservice industries.

In the second step, the household row and the household column from the national I-O table are made region-specific. The household row coefficients, which are derived from the value-added row of the national I-O table, are adjusted to reflect regional earnings leakages resulting from individuals working in the region but residing outside the region. The household column coefficients, which are based on the personal consumption expenditure column of the national I-O table, are adjusted to account for regional consumption leakages stemming from personal taxes and savings.

In the last step, the Leontief inversion approach is used to estimate multipliers. This inversion approach produces output, earnings, and employment multipliers, which can be used to trace the impacts of changes in final demand on directly and indirectly affected industries (BEA 2003b).

7.1.2.1 RIMS II Multipliers

A RIMS II model provides "multipliers" for approximately 500 industries showing the industry outputs stimulated by new activity, the associated household earnings, and the jobs generated.

The RIMS II model of Lea County, New Mexico is based on the National Input-Output table, employment statistics from the Bureau of Labor Statistics, and the Regional Economic Information System (REIS). The National table is regionalized using location quotients, which compare the local proportion of industry employment to total employment to a similar proportion for the Nation. The model is solved to generate a very large table of multipliers for the entire set of industries existing in the county.

Since the 1970s, the Bureau of Economic Analysis (BEA) has provided models designated as RIMS (Regional Industrial Multiplier System). RIMS II is the latest version of this system. The following comments are based on Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II) (BEA, 1997).

RIMS II is based on an accounting framework called an input-output (I-O) table. For each industry, an I-O table shows the distribution of the inputs purchased and the outputs sold. A typical I-O table in RIMS II is derived mainly from two data sources: BEA's national I-O table, which shows the input and output structure of nearly 500 US Industries, and BEA's regional economic accounts, which are used to adjust the national I-O table in order to reflect a region's industrial structure and trading patterns.

The RIMS II model and its multipliers are prepared in three major steps. First, an adjusted national industry-by-industry direct requirements table is prepared. Second, the adjusted national table is used to prepare a regional industry-by-industry direct requirements table. Third, a regional industry-by-industry total requirements table is prepared, and the multipliers are derived from this table.

Unlike the national I-O accounts, RIMS II includes households as both suppliers of labor inputs to regional industries and as purchasers of regional output, because it is customary in regional impact analysis to account for the effects of changes in household earnings and expenditures. Thus, both a household row and a household column are added to the national direct requirements table before the table is regionalized.

The regional industry-by-industry direct requirements table is derived from the adjusted national industry-by-industry direct requirements table. Location quotients (LQ's) are used to "regionalize" the national data. The LQ based on wages and salaries is the ratio of the industry's share of regional wages and salaries to that industry's share of national wages and salaries. The LQ is used as a measure of the extent to which regional supply of an industry's output is sufficient to meet regional demand. If the LQ for a row industry in the regional direct requirements table is greater than, or equal to, one, it is assumed that the region's demand for the output of the row industry is met entirely from regional production. In this instance, all row entries for the industry in the regional direct requirements table are set equal to the corresponding entries in the adjusted national direct requirements table.

Conversely, if the LQ is less than one, it is assumed that the regional supply of the industry's output is not sufficient to meet regional demand, In this instance, all row entries for the industry in the regional direct requirements table are set equal to the product of the corresponding entries in the adjusted national direct requirements table and the LQ for the industry.

The household row and the household column that were added to the national direct requirements table are also adjusted regionally. The household-row entries are adjusted downward, on the basis of commuting data from the Census of Population, in order to account for the purchases made outside the region by commuters working in the region. The household-column entries are adjusted downward, on the basis of tax data from the Internal Revenue Service, in order to account for the dampening effect of State and local taxes on household expenditures.

After the regional direct-requirements table is constructed it is converted into a model using a mathematical process known as "inversion." The resulting model, summarized in a 490-by-490 matrix called the "total requirements" table, now shows the impact of changes in outside sales by each industry on the outputs of every industry in the region. This data can now be manipulated to yield "multipliers."

The output multiplier for an industry measures the total dollar change in output in all industries that results from a $1 change in output delivered to final demand by the industry in question.

The earnings multiplier for an industry measures the total dollar change in earnings of households employed by all industries that results from a $1 change in output delivered to final demand by the industry in question.

7.1.3 Regional Economic Outlook

A socioeconomic profile of the eight-county region surrounding the NEF provides a baseline from which to understand and measure the economic impacts expected to be derived from the NEF. This section includes a discussion of recent regional trends in output and employment, income and other socioeconomic measures and concludes with a brief discussion on the industry structure of the region.

7.1.3.1 Recent Trends in Economic Growth and Employment

The eight-county region has a total current estimated population of 270,000 with 40% of the region's population residents of New Mexico and the remaining 60% residents of Texas.

After rising through the late 1990s, economic growth in New Mexico and Texas slowed in 2001 along with the slowdown in growth of the US economy. Statewide, the Texas economy was hit especially hard from the fallout in the technology sector and weakness in the air transportation sector after the terrorist attacks of September 11, 2001 (Yücek, 2003). The Texas gross state product growth rate declined sharply from 8.8% per annum in 2000 to 3.5% per annum in 2001. Total employment fell 1.4% in 2001 - a greater decline than the 1.1% decrease in employment nationwide - and fell another 0.1% in 2002. The Texas unemployment rate reached an eight-year high of 6.4% in 2002. While the employment situation is beginning to show some signs of recovery (with annual job growth rising 0.8% through May 2003) the recovery is said to be slow and inconsistent across industries (Yücek, 2003). The employment situation for the six Texas Counties included in the analyzed region was worse, with a weighted average unemployment rate of 6.9% in 2002 (that was notably higher than the Texas statewide rate of 6.4%).

In contrast to Texas, New Mexico economic growth slowed during this period, but the annual growth rate in gross state product remained above 5.0% in 2001. According to data published by the BEA, the relative resilience of the New Mexico economy appears to have been related to high government spending and strong manufacturing activity during this unfavorable economic period. Additionally, the unemployment rate in New Mexico rose to 5.5% in 2002, but remained below the national average. In 2002, the two New Mexico Counties analyzed had a 5.5% weighted average unemployment rate, which was consistent with the statewide unemployment rate.

7.1.3.2 Trends in Income

While per capita income in both New Mexico and Texas is below the national average of $22,000, standing at $17,000 and $20,000 respectively, per capita income is notably lower in the eight-county region. For this region as a whole, per capita income was $15,794. This amount is only 73% of the national per capita income. Lea and Eddy Counties in New Mexico had an average per capita income of $15,004, and the six Texas Counties had an average per capita income of $16,058 (DOC, 2002).

While total personal income has increased steadily in the two New Mexico Counties through the 1990s, those counties' total income as a percent of statewide income has declined slightly from 3.2% in 1990, to 2.8% in 2001, reflecting the relatively weak economic performance of the region during the past decade. Additionally, the poverty rate in the eight-county area is significantly higher than the state and national level. Within this region, reported poverty rates range from 16 to 22% of residents, versus the national rate of 12.4%. The Census Bureau defines poverty as those living under specified income thresholds (defined by the Office of Management and Budget) that vary by size of family and composition).

According to LES estimates, the specific jobs created by the NEF will pay wages significantly higher than the regional average income (LES, 2003a). The BEA data reports the 2001 average wage per job in the New Mexico and Texas Counties as $28,013 and $29,799, respectively. In contrast, LES expects to pay an average salary of $39,124 to its construction employees, which is over 1.3 times the average wage per job in the affected Counties. Similarly, LES expects to pay an average salary of $50,000 to its plant operation employees (see Table 7.1-1, Operating Plant Payroll Estimates). (Unless otherwise stated, all fiscal impacts are stated in 2002 real dollars based on the estimated costs and wages/benefits data provided, and are not adjusted for anticipated price or wage inflation over the period analyzed).

7.1.3.3 Regional Industry Analysis

Mining (primarily oil, natural gas, and potash production activities) has been one of the largest and most important industries in the eight-county region throughout the most recent economic history (see Figure 7.1-2, Private Employment in Eight-County Region). According to the BEA, the mining sector directly accounted for 18.6% of total private employment in Lea and Eddy Counties in 2000 and approximately 14% in the eight-county region (BEA, 2003a). More importantly, the dominance of the oil and gas industry in the regional economy is significantly greater when indirect income and employment are considered. (Relying on the RIMS II Multipliers for the eight-county region, the total income and employment generated from the mining sector accounts for nearly 50% of the private sector income and employment). (See Figure 7.1-2, Private Employment in Eight-County Region.)

Unfortunately, mining sector employment in the eight-county region has been declining in recent years, falling 27% from 1990 to 2000 amid increased domestic and foreign competition and consolidation in (primarily) the potash industry. The mining sector was the only major sector in the eight-county region to decline over the past decade. (See Figure 7.1-3, Mining as a Share of Private Employment in Eight-County Region.)

Other important regional industries include agriculture, forestry, and services in education and healthcare. Although accounting for only 2% of employment in the eight-county region, agricultural employment was the fastest growing private sector during 1990s, increasing 43% to 2,233 jobs. While oil and gas continues to have a significant impact, agriculture has underlying influences on the region's development through an active dairy industry, farming, and ranching (EDCLC, 2000). During the last decade, the construction and service industries were also among the fastest growing employment sectors in the eight-county regional economy, enjoying double-digit growth rates.

Although growth in manufacturing employment became a source of strength for central New Mexico in the mid-1990s, it was one of the slower growing employment sectors in the eight-county region, growing only 5% over the 1990s, and currently making up 6.3% of private employment for the region. Additionally, growth in manufacturing employment was somewhat sporadic in Lea and Eddy Counties, declining in 1998 through 2000, and comprising only 3.3% of private employment in these counties by the end of the century.

In the operations phase, the proposed NEF will produce a 14% increase in manufacturing employment in Lea and Eddy Counties. More importantly, however, the introduction of the NEF should work to diversify and stabilize the regional economy as it reduces the dependence on the mining sectors. The development of non-mining industries in this region is especially important as many of the petroleum producing formations in the Permian Basin have reached secondary and tertiary stages of production, and are in normal production decline associated with mature oil and gas production properties. Importantly, revenue and employment volatility associated with petroleum production increases as the production techniques become more expensive in mature fields.

7.1.4 Direct Economic Impact

7.1.4.1 Introduction

In building and operating the NEF, LES direct expenditures are expected to create a total economic impact calculated to provide a discounted present value benefit of $469 million accruing to local employees, businesses, and the government over the eight-year construction period and anticipated 30-year license period for the facility. (The present value is calculated by discounting the annual construction expenditures over a 8-year period and the annual operation expenditures over a 30-year period (NEF license period) using an 8% discount rate. All figures in this analysis are expressed in 2002 dollars, and are not adjusted for inflation over the referenced time period. It should be noted that expenditures occurring beyond a twenty-year time horizon contribute little to the discounted present value economic benefits, as the discounting of those expenditures provide nominal contributions to the assessed present value). Of this amount, 44%, or approximately $204 million, will go to households in the form of salaries, employment, and benefits. Approximately $261 million, or 56% will go to local business in the form of goods and services purchased and the remaining one percent will be paid to the government in the form of state and local taxes and fees. (See Figure 7.1-4, Total Present Value of Expected LES Expenditures.)

LES has estimated the economic impacts to the local economy during the 8-year construction period and 30-year license period of the NEF. This includes a five and one-half year period when both construction and operation and ongoing simultaneously. The analysis traces the economic impact of the proposed NEF, identifying the direct impacts of the plant on revenues of local businesses, on incomes accruing to households, on employment, and on the revenues of state and local government. The analysis also explores the indirect impacts of the NEF within a 80-km (50-mi) radius of the NEF. Details of the analysis are provided below.

7.1.4.2 Construction Expenditures

LES estimates that it will spend $397 million locally on construction expenditures over an 8-year period. Approximately 31% of the total construction costs will be spent on payroll, totaling $122.2 million. This amount is augmented with the inclusion of the $21.4 million in benefits paid to construction employees. (See Figure 7.1-5, Total Construction Expenditures: $397 Million Over Eight Years.)

LES estimates that the construction phase will create an annual average of 397 new jobs over this period, with peak construction employment estimated at 800 jobs in 2009 (see Table 7.1-2, Annual Impact of Construction Payroll). A majority of these jobs will exist in the first four years of construction, and will be at salary levels ranging between $34,000 and $49,000 annually. Figure 7.1-6, Estimated Construction Jobs by Annual Pay, depicts direct employment during the eight-year construction period, grouping jobs by salary range.

The regional construction work force appears to be large enough to support the employment needs for the construction of the NEF. According to 2000 data published by the Bureau of the Census, the construction labor force in Lea County is made up of about 1,200 workers. The construction labor force in the New Mexico Counties (Lea and Eddy Counties) totals more than 3,000 employees, and totals approximately 9,000 construction sector employees for the entire 8-county region. The estimated 397 new construction jobs would represent employment of 13% of the existing construction labor force in the two-New Mexico County region, and 4.5% of the existing eight-county region construction labor force. LES estimates that most construction employees will come from the local labor pool, however, a few positions that require specialized skills may be filled by non-local residents.

The remainder of the construction expenditures will be spent locally on construction goods and services, benefiting local businesses. (See Table 7.1-3, Total Impact of Local Spending for Construction Goods and Services, for additional details of local construction expenditures.)

7.1.4.3 Operation Expenditures

During the operation period, LES estimates that it will spend $10.5 million on operating payroll annually and an additional $3.2 million in benefits. The operation of the plant is expected to generate approximately 210 permanent, full-time jobs. LES will pay a weighted average annual salary of $50,000, which is 1.7 times greater than the average wage per job for the eight-county region. Additionally, as shown in Table 7.1-1, Operating Plant Payroll Estimates, 90% of the jobs will have an annual pay of $42,000 or higher. According to LES, employment opportunities will range from plant operations, maintenance and health physics positions to clerical and security-related jobs. LES plans to provide extensive training for employees, and approximately 20% of employment opportunities will involve an advanced understanding of the NEF. (See Table 7.1-4 for information on the annual impact of operations payroll.)

The local labor force appears to be well positioned for these types of jobs. The total Lea County labor force stands at approximately 25,604 and the Eddy County labor force is an additional 23,957. The total eight-county labor force totals approximately 129,000. Within the eight-county region, between 6% and 14% of the individual county residents have at least a bachelors degree and between 56% and 86% of the individual county residents have graduated from high school (DOC, 2002).

Approximately $9.6 million per year will be spent locally on goods and services, benefiting local businesses. (See Table 7.1-5, Annual Impact of NEF Purchases, below for additional details of local NEF purchases.)

7.1.4.4 Other Expenditures

LES anticipates annual payroll to be $10.5 million with additional $3.2 million expenditure in employee benefits once the plant is operational. Approximately $9.6 million will be spent annually on local goods and services required for operation of the NEF.

The tax revenue to the State of New Mexico and Lea County resulting from the construction and operation of the NEF is estimated to range from $177 million up to $212 million. Refer to Tables 4.10-2, Estimated Tax Revenue, and 4.10-3, Estimated Tax Revenue Allocations, for further details.

Using the New Mexico and Lea County income tax rates and the estimated household income generated (directly and indirectly) from the NEF, it is estimated that income taxes could total as much as $4 million each year during the 8-year construction period and $2 million each year during the anticipated 30-year license period. Additionally, using the estimated total (direct and indirect) new business activity associated with the NEF, gross receipts taxes from local business could total as much as $3 million per year during the 8-year construction period and $928,000 per year during the anticipated 20-year operation period.

Of course, not all of the economic benefits from construction and operations of the NEF can be quantified. For example, due to the relatively small size of the manufacturing sector in this eight-county region, the opening of the NEF should have positive spillover effects throughout the region, such as increasing the skill level of the local labor force and potentially attracting other manufacturing firms. In addition to increasing the role of the manufacturing sector within the region, the NEF will help to diversify the regional economy and provide some additional insulation from the volatility of the oil and gas dependent economy of the region. Additionally, housing values have the potential to increase from current levels as income and relatively high-paying job opportunities in the area grow, potentially attracting new residents. In 2000, the median housing value in the eight-county region was $40,313, which is less than half of New Mexico, Texas, and U.S. levels (DOC, 2002).

7.1.5 Total Economic Impact Using RIMS II

7.1.5.1 Introduction

The RIMS II Methodology, first created by the BEA in the 1970s, is based on an accounting framework called an Input-Output (I-O) table. For each industry, an I-O table shows the distribution of the inputs purchased and the outputs sold among individual sectors of a national or regional economy. Using RIMS II for impact analysis has several advantages. RIMS II multipliers can be estimated for any region composed of one or more counties and for any industry or group of industries characterized in the national I-O table. According to empirical tests, the estimates based on RIMS II are similar in magnitude to the estimates based on relatively expensive surveys. This analysis utilized the RIMS II regional I-O Multipliers for the eight-county, Hobbs-Odessa-Midland, New Mexico-Texas Region based on data obtained from the BEA (BEA 2003a).

7.1.5.2 Construction Impacts

LES estimates that it will spend $122.2 million on payroll over the 8-year construction period. It is possible to compute the total annual impact by converting this amount into an average annual number and using RIMS II Multipliers. An annual payroll of approximately $15 million is expected to generate a total impact on earnings equal to $24 million (i.e., $15 million direct impact, and $8 million indirect impacts) within the 8-county region. The initial annual average 397 direct jobs created during the 8-year construction period are expected to produce a total employment increase of 650 jobs through the construction period. This total direct and indirect economic impact would result in a 1.0% and 0.7% increase (respectively) in total non-mining, private sector personal income and employment, respectively, for the eight-county region.

LES estimates that it will spend between $265 and $462 million on goods and services in the local economy over the 8-year construction period. Using the minimum amount of expected purchases and RIMS II Final Demand Multipliers, these expenditures are expected to generate a total annual output amounting to $53 million and total annual earnings of $15 million. Additionally, these expenditures are expected to produce a total of 452 new jobs per year.

To summarize, the construction phase of the project is expected to generate a total impact of $53 million in output for local businesses, $38 million in household earnings, and 1,102 new jobs. The total impact figures from the construction period are derived from adding the total impacts from construction payroll and employment and local construction expenditures. The output figure comes directly from Table 7.1-3, Total Impact of Local Spending for Construction Goods and Services, and the household earnings figures come from adding the total annual impact on earnings from Table 7.1-2, Annual Impact of Construction Payroll and Table 7.1-3, Total Impact of Local Spending for Construction Goods and Services, as does the total new jobs figure. (See Figure 7.1-7, Annual Flow of Direct and Indirect Economic Benefits Associated with NEF Construction below for the annual flow of benefits associated with the NEF construction period.)

7.1.5.3 Operations Impact

Upon completion of the NEF's construction, LES estimates that it will spend $10.5 million on plant operations payroll and an additional $3.2 million in benefits annually. Using the RIMS II Multipliers, total additional earnings of $20 million will be produced, which would result in a 0.8% increase in total non-mining, private sector income in the eight-county region. Additionally, a total employment impact is estimated at 694 additional jobs, which would result in a 0.7% increase in the 8-county region non-mining, private sector employment.

Lastly, the estimated $9.6 million in annual purchases by LES of goods and services associated with the plant operation are expected to have a total annual impact on local business revenues equal to $14.6 million, $3.3 million for household income, and an increase in employment of 88 jobs.

To summarize, the operations phase of this project is expected to generate a total annual impact of $14.6 million in output for local businesses, $23 million in household earnings, and 782 new jobs. The total impact figures from the operations period are derived from adding the total impacts from operations payroll and local expenditures. The output figure comes directly from Table 7.1-5, Annual Impact of NEF Purchases, the household earnings figure comes from adding the total annual impact on earnings from Table 7.1-4, Annual Impact of Operations Payroll and Table 7.1-5, Annual Impact of NEF Purchases as does the total new jobs figure. (See Figure 7.1-8, Annual Flow of Direct and Indirect Economic Benefits Associated with NEF Operations for annual flows of economic benefits associated with the NEF operation period.)

