3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

This chapter provides information and data for the affected environment at the proposed National Enrichment Facility (NEF) and surrounding vicinity. Topics include land use (3.1), transportation (3.2), and geology and soils (3.3), as well as various resources such as water (3.4), ecological (3.5), historic and cultural (3.8), and visual/scenic (3.9). Other topics included in this chapter are meteorology, climatology, and air pollution (3.6), environmental noise (3.7), socioeconomic information (3.10), public and occupational health (3.11), and waste management (3.12).

3.1 LAND USE

This section describes land uses near the proposed NEF site. It also provides a discussion of off-site areas and the regional setting and includes a map of major land use areas. Major transportation corridors are identified in Section 3.2.

The proposed NEF site is situated within Lea County, on the north side of New Mexico Highway 234, about 0.8 km (0.5 mi) from the New Mexico/Texas state line. It is currently owned by the State of New Mexico and a 35-year easement has been granted to LES. Except for a gravel covered road which bisects the east and west halves of the property, it is undeveloped and utilized for domestic livestock grazing. During the construction phase, a fence runs along the perimeter of the property. An underground carbon dioxide pipeline, running southeast-northwest, traverses the site and an underground natural gas pipeline is located along the south property line.

Surrounding property consists of vacant land and industrial developments. A railroad spur borders the site to the north. Beyond is a sand/aggregate quarry. A vacant parcel of land is situated immediately to the east. Cattle grazing is not allowed on this vacant parcel. Cattle grazing on nearby sites occurs throughout the year. Further east, at the state line and within Andrews County, Texas is a hazardous waste treatment and disposal facility. A landfill is south/southeast of the site, across New Mexico Highway 234 and a petroleum contaminated soil treatment facility is adjacent to the west. Refer to ER Section 2.1.2, Proposed Action, for further discussion of these facilities. Land further north, south and west has been mostly developed by the oil and gas industry. Refer to Section 3.3, Geology and Soils, for further discussion on mineral resources in the site vicinity. Land further east is ranchland. The nearest residences are situated approximately 4.3 km (2.63 mi) west of the site. Beyond is the city of Eunice, which is approximately 8 km (5 mi) to the west. There are no known public recreational areas within 8 km (5 mi) of the site. There is a historical marker and picnic area approximately 3.2 km (2 mi) from the site at the intersection of New Mexico Highways 234 and 18. Transportation corridors are discussed in ER Section 3.2, Transportation. A discussion of schools and hospitals is included in ER Section 3.10, Socioeconmic.

The site and vicinity are located near the boundary between the Southern High Plains Section (Llano Estacado) of the Great Plains Province to the east and the Pecos Plains Section to the west. The boundary between the two sections is the Mescalero Escarpment, locally referred to as Mescalero Ridge. The Elliott Littman field is to the north, Drinkard field to the south and the Monument Jal field to the west. On-site soils are primarily of the Brownfield-Springer association and Kermit Soils and Dune Land. These soils consist of fine sand, loamy fine sand and loose sands surrounding large barren sand dunes. On-site soils are common to areas used for rangeland and wildlife habitat.

Referring to Table 3.1-1a, Land Use Within 8 km (5 mi) of the NEF Site Classification and Area, and Table 3.1-1b, Land Use Within 8 km (5 mi) of the NEF Site Classification Descriptions, and Figure 3.1-1, Land Use Map, rangeland comprises 98.5% of the area within an 8-km (5-mi) radius of the NEF site, encompassing 12,714 ha (31,415 acres) within Lea County, New Mexico and 7,213 ha (17,823 acres) in Andrews County, Texas. Rangeland is an extensive area of open land on which livestock wander and graze and includes herbaceous rangeland, shrub and brush rangeland and mixed rangeland. Built-up land and barren land constitute the other two land use classifications in the site vicinity, but at considerably smaller percentages. Land cover due to built-up areas, which includes residential and industrial developments, makes up 1.2% of the land use. This equates to a combined total of 243 ha (601 acres) for Lea and Andrews Counties. The remaining 0.3% of land area is considered barren land which consists of bare exposed rock, transitional areas and sandy areas. The above, indicated land use classifications are identical to those used by the United States Geological Survey (USGS). No special land use classifications (i.e., Native American reservations, national parks, prime farmland) are within the vicinity of the site.

Wildlife observed on and near the subject site included quail, owls, turtles, white tail and jack rabbits, horny toads, and several javelinas. There are also coyotes, fox and mule deer in addition to emus and ostriches that have been released into the wild by local residents. Dove and quail hunting grounds are located north and west of the site. There are no known game harvests near the site. A nomination has been submitted (Stinnett, 2002) to the Bureau of Land Management (BLM) to designate two public land parcels within Lea County as an Area of Critical Environmental Concern (ACEC) for the lesser prairie chicken (Tympanuchus pallidicinctur). The nearest nominated ACEC is about 48 km (30 mi) northwest of the proposed NEF site. The other nominated ACEC is further north. Currently, the BLM is evaluating this nomination and expects to make a decision within the next several years. See ER Section 3.5, Ecological Resources, for a discussion of other unusual animals that may be found near the site.

Known sources of water in the site vicinity include the following: a manmade pond on the adjacent quarry property to the north which is stocked with fish for private use; Baker Spring, an intermittent surface water feature situated a little over 1.6 km (1 mi) northeast of the site which only contains water seasonally; several cattle watering holes where groundwater is pumped by windmill and stored in above ground tanks; a well by an abandoned home about 4 km (2.5 mi) to the east and Monument Draw, a natural, shallow drainageway situated several miles west of the site. Several longtime, local residents indicated that Monument Draw only contains water for a short period of time following a significant rainstorm. There are also three "produced water" lagoons for industrial purposes on the adjacent quarry property to the north and a manmade pond at the Eunice golf course approximately 15 km (9.5 mi) west of the site.

Although various crops are grown within Lea and Andrews Counties, local and county officials reported that there is no agricultural activity in the site vicinity, except for domestic livestock ranching (see Table 3.1-2, Agriculture Census, Crop and Livestock Information). The principal livestock for both Lea and Andrews Counties is cattle. Although milk cows comprise a significant number of cattle in Lea County, the nearest dairy farms are about 32 km (20 mi) north of the site, near the city of Hobbs, New Mexico. There are no milks cows in Andrews County, Texas. As Table 3.1-2 also shows, the number of farms and acres of farmland decreased slightly within Lea County between 1992 and 1997, whereas the number of farms in Andrews County increased during this same timeframe, but decreased in size (USDA, 2001a; USDA, 2001b; USDA, 2002a; USDA, 2002b). Note that the 1997 census data is the most current information presently available.

Except for the proposed construction of the NEF and the potential citing of a low-level radioactive waste disposal site in Andrews County, Texas, there are no other known current, future or proposed land use plans, including staged plans, for the site or immediate vicinity. Similarly, as the site is not subject to local or county zoning, land use planning or associated review process requirements, there are no known potential conflicts of land use plans, policies or controls.

3.1.1 Section 3.1 Tables

Table 3.1-1aLand Use Within 8 km (5 mi) of the NEF Site Classification and Area

	Area						
Classification	(Hectares)			(Acres)			Percent
	New Mexico	Texas	Total	New Mexico	Texas	Total	
Built Up	243	0	243	601	0	601	1.2
Rangeland	12,714	7,213	19,927	31,415	17,823	49,238	98.5
Barren	69	0	69	170	0	170	0.3
Total	13,026	7,213	20,239	32,186	17,823	50,009	100.0

Table 3.1-1bLand Use Within 8 km (5 mi) of the NEF Site Classification Descriptions

Classification	Description
Built Up	Residential; industrial; commercial services
Rangeland	Herbaceous rangeland; shrub and brush rangeland; mixed rangeland
Barren	Bare exposed rock; transitional areas; beaches; sandy areas other than beaches

Table 3.1-2Agriculture Census, Crop, and Livestock Information

Information	County			
	Lea (New Mexico)		Andrews (Texas)	
Census Data (1992 & 1997)	1997	1992	1997	1992
Number of Farms	528	544	142	134
Total Land in Farms ha (acres)	810,161 (2,001,931)	869,861 (2,149,450)	335,431 (828,859)	389,545 (962,576)
Avg. Farm Size ha (acres)[1]	1,535 (3,792)	1,599 (3,951)	2,362 (5,837)	2,907 (7,183)
Crop Annual Average Yields (Most Current)	Area Harvested Hectares (Acres) in 2001	Yield per Hectare (Acre) in 2001	Area Harvested Hectares (Acres) in 2002	Yield per Unit Area in 2001
Chili Peppers	324 (800)	4.49 MT/ha (2.0 tons/acre)	0	0
Wheat	3,035 (7,500)	3.91 m^3/ha (45.0 bu/acre)	81 (200)	2.61 m^3/ha (30 bu/acre)
Grain Sorghum	688 (1,700)	3.66 m^3/ha (42.1 bu/acre)	688 (1,700)	1,384 kg/ha (1,235 lbs/acre)
Peanuts	5,828 (14,400)	3,182 kg/ha (2,840 lbs/acre)	2,266 (5,600)	4,521 kg/ha (4,035 lbs/acre)
All Hay	4,047 (10,000)	10.9 MT/ha (4.72 tons/acre)	0	0
Alfalfa Hay	2,428 (6,000)	13.6 MT/ha (6.0 tons/acre)	0	0
Pecans[2]	213 (526)	-		-
Upland Cotton	8,984 (22,200)	703 kg/ha (627 lbs/acre)	7,811 (19,300)	435 kg/ha (388 lbs/acre)

Table 3.1-2Agriculture Census, Crop, and Livestock Information

Information	County	
	Lea (New Mexico)	Andrews (Texas)
Livestock (Most Current)	Number in 2001	Number in 2002
All Cattle	82,000	13,000
Beef Cows	27,000	6,000
Milk Cows	25,000	0
Other Cattle (includes cattle on feed)	30,000	0
Sheep and Lambs	4,000	0

[1] Average value per ha (acre) [1998]: New Mexico $536 ($217) / Texas $1,465 ($593) (USDA, National Agricultural Statistical Service)

[2] 1997 Census Data Source: (USDA, 2001a; USDA, 2001b; USDA, 2002a; USDA, 2002b)