7.1.6 Section 7.1 Tables

Table 7.1-1 Operating Plant Payroll Estimates

Level	Proportion	Jobs #	Average Pay	Total Payroll
Management	10%	21	$95,000	$1,995,000
Professional	20%	42	$62,000	$2,604,000
Skilled	60%	126	$42,000	$5,292,000
Administrative	10%	21	$30,000	$ 630,000
Total	**100%**	**210**		**$10,521,000**

Table 7.1-2 Annual Impact of Construction Payroll

	RIMS II Direct Effect Multipliers	**Impact**	**Regional Increase in Non-Mining Sector**
Direct Impact on:			
Earnings by Households		$15,273,750	
Indirect Impact on:			
Earnings by Households	0.5491	$8,386,816	
Total Impact on:			
Earnings by Households	1.5491	$23,660,566	1.0%
Direct Impact on:			
Employment (jobs)		397	
Indirect Impact on:			
Employment (jobs)	0.6385	253	
Total Impact on:			
Employment (jobs)	1.6385	650	0.7%

Table 7.1-3 Total Impact of Local Spending for Construction Goods and Services

Industry	Local Purchases	Final Demand Multipliers			Total Impact			
		Output	Earnings	Employment*	Output	Earnings	Job-years	Jobs/year
Concrete	$5,000,000	1.7112	0.5087	16.4093	$8,556,000	$2,543,500	82	10
Reinforcing Steel	$500,000	1	0	0	$500,000	$0	0	0
Structural Steel	$2,000,000	1	0	0	$2,000,000	$0	0	0
Lumber	$250,000	1	0	0	$250,000	$0	0	0
Site Preparation – Total	$20,000,00	1.6002	0.4459	13.7205	$32,004,000	$8,918,000	274	34
Transportation (freight on all materials)	$2,000,000	1.7782	0.5066	17.6983	$3,556,400	$1,013,200	35	4
Subcontracts by type of service								
Precast Concrete	$20,000,000	1.6002	0.4459	13.7205	$32,004,000	$8,918,000	274	34
Multiple Arch/Bldg. Packages	$40,000,000	1.6002	0.4459	13.7205	$64,008,000	$17,836,000	549	69
Equipment Installation Packages	$25,000,000	1.6002	0.4459	13.7205	$40,005,000	$11,147,500	323	43
Mechanical/Piping/HVAC Packages	$75,000,000	1.6002	0.4459	13.7205	$120,015,000	$33,442,500	1029	129
Electrical/Controls Packages	$75,000,000	1.6002	0.4459	13.7205	$120,015,000	$33,442,500	1029	129
Total	$264,750,000				**$422,913,400**	**$117,261,200**	**3616**	
Per Year (over 8-year period)	$33,093,750	*The employment multiplier is measured on the basis of $1 million change in output delivered to final demand.			**$52,864,175**	**$14,657,650**		**452**
				Indirect Impact	**$19,770,425**			

Table 7.1-4 Annual Impact of Operations Payroll

	RIMS II Direct Effect Multipliers	Impact	Regional Increase in Non-Mining Sector
Direct Impact on:			
Earnings by Households		$10,521,000	
Indirect Impact on:			
Earnings by Households	0.8969	$9,436,285	
Total Impact on:			
Earnings by Households	1.8969	$19,957,285	0.8%
Direct Impact on:			
Employment (jobs)		210	
Indirect Impact on:			
Employment (jobs)	2.3039	484	
Total Impact on:			
Employment (jobs)	3.3039	694	0.7%

Table 7.1-5 Annual Impact of NEF Purchases

Item	Local Purchases	Final Demand Multipliers			Total Impact on 8-County Region		
	(Direct Impact)	Output	Earnings	Employment*	Output	Earnings	Employment
Landscaping	$75,000	1.6154	0.7509	38.1785	$121,155	$56,318	3
Protective Clothing	$30,000	1.4698	0.3211	13.4385	$44,094	$9,633	0
Laboratory Chemicals	$50,000	1.7137	0.3411	6.4671	$85,685	$17,055	0
Plant Spare Equipment	$170,000	1.4774	0.3783	10.722	$251,158	$64,311	2
Office Equipment	$160,000	1	0	0	$160,000	$0	0
Engineered Parts	$150,000	1.6005	0.5761	16.6379	$240,075	$86,415	2
Electrical/Electronic Parts	$220,000	1.5052	0.4576	14.8929	$331,144	$100,672	3
Electricity	$7,000,000	1.5129	0.2892	5.4635	$10,590,300	$2,024,400	38
Natural Gas	$56,000	2.8977	0.3734	7.3419	$162,271	$20,910	0
Waste Water	$93,000	1.7537	0.4507	11.9573	$163,094	$41,915	1
Solid Waste Disposal	$3,000	1.7537	0.4507	11.9573	$5,261	$1,352	0
Insurance	$0	1.5546	0.5486	17.6514	$0	$0	0
Catering	$50,000	1.5453	0.4801	30.1599	$77,265	$24,005	2
Building Maintenance	$370,000	1.5772	0.4727	14.819	$583,564	$174,899	5
Custodial Services	$250,000	1.7909	0.7261	41.7122	$447,725	$181,525	10
Professional Services	$180,000	1.6377	0.6922	18.8168	$294,786	$124,596	3
Security Services	$500,000	1.4976	0.6315	28.894	$784,800	$315,750	14
Mail, Document Services	$100,000	1.637	0.7074	19.4951	$163,700	$70,740	2
Office Supplies	$140,000	1	0	0	$140,000	$0	0
Total	$9,597,000	*The employment multiplier is measured on the basis of $1 million change in output delivered to final demand.			**$14,610,077**	**$3,314,496**	**88**
				Indirect Impact	**$5,013,077**		

7.1.7 Section 7.1 Figures

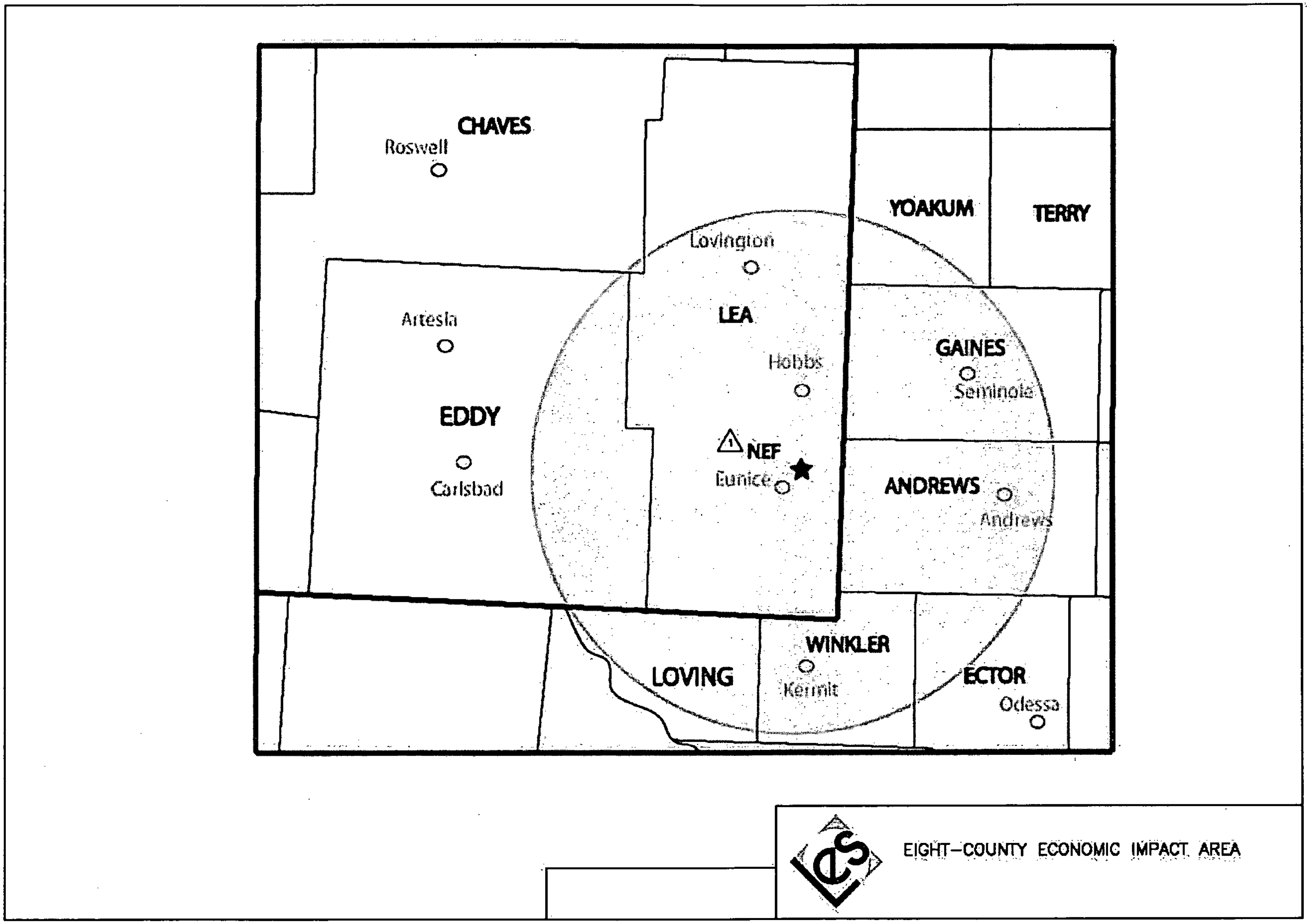


Figure 7.1-1 Eight-County Economic Impact Area

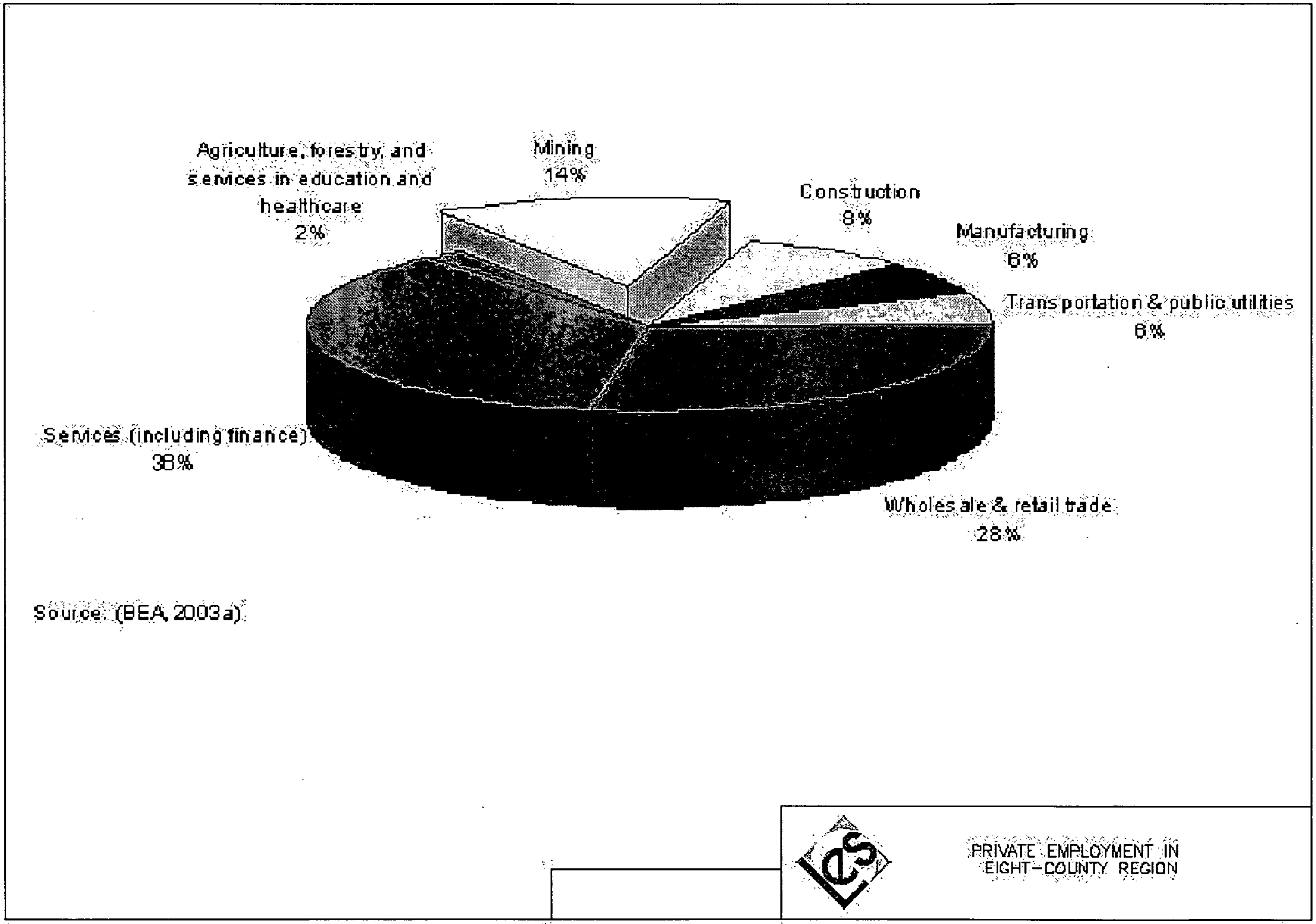
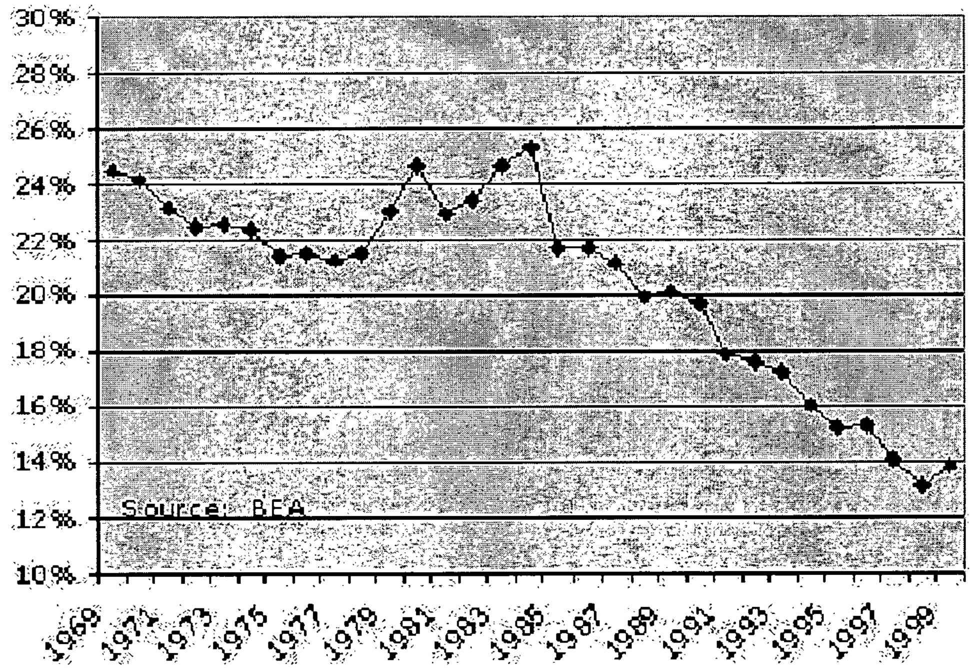


Figure 7.1-2 Private Employment in Eight-County Region



MINING AS A SHARE OF PRIVATE EMPLOYMENT IN EIGHT-COUNTY REGION

Figure 7.1-3 Mining as a Share of Private Employment in Eight-County Region

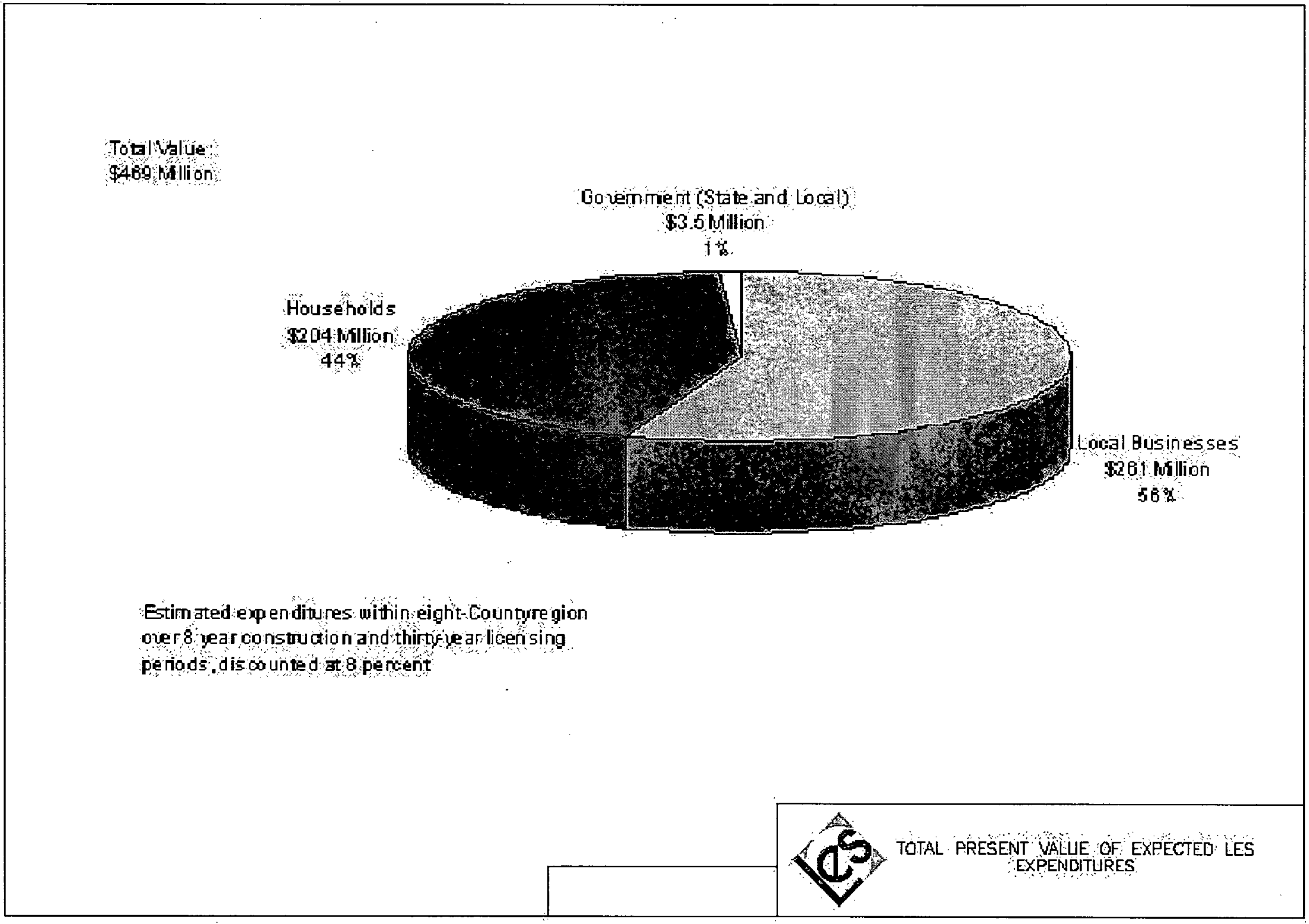


Figure 7.1-4 Total Present Value of Expected LES Expenditures

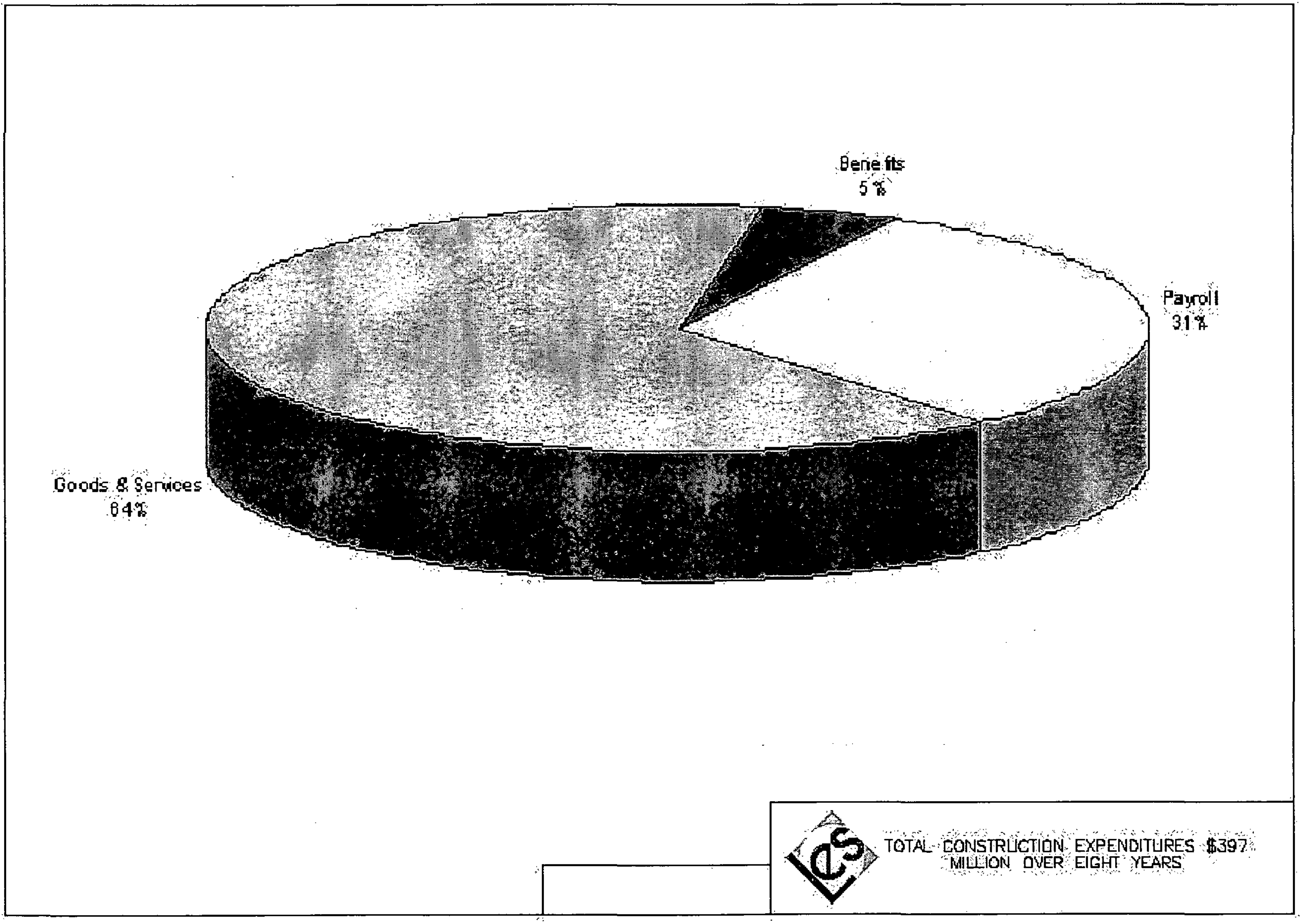
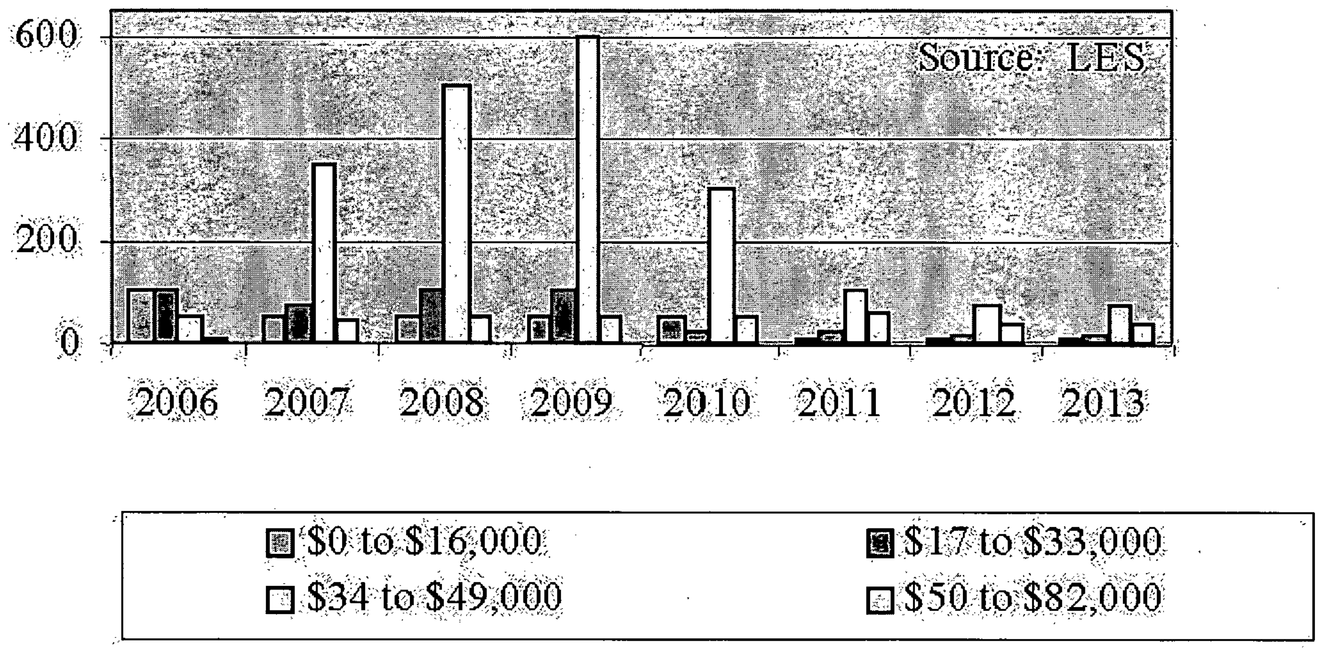


Figure 7.1-5 Total Construction Expenditures: $397 Million Over Eight Years



ESTIMATED CONSTRUCTION JOBS BY ANNUAL PAY

Figure 7.1-6 Estimated Construction Jobs by Annual Pay

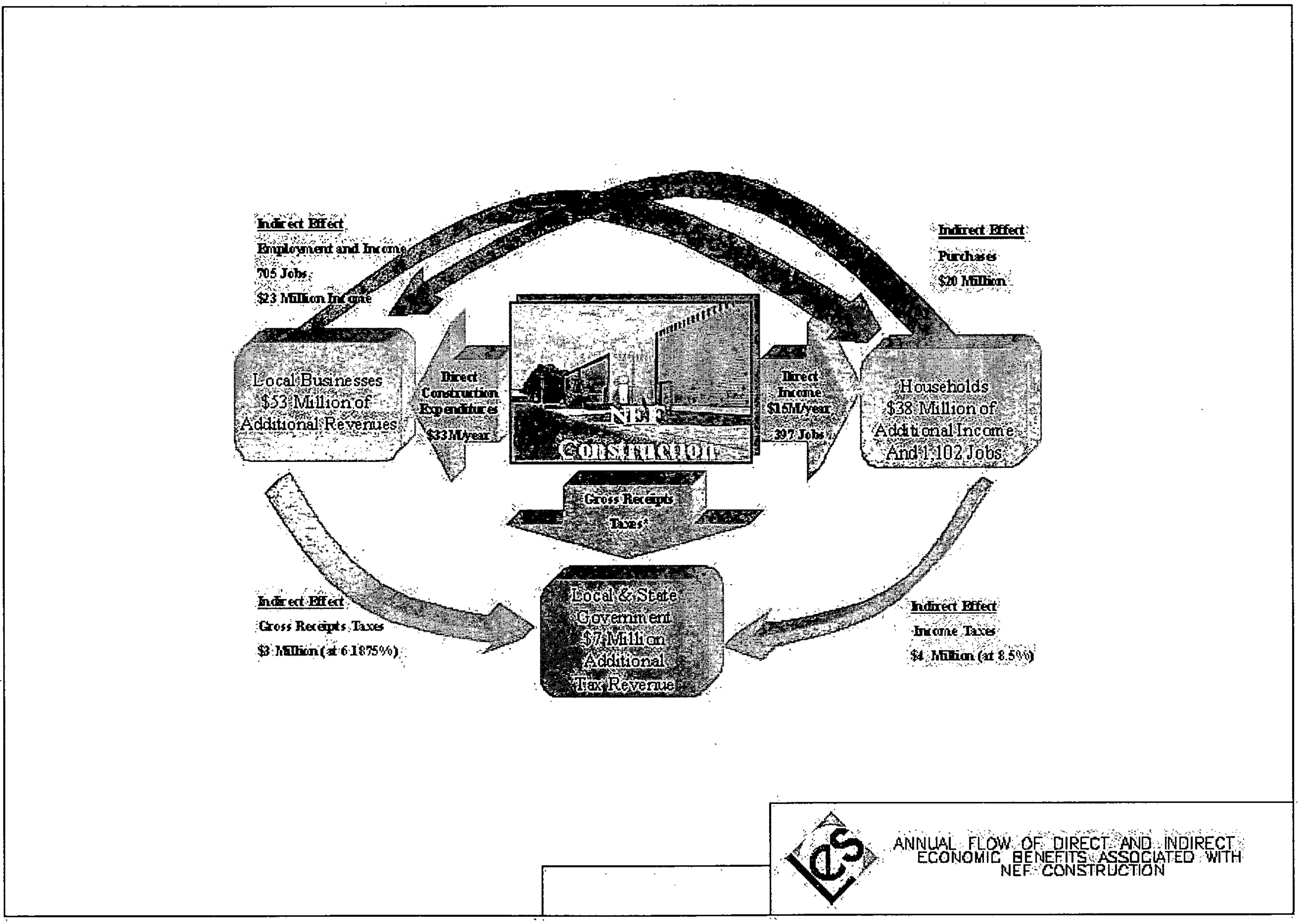


Figure 7.1-7 Annual Flow of Direct and Indirect Economic Benefits Associated with NEF Construction

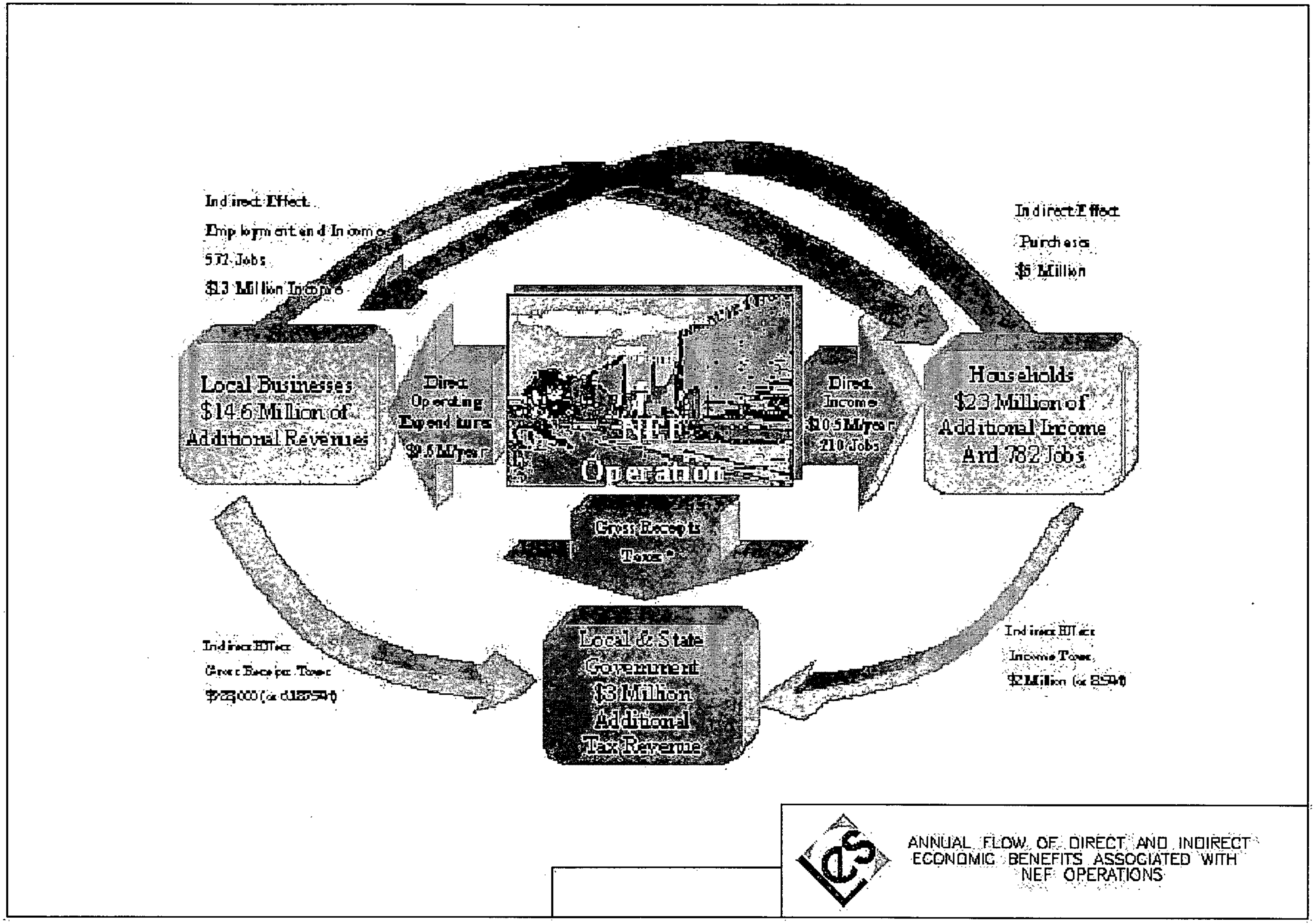


Figure 7.1-8 Annual Flow of Direct and Indirect Economic Benefits Associated with NEF Operations

7.2 ENVIRONMENTAL COST- BENEFIT, PLANT CONSTRUCTION AND OPERATION

This section describes qualitatively the environmental costs and benefits of the proposed NEF in Lea County, New Mexico. It identifies the impacts of the plant construction and operation on the site and adjacent environment. Table 7.2-1, Qualitative Environmental Costs/Benefits of NEF During Construction and Operation, summarizes the results.

7.2.1 Site Preparation and Plant Construction

7.2.1.1 Existing Site

There will be minimal disturbance to the existing site features at the project site associated with construction activities. Potentially, 220 ha (543-acres) could be subjected to clearing and earthmoving activities. Site property outside the primary plant area will generally be left in its preconstruction condition or improved through stabilization as needed.

7.2.1.2 Land Conservation and Erosion Control Measures

Louisiana Energy Services (LES) anticipates there will be some short-term increases in soil erosion at the site due to construction activities. Erosion impacts due to site clearing, excavation, if required, and grading will be mitigated by utilization of proper construction and erosion best management practices (BMPs). These practices include minimizing the construction footprint to the extent possible, mitigating discharge including stormwater runoff (i.e., the use of detention and retention ponds), the protection of all unused naturalized areas, and site stabilization practices to reduce the potential for erosion. Only about one-quarter of the site will be involved in construction activities at any one time. Cleared areas will be seeded as soon as practicable and watering will be used to control fugitive dust. Water conservation will be considered when deciding how often dust suppression sprays will be applied.

7.2.1.3 Aesthetic Changes

Visual and noise impacts due to site preparation and plant construction activities are anticipated to be minimal, due to the remote location of the site and the buffer zone along the outer perimeter of the property boundary. Some elevated and intermittent noise levels during construction may be discernable offsite but should not constitute an annoyance to nearby residences since the nearest resident is 4.3 km (2.63 mi) away. The visual intrusion of the NEF upon an otherwise relatively denuded landscape that constitutes the plant site property should not be objectionable given the vegetative buffer around the site and its remote location.

7.2.1.4 Ecological Resources

Pre-construction and construction activities at the site are not expected to have any significant adverse impact on vegetation and wildlife. LES anticipates that construction activities within the existing clear-cut area will remove some shrub vegetation and cause some small animal life to relocate on the site. No proposed activities will impact communities or habitats defined as rare or unique, or that support threatened and endangered species, since no such communities or habitats have been identified anywhere within the site.

7.2.1.5 Access Roads and Local Traffic

All traffic into and out of the site will be along New Mexico Highway 234 because Highway 234 is dedicated to heavy-duty use and built to industrial standards, it would be able to handle increased heavy-duty traffic adequately. Additionally, due to the already substantial truck traffic using these roads to access Andrews County, Texas there would be little additional effect on other road users.

7.2.1.6 Water Resources

Water quality impacts will be controlled during construction by compliance with the State of New Mexico's water quality regulations and the use of BMPs as detailed in the site Stormwater Pollution Prevention Plan (SWPPP). In addition, a Spill Prevention, Control and Countermeasure (SPCC) plan will be implemented to minimize the possibility of spills of hazardous substances, minimize the environmental impact of any spills and ensure prompt and appropriate remediation. Spills during construction are more likely to occur near vehicle maintenance and fueling operations, storage tanks, painting operations and warehouses. The SPCC plan will identify sources, locations and quantities of potential spills, and response measures. The plan will also identify individuals and their responsibilities for implementation of the plan and provide for prompt notifications of state and local authorities as needed.

7.2.1.7 Noise and Dust Control Measures

Objectionable construction noises are to be reduced to acceptable levels by use of noise control equipment on all powered equipment. Shrub and vegetation buffer areas, which will be left around the plant property, will combine to reduce noise. Since substantial truck traffic already exists along New Mexico State Highway 234, the temporarily increased noise levels along Highway 234 due to construction activities are not expected to adversely affect nearby residents.

Traffic areas during construction will be watered as necessary to prevent dust. Water conservation will be considered when deciding how often dust suppression sprays will be applied. All potential air pollution and dust emission conditions will be monitored to assure compliance with applicable health, safety, and environmental regulations.

7.2.1.8 Socioeconomic

Construction of the NEF is expected to have positive socioeconomic impacts on the region. The Regional Input-Output Modeling System (RIMS II) allows estimation of various indirect impacts associated with each of the expenditures associated with the NEF. According to the RIMS II analysis, the region's residents can anticipate an annual impact of $53 million in increased economic activity for local businesses, $38 million in increased earnings by households, and an annual average of 1,102 new jobs during the 8-year construction period. The temporary influx of labor is not expected to overload local services and facilities within the Hobbs-Eunice, New Mexico area.

7.2.1.8.1 Yearly Purchases of Steel, Concrete and Related Construction Materials

The initial construction period for NEF is approximately three years. This period will encompass site preparation and construction of most site structures. Due to the phased installation of centrifuge equipment, production will commence prior to completion of the initial three-year construction period. The manpower and materials used during this phase of the project will vary depending on the construction plan. Table 7.2-2, Estimated Construction Material Yearly Purchases, provides the estimated total quantities of purchased construction materials and Table 7.2-3, Estimated Yearly Labor Costs for Construction, provides the estimated labor that will be required to install these materials. The scheduling of materials and labor expenditures is subject to the provisions of the project construction execution plan, which has not yet been developed.

Approximately 60 to 80% of the construction materials will be purchased from the local NEF site area. According to the labor survey conducted as part of the conceptual estimate, the major portion of the required craft labor forces will come from the five or six counties around the project area, including the nearby Texas counties.

7.2.2 Plant Operation

7.2.2.1 Surface and Groundwater Quality

Liquid effluents at the NEF will include stormwater runoff, sanitary and industrial wastewater, and treated radiologically contaminated wastewater. Radiologically contaminated process water will be treated to 10 CFR 20, Appendix B limits (CFR, 2003q) and discharged to the Treated Effluent Evaporative Basin, which is a double-lined treated effluent evaporative basin with leak detection. Site stormwater runoff from the Uranium Byproduct Cylinder (UBC) Storage Pad is routed to the UBC Storage Pad Stormwater Retention Basin. The general site runoff is routed to the Site Stormwater Detention Basin. Stormwater discharges will be regulated by the National Pollutant Discharge Elimination System (NPDES) during operation. Approximately 174,100 m^3 (46 million gal) of stormwater from the plant site is expected to be released annually to the two stormwater basins.

7.2.2.2 Terrestrial and Aquatic Environments

No communities or habitats defined as rare or unique or that support threatened and endangered species, have been identified anywhere on the NEF site. Thus, no operation activities are expected to impact such communities or habitats.

7.2.2.3 Air Quality

No adverse air quality impacts to the environment, either on or offsite, are anticipated to occur. Air emissions from the facility during normal facility operations will be limited to the plant ventilation air and gaseous effluent systems. All plant process/gaseous air effluents are to be filtered and monitored on a continuous basis for chemical and radiological contaminants, which could be derived from the UF_6 process system. If any UF_6 contaminants are detected in ambient in plant air systems, the air is treated by appropriate filtration methods prior to its venting to the environment. Two emergency diesel generators that supply standby electrical power operate only in the event of power interruptions. They will have negligible health and environmental impacts.

7.2.2.4 Visual/Scenic

No impairments to local visual or scenic values will result due to the operation of the NEF. The facility and associated structures will be relatively compact, located in a rural location. No offensive noises or odors will be produced as a result of plant operations.

7.2.2.5 Socioeconomic

The Regional Input-Output Modeling System (RIMS) II allows estimation of various indirect impacts associated with each of the expenditures associated with the NEF. Over the anticipated thirty-year license period of the NEF, residents can anticipate an annual total of $15 million in increased economic activity, $23 million in increased earnings by households and an annual average of 782 jobs directly or indirectly relating to the NEF.

In general, no significant impacts are expected to occur for any local area infrastructure (e.g., schools, housing, water, and sewer). Costs of operation should be diffused sufficiently throughout the Hobbs-Eunice, New Mexico area to be indistinguishable from normal economic growth.

7.2.2.6 Radiological Impacts

Potential radiological impacts from operation of the NEF would result from controlled releases of small quantities of UF_6 during normal operations and releases of UF_6 under hypothetical accident conditions. Normal operational release rates to the atmosphere and to the onsite Treated Effluent Evaporative Basin are expected to be less than 8.9 MBq/yr (240 µCi/yr) and 2.1 MBq/yr (56µCi/yr), respectively.

The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from gaseous effluent to an adult located at the plant site south boundary are 1.7×10^{-4} mSv (1.7×10^{-2} mrem) and 1.4×10^{-3} mSv (1.4×10^{-1} mrem), respectively. The maximum effective dose equivalent and maximum annual organ (lung) dose equivalent from discharged gaseous effluent to the nearest resident (teenager) located 4.3 km (2.63 mi) in the west sector are expected to be less than 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.2×10^{-4} mSv (1.2×10^{-2} mrem), respectively.

The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from liquid effluent to an adult at the south site boundary are

1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.5×10^{-4} mSv (1.5×10^{-2} mrem), respectively. The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from liquid effluent to an individual (teenager) at the nearest residence are 1.7×10^{-6} mSv (1.7×10^{-4} mrem) and 1.3×10^{-5} mSv (1.3×10^{-3} mrem), respectively.