3.1.2 Section 3.1 Figures

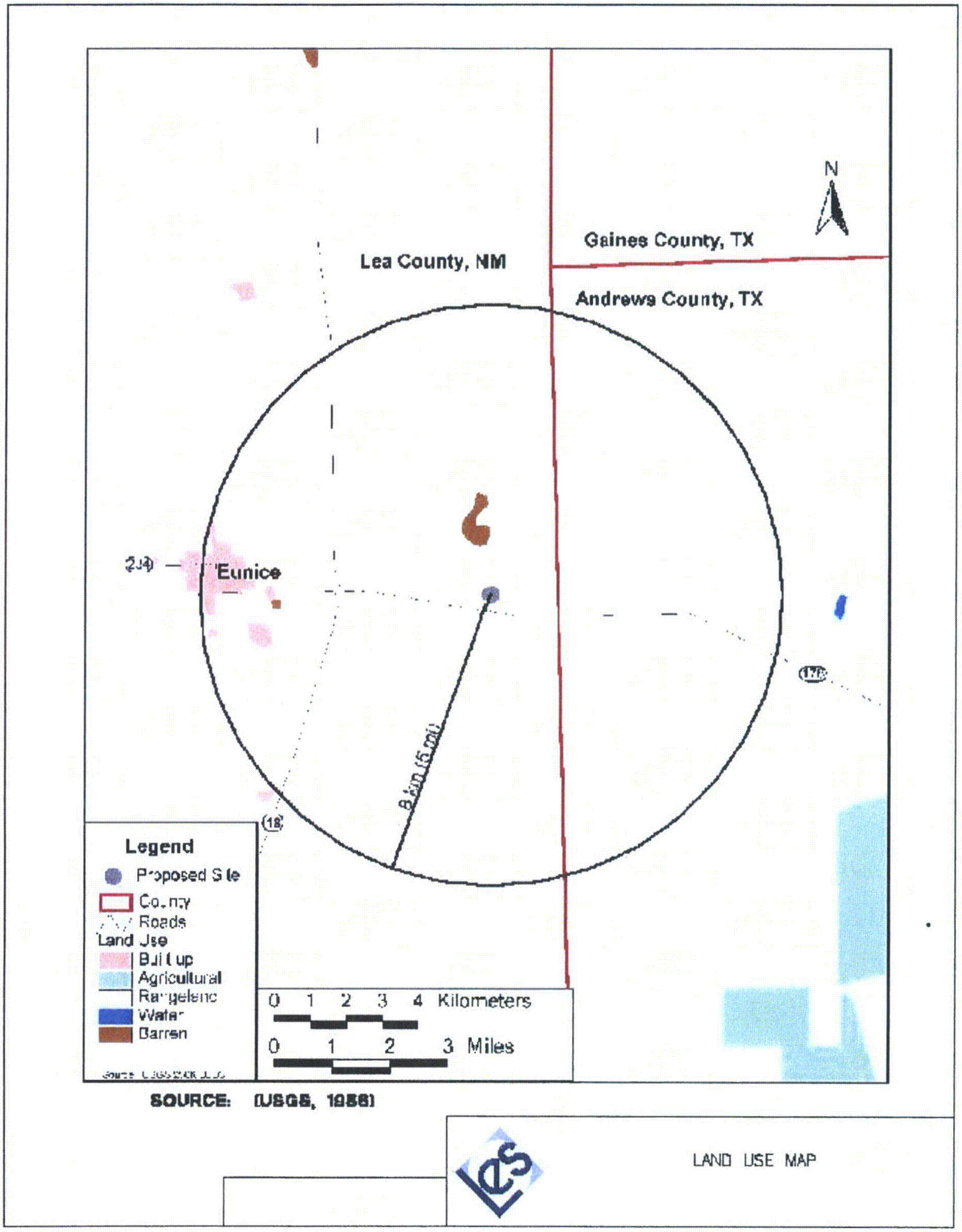


Figure 3.1-1Land Use Map

3.2 TRANSPORTATION

This section describes transportation facilities at or near the NEF site. The section provides input to various other sections such as 3.11, Public And Occupational Health and 3.12, Waste Management, and includes information on access to and from the plant, proposed transportation routes, and applicable restrictions.

3.2.1 Transportation of Access

The proposed NEF 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 is a two-lane highway with 3.7-m (12 ft) driving lanes, along with deceleration, acceleration, and turning lanes. At its widest, across from the facility, the highway is 14.63-m (48 ft) across with an 8 ft shoulder on its southern edge. Across from the facility, the shoulder varies from 2.4-m (8 ft) and about 0.8-m (2.5 ft) along its northern edge. The highway runs within a 61-m (200 ft) wide right-of-way easement. New Mexico Highway 234 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 south to New Mexico Highway 234. New Mexico Highway 18 is a four-lane divided highway which was rehabilitated within the last four to six years north of its intersection with New Mexico Highway 234. It was recently improved south of its intersection with New Mexico Highway 234. To the east in Texas, U.S. Highway 385 intersects Texas Highway 176 providing access from the town of Andrews west to New Mexico Highway 234. To the south in Texas, Interstate 20 intersects Texas Highway 18 which becomes New Mexico Highway 18. West of the site, New Mexico Highway 8 provides access from the city of Eunice east to New Mexico Highway 234. Refer to Figure 2.1-1, 80-Kilometer (50-Mile) Radius With Cities and Roads. Additional information regarding corridor dimensions, corridor uses, and traffic patterns and volumes is provided in ER Section 4.2, Transportation Impacts.

The nearest active rail transportation (the Texas-New Mexico Railroad) is in Eunice, New Mexico to the west about 5.8 km (3.6 mi) from the site. This rail line is used mainly by the local oil and gas industry for freight transport. A train may travel on the rail once a day. There is an active rail spur along the north property line of the site that is owned by the neighboring property to the east (Waste Control Specialists LLC). On average, a train consisting of five to six cars may travel on the rail spur once a week. The speed limit for the rail spur is 16 km (10 mi) per hour.

The nearest airport is in Eunice approximately 16 km (10 mi) west of the site. The airport is used by privately-owned planes.

3.2.2 Transportation Routes

3.2.2.1 Plant Construction Phase

The transportation route for conveying construction material to the site is New Mexico Highway 234, which leads directly into the site. The mode of transportation will consist of over-the-road trucks, ranging from heavy-duty 18-wheeled delivery trucks, concrete mixing trucks and dump trucks, to box and flatbed type light-duty delivery trucks.

3.2.2.2 Plant Operation Phase

All radioactive material shipments will be transported in packages that meet the requirements of 10 CFR 71 (CFR, 2003e) and 49 CFR 171-173 (CFR, 2003k; CFR, 2003l). Uranium feed, product and associated low-level waste (LLW) will be transported to and from the NEF. The following distinguishes each of these conveyances and associated routes.

Uranium Feed

The uranium feed for the NEF is natural uranium in the form of uranium hexafluoride (UF_6). The UF_6 is transported to the facility in 48Y cylinders. These cylinders are designed, fabricated and shipped in accordance with American National Standard Institute N14.1, Uranium Hexafluoride - Packaging for Transport. Feed cylinders are transported to the site by 18-wheeled trucks, one per truck (48Y). In the future, rail transport may also be used to bring uranium feed to the site. Since the NEF has an operational capacity of 690 feed cylinders per year (type 48Y), between 345 and 690 shipments of feed cylinders per year will arrive at the site.

Uranium Product

The product of the NEF is transported in 30B cylinders. These cylinders are designed, fabricated and shipped in accordance with ANSI N14.1, Uranium Hexafluoride - Packaging for Transport. Product cylinders are transported from the site to fuel fabrication facilities by modified flat bed truck - typically two per truck although up to five product cylinders could be transported on the same truck. In the future, rail transport may be used to ship product cylinders from the site. A maximum of 11,500 kg (25,353 lbs) (2,300 kg (5,071 lbs) per cylinder) of enriched uranium could be transported per shipment. There will be approximately 350 product cylinders shipped per year, which would typically result in a shipment frequency of one shipment per three days (122 shipments per year).

Uranium Wastes

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. 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.

Depleted Uranium

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.

3.2.3 Transportation Modes, Route, and Distances

Construction material would be transported by truck from areas north and south of the site via New Mexico Highway 18 to New Mexico Highway 234. From the east, the transportation route would be Texas Highway 176 which becomes New Mexico Highway 234. From the west, New Mexico Highway 8, which becomes New Mexico Highway 234 near the city of Eunice, would serve as the route of transportation. New Mexico Highway 234 provides direct access to the site.

The feed and product materials of the facility will be transported by truck via highway travel only, although use of rail is being considered. Most of the feed material is expected to be obtained from UF_6 conversion facilities near Port Hope, Ontario and Metropolis, IL, although a small amount could come from non-domestic sources. 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 utility 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; Clive UT; Oak Ridge, TN; Paducah, KY; and Portsmouth, OH. Refer to ER Section 3.12.2.1, Radioactive and Mixed Wastes, for disposition options 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. Table 3.2-1, Possible Radioactive Material Transportation Routes, lists the approximate highway distances from the NEF site to the respective conversion facilities, fuel fabrication facilities, and radioactive waste disposal sites.

The highways in the vicinity of the site serve as trucking routes for the local area. Traffic volume on these highways varies greatly during the day. The condition and design basis for these roadways are adequate to meet current traffic flow requirements and future minor changes to traffic patterns brought about by the construction and operation of the NEF.

3.2.4 Land Use Transportation Restrictions

The proposed NEF site is on land currently owned by the State of New Mexico and LES has been granted a 35-year easement for the site. Highway easements associated with state trust land is for highway use only, although application for other uses (i.e., installation of utilities) may be submitted to the state. There are no known restrictions on the types of materials that may be transported along the important transportation corridors. This was confirmed with both the State of New Mexico and Texas officials.

3.2.5 Section 3.2 Tables

Table 3.2-1Possible Radioactive Material Transportation Routes

Facility	Description	Estimated 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 off-site waste processors may also be used.

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

3.3 GEOLOGY AND SOILS

This section identifies the geological, seismological, and geotechnical characteristics of the National Enrichment Facility (NEF) site and its vicinity. Some areas immediately adjacent to the site have been thoroughly studied in recent years in preparation for construction of other facilities including the Waste Control Specialists (WCS) site and the former Atomic Vapor Laser Isotope Separation (AVLIS) site. Data remain available from these investigations in the form of reports (WBG, 1998; TTU, 2000). These documents and related materials provide a significant description of geological conditions for the NEF site. In addition, Louisiana Energy Services (LES) performed field investigations, where necessary, to confirm site-specific conditions.

The NEF site is located in New Mexico west of the Texas border about 48 km (30 mi) from the southeast corner of the state and about 90 km (56 mi) east of the Pecos River. The east edge of the site is 0.8 km (0.5 mi) from the Lea County, New Mexico – Andrews County, Texas border. The site is contained in the Eunice New Mexico, Texas-New Mexico USGS topographic quadrangle (USGS, 1979).

Figure 3.3-1, Regional Physiography, (Raisz, 1957) shows the site is located near the boundary between the Southern High Plains Section (Llano Estacado) of the Great Plains Province to the east and the Pecos Plains Section to the west. The boundary between the two sections is the Mescalero Escarpment, locally referred to as Mescalero Ridge. That ridge abruptly terminates at the far eastern edge of the Pecos Plains. The ridge is an irregular erosional topographic feature in southern Lea County where it exhibits relief of about 9 to 15 m (30 to 50 ft) compared with a nearly vertical cliff and relief of approximately 45 m (150 ft) in northwestern Lea County. The lower relief of the ridge in southeastern Lea County is due to partial cover by wind deposited sand (WBG, 1998). The NEF is located about 6.2 to 9.3 km (10 to 15 mi) southeast of the Mescalero Escarpment (CJI, 2004).

Locally, the proposed NEF site is located on the Eunice Plain just northwest of Rattlesnake Ridge in Section 32, Township 21 South, Range 38 East. The Eunice Plain gently slopes towards Monument Draw, a north to south traversing arroyo. Monument Draw being north of the city of Eunice following a southeasterly trend, and then turns southerly presumably diverted by the Red Bed Ridge.

The dominant geologic feature of this region is the Permian Basin. The NEF site is located within the Central Basin Platform area (Figure 3.3-2, Regional Geology of the Permian Basin). This platform occurs between the Midland and Delaware Basins, which comprises the Permian Basin. The basin, a 250 million-year-old feature, is the source of the region's prolific oil and gas reserves. The late Cretaceous to the early Tertiary periods (65 to 70 million years ago) marked the beginning of the Laramide Orogeny, which formed the Cordilleran Range to the west of the Permian Basin. That orogeny uplifted the region to its present elevation.