The maximum annual dose equivalent due to external radiation from the UBC Storage Pad and all other feed, product and byproduct cylinders on the NEF property (skyshine and direct) is estimated to be less than 2.0×10^{-1} mSv (20 mrem) to the maximally exposed person at the nearest point on the site boundary (2,000 hrs/yr) and 8×10^{-12} mSv/yr (8×10^{-10} mrem/yr) to the maximally exposed resident (8,760 hrs/yr) located at 4.3 km (2.63 mi) west of the NEF. Given the conservative assumptions used in estimating these values, these concentrations and resulting dose equivalents are insignificant and their potential impacts on the environment and health are inconsequential.

These dose equivalents due to normal operations are small fractions of the normal background radiation range of 2.0 to 3.0 mSv (200 to 300 mrem) dose equivalent that an average individual receives in the US, and within regulatory limits. .

7.2.2.7 Other Impacts of Plant Operation

NEF water will be obtained from the Eunice, New Mexico municipal water system, and routine liquid effluent will be treated and discharged to evaporative pond(s), whereas sanitary wastes will be discharged to onsite septic systems. Facility water requirements are relatively low and well within the capacity of the Eunice water utility. The current capacity for the Eunice Potable water supply system is 16,350 m^3/day (4.3 million gpd), and current usage is 5,600 m^3/day (1.48 million gal/d). Requirements for operation of the NEF are expected to be 240 m^3/day (63,423 gal/d), a volume well within the capacity of the supply system. Non-hazardous and non-radioactive solid waste is expected to be approximately 172,500 kg (380,400 lbs) annually. It will be shipped offsite to a licensed landfill. The local Lea County landfill capacity is more than adequate to accept the non-hazardous waste.

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7.2.2.8 Decommissioning

The plan for decommissioning is to decontaminate or remove all materials promptly from the site that prevent release of the facility for unrestricted use. This approach avoids the need for long-term storage and monitoring of wastes on site. Only building shells and the site infrastructure will remain. All remaining facilities, including site basins, will be decontaminated where needed to acceptable levels for unrestricted use. Excavations and berms will be leveled to restore the land to a natural contour.

Depleted UF_6 , if not already sold or otherwise disposed of prior to decommissioning, will be disposed of in accordance with regulatory requirements. Radioactive wastes will be disposed of in licensed low-level radioactive waste disposal sites. Hazardous wastes will be treated or disposed of in licensed hazardous waste facilities. Neither conversion (if done), nor disposal of radioactive or hazardous material will occur at the plant site, but at licensed facilities located elsewhere.

Following decommissioning, all parts of the plant and site will be unrestricted to any specific type of use.

7.2.3 Section 7.2 Tables

Table 7.2-1 Qualitative Environmental Costs/Benefits of NEF During Construction And Operation

Qualitative Costs	**Determination/Evaluation**
Change in real estate values in areas/communities adjacent to the facility (e.g., land, homes, rental property etc.)	Potentially inflationary
Traffic changes along local streets and highways	Some increases during shift changes
Demand on local services, public utilities, schools, etc.	Some increased utilization expected, but within services capacity
Impact to natural environmental components (e.g., ecology, water quality, air quality, etc.)	Minimal impacts
Alteration of aesthetic, scenic, historic, or archaeological areas or values	No measurable impact
Change in local recreational potential	Not significant
Qualitative Benefits	
Site soil stabilization and erosion reduction	Beneficial
Incentive for development of other ancillary/support business development resulting from presence of LES facility	Beneficial
Change in real estate values in areas/communities adjacent to the facility (e.g., land, homes, rental property etc.)	Potentially beneficial
Increase in local employment opportunities	Beneficial
Impacts to local retail trade and services	Beneficial
Development of local workforce capabilities	Beneficial

Table 7.2-2 Estimated Construction Material Yearly Purchases

Commodity	Quantity	Total Value (Material Cost)	Yearly Purchases
Concrete/Forms/Rebar	59,196 m^3 (77,425 yd^3)	$9,441,000	$9,441,000
Pre-Cast Concrete	120,774 m^2 (1,300,000 ft^2)	$25,232,000	$8,410,667
Structural Steel	1,865 t (2,056 tons)	$5,524,000	$5,524,000
Architectural Items	1 Lot	$26,995,000 Finishes, etc.	$26,995,000
HVAC Systems	109 Each	$27,098,000 Systems Mat'ls.	$27,098,000
Utility Piping	55,656 m (182,597 linear ft)	$20,777,000	$20,777,000
Electrical Conduit & Wire	361,898 m (1,187,328 linear ft)	$14,174,000	$7,087,000

Table 7.2-3 Estimated Yearly Labor Costs for Construction

Type of Work	Number Of Craft-Hours	Approx. No. People	Total Value	Yearly Purchases
Civil & Site Work	163,000	65 people for 1 year	$5,264,900	$5,264,900
Concrete Work	541,000	70 people for 3 years	$17,420,200	$5,806,733
Structural Steel	54,000	25 people for 1 year	$1,852,200	$1,852,200
Pre-cast Concrete	166,000	66 people for 1 year	$5,345,200	$5,345,200
Architectural Finishes	284,000	150 people for 1 year	$9,088,000	$9,088,000
Utility Equipment	23,000	15 people for 1 year	$969,450	$969,450
HVAC Sys. & Ductwork	186,000	40 people for 1 year	$6,175,200	$6,175,200
Electrical Conduit & Wire	280,000	70 people for 2 years	$10,556,000	$5,278,000

7.3 NO-ACTION ALTERNATIVE COST-BENEFIT

The no-action alternative would be to not build the proposed NEF. Under the no-action alternative, the NRC would deny the license application for the plant, in which case the proposed site is assumed to continue its current use and the potential impacts of constructing and operating the proposed NEF would not occur. Although the no-action alternative would avoid impacts to the NEF area, it could lead to impacts at other locations.

Under the no-action alternative, for example, reactor licensees would still need uranium enrichment services. LES estimates that the proposed NEF production (3 million SWU/Yr) represents about 25% of the estimated U.S. requirement for enrichment services in the year 2002. During the period 2003 through 2010, these US requirements are forecast to average 11.1 million SWU and during the 10-year period 2011 through 2020 they are forecast to average between 10.1 and 10.2 million SWU. Indigenous supply from the single, aging, high cost, and electric power intensive Paducah GDP, which is operated by USEC, could theoretically supply up to 6.5 million SWU of these requirements (55%). However, USEC has obligated much of the ongoing production from the Paducah GDP to meet the contractual requirements of some of its Far East customers. As a result, a significant amount of USEC's obligations to US customers are being met with a foreign source (Russian HEU-derived SWU) that USEC purchases under its contract as executive agent for the US government

Many US operators of nuclear power plants in the US, who are also the end users of uranium enrichment services in the US, view the present supply situation with concern. They see a world supply and requirements situation for economical uranium enrichment services that is presently in balance, exhibiting a potential for significant shortfall if plans that have been announced by two of the primary enrichers are not executed.

These US purchasers find that as a result of recent trade actions and substantial duties imposed on Eurodif, that one source of competitive enrichment services for US consumption has been significantly reduced for the foreseeable future. They view themselves as being largely dependent on a single enricher, USEC, whose only operating enrichment plant is the Paducah GDP. These purchasers are concerned that the primary source of enrichment services that USEC delivers for use in their nuclear power plants is obtained from Russia and could be vulnerable to either internal or international political unrest in the future. Also, they are concerned that neither the performance nor economics of the updated version of the DOE centrifuge technology that USEC is planning to use have been successfully demonstrated.

Not building the NEF, therefore, could have the following consequences:

- The inability to meet important considerations of energy and national security policy, namely the need for the development of additional, secure, reliable, and economical domestic enrichment capacity.
- Continued reliance on the high-cost, power-intensive, and inefficient technology now in use at the aging Paducah gaseous diffusion plant, or, alternatively, reliance on the proposed USEC gas centrifuge technology that, at present, is still under development and has yet to be deployed on a commercial scale.
- Continued extensive reliance on uranium enriched in foreign countries.
- The inability to ensure both security of supply and diverse domestic suppliers for U.S. purchasers of enrichment services.

- A possible uranium enrichment supply deficit with respect to the uranium enrichment requirements forecasts set forth in ER Section 1.1.2, Market Analysis of Enriched Uranium Supply and Requirements.

ER Section 2.4, Comparison of the Predictive Environmental Impacts, describes the environmental impacts of the no-action alternatives and compares them to the proposed action. Table 2.4-1, Comparison of Potential Impacts for the Proposed Action and the No-Action Alternatives and 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternatives, summarize that comparison in tabular form for the 13 environmental categories, described in detail in ER Chapter 4, Environmental Impacts. In sum, LES anticipates the affects to the environment of all no-action alternatives to be at least equal to or greater than the proposed action in the near term. There are potentially lesser impacts in the long term, but this is based on USEC's unproven commercially demonstrated technology or the availability of the speculative DOE HEU-derived supply source. In addition, under the no-action alternative, attainment of both important national policy and commercial objectives would be, at best, delayed.

The following types of impacts would be avoided in the Lea County area by the no-action alternative (see Table 2.1-1, Chemicals and Their Properties and Table 7.2-1, Qualitative Environmental Costs/Benefits of NEF During Construction and Operation). During construction, the potential, short-term impacts of soil erosion and fugitive emissions from dust and construction equipment; disruption to ecological habitats; noise from equipment; and traffic from worker transportation and supply deliveries. These impacts, as discussed in Chapter 4, are temporary and limited in scope due to construction BMPs. During operation, the no-action alternative would avoid increased traffic due to feed/product deliveries and shipments and worker transportation; increased demand on utility and waste services; and public and occupational exposure from effluent releases. These impacts, however, will be minimal because the area already has traffic from a nearby city and general trucking commerce; there is sufficient capacity of utility and waste services in the region; and effluent releases will be strictly controlled, maintained onsite, monitored, and maintained below regulatory limits.

While the no-action alternative would have no impact on the socioeconomic structure of the Lea County area, the proposed action would have moderate to significant beneficial effects (see Tables 7.1-1 through 7.1-5). The results of the economic analysis show that the greatest fiscal impacts (i.e., 63% of total present value impacts) will derive from the 8-year construction period associated with the proposed facility. The largest impact on local business revenues stems from local construction expenditures, while the most significant impact on household earnings and jobs is associated with construction payroll and employment projected during the 8-year construction period. Operation of the facility will also have a net positive impact on the eight-county area and will help diversify the regional economy and provide some additional insulation from the volatility of the oil and gas dependent economy of the region.

LES estimates that construction payroll will total $122.2 million with an additional $21 million expended for employment benefits over the 8-year construction period. Construction services purchased from third party firms within the region will add $265 million in direct benefits to the local economy during the NEF's construction.

LES anticipates annual payroll to be $10.5 million with an additional $3.2 million expenditure in employee benefits once the plant is operational. Approximately $9.6 million will be spent annually on local goods and services required for operation of the NEF.

The tax revenue to the State of New Mexico and Lea County resulting from the construction and operation of the NEF is estimated to range from $177 million up to $212 million. Refer to Tables 4.10-2, Estimated Tax Revenue, and 4.10-3, Estimated Tax Revenue Allocations, for further details.

The Regional Input-Output Modeling System (RIMS) II allows estimation of various indirect impacts associated with each of the expenditures associated with the operation of NEF. According to the RIMS II analysis, the region's residents can anticipate an annual total of $53 million in increased economic activity, $38 million in increased earnings by households, and an annual average of 1,102 new jobs during the eight-year construction period. Over the anticipated 30-year license period of the NEF, residents can anticipate an annual total of $15 million in increased economic activity, $23 million in increased earnings by households and an annual average of 782 new jobs directly or indirectly relating to the NEF. In general, no significant impacts are expected to occur for any local infrastructure areas (e.g., schools, housing, water, and emergency responders). Costs of operation should be diffused sufficiently to be indistinguishable from normal economic growth. Based on the above information, cost-benefit analyses in Section 7.1, Economic Cost-Benefits, Plant Construction and Operation and Section 7.2, Environmental Cost-Benefit, Plant Construction and Operation, and the minimal impacts to the affected environment demonstrated in Chapter 4, LES has concluded that the preferred alternative is the proposed action, construction and operation of the NEF.

8.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

8.1 INTRODUCTION

This Environmental Report (ER) was prepared by Louisiana Energy Services (LES) to assess the potential environmental impacts of licensing the construction and operation of a uranium enrichment facility to be located in Lea County, near the city of Eunice, New Mexico (the proposed action). The proposed facility will use the centrifuge enrichment process, which is an energy-efficient, proven advanced technology. The National Enrichment Facility (NEF) will be owned and operated by LES, as described in Safety Analysis Report (SAR) Chapter 1, General Information, which is a Delaware limited partnership company. LES prepared this ER in accordance with 10 CFR 51 (CFR, 2003a), which implements the requirements of the National Environmental Policy Act of 1969 (NEPA), as amended (USC, 2003a). This ER also reflects the applicable elements of the Nuclear Regulatory Commission (NRC) guidance, including format, in NUREG-1748, "Environmental Review Guidelines for Licensing Actions Associated with NMSS Programs,". This ER analyzes the potential environmental impacts of the proposed action and eventual Decontamination and Decommissioning (D&D) of the facility, and discusses the effluent and environmental monitoring programs proposed to assess the potential environmental impacts of facility construction and operation. The ER also considers a no-action alternative. LBDCR-07-0022

8.2 PROPOSED ACTION

The proposed action is to license the construction and operation of the NEF uranium enrichment facility in Lea County, near the city of Eunice, New Mexico. The NEF will use the gas centrifuge enrichment process to separate natural uranium hexafluoride UF_6 feed material containing 0.711 $^{w}/_{o}$ ^{235}U into a product stream enriched up to 5.0 $^{w}/_{o}$ ^{235}U and a depleted stream containing approximately 0.32 $^{w}/_{o}$ ^{235}U. Production capacity at design throughput is approximately 3.0 million separative work units (SWU) per year. Facility construction is expected to require eight years. Construction would be conducted in six phases. Operation would commence after the completion of the first cascade in the first phase. The facility is licensed for 30 years. Decontamination and Decommissioning (D&D) is projected to take approximately nine years. LES estimates the cost of the plant to be approximately $1.2 billion (in 2002 dollars) excluding escalation, contingency, interest, tails disposition, decommissioning, and any replacement equipment required during the operational life of the facility.

8.3 NEED FOR THE PROPOSED ACTION

The proposed action will serve the clear and well-substantiated need for additional reliable and economical uranium enrichment capacity in the United States. This underlying need for the proposed NEF stems directly from important US energy and national security concerns and the continuing demand for reliable and economical uranium enrichment services. As the Department of Energy (DOE) has noted (DOE, 2002a), these energy and national security concerns "...are due, in large part, to the lack of available replacement for the inefficient and non-competitive gaseous diffusion enrichment plants. These concerns highlight the importance of identifying and deploying an economically competitive replacement domestic enrichment capacity in the near term." By providing this needed additional domestic enrichment capacity, the NEF would also serve important commercial objectives related to the security of supply of enriched uranium in the US. At present, the enrichment services needs of US utilities are susceptible to "a supply disruption from either the Paducah plant production or the highly-enriched uranium (HEU) Agreement deliveries."

8.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the NRC would not approve the license application to construct and operate the proposed National Enrichment Facility (NEF). As a result, the additional domestic source and supply of enrichment services that would result from the issuance of the license to LES would not become available to utility customers. These potential LES utility customers would be required to fill their enrichment needs through existing suppliers, with USEC's Paducah plant being the only domestic facility available to serve this purpose. Thus, under the no-action alternative, a decision not to approve the license application would result in only one domestic source of enrichment services, a source that employs a high-cost, inefficient technology – a situation that the DOE has indicated could lead to "serious domestic energy consequences." (DOE, 2002a). ER Section 2.4, Comparison of the Predicted Environmental Impacts, describes the environmental impacts of the no-action alternative scenarios and compares them to the proposed action. Table 2.4-1, Comparison of Potential Impacts for the Proposed Action and the No-Action Alternative Scenarios and Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios, which summarizes that comparison in tabular form for thirteen environmental categories, are described in detail in Chapter 4, Environmental Impacts. In summary, LES anticipates that the effects to the environment of all no-action alternative scenarios to be greater than the proposed action in both the short and long term. There are potentially lesser impacts in some environmental categories, but this is based on an unproven commercially demonstrated technology. In addition, the important objective of security of supply is delayed.

The following types of impacts would be avoided in Lea County, New Mexico and the surrounding area by the no-action alternative (see ER Table 2.4-2). During construction, the potential, short-term impacts are soil erosion and fugitive emissions from dust and construction equipment; minor disruption to ecological habitats and cultural resources, noise from equipment; and traffic from worker transportation and supply deliveries. These impacts, as discussed in Chapter 4, are temporary and limited in scope due to construction best management practices (BMPs). During operation, the no-action alternative would avoid increased traffic due to feed/product deliveries and shipments, and worker transportation; increased demand on utility and waste services; and public and occupational exposure from effluent releases. These impacts, however, will be minimal because the local roadway (New Mexico Highway 234) already has significant traffic of similar nature; there is sufficient capacity of utility and waste services in the region; and effluent releases will be strictly controlled, monitored, and maintained below regulatory limits (CFR, 2003q; CFR, 2003w; CFR, 2003o; NMAC 20.2.78). LBDCR-07-0022

While the no-action alternative would have no impact on the socioeconomic structure of the Lea County, New Mexico area, the proposed action would have moderate to significant beneficial effects (see Table 7.1-2, Annual Impact of Construction Payroll, Table 7.1-3, Total Impact of Local Spending for Construction Goods and Services, Table 7.1-4, Annual Impact of Operations Payroll, and Table 7.1-5, Annual Impact of NEF Purchases). The results of the economic analysis show that the greatest fiscal impacts (i.e., 63% of total present value impacts) will derive from the eight-year construction period associated with the proposed facility. The largest impact on local business revenues stems from local construction expenditures, while the most significant impact on household earnings and jobs is associated with construction payroll and employment projected during the eight-year construction period. Operation of the facility will also have a net positive impact on the eight-county area and will help diversify the regional economy and provide some additional insulation from the volatility of the oil and gas dependent economy of the region.

LES has estimated the economic impacts to the local economy during the 8-year construction period and 30-year license period of the NEF. This includes a five and one-half year period when both construction and operation and ongoing simultaneously. The analysis traces the economic impact of the proposed NEF, identifying the direct impacts of the plant on revenues of local businesses, on incomes accruing to households, on employment, and on the revenues of state and local government. The analysis also explores the indirect impacts of the NEF within a 80-km (50-mi) radius of the NEF. Details of the analysis are provided in ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, and are summarized below.

LES estimates that construction payroll will total $122.2 million with an additional $21 million expended for employment benefits over the eight-year construction period. Construction services purchased from third party firms within the region will add $265 million in direct benefits to the local economy during the NEF's construction.

LES anticipates annual payroll to be $10.5 million with additional $3.2 million expenditure in employee benefits once the plant is operational. Approximately $9.5 million will be spent annually on local goods and services required for operation of the NEF.

The tax revenue to the State of New Mexico and Lea County resulting from the construction and operation of the NEF is estimated to range from $177 million up to $212 million. Refer to Tables 4.10-2, Estimated Tax Revenue, and 4.10-3, Estimated Tax Revenue Allocations, for further details.

Based on the cost-benefit analyses in ER Sections 7.1 and 7.2, and the minimal impacts to the affected environment demonstrated in Chapter 4, LES has concluded that the preferred alternative is the proposed action, construction and operation of the NEF.

8.5 ENVIRONMENTAL IMPACTS OF CONSTRUCTION

The construction of the NEF involves the potential clearing of the previously undisturbed 220-ha (543-acre) site. Most of the core buildings area will be graded and will form the Controlled Area that includes all support buildings and the 8.5-ha (21-acre) uranium byproduct cylinder (UBC) Storage Pad. Numerous environmental protection measures will be taken to mitigate potential construction impacts. The measures will include controls for noise, oil and hazardous material spills, and dust. Potential impacts associated with the construction phase of the NEF are primarily limited to increased dust (degraded air quality) and noise from vehicular traffic, and potential soil erosion during excavations. It is unlikely that NEF construction activities will impact water resources since the site does not have any surface water and only limited groundwater. Groundwater resources will not be used during construction or at any time during the operational life of the plant.

During the construction phase of the NEF, standard clearing methods (i.e., the use of heavy equipment) in combination with excavation will be used. Potentially, the total site area will be disturbed, affording the biota of the site an opportunity to move to undisturbed areas of suitable habitat bordering the NEF site. Trenching associated with plant construction and relocation of the existing CO2 line will be in accordance with all applicable regulations so as to minimize any direct or indirect impacts on the environment.

The anticipated effects on the soil during construction activities are limited to a potential short-term increase in soil erosion. However, this will be mitigated by proper construction best management practices (BMPs). These practices include minimizing the construction footprint to the extent possible, avoiding all direct discharges by the use of detention ponds, the protection of all unused naturalized areas, and site stabilization practices to reduce the potential for erosion and sedimentation. Other temporary stormwater detention basins will be constructed and used as sedimentation collection basins during construction and stabilized afterwards. After construction is complete, the site will be stabilized with natural, low-water consumption landscaping, pavement, and crushed stone to control erosion.

Water quality impacts will be controlled during construction by compliance with the requirements of an National Pollutant Discharge Elimination System (NPDES) Construction General Permit and BMPs detailed in the site Stormwater Pollution Prevention Plan (SWPPP). In addition, a Spill Prevention, Control and Countermeasure (SPCC) plan will be implemented to minimize the possibility of spills of hazardous substances, minimize environmental impact of any spills, and ensure prompt and appropriate remediation. Spills during construction are more likely to occur around vehicle maintenance and fueling operations, storage tanks, painting operations and warehouses. The SPCC plan will identify sources, locations and quantities of potential spills, as well as response measures. The plan will also identify individuals and their responsibilities for implementation of the plan and provide for prompt notifications of state and local authorities.

The construction phase impacts on air quality, land use, transportation, and socioeconomics are localized, temporary, and small. The temporary influx of labor is not expected to overload community services and facilities.

Dust will be generated to some degree during the various stages of construction activity. The amount of dust emissions will vary according to the types of activity. The first 5 months of earthwork will likely be the period of highest emissions with the greatest number of construction vehicles operating on an unprepared surface. However, no more than approximately 18 ha (45 acres), will be involved in this type of work at any one time. Airborne dust will be controlled through the use of BMPs such as surface water sprays (when required), by ensuring trucks' loads and soil piles are covered, and by promptly removing construction wastes from the site. The application of water sprays for dust suppression will be applied only when required so that water resources can be conserved to the maximum extent possible.

Construction of the NEF is expected to have generally positive socioeconomic impacts on the region. No radioactive releases (other than natural radioactive materials, for example, in soil) will result from site development and facility construction activities.

8.6 ENVIRONMENTAL IMPACTS OF OPERATIONS

Operation of the National Enrichment Facility (NEF) would result in the production of gaseous effluent, liquid effluent, and solid waste streams. Each stream could contain small amounts of hazardous and radioactive compounds, either alone or in a mixed form. Based on the experience gained from operation of the Urenco European plants, the aggregate routine airborne uranium gaseous releases to the atmosphere are estimated to be less than 10 g (0.35 ounces) annually. However, based on recent environmental monitoring at the Urenco plants, the annual release is closer to 0.1 MBq (2.8 μCi) which is equivalent to 3.9 g of natural uranium. Extremely minute amounts of uranium and hydrogen fluoride (all well below regulatory limits) could potentially be released at the roof-top through the gaseous effluent stacks. The discharge stacks for the Gaseous Effluent Vent System (GEVS) (Separations Building GEVS and Technical Services Building (TSB) GEVS) are co-located atop of the TSB. A third roof-top stack on the TSB discharges effluents from the confinement ventilation function of the TSB heating, ventilation and air conditioning (HVAC). A fourth roof-top stack is located atop the Centrifuge Assembly Building (CAB) that discharges any gaseous effluent from the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System. Gaseous effluent discharges from each of the four stacks are filtered for particulates and hydrogen fluoride (HF), and are continuously monitored prior to release.

Liquid effluents include stormwater runoff, sanitary waste water, cooling tower blowdown water, heating boiler blowdown water and treated contaminated process water. All liquid effluents, with the exception of sanitary waste water, are discharged to one of three onsite basins.

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin. During a rainfall event larger than the design basis, the potential exists to overflow the basin if the outfall capacity is insufficient to pass beyond design basis inflows to the basin. Overflow of the basin is an unlikely event. The additional impact to the surrounding land over that which would occur during such a flood alone, is assumed to be small. Therefore, potential overflow of the Site Stormwater Detention Basin during an event beyond its design basis is expected to have a minimal impact to surrounding land.

The UBC Storage Pad Stormwater Retention Basin, which exclusively serves the UBC Storage Pad, cooling tower blowdown water and heating boiler blowdown water discharges, is lined to prevent infiltration. It is designed to retain a volume slightly more than twice that for the 24-hour, 100-year frequency storm and an allowance for cooling tower blowdown and heating boiler blowdown. This lined basin has no flow outlet and all effluents are dispositioned through evaporation.

Discharge of operations-generated potentially contaminated liquid effluent is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on NRC standards in 10 CFR 20 (CFR, 2003q) are discharged to this basin. The basin is double-lined with leak detection and open to allow evaporation.

Sanitary waste water will be discharged onsite to the NEF septic tanks and leach fields. No contaminated liquid discharges will be allowed through the onsite septic systems.

Since the NEF will not obtain any water from or discharge process effluents from the site, there are no anticipated impacts on natural water systems quality due to facility water use. Control of surface water runoff will be required for NEF activities, covered by the NPDES General Permit and a New Mexico Water Quality Bureau Groundwater Discharge Plan/Permit. As a result, no significant impacts are expected for either surface water bodies or groundwater.

Solid waste that would be generated at NEF is grouped into nonhazardous, radioactive, hazardous, and mixed waste categories. All these wastes will be collected and transferred to authorized offsite treatment or disposal facilities. All solid radioactive waste generated will be Class A low-level waste as defined in 10 CFR 61 (CFR, 2003r). This waste consists of industrial waste, filters and filter material, resins, gloves, shoe covers, and laboratory waste. Approximately 86,950 kg (191,800 lbs) of low-level waste would be generated annually. In addition, annual hazardous and mixed wastes generated at NEF are expected to be about 1,770 kg (3,930 lbs) and 50 kg (110 lbs), respectively. These wastes will be collected, inspected, volume-reduced, and transferred to treatment facilities or disposed of at authorized waste disposal facilities. Nonhazardous waste, including miscellaneous trash, filters, resins, and paper will be shipped offsite for compaction and then sent to a licensed landfill. The NEF is expected to produce approximately 172,500 kg (380,400 lbs) of this waste annually. Local landfill capacity is more than adequate to accept this mass of nonhazardous waste.

Operation of the NEF would also result in the annual nominal production of approximately 7,800 metric tons (8,600 tons) of depleted UF_6. The depleted UF_6 would be stored onsite in cylinders (UBCs) that will have little or no impact while in storage. The removal and disposition of the depleted UF_6 will most likely involve its conversion offsite to triuranium octoxide (U_3O_8).

8.7 RADIOLOGICAL IMPACTS

The assessment of potential impacts considers the entire population surrounding the proposed NEF within a distance of 80 km (50 mi).

Radiological impacts are regulated under 10 CFR 20 (CFR, 2003q), which specifies a total effective dose equivalent (TEDE) limit for members of the public of 1 mSv/yr (100 mrem/yr) from all sources and pathways from the NEF, excluding natural background sources. In addition, 10 CFR 20.1101(d) (CFR, 2003bb) requires that constraints on atmospheric releases be established for the NEF such that no member of the public would be expected to receive a total effective dose equivalent in excess of 0.1 mSv/yr (10 mrem/yr) from these releases. Further, the NEF would be subject to the Environmental Protection Agency's (EPA) standards, including: standards contained in 40 CFR 190 (CFR, 2003f) that require that dose equivalents under routine operations not exceed 0.25 mSv (25 mrem) to the whole body, 0.75 mSv (75 mrem) to the thyroid, and 0.25 mSv (25 mrem) to any other organ from all pathways.

The general public and the environment may be impacted by radiation and radioactive material from the NEF as the result of discharges of gaseous and liquid effluent discharges, including controlled releases from the uranium enrichment process lines during decontamination and maintenance of equipment. In addition, radiation exposure to the public may result from the transportation and storage of uranium hexaflouride (UF_6) feed cylinders, UF_6 product cylinders, low-level radioactive waste, and depleted UF_6 cylinders.

Potential radiological impacts from operation of the NEF would result from controlled releases of small quantities of UF_6 during normal operations and releases of UF_6 under hypothetical accident conditions. Normal operational release rates to the atmosphere and to the onsite Treated Effluent Evaporative Basin are expected to be less than 8.9 MBq/yr (240 μCi/yr) and 2.1 MBq/yr (56 μCi/yr), respectively. The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from discharged gaseous effluent to an adult located at the plant site south boundary are 1.7×10^{-4} mSv (1.7×10^{-2} mrem) and 1.4×10^{-3} mSv (1.4×10^{-1} mrem), respectively. The maximum effective dose equivalent and maximum annual organ (lung) dose equivalent from gaseous effluent to the nearest resident (teenager) located 4.3 km (2.63 mi) in the west sector are expected to be less than 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.2×10^{-4} mSv (1.2×10^{-2} mrem), respectively.

The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from liquid effluent to an adult at the south site boundary are 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.5×10^{-4} mSv (1.5×10^{-2} mrem), respectively, assuming the Treated Effluent Evaporative Basin is dry only 10% of the year (i.e., resuspension of dust when dry). The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from discharged liquid effluent to an individual (teenager) at the nearest residence are 1.7×10^{-6} mSv (1.7×10^{-4} mrem) and 1.3×10^{-5} mSv (1.3×10^{-3} mrem), respectively, for the same release assumptions.

The maximum annual dose equivalent due to external radiation from the UBC Storage Pad and all other feed, product and byproduct cylinders on NEF property (skyshine and direct) is estimated to be less than 2.0×10^{-1} mSv (< 20 mrem) to the maximally exposed person at the nearest point on the site boundary (2,000 hrs/yr) and 8×10^{-12} mSv (8×10^{-10} mrem) to the maximally exposed resident (8,760 hrs/yr) located 4.3 km (2.63 mi) west of NEF.

With respect to the impact from the transportation of UF_6 as feed, product or depleted material and solid low level waste, the cumulative dose impact has been found to be small. The cumulative dose equivalent to the general public from the "worst-case" combination of all transport categories combined equaled 2.33×10^{-6} person-Sv/year (2.33×10^{-4} person-rem/year). Similarly, the dose equivalent to the onlooker, drivers and workers totaled 1.05×10^{-3}, 9.49×10^{-2}, 6.98×10^{-4} person-Sv/year (1.05×10^{-1}, 9.49×10^{-2}, and 6.98×10^{-2} person-rem/year), respectively.

The dose equivalents due to normal operations are small fractions of the normal background range of 2.0 to 3.0 mSv (200 to 300 mrem) that an average individual receives in the US, and well within regulatory limits. Given the conservative assumptions used in estimating these values, these concentrations and resulting dose equivalents are insignificant, and their potential impacts on the environment and health are inconsequential.

Since the NEF will operate with only natural and low enriched (i.e., not reprocessed) uranium in the form of uranium hexafluoride (UF_6), it is unlikely that an accident could result in any significant offsite radiation doses. The only chemical exposures that could impact safety are those associated with the potential release of hydrogen fluoride (HF) to the atmosphere. The possibility of a nuclear criticality occurring at the NEF is highly unlikely. The facility has been designed with operational safeguards common to the most up-to-date chemical plants. All systems are highly instrumented and abnormal operations are alarmed in the facility Control Room.

Postulated accidents are those accidents described in the Integrated Safety Analysis (ISA) that have, for the uncontrolled case, been categorized as having the potential to exceed the performance criteria specified in 10 CFR 70.61(b) (CFR, 2003b). No significant exposure to offsite individuals is expected from any of the accidents, since many barriers are in place to prevent or mitigate such events.

Evaluation of potential accidents at the NEF included identification and selection of a set of candidate accidents and analysis of impacts for the selected accidents. The ISA team identified UF_6 as the primary hazard at the facility. An example of an uncontrolled accident sequence is a seismic event which produces loads on the UF_6 piping and components beyond their capacity. This accident is assumed to lead to release of gaseous UF_6, with additional sublimation of solid UF_6 to gas. The UF_6 gas, when in contact with moisture in the air, will produce HF gas.

For the controlled accident sequence, the mitigating measures are (1) seismically designed buildings (Separations Building, Centrifuge Test Facility, Centrifuge Post Mortem Facility and TSB) designed to withstand a 0.15 g peak ground acceleration; (2) automatic trip off for the ventilation systems servicing the Separations Building and the TSB ; and (3) limited building leakage paths to the outside environment due to appropriate design of doors and building cladding. These mitigating measures are designed to contain the gaseous UF_6 and HF within the buildings and attenuate the release of effluent to the environment through small openings around doors and other small cracks and openings in building cladding. These mitigating measures will reduce the consequences of a seismic event, even if all the gaseous UF_6 is released from the UF_6 piping and components.

Exposures to workers would most likely be higher than those to offsite individuals and highly dependent on the workers proximity to the incident location. All workers at the NEF are trained in the physical characteristics and potential hazards associated with facility processes and materials. Therefore, facility workers know and understand how to lessen their exposures to chemical and radiological substances in the event of an incident at the facility.

Liquefied UF_6 is present only in the Product Liquid Sampling System, where safety process control systems are backed up by redundant safety protection circuits to preclude the occurrence of cylinder overheating. Fire protection systems, administrative controls, and limits on cylinder transporter fuel inventory limit the likelihood of cylinder-overheating in a fire. Thus, this accident scenario is highly unlikely. LES concludes that through the combined result of plant and process design, protective controls, and administrative controls, operation of the NEF does not pose a significant threat to public health and safety.

8.8 NONRADIOLOGICAL IMPACTS

Numerous design features and administrative procedures are employed to minimize gaseous and liquid effluent releases and keep them within regulatory limits. Potential nonradiological impacts of operation of the NEF include releases of inorganic and organic chemicals to the atmosphere and surface water impoundments during normal operations Other potential impacts involve land use, transportation, soils, water resources, ecological resources, air quality, historic and cultural resources, socioeconomic and public health. Impacts from hazardous, radiological and mixed wastes and radiological effluents have been discussed earlier.

The other potential nonradiological impacts from the construction and operation of NEF are discussed below:

Land-Use Impacts:

The anticipated effects on the soil during construction activities are limited to a potential short-term increase in soil erosion. However, this will be mitigated by proper construction best management practices (BMPs). These practices include minimizing the construction footprint to the extent possible, limiting site slopes, using a sedimentation detention basin, protecting undisturbed areas with silt fencing and straw bales as appropriate, and employing site stabilization practices such as placing crushed stone on top of disturbed soil in areas of concentrated runoff. In addition onsite construction roads will be periodically watered when required, to control fugitive dust emissions. Water conservation will be considered when deciding how often dust suppression sprays will be applied. After construction is complete, the site will be stabilized with natural, low-water maintenance landscaping and pavement.

A Spill Prevention, Control and Countermeasures (SPCC) plan will also be implemented during construction to minimize environmental impacts from potential spills and ensure prompt and appropriate remediation. Spills during construction are likely to occur around vehicle maintenance and fueling locations, storage tanks, and painting operations. The SPCC plan will identify sources, locations and quantities of potential spills and response measures. The plan will also identify individuals and their responsibilities for implementation of the plan and provide for prompt notification of state and local authorities, as required.

Waste management BMPs will be used to minimize solid waste and hazardous materials. These practices include the placement of waste receptacles and trash dumpsters at convenient locations and the designation of vehicle and equipment maintenance areas for the collection of oil, grease and hydraulic fluids. Where practicable, materials suitable for recycling will be collected. If external washing of construction vehicles is necessary, no detergents will be used, and the runoff will be diverted to onsite retention basins. Water conservation measures will be considered to minimize water use. Adequately maintained sanitary facilities will be provided for construction crews.

The NEF facility will require the installation of water and electrical utility lines. In lieu of connecting to the local sewer system, six onsite underground septic tanks each with one or more leach fields will be installed for the treatment of sanitary wastes. LBDCR-07-0011

A new potable water supply line will be extended from the city of Eunice to the NEF site. The line from Eunice will be about 8 km (5 mi) in length. Placement of the new water supply lines along New Mexico Highways 18 and 234 would minimize impacts to vegetation and wildlife. Since there are no bodies of water between the site and the city of Eunice, no waterways will be disturbed. LBDCR-07-0005 LBDCR-07-0005

Two new electrical transmission lines on a large loop system are proposed for providing electrical service to the NEF. These lines would tie into a trunk line about 13 km (8 mi) to the west. Similar to the new water supply lines, land use impacts would be minimized by placing associated support structures along New Mexico Highway 234. An application for highway easement modification will be submitted to the state. There are currently several power poles along the highway in front of the adjacent, vacant parcel east of the site. In conjunction with the new electrical lines serving the site, the local company providing electrical service, Xcel Energy, will install two onsite transformers for redundant service assurance. LBDCR-07-0011

Six underground septic tanks will be installed onsite. The combined leach fields will require about 975 m (3,200 ft) of percolation drain field. The drain field will either be placed below grade or buried in a mound consisting of sand, aggregate and soil.

Overall land use impacts to the site and vicinity will be minimal considering that the majority of the site will remain undeveloped, the current industrial activity on neighboring properties, the nearby, expansive oil and gas well fields, and the placement of most utility installations along highway easements.

Transportation Impacts:

Impacts from construction and operation on transportation will include the generation of fugitive dust, changes in scenic quality, added environmental noise and small radiation dose to the public from the transport of UF_6 feed and product cylinders, as well as low-level radioactive waste.

Dust will be generated to some degree during the various stages of construction activity. The amount of dust emissions will vary according to the types of activity. LES estimated that fugitive dust are expected to be well below the National Ambient Air Quality Standards (CFR, 2003w).

Although site construction will significantly alter its natural state, and considering that there are no high quality viewing areas and the industrial development of surrounding properties, impacts to the scenic quality of the site are not considered to be significant. Also, construction vehicles will be comparable to trucks servicing neighboring facilities. Construction worker and worker during operation transportation impacts are not considered to be significant.

The temporary increase in noise levels along New Mexico Highways 18 and 234 and Texas Highway 176 due to construction vehicles are not expected to impact nearby receptors significantly, due to substantial truck traffic currently using these roadways, and the large distance between the nearest receptors and the site, i.e., 4.3 km (2.63 mi). See the environmental noise discussion below concerning noise levels due to traffic during operations.

Water Resources:

Site groundwater will not be utilized for any reason, and therefore, should not be impacted by routine NEF operations. The NEF water supply will be obtained from the city of Eunice, New Mexico. The current capacity for the Eunice, New Mexico municipal water supply system is 16,350 m^3/day (4.32 million gpd) and current usage is 5,600 m^3/day (1.48 million gpd). Average and peak potable water requirements for operation of the NEF are expected to be approximately 240 m^3/day (63,423 gpd) and 85 m^3/hr (378 gpm), respectively. These usage rates are well within the capacity of the water system. LBDCR-07-0005 LBDCR-07-0005

Liquid effluents include stormwater runoff, sanitary waste water, cooling tower blowdown water, heating boiler blowdown water and treated contaminated process water. All liquid effluents, with the exception of sanitary waste water, are discharged to one of three onsite basins.

Stormwater from the site will be diverted and collected in the Site Stormwater Detention Basin. This basin collects runoff from various developed parts of the site. It is unlined and will have an outlet structure to control discharges above the design level. The normal discharge will be through evaporation and infiltration into the ground. The basin is designed to contain runoff for a volume equal to that for the 24-hour, 100-year return frequency storm, a 15.2-cm (6.0-in) rainfall. It will have approximately 123,350 m^3 (100-acre-ft) of storage capacity. In addition, the basin has 0.6 m (2 ft) of free-board beyond the design capacity. It will also be designed to discharge post-construction peak flow runoff rates from the outfall that are equal to or less than the pre-construction runoff rates from the area.

Cooling tower blowdown water, heating boiler blowdown water and stormwater runoff from the UBC Storage Pad are discharged to the UBC Storage Pad Stormwater Retention Basin. The ultimate disposition of this water will be through evaporation along with permanent impoundment of the residual dry solids byproduct of evaporation. It is designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency storm, a 15.2-cm (6.0-in) rainfall and an allowance for cooling tower blowdown water and heating boiler blowdown water. The UBC Storage Pad Stormwater Retention Basin is designed to contain a volume of approximately 77,700 m^3 (63 acre-ft). This basin is designed with a synthetic membrane lining to minimize any infiltration into the ground.

Discharge of treated contaminated plant process water will be to the onsite Treated Effluent Evaporative Basin. The Treated Effluent Evaporative Basin is utilized for the collection and containment of liquid effluent from the Liquid Effluent Collection and Treatment System. The ultimate disposal the liquid effluent will be through evaporation of water and permanent impoundment of the residual dry solids. Total annual discharge to that basin will be approximately 2,535 m^3/yr (669,844 gal/yr). The basin will be designed for double that volume. Evaporation will provide the only means of liquid disposal from this basin. The basin will include a double-layer membrane liner with a leak detection system to prevent infiltration of basin water into the ground.

Ecological Resources:

No communities or habitats that have been defined as rare or unique or that support threatened and endangered species have been identified as occurring on the 220-ha (543-acre) NEF site. Thus, no proposed activities are expected to impact communities or habitats defined as rare or unique or that support threatened and endangered species within the site area. Field surveys that were performed in September and October 2003, and April 2004, for the lesser prairie chicken, the sand dune lizard, and the black-tailed prairie dog determined that these species were not present at the NEF site. Another survey for the sand dune lizard was conducted in June 2004 and confirmed there were no sand dune lizards at the NEF site.