The primary difference between the Pecos Plains and the Southern High Plains physiographic sections is a change in topography. The High Plains is a large flat mesa which uniformly slopes to the southeast. In contrast, the Pecos Plains section is characterized by its more irregular erosional topographic expression (WBG, 1998). Topographic relief on the site is generally subdued. NEF site elevations range between about +1,030 and +1,053 m (+3,380 and +3,455 ft), mean sea level (msl). Finished site grade will be about +1,041 m (+3,415 ft), msl (Figure 3.3-3, Site Topography). The NEF site itself encompasses approximately 220 ha (543 acres), of which approximately 73 ha (180 acres) will be developed. Small-scale topographic features within the boundary of the proposed NEF site include a closed depression evident at the northern center of the site, the result of eolian processes, and a topographic high at the southwest corner of the site that was created by dune sand. In general the site slopes from northeast to southwest with a general overall slope of about 0.5%. Red Bed Ridge (TTU, 2000) is an escarpment of about 15 m (50 ft) in height that occurs just north and northeast of the NEF site. It is a prominent buried ridge developed on the upper surface of the Triassic Dockum Group "red beds" (Rainwater, 1996). The crest of the buried Red Bed Ridge is approximately 1.6 km (1 mi) or so in width and extends for at least 160.9 km (100 mi) in length from northern Lea County, New Mexico, through western Andrews County, Texas, and southward into Winkler and Ector Counties in Texas. The Red Bed Ridge runs from the northwest to the southeast, just north and northeast of the NEF site through the adjacent Wallach Quarry and Waste Control Specialists (WCS) properties (TTU, 2000). The Red Bed Ridge origin appears to be the result of the relative resistant character of the claystone of the Chinle Formation and to caliche deposits that cap the ridge.

Although the Mescalero Escarpment and the Red Bed Ridge are likely to have originated due to similar geomorphological processes, as both appear to be remnant erosional features, they are not associated with each other.

Geologically the site is located in an area where surface exposures consist mainly of Quaternary-aged eolian and piedmont sediments along the far eastern margin of the Pecos River Valley (NMIMT, 2003). Figure 3.3-4, Surficial Geologic Map of the NEF Site Area is a portion of the Surficial Geologic Map of Southeast New Mexico (NMIMT, 1977), which includes the area of the NEF site. The surficial unit shown on this map at the NEF site is described as a sandy alluvium with subordinate amounts of gravel, silt and clay. Figure 3.3-4 also describes other surficial units in the site vicinity including caliche, a partly indurated zone of calcium carbonate accumulation formed in the upper layers of surficial deposits including tough slabby surface layers and subsurface nodules, fibers and veinlets; loose sand deposits, some gypsiferous, and subject to wind erosion. Other surficial deposits in the site area include floodplain channel deposits along dry channels and playa sands.

Recent deposits of dune sands are derived from Permian and Triassic rocks. These so-called Mescalero Sands (also known as the Blackwater Draw Formation) occur over 80% of Lea County and are generally described as fine to medium-grained and reddish brown in color. The USDA Soil Survey of Lea County identifies the dune sands at the site as the Brownsfield¬-Springer Association of reddish brown fine to loamy fine sands (USDA, 1974).

Figure 3.3-5, Preliminary Site Boring Plan and Profile, includes the preliminary NEF site borings, adjacent site borings and a geologic profile from the immediately adjacent parcel to the east that provides a representation of site geology. The profile shows alluvial deposits about 9 to 15 m (30 to 60 ft) thick, cemented by a soft caliche layer of 1 to 4 m (3 to 13 ft) that occurs at the top of the alluvium. Locally on the site, dune sand overlies both these deposits. The alluvium rests on the red beds of the Chinle Formation, a silty clay with lenses of sandy clay or claystone and siltstone. Information from borings initiated by LES on the NEF site in September 2003 is consistent with the data shown on the profile in Figure 3.3-5 as discussed in ER Section 3.3.1, Stratigraphy and Structures.

Borings on the NEF site depicted on Figure 3.3-5 include:

- Three borings/monitoring wells (MW-1, MW-2, and MW-3)
- Nine site groundwater exploration borings (B-1 through B-9)
- Five geotechnical borings (B-1 through B-5).

Other borings depicted on Figure 3.3-5, not on the NEF site, were performed by others.

In 2007, fifteen additional groundwater monitoring wells were drilled at locations depicted on Figure 6.1-2A and monitoring well MW-3 was plugged and abandoned because of its location in the footprint of the Storm Water Detention Basin.

In 2008, eight more ground water monitoring wells were drilled adjacent to the UBC Storage Pad and UBC Storage Pad Storm Water Retention Basin. Monitoring well locations are depicted on figure 6.1-2A.

Detailed information about soil composition across the NEF site, which was taken from a larger number of geotechnical boring, can be found in Appendices A and C of the Geotechnical Report (NTS Report 114489-G-01, Rev. 00).

The Southeast New Mexico-West Texas area presently is structurally stable. The Permian Basin has subsided slightly since the Laramide Orogeny. This is believed to be a result of dissolution of the Permian evaporite layers by groundwater infiltration and possibly from oil and gas extraction (WBG, 1998).

The NEF site lies within the Landreth-Monument Draw Watershed. Site drainage is to the southwest with runoff not able to reach any water body before it evaporates. The only major regional drainage feature is Monument Draw, which is located just over 4 km (2.5 mi) west of the site, between the proposed NEF site and the city of Eunice, New Mexico (USDA, 1974). The draw begins with a southeasterly course to a point north of Eunice where it turns south and becomes a well defined cut approximately 9 m (30 ft) in depth and 550 to 610 m (1,800 to 2,000 ft) in width. The draw does not have through-going drainage and is partially filled with dune sand and alluvium.

Along Red Bed Ridge (TTU, 2000), approximately 1.6 km (1 mi) northeast of the NEF site is Baker Spring (Figure 3.3-5, Preliminary Site Boring Plan and Profile). The depression contains water only intermittently (see ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems). No defined drainage features are present at the site. Rainfall on the site will be collected in detention/retention basins. Rainfall that is not collected is expected to infiltrate, or evaporate without creating any runoff that flows beyond site boundaries.

Within Lea County, New Mexico and Andrews County, Texas there are water-bearing strata used for water production. North and east of the NEF site, beneath the High Plains, the Ogallala Aquifer is the most productive of these regional aquifers. West of the site, in the alluvial deposits of Monument Draw, subsurface flow is also locally used as a minor aquifer. Lastly, the Santa Rosa Formation of the Lower Dockum Group and sandy lenses in the Upper Dockum Chinle formation are occasionally used as aquifers on a regional basis.

The most shallow strata to produce measurable quantities of water is an undifferentiated siltstone seam of the Chinle encountered at approximately 65 to 68 m (214 to 222 ft) below ground surface (WBG, 1998). There is also a 30.5-meter (100-foot) thick water-bearing sandstone layer at about 183 m (600 ft) below ground surface. However, the uppermost aquifer capable of producing significant volumes of water is the Santa Rosa Formation located approximately 340 m (1,115 ft) below ground surface (CJI, 2004).

With respect to the environment, geologic conditions at the NEF site will not be significantly affected by construction or operation of the NEF. (See ER Section 4.3, Geology and Soils Impact.)

3.3.1 Stratigraphy and Structures

The Permian Basin, a massive subsurface bedrock structure, is a downward flexure of a large thickness of originally flat-lying, bedded, sedimentary rock. It dominates the geologic structure of the region. It extends to 4,880 meters (16,000 feet) below msl. The NEF site is located above the Central Basin Platform that divides the Permian Basin into the Midland and Delaware sub-basins, as shown in Figure 3.3-2, Regional Geology of the Permian Basin. The base of the Permian basin sediments extends about 1,525 m (5,000 ft) deep beneath the NEF site.

The top of the Permian deposits are approximately 434 m (1,425 ft) below ground surface. Overlying the Permian are the sedimentary rocks of the Triassic Age Dockum Group. The upper formation of the Dockum Group is the Chinle. Locally, the Chinle Formation consists of red, purple and greenish micaceous claystone and siltstone with interbedded fine-grained sandstone. The Chinle is regionally extensive with outcrops as far away as the Grand Canyon region in Arizona (WBG, 1998). Locally overlying the Chinle Formation in the Permian Basin is either the Tertiary Ogallala, Gatuña or Antlers Formations, or Quaternary alluvium. The Tertiary Ogallala Formation underlies all of the High Plains (to the east) and mantles several ridges in Lea County. Unconsolidated sediments northeast of the NEF site are recognized as the Ogallala and deposits west of the NEF site are mapped as the Gatuña or Antlers Formations. This sediment is described as alluvium (WBG, 1998) and is mined as sand and gravel in the NEF site area.

As shown in Table 3.3-1, Geological Units Exposed At, Near, or Underlying the Site, the uppermost 340 m (1,115 ft) of the subsurface in the NEF site vicinity can include up to 0.6 m (2 ft) of silty fine sand, about 3 m (10 ft) of dune sand, 6 m (20 ft) of caliche, and 16 m (54 ft) of alluvium overlying the Chinle Formation of the Triassic Age Dockum Group. The Chinle Formation is predominately red to purple moderately indurated claystone, which is highly impermeable (WBG, 1998). Red Bed Ridge is a significant topographic feature in this regional plain that is just north and northeast of the NEF site, and is capped by relatively resistant caliche. Ground surface elevation increases about 15 m (50 ft) from +1,045 m (+3,430 ft) to +1,059 m (+3,475 ft) across the ridge.

Recent deposits at the site and in the site area are primarily dune sands derived from Permian and Triassic rocks of the Permian Basin. These so-called Mescalero Sands cover approximately 80% of Lea County, locally as active sand dunes.

Information from borings initiated by LES on the NEF site in September 2003 is consistent with the data shown on the profile in Figure 3.3-5, Preliminary Site Boring Plan and Profile. This includes a thin layer of loose sand at the surface; about 12 m (40 ft) of high blow count alluvial silty sand and sand and gravel locally cemented with caliche; and the Chinle clay at a depth of about 12 m (40 ft) below the ground surface. No sandy clay layers were reported in the clay.

The boring logs for the preliminary set of NEF site geotechnical borings (Borings B-1 through B-5) are provided in the Integrated Safety Analysis Summary Figures 3.2-10 through 3.2-15.

The boring logs for the detailed set of NEF site geotechnical borings can be found in Appendix A of the Geotechnical Report (NTS Report No. 114489-G-01, Rev. 00), and the drawing in Appendix C of the Geotechnical Report shows the locations of these borings.

Two types of faulting were associated with early Permian deformation. Most of the faults were long, high-angle reverse faults with well over a hundred meters (several hundred feet) of vertical displacement that often involved the Precambrian basement rocks. The second type of faulting is found along the western margin of the platform where long strike-slip faults, with displacements of tens of kilometers (miles), are found. The closest fault to the site as defined by the New Mexico Bureau of Geology and Mineral Resources (NMIMT, 2003) is over 161 km (100 mi) to the west and is associated with the deeper portions of the Permian Basin (Machette, 1998).

The large structural features of the Permian Basin are reflected only indirectly in the Mesozoic and Cenozoic rocks, as there has been virtually no tectonic movement within the basin since the Permian period. Figure 3.3-2, Regional Geology of the Permian Basin, shows the structure that causes the draping of the Permian sediments over the Central Basin Platform structure, located approximately 2,134 m (7,000 ft) beneath the present land surface. The faults that uplifted the platform do not appear to have displaced the younger Permian sediments.

In addition to the lack of regional information indicating the presence of post-Permian faulting, the local information does not indicate Holocene displacement of faults near the proposed NEF site. Site investigations carried out for the WCS site provide an indication that faulting is absent in the subsurface beneath that site. The majority of Quaternary age faults within New Mexico are mapped along the north-south trending Rio Grande Rift located approximately 290 km (180 mi) west of the site.

According to Machette et al. (Machette, 1998), Quaternary age faults are not identified in New Mexico within 161 km (100 mi) of the site. Quaternary age faults designated as capable within 240 km (150 mi) of the site include the Guadalupe fault, located approximately 191 km (119 mi) west of the site in New Mexico, and in Texas, the West Delaware Mountains fault zone, East Sierra Diablo fault, and East Flat Top Mountain fault, located 185 km (115 mi) southwest, 196 km (122 mi) southwest, and 200 km (124 mi) west-southwest, respectively. The East Baylor Mountain-Carrizo Mountain fault is considered a possible, capable fault located 201 km (125 mi) southwest of the NEF site, but movement within the last 35,000 years has not been demonstrated (DOE, 2003d; Machette, 2000; USGS, 2004).