Several practices and procedures have been designed to minimize adverse impacts to the ecological resources of the NEF site. These practices and procedures include the use of BMPs, i.e., minimizing the construction footprint to the extent possible, channeling site stormwater to temporary detention basins during construction, the protection of all unused naturalized areas, and site stabilization practices to reduce the potential for erosion and sedimentation.

Historic and Cultural Resources:

A pedestrian cultural resource survey of the 220-ha (543-acre) NEF site identified seven prehistoric archaeological sites; three of these sites are located in the Area of Potential Effect (APE). Based on its survey findings and consultations with the New Mexico State Historic Preservation Officer (SHPO), LES is developing a treatment/mitigation plan to recover any significant information from the identified archaeological sites.

Given the small number of potential archaeological sites and isolated occurrences located on the site, and LES's ability to avoid or mitigate impacts to those sites, the NEF project will not have a significant impact on historic and cultural resources. (See ER Section 4.8.6, Minimizing Adverse Impacts.)

Environmental Noise:

Noise generated by the operation of NEF will be primarily limited to truck movements on the road. Potential impacts to local schools, churches, hospitals, and residences are expected to be insignificant because of the large distance to the nearest sensitive receptors. The nearest home is located west of the site at a distance of approximately 4.3 km (2.63 mi) and is not expected to perceive operational noise levels from the plant. The nearest school, hospital, church and other sensitive noise receptors are beyond this distance, thus the noise will be dissipated and attenuated, helping decrease the sound levels even further. Homes located near the construction traffic at the intersection of New Mexico Highway 234 and New Mexico Highway 18 will be affected by the vehicle noise, but due to existing heavy tractor trailer vehicle traffic, the change should be minimal. No schools, hospitals, or any other sensitive receptors are located at this intersection. Expected noise levels will mostly affect a 1.6-km (1-mi) radius and due to the large size of the site, sound levels resulting from the cumulative noise of all site activities will not have a significant impact on even those receptors closest to the site boundary.

Socioeconomics:

LES has estimated the economic impacts to the local economy during the 8-year construction period and 30-year license period of the NEF. This includes a five and one-half year period when both construction and operation are ongoing simultaneously. The analysis traces the economic impact of the proposed NEF, identifying the direct impacts of the plant on revenues of local businesses on incomes accruing to households, on employment, and on the revenues of the state and local government. The analysis also explores the indirect impacts of the NEF within a 80-km (50-mi) radius of the NEF. Details of the analysis are provided in ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, and are summarized below.

LES estimates that construction payroll will total $122.2 million with an additional $21 million expended for employment benefits over the eight-year construction period. Construction services purchased from third party firms within the region will add $265 million in direct benefits to the local economy during NEF's construction. See ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation.

LES anticipates annual payroll to be $10.5 million with an additional $3.2 million expenditure in employee benefits once the plant is operational. Approximately $9.5 million will be spent annually on local goods and services required for operation of the NEF.

The tax revenue to the State of New Mexico and Lea County resulting from the construction and operation of the NEF is estimated to range from $177 million up to $212 million. Refer to Tables 4.10-2, Estimated Tax Revenue, and 4.10-3, Estimated Tax Revenue Allocations, for further details.

The Regional Input-Output Modeling System (RIMS) II allows estimation of various indirect impacts associated with each of the expenditures listed above. According to the RIMS II analysis, the region's residents can anticipate an annual total of $53 million in increased economic activity, $38 million in increased earnings by households, and an annual average of 1,102 new jobs during the eight-year construction period. Over the anticipated thirty-year license period of the NEF, residents can anticipate an annual total of $15 million in increased economic activity, $23 million in increased earnings by households and an annual average of 782 new jobs directly or indirectly relating to the NEF. Table 8.8-1, Estimated Annual Economic Impacts from the National Enrichment Facility, summarizes the impact economic by the facility on Lea County and the surrounding area. A more detailed discussion of the RIMS II methodology and results is found in ER Section 7.1.

The major impact of facility construction on human activities is expected to be a result of the influx of labor into the area on a daily or semi-permanent basis. LES estimates that approximately 15% of the construction work force (120 workers) is expected to move into the vicinity as new residents. Previous experience regarding construction for the nuclear industry projects suggests that of those who move, approximately 65% will bring their families, which on average consist of the worker, a spouse, and one school-aged child. The likely increase in area population during peak construction, therefore, will total 360. This is less than 1% of the total Lea, New Mexico-Andrews, Texas Counties' 2000 population. For additional information, refer to ER Section 4.10.

The increase in jobs and population would lead to a need for additional housing and an increased level of community services, such as schools, fire and police protection, and medical services. However, since the growth in jobs and population would occur over a period of several years, providers of these services should be able to accommodate the growth. For example, the estimated peak increase in school-age children is 120, or less than 1% of the total Lea, New Mexico-Andrews, Texas Counties' 2000 enrollment. Based on the local area teacher-student ratio of approximately 1:17 and assuming an even distribution of students among all grade levels, the increase in students represents seven classrooms. This impact should be manageable, however, considering that Lea County has experienced a far greater temporary population growth due to petroleum industry work in the mid-1980s.

Similarly, an estimated 120 housing units would be needed to accommodate the new NEF construction workforce. The percentage of vacant housing units in the Lea, New Mexico-Andrews, Texas County area in 2000 was about 16% and 15%, respectively, meaning that more than 4,000 housing units were available. Accordingly, there should be no measurable impact related to the need for additional housing.

While some additional investment in facilities and equipment may be necessary, local government revenues would also increase (see ER Section 7.1 and discussion above

concerning LES' anticipated payments to the State of New Mexico and to Lea County, New Mexico under the Lea County Industrial Revenue Bond business incentive program during the construction and operation of the facility). These benefits and payments will provide the source for additional government investment in facilities and equipment. That revenue increase may lag somewhat behind the need for new investment more easily, but the incremental nature of the growth should allow local governments to more easily accommodate the increase. Consequently, insignificant negative impacts on community services would be expected.

Public Health Impacts:

Trace quantities of hydrogen fluoride (HF) are released to the atmosphere during normal separation operations. The annual HF release rate is estimated as less than 1 kg (< 2.2 lb). The HF emissions from the plant will not exceed the strictest of regulatory limits at the point of release. Standard dispersion modeling techniques estimated the HF concentration at the nearest fence boundary to be 3.2×10^{-4} μg/m^3 and the concentration at the nearest residence located west of the site at a distance of 4.3 km (2.63 mi) as 6.4×10^{-6} μg/m^3. Both of these concentrations are several orders of magnitude below the strictest HF exposure standards in use today (see ER Section 4.12.1.1, Routine Gaseous Effluent).

Radiological public health impacts were summarized previously in ER Section 8.7, Radiological Impacts.

Methylene chloride is used in small bench-top quantities to clean certain components. All chemicals at NEF will be used in accordance with the manufacturer's recommendations. All chemicals are used in quantities that are considered deminimus with respect to air emissions outside the NEF. Its use and the resulting emissions have been evaluated and determined to pose minimal or no public risk. All regulated gaseous effluents will be below regulatory limits as specified in permits issued by the New Mexico Air Quality Bureau (NMAC 20.2.78). LES has concluded that the public health impacts from radiological and nonradiological constituents used within NEF are minimal and well below regulatory limits at the point of discharge. All hazardous materials and waste streams will be managed and disposed of in accordance with the permit requirements issued by the EPA Region 6 and the New Mexico Environment Department. LBDCR-07-0022

8.9 DECONTAMINATION AND DECOMMISSIONING

Decontamination and decommissioning of the facility will be staged during facility operations and is projected to take approximately nine years. Potential adverse environmental impacts would primarily be the release of small quantities of uranium to the Treated Effluent Evaporative Basin as a consequence of decontamination operations. Releases will be maintained such that associated impacts are the same order of magnitude or less than normal operational impacts. Decommissioning would also result in release of the facilities and land for unrestricted use, discontinuation of water and electrical power usage, and reduction in vehicular traffic.

As Urenco plant experience in Europe has demonstrated, conventional decontamination techniques are entirely effective for all plant items. All recoverable items will be decontaminated except for a relatively small amount of intractably contaminated material. The majority of materials requiring disposal will include centrifuge rotor fragments, trash, and residue from the effluent treatment systems. No problems are anticipated which will prevent the site from being released for unrestricted use. Additional details concerning decommissioning are provided in SAR Chapter 10, Decommissioning.

8.10 DEPLETED URANIUM DISPOSITION

Enrichment operations at the NEF will generate an average 7,800 metric tons (8,600 tons) of depleted UF_6 per year. After temporary storage onsite, the depleted UF_6 in Uranium Byproduct Cylinders (UBCs) would then be shipped offsite in preparation for appropriate deconversion to a more chemically stable form. Currently, there are no deconversion facilities in the US for large quantities of depleted UF_6, although DOE has awarded a commercial contract that provides for two deconversion facilities to be operational within approximately three to five years. Nevertheless, LES is pursuing commercially available deconversion services in lieu of counting on the availability of the DOE facilities as described below. Therefore, LES evaluated expected environmental impacts based on plausible strategies for offsite deconversion and disposal. LES projects that the depleted UF_6 will be deconverted from fluoride to the more stable oxide form, and disposed of in a deep geological facility or placed in long-term storage. LES estimates that the environmental impacts associated with such a strategy will be small.

LES has committed to the Governor of New Mexico (LES, 2003b) that: (1) there will be no long-term disposal or long-term storage (beyond the life of the plant) of UBCs in the State of New Mexico; (2) a disposal path outside the State of New Mexico is utilized as soon as possible; (3) LES will aggressively pursue economically viable paths for UBCs as soon as they become available; (4) LES will work with qualified vendors pursuing construction of private deconversion facilities by entering in good faith discussions to provide such vendor long-term UBC contracts to assist them in their financing efforts; and (5) LES will put in place as part of the NRC license a financial surety bonding mechanism that assures funding will be available in the event of any default by LES.

8.11 ENVIRONMENTAL JUSTICE

An analysis of census block groups (CGBs) within a 6.4-km (4-mi) radius of the site was conducted in accordance with NRC guidance in NUREG-1748 to assess whether any disproportionately large minority or low-income populations were present that warranted further analysis of the potential for disproportionately high and adverse environmental impacts upon those populations. LBDCR-07-0022

The LES environmental justice analysis demonstrates that no individual CBG and the 130-km^2 (50-mi^2) area around the NEF are comprised of more than 50% of any minority population. With respect to the Hispanic or Latino population, the largest minority population in both census tracts, the percentages are as follows: Census Tract 8, CGB 2 – 24.8%; Census Tract 9501, CBG 4 – 19.8%. The largest minority group in the 130-km^2 (50-mi^2) area around the NEF is Hispanic or Latino, accounting for 11.7%. Moreover, none of these percentages exceeds the applicable State or County percentages for this minority population by more than 20 percentage points.

In addition, the LES analysis demonstrates that no individual CBG is comprised of more than 50% of low-income households. The percentages are as follows: Tract 8, CBG 2 –3.6%; Tract 9501, CBG 4- 9.9%. Neither of these percentages exceeds 50 percent; moreover, neither of these populations significantly exceeds the percentage of low-income households in the applicable State or County.

Based on this analysis, LES has concluded that no disproportionately high minority or low-income populations exist that would warrant further examination of disproportionately high and adverse environmental impacts upon such populations.

8.12 CONCLUSION

In conclusion, analysis of the potential environmental impacts associated with construction and operation of NEF indicates that adverse impacts are small and are outweighed by the substantial socioeconomic benefits associated with plant construction and operation. Additionally, the NEF will meet the underlying need for additional reliable and economical uranium enrichment capacity in the United States, thereby serving important energy and national security policy objectives. Accordingly, because the impacts of the proposed NEF are minimal and acceptable, and the benefits are desirable, the no-action alternative may be rejected in favor of the proposed action. Significantly, LES has also completed a safety analysis of the proposed facility, in which demonstrates that NEF operation will be conducted in a safe and acceptable manner.

8.12.1 Section 8 Tables

Table 8.8-1 Estimated Annual Economic Impacts From the National Enrichment Facility (Lea County and Nearby)

Impact	Construction	Operations
Local Businesses Additional Revenues	$53 Million	$14.6 Million
Household Additional Income	$38 Million	$23 Million
State & Local Government Additional Tax Revenue	$7.0 Million	$3 Million
Employment	1,102 Jobs	782 Jobs

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Mark S. Strum
Technical Systems Manager II, Radiological Engineering

Stacy T. Thomson, P.E.
Senior Engineer, Plant Life Extension Programs

Table 10-1 Principal Contributors to the ER

Principal Contributor	Chapters										Appendices	
	1	2	3	4	5	6	7	8	9	10	A	B
Devine Tarbell & Associates, Inc.												
Peter M. Browne Environmental Scientist			C	C					C			
Energy Economics & Environmental Consultants (E3c) Inc.												
John C.Tysseling, Ph.D. President							R		C			
Olivia E. Padilla-Jackson Senior Economic Analyst							L		C			
Energy Resources International, Inc.												
Julian J. Steyn, Ph.D. Principal	C	C							C			
Michael Schwartz Principal	C	C							C			
Entech Engineering												
John N. Hamawi, Ph.D. Consulting Radiological Engineer			C	C					C			
EXCEL Services Corporation												
Daniel G. Green Licensing Consultant	R	R	R	R	R	R	R	R	R	R	R	R
GL Environmental, Inc.												
V. Denise Gallegos Principal			C	C		C			C			
Tim J. Leftwich Principal			C	C		C			C			
Georgia Institute of Technology												
William A. Schaffer, Ph.D. Economist		C					C		C			
Lockwood Greene												
Rebecca Punch Draftsman	C	C	C	C		C	C					
John L. Shaw, P.E. Project Director	R	R	R	R	R	R	R	R	R	R		
Carroll Walker, P.E. Assistant Manager	C	C	C	C		C	C					
Marsha Wood Administrative Assistant							A		A	A	A	
Louisiana Energy Services												
Rod M. Krich, Vice President Licensing, Safety & Nuclear Engineering	R	R	R	R	R	R	R	R	R	R	R	R
Weston Geophysical Engineers, Inc.			C						C			
George C. Klimkiewicz President			C						C			
Winston & Strawn												
James R. Curtiss Attorney at Law	R	R	R	R	R	R	R	R	R	R	R	R
Martin J. O'Neill Attorney at Law	R	R	R	R	R	R	R	R	R	R	R	R
Brooke D. Poole Attorney at Law		R	R	R	R	R		R	R	R	R	R
Urenco												

Table 10-1 Principal Contributors to the ER

Principal Contributor	Chapters										Appendices	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**A**	**B**
Allan J. Brown Project Manager	R	R	R	R		R						R
Philip Hale Lead Engineer, Mechanical & Process			R	R			R					
Michael Lynch Project Manager	R	R	R	R	R	R	R	R	R	R	R	R
Framatome ANP												
Francis X. Bellini Senior Geologist			C	C					C			
Matthew D. Fuller Health & Safety Technologist			C	C		C			C			
George A. Harper, P.E. Manager, Regulatory Compliance Programs	R	R	C	C	R	R	R	R	R		R	R
Andrew D. Hodgdon, CHP Health Physicist				C					C			
Michael F. Kennedy, Ph.D. Manager, Integrated Safety Analysis		C		C								
Robert G. Knowlton, Ph.D., P.E. Manager, Performance Assessment			C	C					C			
Linda L. Laws Senior Project Administrator									A	A		
Maureen L. Lyons Senior Project Administrator	A	A	A	A	A	A	A	A	A	A	A	A
Edward F. Maher, Sc.D., CHP Environmental Report Manager	L	L	L	L R	R	R	R	L	L	L	R	R
David G. Marcelli Project Manager	R	R	R	R	R	R	R	R	R	R	R	R
Theodore A. Messier Senior Technical Specialist			C	C					C			L
Tina L. Niedzialkoski Senior Project Administrator	A	A	A	A	A	A	A	A	A	A	A	A
Nicholas M. Panzarino, CHP Technical Services Manager II			C	C	L	R						
Jo-Ann Pelczar Health Physicist/Scientist			C	C					C			
David M. Pepe Engineer	R	R	R	R	R		R	R				
Glen D. Seeburger Senior Engineer				C					C			
John H. Snooks Senior Environmental Consultant				C					C			
Mark S. Strum, CHP Technical Systems Manager II			C	C		L			C			
Stacy T. Thomson, P.E. Senior Engineer		C	C	C								

L = Lead Author C = Contributing Author A = Admin R = Reviewer

11.0 APPENDIX A CONSULTATION DOCUMENTS

American Indian Consultation List of Addressees

Apache of Oklahoma

Alonso Chalepah
Apache Tribe of Oklahoma
PO Box 1220
Anadarko, OK 73005

Cc:
Mr. Gene Maroquin, Chairman
Apache Tribe of Oklahoma
PO Box 1220
Anadarko, OK 73005

Comanche of Oklahoma

Jimmy Arterberry, NAGPRA Director
Comanche of Oklahoma
PO Box 908
Lawton, OK 73502

Cc:
Johnny Wauqua, Chairman
Comanche of Oklahoma
PO Box 908
Lawton, OK 73502

Fort Sill Apache Tribe

Michael Darrow, Historian
FORT SILL APACHE TRIBE
Route 1 Box 445
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Cc:
Mrs. Ruey Darrow, Chairperson
Fort Sill Apache Business Committee
Route 2, Box 121
Apache, Oklahoma 73006

Kiowa Tribe of Oklahoma

George Daingkau, NAGPRA Representative
Kiowa Tribe of Oklahoma
118 North Stephans
Hobart, OK 73657

Cc:
Clifford A. McKenzie, Chairman
Kiowa Tribe of Oklahoma
PO Box 369
Carnegie, OK 73015

Mescalero Apache Tribe

Ms. Naida Natchez
Assistant Tribal Historic Preservation Officer
Mescalero Apache Tribe
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Cc:
Sara Misquez, President
Mescalero Apache Tribe
P.O. Box 227
Mescalero, New Mexico 88340

Tonto Apache Tribe

Vivian Burdette, Chairperson
TONTO APACHE TRIBE
Reservation #30
Payson, AZ 85541

Cc:
Vincent Randall, Tribal Historian and Chairperson,
YAVAPAI-APACHE NATION
[Official] 3435 Shaw Ave.
P.O. Box 1188
Camp Verde, AZ 86322

Dear xxxxx,

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

Framatome ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments concerning the proposed facilities as they relate to archeological, cultural and historical sites important to Native American groups. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or edward.maher@framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

Mr. Ed Roberson
Roswell Field Office Manager
Bureau Of Land Management
2909 W. Second
Roswell, NM 88201

Dear Mr. Roberson:

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

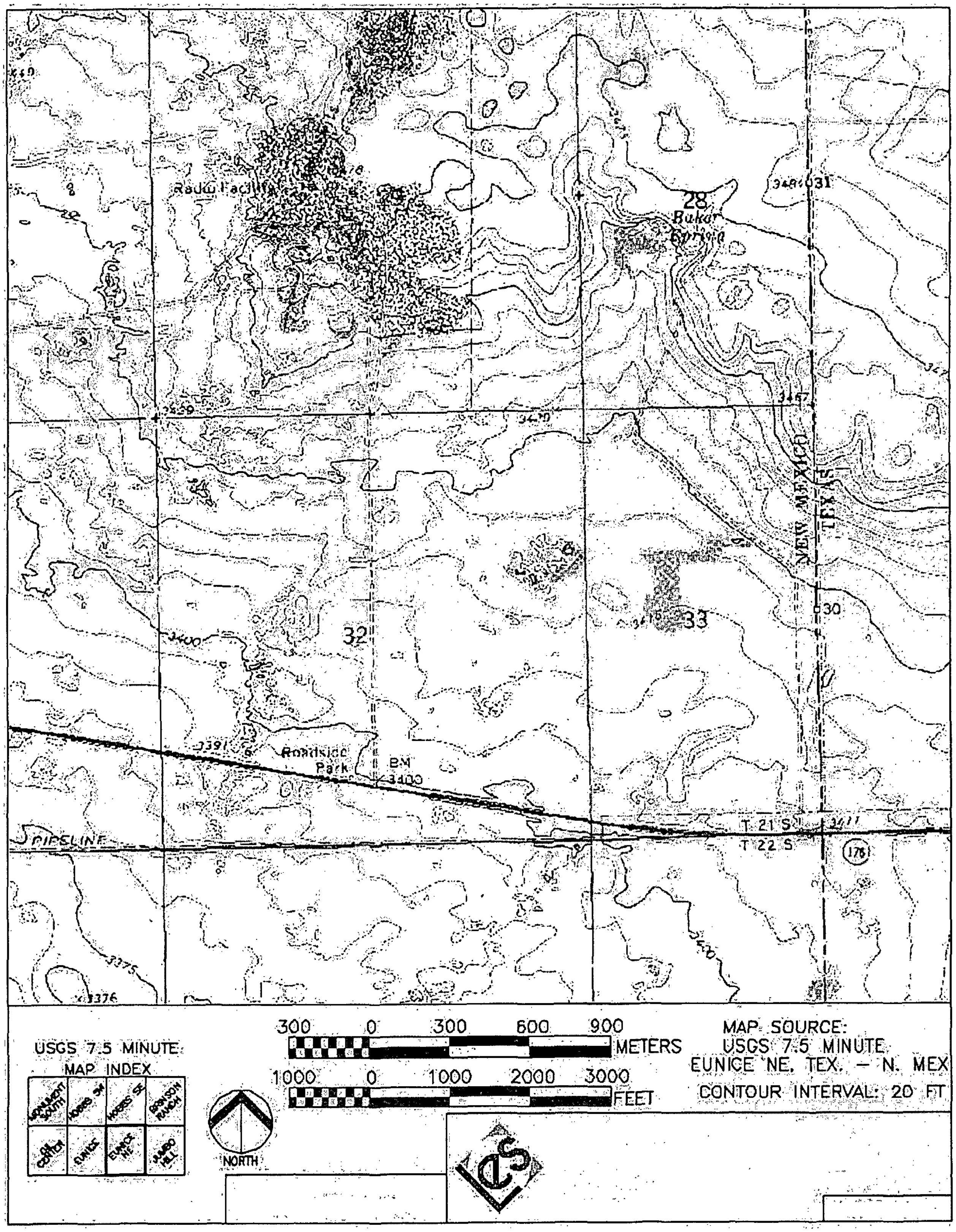
Framatome ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments and information concerning the proposed facilities as they relate to threatened and endangered species, critical habitats, other wildlife, wetlands, and any other natural resource concerns. Based on an initial environmental analysis, this project is not expected to result in significant negative effects on the local environment. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or Edward.maher@.framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map



Radio Facility
28
Baker Spring
31
32
33
30
Roadside Park
BM 3400
PIPELINE
T 21 S
T 22 S
176
NEW MEXICO
TEXAS
USGS 7.5 MINUTE MAP INDEX
NORTH
300 0 300 600 900 METERS
1000 0 1000 2000 3000 FEET
MAP SOURCE:
USGS 7.5 MINUTE
EUNICE NE, TEX. – N. MEX
CONTOUR INTERVAL: 20 FT

Mr. Bruce Thompson
New Mexico Department of Game & Fish
1 Wildlife Way
P.O. Box 25112
Santa Fe, NM 87504

Dear Mr. Thompson:

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project, will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

Framatome ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments and information concerning the proposed facilities as they relate to threatened and endangered species, critical habitats, other wildlife, wetlands, and any other natural resource concerns. Based on an initial environmental analysis, this project is not expected to result in significant negative effects on the local environment. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or Edward.maher@framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

Ms. Katherine Slick, Director
NM Historic Preservation Division
228 E. Palace Ave., Room 320
Santa Fe, NM 87501

Dear Ms. Slick:

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543 acre site. Approximately 350 acres will be directly impacted by construction of the facility. A complete cultural resources survey will be conducted on the project area by WCRM, Inc.