3.3.1.1 Potential Mineral Resources at the Site

No significant non-petroleum mineral deposits are known to exist in the vicinity of the NEF site. The surface cover of silty sand and gravel overlies a claystone of no economic value. No mineral operations are noted in Lea County by the New Mexico Bureau of Mines Inspection (NMBMI, 2001). Mining and potential mining of potash, a commonly extracted mineral in New Mexico, is followed by the New Mexico Energy, Minerals and Natural Resources Department, which maintains a map of areas with potash mines and mining potential (NMEMNRD, 2003). Those data indicate neither mining nor potential for mining of potash in the site area.

The topographic quadrangle map that contains the site (USGS, 1979) contains 10 locations where sand and gravel have been mined from surface deposits, spread across the quadrangle, an area about 12 by 14 km (7.5 by 8.9 mi), suggesting that suitable surficial deposits for borrow material are widespread.

Exploratory drill holes for oil and gas are absent from the site area and its vicinity, but are common 8 km (5 mi) west in and around the city of Eunice, New Mexico. See ER Figure 3.4-7, Water and Oil Wells in the Vicinity of the NEF Site, for nearby well locations. That distribution and the time period of exploration since the inception of exploration for this area suggest that the potential for productive oil drilling at the NEF site is not significant.

3.3.1.2 Volcanism

No volcanic activity exists in the NEF site region.

3.3.2 Site Soils

Soil development in the region is generally limited due to its semi-arid climate. The site has a minor thickness of silty fine sand soil (generally less than 0.4 m (1.4 ft)) developed from subaerial weathering. Caliche deposits are common in the near-surface soils. A small deposit of active dune sand is present at the southwest corner of the site.

The U. S. Department of Agriculture soil survey for Lea County, New Mexico (USDA, 1974) categorizes site soils as hummocky loamy (silty) fine sand. Near-surface caliche deposits may locally limit (limiting soil porosity) or enhance (fractured caliche) surface drainage. Figure 3.3-6, Site Soils Map Per USDA Data, shows the soil map for the NEF site (USDA, 1974). The legend for that map lists each of the soils present at the NEF site, describing them and citing their Unified Soil Classification designations (ASTM, 1993).

Detailed information about soil composition across the NEF site can be found in Appendices A and C of the Geotechnical Report (NTS Report No. 114489-G-01, Rev. 00).

Eight surface soil samples were collected and analyzed for both radiological and non-radiological chemical analyses. Refer to ER Section 3.11.1.1 for a discussion of the radiological analyses results for these eight samples as well as for ten surface soil samples that were previously collected for initial radiological characterization of the NEF site.

The non-radiological chemical analyses included volatiles, semi-volatiles, 8 Resource Conservation and Recovery Act (RCRA) metals, organochlorine pesticides, organophosphorous compounds, chlorinated herbicides and fluoride. 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. Table 3.3-8, NEF Site Soil Sample Locations, provides descriptions and the latitude and longitude of the soil samples locations. The approximate locations of the soil samples are shown on Figure 3.3-12, Soil Sample Locations.

The non-radiological analytical results for the eight soil samples are provided in Table 3.3-9, Non-Radiological Chemical Analyses of NEF Site Soil. Barium, chromium and lead were detected above laboratory reporting limits in all eight soil samples. However, their detected levels are below State of New Mexico Soil Screening Levels as developed by the New Mexico Environment Department (NMED, 2004b). Other non-radiological parameters were not detected at levels above the laboratory reporting limits.

3.3.2.1 Geotechnical Investigations

Previously completed geotechnical investigations on property near the NEF site provide the following subsurface information.

The granular soils in the uppermost 12 m (40 ft) of the subsurface provide potentially high-quality bearing materials for building and heavy machine foundations. For extremely heavy or settlement intolerant facilities, foundations can be founded in the Chinle Formation which has an unconfined compressive strength of over 195,000 kg/m2 (20 ton/ft2) (WBG, 1998).

Topsoil occurs as 0.3 m (1 ft) or less of brown organic silty sand that overlies a formation of white or tan caliche. The caliche consists of very hard to friable cemented sand, conglomerate limestone rock, silty sand and gravel. A sand and gravel layer varying from 0 to 6 m (0 to 20 ft) in thickness occurs at the bottom of the caliche strata. Below the caliche is a reddish brown silt clay that extends to the termination of the preliminary borings, 30 to 91 m (100 to 300 ft) below grade. The red beds consist of a highly consolidated, impervious clay:

- mottled reddish brown-gray clay;
- purple-gray silty clay;
- yellowish brown-gray silty clay; and
- siltstones and sandstone layers found at various depths with varying thicknesses

The depth to the top of the red beds in preliminary borings done for engineering purposes ranged from about 3.6 to 9.1 m (12 to 30 ft).

Permeabilities were measured for the reddish brown silty clays, sandstones and siltstones. Ranges were determined as shown in Table 3.3-2, Measured Permeabilities Near the NEF Site. The values for the clay indicate that it is highly impervious. Siltstones are slightly more permeable, but still having relatively poor permeability.

Unconfined compressive tests on the clay during the September 2003 geotechnical investigation resulted in values from 136,000 kg/m2 to 485,000 kg/m2 (13.9 to 49.7 tons/ft2) with an average value of 293,000 kg/m2 (30 tons/ft2).

According to the Geotechnical Report (NTS Report No. 114489-G-01, Rev. 00), there is no potential for liquefaction at the site.

Detailed information about soil composition across the NEF site, including N-values, can be found in Appendices A and C of the Geotechnical Report (NTS Report No. 114489-G-01, Rev. 00). Allowable bearing pressures can be found in Table 5.8-2 and Figures 5.8-1 and 5.8-2 of the Geotechnical Report, and these values are based on the assumptions in Section 5.8 of the report. The California Bearing Ratio (CBR) test results can be found in Section 5.6.1 of the report. Table 5.9-4 of the report gives the maximum dry density values. A discussion of the soil's Young's modulus and a plot of the soil's Young's modulus can be found in Section 5.9.3 and Figure 5.9-4 of the report, respectively. Information on Atterberg limits can be found in Table 2-2 and Figure 2-5 of the report. A graph of the percentage of soil particles passing No. 200 sieve size vs. elevation is given in Figure 2-3 of the report.

For samples from the shallow sand and gravel unit, California Bearing Ratio values of 10.5 and 34.4 were obtained along with a maximum dry density value of 1.97 g/cm3 (123 lbs/ft3). Fines in this material were generally non-plastic with 17% to 31% of samples finer than 200 sieve size. Clay samples had relatively high liquid limits of 50% to 60% and plastic limits of 18% to 23%, suggesting high silt content.

Footings bearing in the firm and dense sandy soils below the upper loose eolian soils are estimated to have an allowable bearing pressure of 34,177 kg/m2 (7,000 lbs/ft2).

3.3.3 Seismology

The majority of earthquakes in the United States are located in the tectonically active western portion of the country. However, areas within New Mexico and the southwestern United States also experience earthquakes, although at a lower rate and at lower intensities. Earthquakes in the region around the NEF site include: isolated and small clusters of low to moderate size events toward the Rio Grande Valley of New Mexico and in Texas, southeast of the NEF site.

3.3.3.1 Seismic History of the Region and Vicinity

The NEF site is located within the Permian Basin as shown on Figure 3.3-7, Tectonic Subdivisions of the Permian Basin (Talley, 1997). Specifically, the site is located near the northern end of the Central Basin Platform (CBP). The CBP became a distinct dividing feature within the Permian Basin as a result of Pennsylvanian and early Permian compressional stresses. This tectonism resulted in a deeper Delaware Basin to the west and shallower Midland Basin to the east of the ridge-like CBP.

The last episode of tectonic activity centered on the late Cretaceous and early Tertiary Laramide Orogeny that formed the Cordilleran Range to the west of the Permian Basin. The Permian Basin region was uplifted to its present position during this orogenic event. There has not been any further tectonic activity since the early Tertiary. Structurally, the Permian Basin has subsided slightly since the Larmaide tectonic event. Dissolution of Permian evaporate layers by groundwater infiltration or possibly from oil and gas extraction is suggested as a possible cause for this observed subsidence.

The 250-million year old Permian Basin is the source of abundant gas and oil reserves that continue to be extracted. These oil fields in southeast New Mexico are characterized as "in a mature stage of secondary recovery effort" (Talley, 1997). Water flooding began in the late 1970's followed by carbon dioxide (CO2) flooding now being used to enhance recovery in some fields. Industry case studies describe hydraulic fracturing procedures used in the Queen and San Andres formations near the NEF site that produced fracture half-lengths from 170 to 259 m (560 to 850 ft) in these formations.

No Quaternary faults are mapped for the site locale. The nearest recent faulting is situated more than 161 km (100 mi) west of the site (Machette, 1998).

The study of historical seismicity includes earthquakes in the region of interest known from felt or damage records and from more recent instrumental records (since early 1960's). Most earthquakes in the region have left no observable surface fault rupture.

Figure 3.3-8, Seismicity Map for 322-Kilometer (200-Mile) Radius of the NEF Site indicates the location of earthquakes which have occurred within a 322 km (200 mi) radius of the NEF site with magnitude > 0). The earthquakes are also listed in Table 3.3-3, Earthquakes Within a 322 Kilometer (200 Mile) Radius of the NEF Site. Figure 3.3-9, Seismicity in the Immediate Vicinity of the NEF Site, indicates the location of earthquakes within about 97 km (60 mi) of the NEF site. Earthquakes, which have occurred within a 322 km (200 mi) radius of the NEF site with a magnitude of 3.0 and greater, are listed in Table 3.3-4, Earthquakes of Magnitude 3.0 and Greater Within 322 Kilometers (200 Mile) of the NEF Site.

The data reflected in the above figures and tables are from earthquake catalogs from the University of Texas Institute for Geophysics (UTIG, 2002), New Mexico Tech Historical Catalog (NMIMT, 2002), Advanced National Seismic System (USGS, 2003a) and the New Mexico Tech Regional Catalog, exclusive of Socorro New Mexico events (NMIMT, 2002).

Earthquake data for a 322 km (200 mi) radius of the NEF site were acquired from public domain resources. Table 3.3-5, Earthquake Data Sources for New Mexico and West Texas, lists organizations and data sources that were identified and earthquake catalogs were obtained.

Earthquake parameters (e.g., date, time, location coordinates, magnitudes, etc.) from the data repositories listed in Table 3.3-5 were combined into a uniformly formatted database to allow statistical analyses and map display of the four catalogs. Through a process of comparison of earthquake entries among the four catalogs, duplicate events were purged to achieve a composite catalog. In addition, aftershocks and aftershock sequences were purged from one version of the catalog for computation of earthquake recurrence statistical models, which describe recurrence rates of earthquake main shocks. The composite list of earthquakes, with aftershocks and aftershock sequences purged, for the 322 km (200 mi) radius of the NEF site is provided in Table 3.3-3, Earthquakes Within a 322 Kilometer (200 Mile) Radius of the Site. The regional seismicity map is shown on Figure 3.3-8, Seismicity Map for 322-Kilometer (200-Mile) Radius of the NEF Site. Local seismicity is shown on Figure 3.3-9, Seismicity in the Immediate Vicinity of the NEF Site. The large majority of events (i.e., 82%) in the composite catalog originate from the Earthquake Catalogs for New Mexico (exclusive of the Socorro New Mexico immediate area) (NMIMT, 2002) as observed in the event counts in Table 3.3-5, Earthquake Data Sources for New Mexico and West Texas. Earthquake magnitudes in these catalogs (NMIMT, 2002) are tied to the New Mexico duration magnitude scale, Md, that in turn approximate Local Magnitude, ML. All events in the composite catalog are specified to have an undifferentiated local magnitude.