Framatome-ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments concerning the proposed facilities as they relate to archeological, cultural and historical sites. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or Edward.maher@framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

Ms. Joy Nicholopoulous
U.S. Fish & Wildlife Service
New Mexico Field Office
2105 Osuna Road NE
Albuquerque, NM 87113-1001

Dear Ms. Joy Nicholopoulous:

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

Framatome-ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments and information concerning the proposed facilities as they relate to threatened and endangered species, critical habitats, other wildlife, wetlands, and any other natural resource concerns. Based on an initial environmental analysis, this project is not expected to result in significant negative effects on the local environment. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or edward.maher@framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

STATE OF NEW MEXICO
DEPARTMENT OF CULTURAL AFFAIRS
HISTORIC PRESERVATION DIVISION

228 EAST PALACE AVENUE
SANTA FE, NEW MEXICO 87501
(505) 827-6320

BILL RICHARDSON
Governor

October 8, 2003

Dr. Edward F. Maher
Framatome ANP
400 Donald Lynch Blvd.
Marlborough, MA 01752

Re: National Enrichment Facility Near Eunice, Lea County, New Mexico

Dear Dr. Maher:

I am writing in response to the letter the Historic Preservation Division (HPD) received September 18, 2003 from R.M. Krich, Vice President of Louisiana Energy Services. As you are probably aware, involvement of the U.S. Nuclear Regulatory Commission brings this project under the purview of Section 106 of the National Historic Preservation Act (NHPA). Under Section 106, the effects on cultural resources must be evaluated.

Our records show that Western Cultural Resource Management (WCRM) has been retained to conduct a pedestrian archaeological survey of the proposed project area. That survey resulted in the identification of seven archaeological sites. WCRM will (if they have not already) prepare a report of their findings and submit it to your office for review. Please forward the report to HPD for review so that we can issue a determination of effect for this project.

In addition, if tribal consultation has not already been conducted, now is a good time to initiate it. I have enclosed a listing of tribes that have indicated they wish to be contacted for projects occurring in Lea County. This list is provided as guidance only and you may wish to contact other tribes as well. Please forward us a copy of a letter that is sent to the tribes and indicate which tribes were contacted. Please also send us copies of any responses you may receive.

We look forward to reviewing the archaeological survey report. If you have any questions, please do not hesitate to contact me. I can be reached by telephone at (505) 827-4064 or by email at mensey@oca.state.nm.us.

Sincerely,

Michelle M. Ensey
Staff Archaeologist

Log: 68950
Enc.

OTHER TRIBAL OFFICIALS

Chairman Frederick Vigil
All Indian Pueblo Council
123 4th Street S.W.
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Albuquerque, NM 87103
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Fax: (505) 883-7682

Roger Madalena, Director
Five Sandoval Indian Pueblo, Inc.
1043 Highway 313
Bernalillo, NM 87004
Phone: (505) 867-3351
Fax: (505) 867-3514

Bernie Teba, Director
Eight Northern Indian Pueblo Council
P.O. Box 969
San Juan Pueblo, NM 87566
Phone: (505) 852-4265
Fax: (505) 852-4835

OTHER TRIBES HAVING TRADITIONAL USE AREAS IN NEW MEXICO

Arizona

Wayne Taylor, Jr., Chairman
Hopi Tribal Council
P.O. Box 123
Kykotsmovi, AZ 86039
Phone: (928) 734-2441
Fax: (928) 734-6665
Attn: Leigh Kuwanwisiwma
Director, Cultural Preserv. Office
(928) 734-3751

Dallas Massey, Sr., Chairman
White Mountain Apache
Tribal Council
P.O. Box 700
Whiteriver, AZ 85941
Phone: (928) 338-4346
Fax: (928) 338-4778
Historic Preservation: John Welch
(928) 338-3033

Raymond Stanley, Jr., Chairman
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San Carlos, AZ 85550
Phone: (520) 475-2361
Fax: (520) 475-2567

Colorado

Howard Richards, Sr., Chairman
Southern Ute Tribe
P.O. Box 737
Ignacio, CO 81137
Phone: (970) 563-0100
Fax: (970) 563-0396

Ernest House, Chairman
Ute Mountain Ute Tribe
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Wallace Coffey, Chairman
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Fax: (580) 492-3796
THPO: Jimmy Arterberry (580) 492-3754

Jeff Houser, Chairman
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Fax: (580) 588-3133

Earl Yeahquo, Chairman
Kiowa Tribe of Oklahoma
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Fax: (580) 654-2188
Historic Preservation: R.H. Hess Bointy

Robert Chapman, President
Pawnee Tribal Business Council
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Fax: (918) 762-6446
THPO: Alice Alexander

Gary McAdams, President
Wichita and Affiliated Tribes
P.O. Box 729
Anadarko, OK 73005
Phone: (405) 247-2425
Fax: (405) 247-2430

Texas

Albert Alvidrez, Governor
Ysleta del Sur Pueblo
P.O. Box 17579 – Ysleta Station
El Paso, TX 79917
Phone: (915) 859-7913
Fax: (915) 859-2988

rev. 07/02/2003

Native American Consultations
New Mexico Historic Preservation Division (HPD)

(NOTE: This is a county-by-county working list for determining which Native American Indian tribes want to be consulted for proposed projects in various geographic parts of New Mexico. It has been generated from a HPD ethnographic study, the National Park Service's Native American Consultation Database, and tribes telling us they wish to be consulted for at least "certain projects" in that specific county. We are always in the process of updating and refining consultative efforts. It is NOT a definitive list, and may change depending on the type and location of the proposed project. We have been working with agencies, Native American Indian tribes, and The Advisory Council on Historic Preservation to develop a GIS based map resource system. Tribes wishing to amend or change their areas of geographic interest should contact the HPD at 228 E. Palace Ave., Room 320, Santa Fe, NM 87501; 505-827-6320; fax 505-827-6338)

BERNALILLO
Hopi Tribe
Isleta Pueblo
Laguna Pueblo
Navajo Nation
Sandia Pueblo.
White Mountain Apache Tribe
Ysleta del Sur

CATRON
Acoma Pueblo
Fort Sill Apache Tribe
Hopi Tribe
Isleta Pueblo
Laguna Pueblo
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

CHAVES
Apache Tribe of Oklahoma
Comanche Indian Tribe
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

CIBOLA
Acoma Pueblo
Hopi Tribe
Isleta Pueblo
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe
Zuni Pueblo

COLFAX
Comanche Indian Tribe
Kiowa Tribe
Jicarilla Apache Nation
Taos Pueblo

CURRY
Apache Tribe of Oklahoma
Comanche Indian Tribe
Kiowa Tribe

De BACA
Comanche Indian Tribe
Isleta Pueblo
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation

DONA ANA
Comanche Indian Tribe
Fort Sill Apache Tribe
Isleta Pueblo
Kiowa Tribe (east half of county)
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe
Ysleta del Sur Pueblo

EDDY
Comanche Indian Tribe
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

GRANT
Fort Sill Apache Tribe
Hopi Tribe
Isleta Pueblo
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

GUADALUPE
Comanche Indian Tribe
Isleta Pueblo
Jicarilla Apache Nation
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation

HARDING
Comanche Indian Tribe
Jicarilla Apache Nation
Kiowa Tribe

HIDALGO
Fort Sill Apache Tribe
Hopi Tribe
Mescalero Apache Tribe
White Mountain Apache Tribe

LEA
Apache Tribe of Oklahoma
Comanche Indian Tribe
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

LINCOLN
Comanche Indian Tribe
Isleta Pueblo
Kiowa Tribc
Mescalero Apache Tribe
Ysleta del Sur Pueblo

LOS ALAMOS
Cochiti Pueblo
Comanche Indian Tribe
Hopi Tribe
Jemez Pueblo
Navajo Nation
Santa Clara Pueblo
San Ildefonso Pueblo

LUNA
Fort Sill Apache Tribe
Hopi Tribe
Mescalero Apache Tribe
White Mountain Apache Tribe
Ysleta del Sur Pueblo

McKINLEY
Acoma Pueblo
Comanche Indian Tribe
Hopi Tribe
Isleta Pueblo
Laguna Pueblo
Navajo Nation
San Ildefonso Pueblo
White Mountain Apache Tribe
Zuni Pueblo

MORA
Comanche Indian Tribe
Hopi Tribe
Jicarilla Apache Nation
Kiowa Tribe
Navajo Nation
Taos Pueblo

OTERO
Comanche Indian Tribe
Isleta Pueblo
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

QUAY
Apache Tribe of Oklahoma
Comanche Indian Tribe
Isleta Pueblo
Jicarilla Apache Nation
Kiowa Tribe
Pawnee Tribe

PUEBLO GOVERNORS/TRIBAL OFFICIALS

SOUTHERN PUEBLOS

Governor Fred S. Vallo
Pueblo of Acoma
P.O. Box 309
Acoma, NM 87034
Phone: (505) 552-6604/6605
Fax: (505) 552-7204
1st Lt. Gov. Marcus J. Aragon Jr.
2nd Lt. Gov. Jason Johnson
Historic Preservation: Damian Garcia

Governor Simon Suina
Pueblo of Cochiti
P.O. Box 70
Cochiti Pueblo, NM 87072
Phone: (505) 465-2244
Fax: (505) 465-1135
Lt. Gov. Vernon Garcia
DNR&C: Jacob Pecos (505) 465-0617

Governor Alvino Lucero
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Fax: (505) 869-4236
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2nd Lt. Gov. Emil Jojola
Historic Preservation: Ben Lucero (505) 869-3379

Governor Raymond Loretto
Pueblo of Jemez
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Jemez Pueblo, NM 87024
Phone: (505) 834-7359/7525
Fax: (505) 834-7331
1st Lt. Gov. Augustine Fragua Jr.
2nd Lt. Gov. George Shendo
DRP: David Duffy (505) 834-7696

Governor Anthony Ortiz
Pueblo of San Felipe
P.O. Box 4339
San Felipe Pueblo, NM 87001
Phone: (505) 867-3381/3382
Fax: (505) 867-3383
Lt. Gov. Timothy Sandoval
Administrator: Bruce Garcia

Governor Myron Armijo
Pueblo of Santa Ana
2 Dove Road
Bernalillo, NM 87004
Phone: (505) 867-3301/3302
Fax: (505) 867-3395
Lt. Gov. Glenn Tenorio
NAGPRA: Ben Robbins

Governor Everett Chaves
Pueblo of Santo Domingo
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Santo Domingo Pueblo, NM 87052
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Fax: (505) 465-2688
Lt. Gov. John Nieto
Administrator: Boyd Nystedt (505)465-0055

Governor Gilbert Lucero
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135 Capitol Square Dr.
Zia Pueblo, NM 87053-6013
Phone: (505) 867-3304/3305
Fax: (505) 867-3308
Lt. Gov. Alfredo Medina
Environmental: Harold Reid

Governor Roland E. Johnson
Pueblo of Laguna
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Laguna Pueblo, NM 87026
Phone: (505) 552-6654/6655
Fax: (505) 552-6941
1st Lt. Gov. Clarence Marie
2nd Lt. Gov. Harry Cheromiah
Environ: Barbara Bernacik (505) 552-7534

Governor Stuwart Paisano
Pueblo of Sandia
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Fax: (505) 867-9235
Lt. Gov. Felix Chaves
Cultural Preservation: Sam Montoya (505) 771-5080

Governor Arlen P. Quetawki Sr.
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Zuni, NM 87327
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Lt. Gov. Carmelita Sanchez
THPO Jonathan Damp (505) 782-4814

NORTHERN PUEBLOS

Governor Tom F. Talache Jr.
Pueblo of Nambe
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Santa Fe, NM 87501
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Lt. Gov. Shannon McKenna
Historic Preservation: Ernest Mirabal Sr. (505) 455-2979

Governor Earl Salazar
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1st Lt. Gov. Eugene Cruz
2nd Lt. Gov. Louis Cata
Environ: Charles Lujan (505) 852-4212

Governor Gerald Nailor
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Lt. Gov. Manuel Archuleta
Historic Preservation: Richard Meremejo (505) 827-2519

Governor Denny Gutierrez
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Espanola, NM 87532
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Fax: (505) 753-8988
Lt. Gov. Edwin Tafoya
Historic Preservation: Paul Baca x 238

Governor Jacob Viarrial
Pueblo of Pojoaque
No. 39 Camino Del Rincon, Tribal Admin. Suite 6
Santa Fe, NM 87501
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Fax: (505) 455-3363
Lt. Gov. George Rivera
Historic Preservation: Charles Tapia (505) 455-2916

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September 30, 2003

Dr. Edward F. Maher
Framatome ANP
4000 Donald Lynch Blvd.
Marlborough MA 01752

Re: Louisiana Energy Services National Enrichment Facility, Lea County, New Mexico
NMGF Project No.: 8926

Dear Dr. Maher:

This letter was prepared in response to a September 15, 2003, letter from R.M. Krich of Louisiana Energy Services, requesting written comment from the NM Department of Game and Fish (Department) on the above referenced project. A project scoping meeting for state regulatory agencies, held in Santa Fe on September 17, 2003, was attended by Rachel Jankowitz of my staff.

The proposed project is a gas centrifuge uranium enrichment facility, located on Section 32 and 33, Township 21S, Range 38E. The size of the site is 543 acres, of which approximately 350 acres will be directly impacted by construction. Facilities will include process and administrative structures, access roads and a depleted uranium storage pad. Framatome ANP is in process of generating an Environmental Report which will be used by the U.S. Nuclear Regulatory Commission to prepare an Environmental Impact Statement for the facility, as required under the National Environmental Policy Act (NEPA).

The project location is within the range of a state listed threatened species, *Scleroporus arenicolus*, the sand dune lizard. Ms Denise Gallegos of GL Environmental, a subcontractor for Framatome ANP, has identified potential suitable habitat for the sand dune lizard on the project site. She stated that occupancy surveys had not yet been completed, and also that GL Environmental had been in contact with the Department herpetologist, Mr. Charlie Painter.

The sand dune lizard occurs only in a limited range comprising a narrow band of shinnery oak sand dunes in southeast New Mexico and adjacent Texas. The Department species management plan identifies the range east of Highway 18 to the Texas border as a one mile wide band of primary habitat, with up to three miles wide marginal habitat. "Future disruptions in this restricted habitat can sever the TX-NM habitat corridor of *S. arenicolus* populations and increase the risk of local extinction." It is considered prudent to conserve even unoccupied suitable habitat because of the dynamic nature of the sand dune system, and uncertainties regarding the life history and metapopulation characteristics of the lizard. Oil and gas development has been identified as a threat to the species. NEPA analysis of the project's impact on sand dune lizard should include a discussion of the cumulative impacts in the region.

For the purpose of minimizing adverse impact to sand dune lizards and their habitat, facilities (including parking lots, drainage ponds, storage sheds, etc) should be located as far as feasible from occupied or suitable dune blowouts and associated stands of shinnery oak. Suitable habitat should be clearly identified and protected from traffic or other damage during construction and operation. It should be noted that while the lizards may be active until mid-September, the management plan survey methodology recommends that, in order to increase the probability of finding sand dune lizards if they occur, presence/absence surveys should be conducted during May and June between 0800 and 1300 h. If occupancy of the project site is documented, or for any further information, please contact Mr. Painter at (505) 476-8106.

Approximately one mile of carbon dioxide transmission pipeline will be relocated off the proposed project site to the Highway 176 corridor. Any impact associated with the pipeline relocation should be included in NEPA analysis as an indirect impact of the enrichment facility project. A copy of the Department trenching guidelines is enclosed with this letter.

The site design includes three ponds which will hold runoff and cooling water. The NM Water Quality Control Commission has established surface water quality standards for wildlife usage. If the ponds will not meet those standards, compliance with the federal Migratory Bird Treaty Act requires that they be protected from avian wildlife. This is usually accomplished by the use of netting or floating plastic balls. It was indicated at the scoping meeting that floating balls will be used to exclude birds. Advantages of floating balls over netting include disguising of the water surface so birds don't try to land, and lower maintenance needs. Disadvantages include higher initial cost and susceptibility to high winds. The bird exclusion balls also reduce evaporation, which may be an advantage or disadvantage depending on the design purpose of the pond.

Thank you for the opportunity to review and comment on your project. If you have any questions, please contact Rachel Jankowitz of my staff at 505-476-8159 or rjankowitz@state.nm.us.

Sincerely,

Lisa Kirkpatrick, Chief
Conservation Services Division

LK/rjj

(encl)

CC: Joy Nicholopoulos, Ecological Services Field Supervisor, USFWS
Roy Hayes, SE Area Operations Chief, NMGF
Alexa Sandoval, SE Area Habitat Specialist, NMGF
Rachel Jankowitz , Habitat Specialist, NMGF

TRENCHING GUIDELINES

NEW MEXICO DEPARTMENT OF GAME AND FISH

November 1994

Open trenches and ditches can trap small mammals, amphibians and reptiles and can cause injury to large mammals. Periods of highest activity for many of these species include night time, summer months and wet weather. Loss of wildlife can be minimized by implementing the following recommendations.

- To minimize the amount of open trenches at any given time, keep trenching and back-filling crews close together.
- Trench during the cooler months (October – March). However, there may be exceptions (e.g., critical wintering areas) which need to be assessed on a site-specific basis.
- Avoid leaving trenches open overnight. Where trenches cannot be back-filled immediately, escape ramps should be constructed at least every 90 meters. Escape ramps can be short lateral trenches sloping to the surface or wooden planks extending to the surface. The slope should be less than 45 degrees (100%). Trenches that have been left open overnight, especially where endangered species occur, should be inspected and animals removed prior to back-filling.

State wide there are 41 threatened, endangered or sensitive species potentially at risk by trenching operations. (Source: 11/01/94 query of Biota Information System of New Mexico, version 2.5). Risk to these species depends upon a wide variety of conditons at the trenching site, such as trench depth, side slope, soil characteristics, season, and precipitation events.