Table 3.3-4, Earthquakes of Magnitude 3.0 and Greater Within 322 Kilometer (200 Mile) of the NEF Site, shows all earthquake main shocks of magnitude 3.0 and larger within a 322 km (200 mi) radius of the NEF site. The largest earthquake within 322 km (200 mi) of the NEF is the August 16, 1931 earthquake located near Valentine, Texas. This earthquake has an estimated magnitude of 6.0 to 6.4 and produced a maximum epicentral intensity of VIII on the Modified Mercalli Intensity (MMI) Scale. The intensity observed at the NEF site is IV on the MMI scale (NMGS, 1976). A copy of the MMI scale is provided in Table 3.3-6, Modified Mercalli Intensity Scale. The closest of these moderate earthquakes occurred about 16 km (10 mi) southwest of the site on January 2, 1992.

It is noted that the University of Texas Geophysics Institute Catalog of West Texas Earthquakes reports a smaller magnitude of 4.6 and a more easterly epicenter location in Texas for the January 2, 1992 earthquake. Table 3.3-7, Comparison of Parameters for the January 2, 1992 Eunice, New Mexico Earthquake, shows the location and size parameters for the January 2, 1992 earthquake. Parameters given by the New Mexico Tech Regional Catalog were adopted for the seismic hazard assessment of the NEF site.

3.3.3.2 Correlation of Seismicity with Tectonic Features

Earthquake epicenters scaled to magnitude for the site region are plotted over Permian Basin tectonic elements on Figure 3.3-10, Regional Seismicity and Tectonic Elements of the Permian Basin. Most epicenters lie within the Central Basin Platform, however, earthquake clusters also occur within the Delaware and Midland Basins. Although events local to the NEF site are likely induced by gas/oil recovery methods, the resulting ground motions are transmitted similar to earthquakes on tectonic faults and impacts at the NEF site are analyzed using standard seismic hazard methods. Furthermore, given the published uncertainties on discrimination between natural and induced seismic events and that earthquake focal depths, critical for correlation with oil/gas reservoirs, are largely unavailable, the January 2, 1992 event is attributed to a tectonic origin. For this magnitude 5 earthquake, focal depths range from 5 km (3.1 mi) (USGS, 2004) to 12 km (7.5 mi) (DOE, 2003). Therefore, studies conclude that seismological data are insufficient for this moderate earthquake to constrain the depth sufficiently to permit a correlation with local oil/gas producing horizons.

Analysis of the spatial density of earthquakes in the composite catalog is shown on Figure 3.3 11, Earthquake Frequency Contours and Tectonic Elements of the Permian Basin. This form of spatial analysis has historically been used to define the geometry of seismic source zones for seismic hazard investigations (USGS, 1997; USGS, 1976). Seismic source areas for the NEF site region are determined on the basis of the earthquake frequency pattern shown on Figure 3.3-11. The NEF site is located near the northern end of the region of highest observed earthquake frequency within the Central Basin Platform of the Permian Basin.

The Waste Isolation Pilot Project (WIPP) Safety Analysis Report (SAR) (DOE, 2003d) suggests that the cluster of small events located along the Central Basin Platform (Figure 3.3-10, Regional Seismicity and Tectonic Elements of the Permian Basin) are not tectonic in origin, but are instead related to water injection and withdrawal for secondary recovery operations in oil fields in the Central Basin Platform area. Such a mechanism for the Central Basin Platform seismic activity could provide a reason why the Central Basin Platform is separable from the rest of the Permian Basin on the basis of seismicity data but not by using other common indicators of tectonic character. Both the spatial and temporal association of Central Basin Platform seismicity with secondary recovery projects at oil fields in the area are suggestive of some cause and effect relationship of this type.

3.3.4 Section 3.3 Tables

Table 3.3-1 Geological Units Exposed At, Near, or Underlying the Site

Formation	Geologic Age	Descriptions	Estimates for the NEF Site Area[1], [6]	
			Depths: m (ft)	Thickness: m (ft)
Topsoils	Recent	Silty fine sand with some fine roots - eolian	Range: 0 to 0.6 (0 to 2) Average: 0 to 0.4 (0 to 1.4)	Range: 0.3 to 0.6 (1 to 2) Average: 0.4 (1.4)
Mescalero Sands/ Blackwater Draw Formation	Quaternary	Dune or dune-related sands	Range (sporadic across site): 0 to 3 (0 to 10) Average: NA[4]	Range (sporadic across site): 0 to 3 (0 to 10) Average: NA[5]
Gatuña/ Antlers Formation	Pleistocene/ mid-Pliocene	Pecos Valley alluvium: Sand and silty sand with interbedded caliche near the surface and a sand and gravel base layer	Range: 0.3 to 17 (1 to 55) Average: 0.4 to 12 (1.4 to 39)	Range: 6.7 to 16 (22 to 54) Average: 12 (38)
Mescalero Caliche	Quaternary	Soft to hard calcium carbonate deposits	Range: 1.8 to 12 (6 to 38) Average: 3.7 to 8 (12 to 26)	Range: 0 to 6 (0 to 20) Average (all 14 borings) [2]: 1.4 (5) Average (five borings that encountered caliche): 4.3 (14)
Chinle Formation	Triassic	Claystone and silty clay: red beds	Range: 7 to 340 (23 to 1,115) Average: 12 to 340 (39 to 1,115)	Range: 323 to 333 (1,060 to 1,092) Average: 328 (1,076)
Santa Rosa Formation	Triassic	Sandy red beds, conglomerates and shales	Range: 340 to 434 (1,115 to 1,425) Average: NA[4]	Range: NA[3] Average: 94 (310)
Dewey Lake	Permian	Muddy sandstone and shale red beds	Range: 434 to 480 (1,425 to 1,575) Average: NA[4]	Range: NA[3] Average: 46 (150)

Notes:

1. Range of depths is below ground level to shallowest top and deepest bottom of geological unit determined from site boring logs, unless noted.
   Average depths are below ground level to average top and average bottom of geological unit determined from site boring logs, unless noted.
   Range of thickness is from the smallest thickness to the largest thickness of geological unit determined from site boring logs, unless noted.
   Average thickness is the average as determined from site boring logs, unless noted.
   Bottom of Chinle Formation, top and bottom of Santa Rosa Formation and top and bottom of Dewey Lake Formation are single values from a deep boring just south of the NEF.
2. Caliche is not present at some locations of the site. Where not present in a particular boring, a thickness of '0' m (ft) was used in calculating the average.
3. Range of thickness is not available.
4. Average depths are not available.
5. Average thickness is not available.
6. Near surface depth and thickness information is primarily from sources (CJI, 2003) and (MACTEC, 2003). Deeper depth and thickness information is from source (CJI, 2004).

Sources: (CJI, 2003; CJI, 2004; DOE, 1997b; MACTEC, 2003; TTU, 2000)

Table 3.3-2Measured Permeabilities Near the NEF Site

Permeability Direction	Sediment Type	Permeability, cm/s (ft/s)
Vertical	Clays	$1.00x10^{-9}$ to $1.76x10^{-8}$ ($3.28x10^{-11}$ to $5.77x10^{-10}$)
Horizontal	Clays	$1.63x10^{-9}$ to $1.10x10^{-8}$ ($5.35x10^{-11}$ to $3.61x10^{-10}$)
Vertical	Siltstones and sandstones within 18 to 27 m (56 to 90 ft) depth	$2.58x10^{-8}$ to $1.93x10^{-6}$ ($8.46x10^{-10}$ to $6.33x10^{-8}$)
Horizontal	Siltstones and sandstones within 18 to 27 m (56 to 90 ft) depth	Average: $6.53x10^{-7}$ ($2.14x10^{-8}$)
Vertical	Siltstone at 63 m (208 ft) depth	$2.06x10^{-8}$ ($6.76x10^{-10}$)

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site	Longitude	Latitude
Coordinates	-103.0820	32.4360

Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal Depth[1] (km)	Focal Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	Epicentral Distance (mi)	Data Sources[4]
1931	8	16	-104.60	30.70			6.00	M	240.3	149.3	UTIG
1949	5	23	-105.20	34.60			4.50	M	310.0	192.6	NMTH
1955	1	27	-104.50	30.60			3.30	M	244.0	151.6	UTIG
1962	3	6	-104.80	31.20			3.50	M	212.3	131.9	UTIG
1963	12	19	-104.27	34.82			3.40	M	287.0	178.3	NMTR
1964	2	11	-103.94	34.23			2.10	M	214.2	133.1	NMTR
1964	3	3	-103.60	34.84			2.90	M	271.0	168.4	NMTR
1964	6	19	-105.77	32.95			1.90	M	257.4	159.9	NMTR
1964	8	14	-102.94	31.97			1.90	M	53.1	33.0	NMTR
1964	9	7	-102.92	31.94			1.60	M	56.9	35.3	NMTR
1964	11	8	-103.10	31.90			3.00	M	59.5	37.0	UTIG
1964	11	21	-103.10	31.90			3.10	M	59.5	37.0	UTIG
1964	11	27	-102.97	31.89			1.90	M	61.1	38.0	NMTR
1965	1	21	-102.85	32.02			1.30	M	50.9	31.6	NMTR
1965	2	3	-103.10	31.90			3.30	M	59.5	37.0	UTIG
1965	8	30	-103.00	31.90			3.50	M	60.0	37.3	UTIG
1966	8	14	-103.00	31.90			3.40	M	60.0	37.3	UTIG
1966	9	17	-103.98	34.89			2.70	M	284.6	176.9	NMTR
1966	10	6	-104.12	35.13			2.90	M	314.4	195.4	NMTR
1966	11	26	-105.44	30.95			3.50	M	277.5	172.4	NMTR
1968	3	23	-105.91	32.67			2.60	M	265.7	165.1	NMTR
1968	5	2	-105.24	33.10			2.60	M	214.3	133.1	NMTR
1969	6	1	-105.21	34.20			1.90	M	277.7	172.5	NMTR
1969	6	8	-105.19	34.15			2.60	M	272.8	169.5	NMTR
1971	7	30	-103.00	31.72	10.0	6.2	3.00	mb	79.9	49.6	ANSS
1971	7	31	-103.06	31.70	10.0	6.2	3.40	mb	81.4	50.6	ANSS
1971	9	24	-103.20	31.60			3.20	M	93.5	58.1	UTIG
1972	7	26	-104.01	32.57			3.10	M	88.3	54.9	NMTR
1973	3	17	-102.36	31.59			2.50	M	115.7	71.9	NMTR
1973	8	2	-105.56	31.04			3.60	M	280.7	174.5	NMTR
1973	8	4	-103.22	35.11			3.00	M	296.6	184.3	NMTR
1974	7	31	-104.19	33.11			0.00	M	128.0	79.5	NMTR
1974	10	2	-100.86	31.87			0.00	M	217.7	135.3	NMTR
1974	10	27	-104.83	30.63			0.00	M	259.6	161.3	NMTR
1974	11	12	-102.67	32.14			0.00	M	51.0	31.7	NMTR
1974	11	21	-102.75	32.07			0.00	M	51.0	31.7	NMTR
1974	11	22	-101.26	32.94			0.00	M	179.2	111.3	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site Coordinates			Longitude	Latitude							
			-103.0820	32.4360							
Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral (km)	Distance (mi)	Data Sources[4]
1974	11	22	-105.21	33.78			0.00	M	247.7	153.9	NMTR
1974	11	28	-103.94	32.58			0.00	M	82.2	51.1	NMTR
1974	11	28	-104.14	32.31	5.0	3.1	3.90	mb	100.4	62.4	ANSS
1974	12	30	-103.10	30.90			3.70	M	170.5	106.0	UTIG
1975	1	30	-103.08	30.95			2.10	M	165.1	102.6	NMTR
1975	2	2	-103.19	35.05			3.00	M	290.7	180.6	NMTR
1975	4	8	-101.69	32.18			0.00	M	133.9	83.2	NMTR
1975	7	25	-102.62	29.82			0.00	M	293.4	182.3	NMTR
1975	8	1	-104.60	30.49			0.00	M	259.5	161.3	NMTR
1975	8	1	-104.00	31.40			3.00	M	143.9	89.4	UTIG
1975	8	3	-104.45	30.71			0.00	M	231.0	143.5	NMTR
1975	10	10	-105.02	33.36			0.00	M	207.4	128.9	NMTR
1975	12	12	-102.31	31.61			3.00	M	117.5	73.0	NMTR
1976	1	10	-102.76	31.79			0.00	M	78.4	48.7	NMTR
1976	1	15	-102.32	30.98			0.00	M	176.6	109.7	NMTR
1976	1	19	-103.09	31.90			3.50	M	59.5	37.0	UTIG
1976	1	21	-102.29	30.95			0.00	M	180.8	112.4	NMTR
1976	1	22	-103.07	31.90	1.0	0.6	2.80	un	59.5	37.0	ANSS
1976	1	25	-103.08	31.90	2.0	1.2	3.90	un	59.3	36.8	ANSS
1976	1	28	-100.89	31.99			0.00	M	211.8	131.6	NMTR
1976	2	4	-103.53	31.68			0.00	M	94.1	58.4	NMTR
1976	2	14	-102.47	31.63			0.00	M	106.2	66.0	NMTR
1976	3	5	-102.25	31.66			0.00	M	116.7	72.5	NMTR
1976	3	15	-102.58	32.50			0.00	M	47.3	29.4	NMTR
1976	3	18	-102.96	32.33			0.00	M	16.5	10.3	NMTR
1976	3	20	-104.94	31.27			0.00	M	217.4	135.1	NMTR
1976	3	20	-103.06	32.22			0.00	M	24.4	15.2	NMTR
1976	3	27	-103.07	32.22			0.00	M	23.7	14.7	NMTR
1976	4	3	-103.10	31.24			0.00	M	132.5	82.3	NMTR
1976	4	12	-103.00	32.27			0.00	M	20.2	12.5	NMTR
1976	4	21	-102.89	32.25			0.00	M	27.7	17.2	NMTR
1976	4	30	-103.09	31.98			0.00	M	50.7	31.5	NMTR
1976	4	30	-103.11	31.92			0.00	M	57.6	35.8	NMTR
1976	5	1	-103.06	32.37			0.00	M	8.0	5.0	NMTR
1976	5	3	-105.66	32.41			0.00	M	241.7	150.2	NMTR
1976	5	3	-103.20	32.03			0.00	M	47.0	29.2	NMTR
1976	5	3	-103.03	32.03			0.00	M	45.6	28.3	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral	Distance	Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1976	5	4	-103.23	31.86			0.00	M	65.3	40.6	NMTR
1976	5	6	-103.18	31.97			0.00	M	53.1	33.0	NMTR
1976	5	6	-103.16	31.87			0.00	M	63.3	39.3	NMTR
1976	5	11	-102.92	32.29			0.00	M	22.2	13.8	NMTR
1976	5	21	-105.59	32.49			0.00	M	234.9	146.0	NMTR
1976	6	14	-102.49	31.52			0.00	M	116.5	72.4	NMTR
1976	6	15	-102.34	31.56			0.00	M	120.0	74.6	NMTR
1976	6	15	-102.37	31.60			0.00	M	115.0	71.5	NMTR
1976	7	28	-102.29	33.02			0.00	M	98.7	61.4	NMTR
1976	8	5	-101.73	30.87			0.00	M	216.3	134.4	NMTR
1976	8	5	-103.00	31.60			3.00	M	93.1	57.9	UTIG
1976	8	6	-102.59	31.78			2.10	M	86.3	53.6	NMTR
1976	8	10	-102.03	31.77			0.00	M	123.8	76.9	NMTR
1976	8	10	-102.06	31.79			0.00	M	119.5	74.3	NMTR
1976	8	25	-101.94	31.55			0.00	M	146.1	90.8	NMTR
1976	8	26	-102.01	31.84			0.00	M	120.8	75.1	NMTR
1976	8	30	-101.98	31.57			0.00	M	141.7	88.0	NMTR
1976	8	31	-102.18	31.46			0.00	M	137.4	85.4	NMTR
1976	9	3	-103.48	31.55			2.00	M	105.2	65.4	NMTR
1976	9	5	-102.74	32.23			0.00	M	39.3	24.4	NMTR
1976	9	17	-103.06	32.24			0.00	M	22.4	13.9	NMTR
1976	9	17	-102.50	31.40			3.10	M	127.4	79.2	UTIG
1976	9	19	-104.57	30.47			0.00	M	259.7	161.4	NMTR
1976	10	22	-102.16	31.55			0.00	M	131.6	81.8	NMTR
1976	10	23	-102.38	31.62			0.00	M	112.2	69.7	NMTR
1976	10	25	-102.53	31.84			0.00	M	84.3	52.4	NMTR
1976	10	26	-103.28	31.33			2.40	M	124.2	77.2	NMTR
1976	11	3	-102.27	30.92			0.00	M	185.6	115.3	NMTR
1976	12	12	-102.46	31.57			2.80	M	112.5	69.9	NMTR
1976	12	12	-102.49	31.61			1.90	M	107.3	66.6	NMTR
1976	12	15	-102.22	31.59			1.40	M	124.2	77.2	NMTR
1976	12	18	-103.02	31.62			1.80	M	90.8	56.4	NMTR
1976	12	19	-102.45	31.87			2.20	M	86.0	53.5	NMTR
1976	12	19	-103.14	32.25			1.80	M	20.9	13.0	NMTR
1976	12	19	-103.08	32.27			2.70	M	18.7	11.6	NMTR
1977	1	29	-104.59	30.58			0.00	M	250.3	155.5	NMTR
1977	2	4	-104.70	30.59			0.00	M	256.1	159.2	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1977	2	18	-103.05	32.24			0.00	M	21.7	13.5	NMTR
1977	3	5	-102.66	31.16			0.00	M	146.9	91.3	NMTR
1977	3	14	-101.01	33.04			0.00	M	204.7	127.2	NMTR
1977	3	20	-103.10	32.21			0.00	M	25.5	15.8	NMTR
1977	3	29	-103.28	31.60			0.00	M	94.2	58.5	NMTR
1977	4	3	-103.17	31.49			1.90	M	105.3	65.5	NMTR
1977	4	3	-103.20	31.47			0.00	M	107.8	67.0	NMTR
1977	4	4	-103.36	31.00			0.00	M	161.4	100.3	NMTR
1977	4	7	-103.05	32.19			0.00	M	27.7	17.2	NMTR
1977	4	7	-102.70	31.32			0.00	M	129.3	80.3	NMTR
1977	4	7	-102.94	31.35			0.00	M	120.9	75.1	NMTR
1977	4	12	-102.55	31.28			0.00	M	137.4	85.4	NMTR
1977	4	17	-102.35	31.50			0.00	M	124.7	77.5	NMTR
1977	4	18	-103.25	31.60			0.00	M	93.7	58.2	NMTR
1977	4	22	-103.02	32.18			0.00	M	28.8	17.9	NMTR
1977	4	25	-102.81	32.07			0.00	M	47.9	29.8	NMTR
1977	4	26	-103.08	31.90	4.0	2.5	3.30	un	59.3	36.8	ANSS
1977	4	28	-102.52	31.83			0.00	M	86.1	53.5	NMTR
1977	4	28	-101.99	31.87			0.00	M	120.6	75.0	NMTR
1977	4	29	-102.65	31.77			0.00	M	84.0	52.2	NMTR
1977	6	7	-100.75	33.06	5.0	3.1	4.00	un	228.5	142.0	ANSS
1977	6	8	-100.83	32.83			0.00	M	215.4	133.9	NMTR
1977	6	8	-100.82	32.92			0.00	M	218.4	135.7	NMTR
1977	6	8	-101.04	32.87			0.00	M	196.4	122.1	NMTR
1977	6	17	-100.95	32.90			2.70	M	206.1	128.1	NMTR
1977	6	28	-103.30	31.54			2.30	M	101.6	63.1	NMTR
1977	7	1	-103.34	31.50			2.00	M	106.7	66.3	NMTR
1977	7	11	-102.62	31.80			0.00	M	83.1	51.6	NMTR
1977	7	11	-102.68	31.79			0.00	M	81.4	50.6	NMTR
1977	7	12	-102.64	31.77			0.00	M	84.6	52.6	NMTR
1977	7	18	-102.70	31.78			0.00	M	81.4	50.6	NMTR
1977	7	22	-102.72	31.80			0.00	M	78.2	48.6	NMTR
1977	7	22	-102.70	31.80			3.00	M	79.2	49.2	UTIG
1977	7	24	-102.70	31.79			0.00	M	79.7	49.5	NMTR
1977	8	20	-103.33	31.60			1.90	M	95.7	59.5	NMTR
1977	8	21	-104.91	30.54			0.00	M	272.4	169.3	NMTR
1977	10	13	-100.81	32.91			2.20	M	218.8	135.9	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1977	10	17	-102.46	31.57			1.80	M	112.6	69.9	NMTR
1977	11	14	-104.96	31.52			0.00	M	203.7	126.6	NMTR
1977	11	27	-101.14	33.02			0.00	M	192.7	119.8	NMTR
1977	11	28	-100.84	32.95	5.0	3.1	3.50	un	217.4	135.1	ANSS
1977	12	16	-102.40	31.52			0.00	M	120.2	74.7	NMTR
1977	12	21	-102.41	31.52			0.00	M	120.3	74.7	NMTR
1977	12	31	-102.46	31.60			2.10	M	109.7	68.2	NMTR
1978	1	2	-102.53	31.60			2.20	M	106.3	66.1	NMTR
1978	1	12	-102.30	31.49			0.00	M	128.1	79.6	NMTR
1978	1	15	-101.70	31.36			0.00	M	177.0	110.0	NMTR
1978	1	18	-103.23	31.61			0.00	M	92.9	57.7	NMTR
1978	1	19	-103.71	32.56			0.00	M	60.5	37.6	NMTR
1978	2	5	-102.60	31.89			0.00	M	76.2	47.4	NMTR
1978	2	5	-104.55	31.41			0.00	M	179.5	111.5	NMTR
1978	2	18	-104.69	31.21			2.30	M	203.8	126.6	NMTR
1978	3	2	-103.06	32.82			1.50	M	42.5	26.4	NMTR
1978	3	2	-102.38	31.58			3.30	M	115.4	71.7	NMTR
1978	3	2	-102.61	31.59			2.10	M	103.9	64.6	NMTR
1978	3	2	-102.56	31.55			3.50	M	109.9	68.3	UTIG
1978	3	19	-102.49	31.47			1.60	M	120.5	74.9	NMTR
1978	6	16	-100.80	33.00			3.40	M	222.1	138.0	UTIG
1978	6	16	-100.77	33.03	10.0	6.2	5.30	un	226.1	140.5	ANSS
1978	6	29	-102.42	31.08			3.20	M	163.1	101.4	NMTR
1978	7	5	-102.20	31.61			0.00	M	123.2	76.5	NMTR
1978	7	18	-104.36	30.36			0.00	M	260.4	161.8	NMTR
1978	7	21	-102.77	31.34			0.00	M	125.0	77.7	NMTR
1978	8	14	-102.18	31.58			2.20	M	127.4	79.2	NMTR
1978	9	29	-102.42	31.52			0.00	M	119.2	74.1	NMTR
1978	9	30	-102.17	31.36			0.00	M	146.7	91.1	NMTR
1978	10	2	-102.43	31.53			0.00	M	117.6	73.1	NMTR
1978	10	2	-102.19	31.51			0.00	M	132.5	82.3	NMTR
1978	10	2	-102.36	31.48			0.00	M	126.4	78.5	NMTR
1978	10	3	-102.99	31.90			0.00	M	59.7	37.1	NMTR
1978	10	6	-102.36	31.55			0.00	M	119.8	74.4	NMTR
1979	4	28	-104.72	30.47			0.00	M	267.7	166.3	NMTR
1979	7	17	-103.73	32.65			2.00	M	65.4	40.6	NMTR
1979	8	3	-100.81	32.87			2.40	M	217.5	135.1	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral (km)	Distance (mi)	Data Sources[4]
1980	1	21	-105.00	34.20			1.30	M	264.2	164.2	NMTR
1980	3	21	-102.34	31.57			1.60	M	118.5	73.6	NMTR
1981	8	13	-102.70	31.90			2.20	M	69.7	43.3	NMTR
1981	9	16	-105.23	33.72			1.80	M	245.2	152.4	NMTR
1982	1	4	-102.49	31.18	5.0	3.1	3.90	un	149.9	93.2	ANSS
1982	4	26	-100.84	33.02	5.0	3.1	2.80	un	218.8	136.0	ANSS
1982	5	1	-103.04	32.33			2.10	M	12.3	7.6	NMTR
1982	10	17	-102.71	30.90			2.00	M	174.0	108.1	NMTR
1982	10	26	-103.59	33.67			1.50	M	144.6	89.8	NMTR
1982	10	26	-103.61	33.63			1.50	M	141.3	87.8	NMTR
1982	11	25	-100.78	32.89			2.30	M	220.7	137.1	NMTR
1982	11	28	-100.84	33.00	5.0	3.1	3.30	un	218.4	135.7	ANSS
1983	1	9	-104.19	30.65			1.90	M	224.3	139.4	NMTR
1983	1	12	-105.19	34.32			1.50	M	286.7	178.2	NMTR
1983	1	29	-102.08	31.75			2.20	M	121.2	75.3	NMTR
1983	3	3	-104.35	29.96			2.80	M	299.6	186.2	NMTR
1983	6	5	-105.35	32.52			1.30	M	212.6	132.1	NMTR
1983	6	21	-103.58	33.63			1.60	M	140.9	87.5	NMTR
1983	7	21	-105.14	30.97			1.60	M	253.4	157.5	NMTR