COMANCHE TRIBE
NAGPRA

October 8, 2003

Greetings,

The Comanche Nation is in receipt of your request for consultation in compliance with the revised 36 CFR 800 Guidelines issued by the Advisory Council for Historic Preservation.

We are unable to confirm the determination of "*no effect*" on our Traditional Ancestral lands. However, in the scope of work, if archaeological materials are exposed, such as bone, organic/inorganic materials, glass, metal, pottery, chipped stone tools, or historic crockery, we respectfully request that all activities are halted and the Comanche Nation notified immediately.

If you have any questions or concerns, please feel free to contact me at (580) 492-3754.

Sincerely,

Donnita F. Sovo
Administrative Assistant
Comanche Nation Environmental Program

P.O. Box 908 • Lawton, Oklahoma 73502 • (580) 492-3754 • (580) 492-3733 FAX

1133 Connecticut Ave. NW Suite 200 Washington D.C. 20036
(Voice) 202.659.4344 (Fax) 202.659.0791

September 15, 2003

Vivian Burdette, Chairperson
TONTO APACHE TRIBE
Reservation #30
Payson, AZ 85541

Dear Ms. Burdette:

Louisiana Energy Services (LES) is proposing to construct a gas centrifuge uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Section 32 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

Framatome ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. This document, along with other environmental information, will be used by the U.S. Nuclear Regulatory Commission (NRC) to prepare an Environmental Impact Statement for the facility. In addition to informing your agency of LES's plans, we are asking for comments and information concerning the proposed facility as it relates to threatened and endangered species, critical habitats, other wildlife, wetlands, and any other natural resource concerns. Based on an initial environmental analysis, this project is not expected to result in significant negative effects on the local environment. To facilitate your review, a site map of the project area has been enclosed. Your comments will be included in the ER that will be submitted to the NRC.

We would appreciate receiving your comments within 30 days from receipt of this letter; please return them to Dr. Edward F. Maher, Framatome ANP, 400 Donald Lynch Blvd, Marlborough, MA 01752. Should you have any questions or need additional information please contact Dr. Maher at (978) 568-2785 or edward.maher@framatome-anp.com.

Respectfully,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

MESCALERO APACHE TRIBAL HISTORIC PRESERVATION OFFICE
P.O. Box 227
Mescalero, New Mexico 88340
Phone: 505/464-4711
Fax: 505/464-4637

September 24, 2003

R. M. Kirch
Louisiana Energy Services
1133 Connecticut Ave. NW Suite 200
Washington D.C 20036

Dear Mr. Kirch:

Thank you for providing the Mescalero Apache Tribe the opportunity to comment on the National Enrichment Facility near the town of Eunice, Lea County, New Mexico. This project is located within the Mescalero Apache Tribe's traditional homelands and thus we are interested in this project.

There is no knowledge of any Traditional Cultural Places in this area, but we would like to request that a cultural resources survey be undertaken for this project. The survey would aid in our assurance that no cultural or archeological sites that are affiliated to the Apache are located in this area that could be impacted by this project. Please send us a copy of the survey report when it is completed for our review.

Feel free to contact me if you have any questions or if our concerns cannot be met.

Sincerely,

Holly B.E. Houghten
Tribal Historic Preservation Officer

CC: Sara Misquez, Tribal President

12.0 APPENDIX B AIR QUALITY IMPACTS OF CONSTRUCTION SITE PREPARATION ACTIVITIES

Introduction

Air quality impacts from construction site preparation were evaluated using emission factors and air dispersion modeling. Emission rates of Clean Air Act Criteria Pollutants and non-methane hydrocarbons (a precursor of ozone, a Criteria Pollutant) were estimated for exhaust emissions from construction vehicles and for fugitive dust using emission factors provided in AP-42, the Environmental Protection Agency (EPA's) Compilation of Air Pollutant Emission Factors (EPA, 1995). These emission rates were input into the Industrial Source Complex Short-Term (ISCST3) air dispersion model to estimate both short-term and annual average air concentrations at the facility property boundary. ISCST3 is a refined, EPA-approved air dispersion model in the Users Network for Applied Modeling of Air Pollution (UNAMAP) series of air models (EPA, 1987). It is a steady-state Gaussian plume model that can be used to estimate ground-level air concentrations from industrial sources out to a distance of 50 km (31 mi). The air emissions calculations and air dispersion modeling are discussed in more detail below. Air concentrations predicted at the property boundary are then compared to National Ambient Air Quality Standards (NAAQS).

Emission Rate Estimates

Sources of Criteria Pollutants during construction site preparation will include combustion sources and fugitive dust. Of the combustion sources, vehicle exhaust will be the dominant source. Fugitive volatile emissions will also occur because vehicles will be refueled on-site. Fugitive dust will originate predominantly from vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing, and to a lesser extent from wind erosion. Emission rates from vehicle exhaust and fugitive dust were estimated for a 10-hour workday assuming peak construction activity levels were maintained throughout the year. This will lead to a conservative estimate of the annual average air concentrations because the peak construction activity levels will occur for only a portion of the year. Emission factors and assumptions specific to each of these two sources are discussed separately in the following paragraphs:

Vehicle Exhaust

Vehicles that will be operating on the site during construction consist of two types: support vehicles and construction equipment. The support vehicles will include twenty pickup trucks, ten gators (gas-powered carts), five fuel trucks, three stakebody trucks, five mechanic's trucks and five boom trucks. Emission factors in AP-42 for "highway mobile sources" were used to estimate emissions of criteria pollutants and non-methane hydrocarbons for these vehicles. Use of AP-42 requires that highway mobile sources be categorized by vehicle size: the gators were assumed to be Light Duty Vehicles, the pickup trucks and the mechanic's trucks were assumed to be Category I Light Duty Trucks; the boom trucks and stakebody trucks were assumed to be Category II Light Duty Trucks; and the fuel trucks were assumed to be Heavy Duty Trucks. Baseline emission factors for each of the vehicle categories are provided in AP-42 as a function of the model year of the vehicle and the year of emissions, and increase with the age of the vehicle. Emission factors were used for emissions occurring from model year 2001 vehicles on January 1, 2003. An assumption of three-year old vehicles is conservative yet realistic, given the typical operating life of construction vehicles. The baseline emissions from AP-42 can be adjusted based on operating conditions that vary from those under which the emissions in the baseline tables were measured (e.g., average speed, percentage of cold starts, ambient temperature, mileage accumulation, etc.). However, in the absence of any detailed knowledge of the likely operating conditions of the support vehicles, the baseline emission factors were used and are considered adequate for a screening-level analysis of the air quality impacts from the site preparation activities. It should be noted that the emission factor for non-methane hydrocarbons includes refueling emissions, and therefore, no separate emission estimates are needed to account for onsite refueling. It was assumed that each of the support vehicles would be in use each workday and would travel an average of 16.1 km (10 mi) around the construction site. Average emission rates (in g/s) for the entire workday for each vehicle were estimated by multiplying the AP-42 emission factor (in g/mi) by 16.1 km (10 mi) and dividing by the number of seconds in the workday (36,000). Table B-1, Support Vehicle Emissions, lists the emission factors used and the resulting emission rates for the support vehicles.

The construction equipment that will be operating on the site during peak construction consists of five bulldozers, three graders, three pans, six dump trucks, three backhoes, four loaders, four rollers, three water trucks and two tractors. Emission factors, in units of grams per hour of operation, provided in AP-42 for diesel-powered construction equipment, were compiled. The emission factors used are listed in Table B-2, Construction Equipment Inventory and Emission Factors, along with a count of the number of pieces of equipment which fall into each of the construction equipment types for which emission factors are provided in AP-42. The EPA does not include refueling emissions in the diesel emission factors for non-methane hydrocarbons because the low-volatility of diesel fuel results in these emissions being relatively insignificant. In calculating emissions, it was conservatively assumed that all the equipment listed in Table B-2 would be in continuous operation throughout the 10-hour workday. Table B-3, Emission Rates for All Construction Vehicles, contains the emission estimates for all the equipment operating simultaneously. These emissions were treated as workday average emission rates in the air dispersion modeling, even though they are more representative of peak emissions.

Fugitive Dust

A fugitive dust emission factor of 2.7 MT per ha (1.2 tons per acre) per month of construction activity is provided in AP-42 for heavy construction activities. This factor is based on downwind measurements of construction sites and therefore includes background and all site-related sources of particulates. The value is most applicable to construction sites with: (1) medium activity level, (2) moderate silt content (~30%), and (3) a semi-arid climate. Note that this factor is referenced to total suspended particulates (TSP), and use of it to estimate particulate matter no greater than 10 µm in diameter (PM10) will result in conservatively high estimates. Also, because derivation of this factor assumes that construction activity occurs 30 days per month, the factor itself is conservatively high for TSP.

The AP-42 emission factor applies to particles 30 µm or less in size, whereas the NAAQS for particulates applies to PM10 (i.e., particles 10 µm or less in size). Based on particle size multipliers presented in AP-42 for other fugitive dust sources, PM10 typically is generated in about a 1:2 ratio with total particulates 30 µm or less in size. Therefore, a correction factor of 0.5 was applied to the construction emission factor in order to adjust it to PM10.

Since the derivation of the AP-42 emission factor assumed construction activity on 30 days per month, a second correction factor to account for actual number of workdays was applied. The average number of workdays per month is 21.4 (4 major holidays were excluded). The second correction factor is therefore 21.4/30 or 0.71.

The AP-42 emission factor also assumes uncontrolled emissions, whereas the NEF construction site will undergo watering for dust suppression. Water conservation will be considered when deciding how often dust suppression sprays will be applied. The EPA suggests in AP-42 that a twice-daily watering program will reduce dust emissions by up to 50%. Other EPA research suggests that watering can achieve emission reductions upwards of 90%. Therefore, a third correction factor of 0.1 was applied to the AP-42 emission factor to account for fugitive dust controls.

The resulting emission factor after application of the three correction factors is 1.2 x 0.5 x 0.71 x 0.1 = 0.04 tons of dust/acre/month (0.09 MT of dust/ha/month). To this point, an assumption has been made that the fugitive dust emissions will occur from the entire site. This assumption is representative of peak emissions rather than average emissions over the construction period. To account for this, the workday average emission rate (in g/s) was calculated assuming that 18 ha (45 acres) of the entire 73-ha (180-acre) site would be under construction at any given time over the period of construction and that emissions occur entirely within the 10-hour workday. This assumption is still conservative considering there are only 33 construction vehicles to be onsite during peak activity. This average workday emission rate was assumed to occur 5 days per week for 50 weeks per year.

The resulting estimate of the workday average emission rate of PM10 is 2.4 g/s (19.1 .91lbs/hr). Because this emission rate is based on an assumption of emissions occurring from 18 ha (45 acres) of the entire site, it is more representative of peak emissions than of the average over the entire construction period.

Air Dispersion Modeling

The ISCST3 air dispersion model was used to estimate maximum short-term and annual average air concentrations of criteria pollutants and non-methane hydrocarbons released by construction site preparation activities. Averaging periods used for short-term air concentrations included all those for which a NAAQS exists (i.e., 1-hour, 3-hour, 8-hour and 24-hour averages). Maximum ground-level air concentrations were determined along the facility property boundary that was assumed to be 150 m (492 ft) from the construction area.

Because vehicles will be moving and working at varying points within the construction site, both vehicle emissions and fugitive dust were modeled as if emitted uniformly over the entire 73-ha (180-acre) construction site. Emissions were thus represented in the ISCST3 model as aarea source 853 m (2,798 ft) on each side centered over the construction site. A unit emission rate of 1 g/s (7.9 lbs/hr) was assumed for the 18-ha (45-acre) source. Because predicted air concentrations are directly proportional to the emission rate, pollutant-specific air concentrations were obtained by multiplying the air concentrations output by ISCST3 using a unit emission rate by the actual pollutant emission rates.

An important aspect of refined air dispersion modeling is use of appropriate meteorological data into the model. ISCST3 requires hourly observations of wind speed and direction, mixing height, air temperature and atmospheric stability. This requires both surface and upper-air meteorological data. Surface meteorological data from the Midland-Odessa, Texas, National Weather Service (NWS) station were combined with concurrent mixing height data from Midland-Odessa for use in the ISCST3 model. According to air modeling guidance, a five-year record of meteorological data should be used. Five years of data (1987 to 1991) were used in the modeling so that expected worst-case meteorological conditions for the area would be included. This 5-year data set is the most recent set of verified data available from the EPA for Midland-Odessa. In order to account for the fact that emissions will occur primarily during the workday, air concentrations were calculated for 7 a.m. to 5 p.m. for 5-day intervals separated by 2-day gaps to account for weekends. This was done for 50 weeks per year.

For each of the five years in the meteorological record, the maximum 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at the site property boundary were determined. In addition, because the NAAQS for PM10 allows for one exceedance of the 24-hour standard per year, the second highest 24-hour averages were also determined. Air concentrations at the property boundary were located using a discrete receptor grid with a distance of 150 m (492 ft) to the boundary. Table B-4, Maximum Predicted Site-Boundary Air Concentrations Based on a 1.0 g/s Emission Rate, lists the maximum site-boundary air concentrations (based on a unit emission rate) for each of the averaging times and the direction from the construction site of the receptor grid point at which it occurred.

Pollutant-Specific Air Concentrations and Comparison to NAAQS

The air concentrations in Table B-4 were multiplied by the emission rates in Tables B-1 and B-3 to obtain pollutant-specific air concentrations. These concentrations were then compared to the appropriate NAAQS. The predicted maximum air concentrations and NAAQS are shown in Table B-5, Predicted Property-Boundary Air Concentrations and Applicable NAAQS (µg/m3). No NAAQS has been set for hydrocarbons; however, the total annual emissions of hydrocarbons predicted from the site (approximately 4.08 MT (4.5 tons)) are well below the level 36.3 MT (40 tons) that defines a significant source of volatile organic compounds (40 CFR 50.21) (CFR, 2003w). Air concentrations of the Criteria Pollutants predicted for vehicle emissions were all at least an order of magnitude below the NAAQS. PM10 emissions from fugitive dust were also below the NAAQS. The maximum annual average concentration was lower by a factor of 2:1 and the second highest 24-hour average was lower by about a factor of 1:1. The results of the fugitive dust estimates should be viewed in light of the fact that the peak anticipated fugitive emissions were assumed to occur throughout the year, and that one quarter of the entire construction site was assumed to be under construction at any given time during the construction process. These conservative assumptions will result in predicted air concentrations that tend to overestimate the potential impacts.

Table B-1 Support Vehicle Emissions

Vehicle	Emission Factor g/km (g/mi)	Number	Daily Mileage km (mi)	Daily Emissions g (lb)		Work-day (10-hr) Average Emission Rate g/s (lb/hr)	
NONMETHANE HYDROCARBONS:							
Light Duty Vehicles	0.75 (1.2)	10	16.1 (10)	120	(0.26)	0.00333	(0.0264)
Light Duty Truck I	0.81 (1.3)	25	16.1 (10)	325	(0.72)	0.00903	(0.0717)
Light Duty Truck II	0.87 (1.4)	8	16.1 (10)	112	(0.25)	0.00311	(0.2247)
Heavy Duty Truck	1.55 (2.5)	5	16.1 (10)	125	(0.28)	0.00347	(0.0275)
Total				682	(1.50)	0.01894	(0.1503)
CARBON MONOXIDE:							
Light Duty Vehicles	2.86 (4.6)	10	16.1 (10)	460	(1.01)	0.01278	(0.1014)
Light Duty Truck I	4.41 (7.1)	30	16.1 (10)	2130	(4.69)	0.05917	(0.4696)
Light Duty Truck II	4.47 (7.2)	8	16.1 (10)	576	(1.27)	0.01600	(0.1269)
Heavy Duty Truck	7.89 (12.7)	5	16.1 (10)	635	(1.40)	0.01764	(0.1400)
Total				3801	(8.37)	0.10559	(0.8380)
NITROGEN OXIDES:							
Light Duty Vehicles	0.43 (0.7)	10	16.1 (10)	70	(0.15)	0.00194	(0.0154)
Light Duty Truck I	0.56 (0.9)	30	16.1 (10)	270	(0.59)	0.00750	(0.0595)
Light Duty Truck II	0.56 (0.9)	8	16.1 (10)	72	(0.16)	0.00200	(0.0159)
Heavy Duty Truck	2.24 (3.6)	5	16.1 (10)	180	(0.40)	0.00500	(0.0397)
Total				592	(1.30)	0.01644	(0.1305)

Table B-2 Construction Equipment Inventory And Emission Factors

		Emission Factors Per Vehicle, g/s (lb/hr)				
Equipment	Numbers	Exhaust Hydrocarbons	Carbon Monoxide	Nitrogen Oxides	Sulfur Oxides	Particulates
Wheeled Tractor	2	85.26 (676.7)	1622.77 (12879.4)	575.84 (4570.2)	40.9 (325)	61.5 (488)
Grader	3	18.07 (143.4)	68.46 (543.3)	324.43 (2574.9)	39.0 (310)	27.7 (220)
Pans	3	18.07 (143.4)	68.46 (543.3)	324.43 (2574.9)	39.9 (317)	27.7 (220)
Wheeled Loader	4	113.17 (898.19)	259.58 (2060.2)	858.19 (6811.2)	82.5 (655)	77.9 (618)
Track-type Loader	5	44.55 (353.6)	91.15 (723.4)	375.22 (2978.0)	34.4 (273)	26.4 (210)
Off-Road Truck	7	86.84 (689.2)	816.81 (6482.7)	1889.16 (14,993.6)	206.6 (1640)	116.0 (921)
Roller	4	30.58 (242.7)	137.97 (1095.0)	392.9 (3118)	30.5 (242)	22.7 (180)
Miscellaneous	5	69.35 (550.4)	306.37 (2431.6)	767.3 (6090)	64.7 (514)	63.2 (502)

Table B-3 Emission Rates For All Construction Vehicles

Equipment	Work-Day Average Emissions Rates g/s (lb/hr)				
	Exhaust Hydrocarbons	Carbon Monoxide	Nitrogen Oxides	Sulfur Oxides	Particulates
Wheeled Tractor	0.047 (0.37)	0.902 (0.716)	0.320 (2.5)	0.023 (0.18)	0.034 (0.27)
Grader	0.015 (0.12)	0.057 (0.45)	0.270 (2.1)	0.033 (0.26)	0.023 (0.18)
Pans	0.015 (0.12)	0.057 (0.45)	0.270 (2.1)	0.033 (0.26)	0.023 (0.18)
Wheeled Loader	0.126 (1.00)	0.288 (2.29)	0.954 (7.57)	0.092 (0.73)	0.087 (0.69)
Track-Type Loader	0.062 (0.49)	0.127 (1.01)	0.521 (4.13)	0.048 (0.38)	0.037 (0.29)
Off-Road Truck	0.169 (1.34)	1.588 (12.60)	3.673 (29.15)	0.402 (3.19)	0.226 (1.79)
Roller	0.034 (0.27)	0.153 (1.21)	0.437 (3.47)	0.034 (0.27)	0.025 (0.20)
Miscellaneous	0.096 (0.076)	0.426 (3.38)	1.066 (8,460)	0.090 (0.71)	0.088 (0.70)
Total	0.564 (4.48)	3.598 (28.56)	7.511 (59.61)	0.755 (5.99)	0.543 (4.31)

Table B-4 Maximum Predicted Site-Boundary Air Concentrations Based On A 1.0 g/s Emission Rate

Averaging Time	Maximum Air Concentration (μg/m³)	Direction From Site
1-Hour	1089.9	North-Northeast
3-Hour	409.9	North
8-Hour	145	North-Northeast
Highest 24-Hour	63.3	North
2nd Highest 24-Hour	32.3	North
1-Year	5	North

Table B-5 Predicted Property-Boundary Air Concentrations and Applicable NAAQS

	Maximum 1-Hr Average (μg/m^3)		Maximum 3-Hr Average (μg/m^3)		Maximum 8-Hr Average (μg/m^3)		Maximum 24-Hr Average (μg/m^3)		2nd Highest 24-Hr Average (μg/m^3)		Maximum Annual Average (μg/m^3)	
Pollutant	Predicted	NAAQS	Predicted	NAAQS	Predicted	NAAQS	Predicted	NAAQS	Predicted	NAAQS	Predicted	NAAQS
VEHICLE EMISSIONS												
Hydrocarbons	635.3	NA	238.9	NA	84.5	NA	36.9	NA	18.8	NA	2.9	NA
Carbon Monoxide	4,036.5	40,000	1,518.1	NA	537.0	10,000	234.4	NA	119.6	NA	18.5	NA
Nitrogen Oxides	8,204.2	NA	3,085.5	NA	1,091.5	NA	476.5	NA	243.1	NA	37.6	100
Sulfur Oxides	822.9	NA	309.5	1310(a)	109.5	NA	47.8	365	24.4	NA	3.8	80
Particulates	591.8	NA	222.6	NA	78.7	NA	34.4	NA	17.5	150	2.7	50
FUGITIVE DUST												
Particulates	2,615.8	NA	983.8	NA	348.0	NA	151.9	NA	77.5	150	12.0	50

(a) Secondary standard

NA Not applicable