1983	8	4	-105.14	32.57			1.30	M	193.4	120.2	NMTR
1983	8	19	-102.23	31.31			1.80	M	148.8	92.5	NMTR
1983	8	22	-105.08	34.06			1.30	M	258.6	160.7	NMTR
1983	8	23	-105.52	31.17			2.10	M	269.7	167.6	NMTR
1983	8	26	-102.53	33.62			1.60	M	140.9	87.5	NMTR
1983	8	29	-100.62	31.80			2.60	M	242.0	150.4	NMTR
1983	9	15	-104.43	34.92			3.10	M	302.6	188.1	NMTR
1983	9	29	-104.45	34.89			2.70	M	300.0	186.4	NMTR
1983	9	30	-103.97	30.57			1.70	M	224.0	139.2	NMTR
1983	12	1	-101.99	31.86			1.40	M	121.1	75.3	NMTR
1983	12	3	-103.32	30.97			2.10	M	164.1	102.0	NMTR
1983	12	26	-102.88	30.77			1.70	M	186.4	115.8	NMTR
1984	1	2	-102.12	31.81			1.80	M	114.4	71.1	NMTR
1984	1	3	-102.69	31.21			1.70	M	141.3	87.8	NMTR
1984	1	3	-103.04	30.76			2.00	M	186.3	115.8	NMTR
1984	1	16	-102.20	31.56			1.40	M	127.5	79.2	NMTR
1984	3	2	-104.84	30.81			1.90	M	245.5	152.5	NMTR
1984	3	23	-100.78	32.45			1.50	M	215.2	133.7	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1984	5	21	-102.59	31.14			1.30	M	151.3	94.0	NMTR
1984	5	21	-102.23	35.07	5.0	3.1	3.10	un	302.5	188.0	ANSS
1984	6	27	-102.48	31.22			2.00	M	146.5	91.0	NMTR
1984	7	17	-105.77	32.85			1.30	M	255.7	158.9	NMTR
1984	8	18	-103.56	30.78			1.80	M	189.8	118.0	NMTR
1984	8	24	-104.48	30.67			1.30	M	236.8	147.1	NMTR
1984	8	26	-104.27	30.38			2.10	M	254.4	158.1	NMTR
1984	9	11	-100.70	31.99	5.0	3.1	3.20	un	229.4	142.5	ANSS
1984	9	19	-100.69	32.03	5.0	3.1	3.00	un	229.3	142.5	ANSS
1984	9	27	-103.42	32.59			1.60	M	36.0	22.4	NMTR
1984	10	4	-102.70	33.58			1.30	M	132.3	82.2	NMTR
1984	10	4	-102.24	31.65			1.30	M	118.4	73.6	NMTR
1984	10	11	-100.56	31.95			2.40	M	243.2	151.1	NMTR
1984	10	27	-104.56	30.62			1.70	M	245.1	152.3	NMTR
1984	11	27	-105.41	33.57			1.60	M	250.6	155.7	NMTR
1984	12	4	-101.93	30.10			2.30	M	281.6	175.0	NMTR
1984	12	4	-103.21	32.64			2.10	M	25.4	15.8	NMTR
1984	12	4	-103.56	32.27	5.0	3.1	2.90	un	48.3	30.0	ANSS
1984	12	12	-105.61	33.36			1.50	M	256.9	159.6	NMTR
1985	2	21	-100.75	32.88			1.40	M	223.3	138.7	NMTR
1985	2	21	-100.81	32.72			1.50	M	214.6	133.4	NMTR
1985	3	9	-105.12	33.97			1.30	M	254.4	158.1	NMTR
1985	5	3	-104.95	31.04			1.90	M	234.5	145.7	NMTR
1985	6	1	-102.83	31.06			1.50	M	154.6	96.0	NMTR
1985	6	2	-102.28	31.18			1.60	M	158.7	98.6	NMTR
1985	6	12	-103.90	34.64			1.60	M	255.9	159.0	NMTR
1985	8	2	-104.34	32.48			1.40	M	118.0	73.3	NMTR
1985	9	5	-103.77	33.66			1.80	M	150.1	93.3	NMTR
1985	9	18	-103.42	30.90			2.00	M	173.1	107.6	NMTR
1985	10	21	-101.88	32.04			1.30	M	121.3	75.4	NMTR
1985	11	13	-103.08	32.10			1.80	M	37.8	23.5	NMTR
1985	11	28	-101.99	31.61			1.80	M	138.2	85.9	NMTR
1985	12	5	-102.94	32.42			1.60	M	13.9	8.6	NMTR
1986	1	25	-100.73	32.06	5.0	3.1	2.90	un	224.3	139.4	ANSS
1986	1	30	-104.01	33.54			1.90	M	150.1	93.3	NMTR
1986	1	30	-100.69	32.07	5.0	3.1	3.30	un	228.0	141.7	ANSS
1986	2	7	-105.44	32.54			1.40	M	221.0	137.3	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site Coordinates			Longitude	Latitude							
			-103.0820	32.4360							
Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	(mi)	Data Sources[4]
1986	2	14	-100.76	31.53			2.60	M	240.9	149.7	NMTR
1986	3	1	-102.57	31.16			1.70	M	149.6	92.9	NMTR
1986	3	11	-105.08	32.11			2.00	M	190.7	118.5	NMTR
1986	3	21	-105.64	33.43			1.60	M	262.8	163.3	NMTR
1986	5	28	-105.12	31.76			1.60	M	205.8	127.9	NMTR
1986	6	12	-102.22	31.77			1.80	M	109.6	68.1	NMTR
1986	6	27	-102.01	32.06			2.20	M	109.3	67.9	NMTR
1986	7	9	-102.48	31.55			1.60	M	113.3	70.4	NMTR
1986	7	20	-105.00	33.47			1.50	M	212.8	132.2	NMTR
1986	8	2	-103.79	33.68			1.70	M	153.4	95.3	NMTR
1986	8	6	-103.03	33.86			2.40	M	158.4	98.5	NMTR
1986	8	14	-104.66	32.53			1.30	M	148.0	92.0	NMTR
1986	8	15	-103.43	33.14			1.70	M	84.2	52.3	NMTR
1986	8	29	-102.41	31.31			1.40	M	140.1	87.1	NMTR
1986	9	18	-102.37	31.51			1.80	M	123.2	76.5	NMTR
1986	10	18	-102.69	30.07			1.60	M	265.4	164.9	NMTR
1986	10	25	-102.13	31.60			1.70	M	129.0	80.2	NMTR
1986	11	3	-104.64	31.09			2.00	M	209.5	130.2	NMTR
1986	11	6	-104.58	32.55			1.60	M	140.4	87.2	NMTR
1986	11	17	-100.73	33.08			2.00	M	230.6	143.3	NMTR
1986	11	24	-102.16	31.68			2.00	M	121.1	75.3	NMTR
1986	12	6	-102.16	31.59			2.40	M	127.6	79.3	NMTR
1986	12	6	-102.23	31.47			2.10	M	133.9	83.2	NMTR
1986	12	6	-102.17	31.65			1.70	M	122.0	75.8	NMTR
1986	12	6	-102.09	31.72			2.20	M	122.6	76.2	NMTR
1986	12	15	-103.19	35.07			1.50	M	292.9	182.0	NMTR
1986	12	15	-102.02	31.76			1.50	M	125.0	77.7	NMTR
1987	1	25	-104.86	31.74			1.70	M	184.3	114.5	NMTR
1987	2	9	-103.45	30.69			2.30	M	196.8	122.3	NMTR
1987	2	9	-101.96	31.86			1.60	M	123.6	76.8	NMTR
1987	2	12	-101.94	31.66			1.60	M	137.9	85.7	NMTR
1987	2	17	-104.52	30.60			2.10	M	244.8	152.1	NMTR
1987	3	2	-105.08	30.78			1.80	M	263.6	163.8	NMTR
1987	3	3	-105.44	31.17			1.50	M	263.4	163.7	NMTR
1987	3	10	-105.66	31.13			1.50	M	282.7	175.7	NMTR
1987	3	26	-103.28	30.96			2.60	M	165.2	102.6	NMTR
1987	3	31	-104.95	31.52			2.80	M	203.4	126.4	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	(mi)	Data Sources[4]
1987	4	23	-105.02	32.03			1.60	M	187.7	116.7	NMTR
1987	4	25	-105.22	33.97			1.90	M	261.2	162.3	NMTR
1987	4	29	-105.92	32.67			2.30	M	267.0	165.9	NMTR
1987	7	5	-104.77	30.85			2.00	M	237.5	147.6	NMTR
1987	7	23	-103.03	35.29			1.90	M	316.9	196.9	NMTR
1987	7	30	-103.87	34.54			1.50	M	244.4	151.9	NMTR
1987	8	4	-102.12	31.87			1.70	M	110.1	68.4	NMTR
1987	9	11	-103.62	33.61			2.00	M	139.1	86.4	NMTR
1987	9	21	-103.74	33.68			1.80	M	150.6	93.6	NMTR
1987	10	1	-105.16	30.47			1.60	M	294.1	182.7	NMTR
1987	10	1	-103.76	33.66			1.50	M	150.0	93.2	NMTR
1987	10	9	-104.59	31.07			1.40	M	208.4	129.5	NMTR
1987	10	31	-105.31	32.86			1.30	M	213.8	132.9	NMTR
1987	11	3	-103.71	33.70			1.30	M	151.6	94.2	NMTR
1987	11	17	-101.97	32.06			1.60	M	112.9	70.1	NMTR
1987	12	6	-102.76	31.83			1.60	M	74.2	46.1	NMTR
1987	12	20	-103.07	32.29			2.20	M	15.8	9.8	NMTR
1987	12	28	-102.25	31.47			2.10	M	133.3	82.8	NMTR
1987	12	29	-102.11	31.58			1.50	M	132.1	82.1	NMTR
1988	1	26	-102.42	31.24			2.30	M	146.4	90.9	NMTR
1988	2	14	-102.06	31.78			1.40	M	121.0	75.2	NMTR
1988	2	21	-103.02	30.45			1.40	M	220.3	136.9	NMTR
1988	2	27	-103.75	33.67			1.80	M	150.3	93.4	NMTR
1988	3	9	-102.44	31.24			1.70	M	146.0	90.7	NMTR
1988	3	15	-105.52	31.72			1.30	M	242.7	150.8	NMTR
1988	3	17	-102.20	31.66			1.60	M	119.8	74.4	NMTR
1988	4	5	-102.33	31.44			2.10	M	131.6	81.8	NMTR
1988	4	6	-102.09	31.94			1.30	M	107.9	67.1	NMTR
1988	5	3	-104.39	30.52			1.30	M	246.2	153.0	NMTR
1988	5	10	-105.20	30.96			1.40	M	258.4	160.6	NMTR
1988	5	27	-102.12	31.78			1.30	M	116.1	72.1	NMTR
1988	5	27	-102.02	32.06			1.30	M	108.3	67.3	NMTR
1988	7	4	-100.74	33.74			2.00	M	261.5	162.5	NMTR
1988	7	11	-103.25	35.28			1.90	M	316.6	196.7	NMTR
1988	7	20	-102.43	29.77			2.20	M	301.9	187.6	NMTR
1988	7	25	-104.91	31.98			1.50	M	178.9	111.2	NMTR
1988	7	26	-105.14	30.94			1.50	M	255.5	158.8	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral	Distance	Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1988	8	23	-102.02	32.26			1.50	M	101.1	62.8	NMTR
1988	9	15	-103.32	31.68			1.50	M	86.7	53.9	NMTR
1988	9	19	-102.45	32.46			2.00	M	59.3	36.8	NMTR
1988	10	2	-103.79	33.63			1.30	M	147.8	91.8	NMTR
1988	11	10	-102.40	31.55			1.90	M	117.3	72.9	NMTR
1989	1	9	-102.59	31.44			1.80	M	119.6	74.3	NMTR
1989	1	9	-102.12	31.78			1.30	M	116.5	72.4	NMTR
1989	1	20	-101.97	32.08			1.90	M	112.1	69.6	NMTR
1989	2	21	-103.39	35.29			2.30	M	318.4	197.8	NMTR
1989	3	19	-103.55	31.19			1.50	M	145.2	90.2	NMTR
1989	3	21	-102.33	31.42			1.50	M	133.5	83.0	NMTR
1989	3	30	-102.86	33.24			1.40	M	91.5	56.9	NMTR
1989	6	5	-102.09	32.10			2.10	M	100.1	62.2	NMTR
1989	6	23	-102.23	31.59			1.60	M	123.2	76.6	NMTR
1989	6	28	-105.08	30.93			2.30	M	252.3	156.8	NMTR
1989	7	13	-105.27	33.53			1.50	M	237.1	147.3	NMTR
1989	7	24	-100.93	32.92			1.60	M	208.3	129.5	NMTR
1989	7	25	-101.76	30.90			2.10	M	211.2	131.3	NMTR
1989	8	8	-102.70	31.30			2.30	M	131.3	81.6	NMTR
1989	8	16	-101.96	31.70			1.60	M	133.3	82.8	NMTR
1989	9	5	-102.50	34.25			2.50	M	208.9	129.8	NMTR
1989	11	2	-100.94	33.02			2.00	M	210.4	130.7	NMTR
1989	11	16	-103.12	35.11			2.60	M	296.7	184.4	NMTR
1989	12	7	-103.67	34.58			1.40	M	244.1	151.7	NMTR
1989	12	28	-101.06	31.70			2.10	M	207.6	129.0	NMTR
1989	12	28	-100.96	32.04			1.70	M	203.9	126.7	NMTR
1990	1	16	-105.32	31.74			1.80	M	224.4	139.4	NMTR
1990	3	4	-103.92	30.53			1.70	M	226.3	140.6	NMTR
1990	3	30	-100.53	32.96			2.30	M	245.1	152.3	NMTR
1990	3	30	-100.56	32.99			2.20	M	243.5	151.3	NMTR
1990	4	6	-103.36	31.51			1.90	M	106.3	66.0	NMTR
1990	5	10	-102.37	31.14			2.20	M	159.2	98.9	NMTR
1990	5	10	-101.96	32.13			1.60	M	110.9	68.9	NMTR
1990	5	16	-102.04	31.86			2.40	M	117.2	72.8	NMTR
1990	5	22	-102.09	30.24			2.20	M	261.5	162.5	NMTR
1990	6	22	-100.76	32.58			2.20	M	218.3	135.7	NMTR
1990	7	3	-102.22	31.44			1.50	M	137.6	85.5	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude	Latitude	Focal Depth[1]		MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1990	7	13	-101.81	34.86			2.70	M	293.9	182.6	NMTR
1990	8	3	-100.69	32.21			3.40	M	225.6	140.2	NMTR
1990	8	9	-102.67	31.21			1.90	M	141.8	88.1	NMTR
1990	8	14	-102.26	31.39			1.80	M	139.8	86.9	NMTR
1990	8	25	-102.01	31.91			1.80	M	116.0	72.1	NMTR
1990	10	8	-105.12	30.94			1.30	M	254.0	157.8	NMTR
1990	12	20	-103.14	35.27			2.50	M	315.1	195.8	NMTR
1991	1	1	-105.27	32.44			1.60	M	205.4	127.6	NMTR
1991	1	29	-103.04	32.89			1.40	M	50.8	31.6	NMTR
1991	2	3	-104.49	32.81			1.30	M	137.7	85.6	NMTR
1991	2	3	-103.96	35.00			2.10	M	296.2	184.0	NMTR
1991	3	10	-103.97	30.47			2.10	M	234.3	145.6	NMTR
1991	3	10	-103.33	33.58			2.00	M	128.8	80.0	NMTR
1991	4	8	-103.13	34.98			2.10	M	282.4	175.5	NMTR
1991	5	16	-103.75	33.67			2.00	M	150.4	93.5	NMTR
1991	6	4	-102.31	32.05			2.00	M	83.9	52.1	NMTR
1991	7	16	-101.12	33.09			2.10	M	197.3	122.6	NMTR
1991	8	1	-104.02	34.59			2.70	M	254.6	158.2	NMTR
1991	8	7	-104.81	31.62			1.80	M	186.1	115.6	NMTR
1991	8	17	-100.99	32.09			2.00	M	200.2	124.4	NMTR
1991	9	22	-101.30	31.32			2.10	M	209.2	130.0	NMTR
1991	9	28	-103.77	33.63			1.70	M	147.3	91.6	NMTR
1991	9	30	-100.73	31.85			2.20	M	230.5	143.2	NMTR
1991	10	5	-105.41	31.38			2.20	M	248.6	154.5	NMTR
1992	1	2	-103.19	32.30			5.00	M	17.8	11.0	NMTR
1992	1	2	-103.19	32.30			1.80	M	17.8	11.0	NMTR
1992	1	2	-103.19	32.30			1.50	M	17.8	11.0	NMTR
1992	1	2	-103.19	32.30			2.40	M	17.8	11.0	NMTR
1992	1	2	-103.19	32.30			1.80	M	17.8	11.0	NMTR
1992	1	3	-103.19	32.30			1.90	M	17.8	11.0	NMTR
1992	1	4	-103.19	32.30			1.50	M	17.8	11.0	NMTR
1992	1	7	-103.19	32.30			2.40	M	17.8	11.0	NMTR
1992	1	9	-103.19	32.30			2.80	M	17.8	11.0	NMTR
1992	1	11	-103.19	32.30			2.00	M	17.8	11.0	NMTR
1992	1	23	-102.29	31.84			1.90	M	99.2	61.7	NMTR
1992	2	2	-102.86	32.17			1.90	M	36.4	22.6	NMTR
1992	3	15	-104.12	34.92			1.70	M	292.1	181.5	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site Coordinates	Longitude	Latitude
	-103.0820	32.4360

Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal Depth[1] (km)	(mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	(mi)	Data Sources[4]
1992	3	28	-105.39	33.45			1.80	M	242.2	150.5	NMTR
1992	4	3	-103.03	32.26			2.10	M	19.9	12.4	NMTR
1992	4	6	-102.61	31.86			1.70	M	77.7	48.3	NMTR
1992	4	7	-102.29	31.56			1.60	M	122.6	76.2	NMTR
1992	4	7	-102.29	31.56			2.30	M	122.6	76.2	NMTR
1992	4	7	-102.29	31.56			1.70	M	122.6	76.2	NMTR
1992	4	8	-104.86	32.41			1.60	M	166.9	103.7	NMTR
1992	4	30	-104.31	30.66			1.70	M	229.0	142.3	NMTR
1992	5	9	-104.34	30.49			1.60	M	246.7	153.3	NMTR
1992	5	15	-103.08	32.28			1.60	M	17.5	10.9	NMTR
1992	5	16	-102.34	31.75			1.70	M	103.0	64.0	NMTR
1992	6	14	-103.10	32.30			2.30	M	15.1	9.4	NMTR
1992	6	20	-102.42	31.43			1.60	M	127.5	79.2	NMTR
1992	6	20	-102.42	31.43			1.50	M	127.5	79.2	NMTR
1992	6	29	-102.47	31.42			1.40	M	126.9	78.8	NMTR
1992	6	29	-102.47	31.42			1.40	M	126.9	78.8	NMTR
1992	6	29	-102.47	31.42			2.00	M	126.9	78.8	NMTR
1992	7	5	-102.39	31.88			1.50	M	89.4	55.6	NMTR
1992	7	5	-102.39	31.88			1.30	M	89.4	55.6	NMTR
1992	7	21	-103.13	32.28			1.90	M	17.8	11.1	NMTR
1992	8	12	-102.41	31.39			1.50	M	131.9	82.0	NMTR
1992	8	18	-102.45	31.46			1.90	M	123.5	76.7	NMTR
1992	8	19	-100.92	33.11			2.20	M	215.3	133.8	NMTR
1992	8	26	-102.71	32.17	5.0	3.1	3.00	un	45.6	28.4	ANSS
1992	8	28	-100.98	32.38			1.70	M	197.4	122.6	NMTR
1992	9	4	-102.26	31.42			1.90	M	136.8	85.0	NMTR
1992	9	15	-103.02	32.16			2.20	M	31.6	19.6	NMTR
1992	10	8	-102.81	32.25			1.60	M	33.1	20.6	NMTR
1992	10	10	-102.41	31.71			1.60	M	102.2	63.5	NMTR
1992	10	27	-101.93	34.12			1.30	M	215.1	133.7	NMTR
1992	11	22	-103.16	32.29			1.70	M	18.0	11.2	NMTR
1992	11	27	-102.49	31.44			1.30	M	124.0	77.1	NMTR
1992	12	2	-102.35	31.42			2.40	M	131.5	81.7	NMTR
1992	12	3	-103.74	33.66			1.90	M	149.6	93.0	NMTR
1992	12	5	-102.51	31.87			1.40	M	83.0	51.6	NMTR
1993	1	4	-105.27	31.06			1.30	M	256.5	159.4	NMTR
1993	1	28	-102.58	31.85			1.80	M	80.3	49.9	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site Coordinates			Longitude	Latitude							
			-103.0820	32.4360							
Year	Month	Day	Longitude	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1993	1	31	-104.64	30.60			1.50	M	250.8	155.9	NMTR
1993	2	11	-105.23	31.12			2.00	M	250.1	155.4	NMTR
1993	2	28	-102.43	31.21			1.30	M	149.4	92.8	NMTR
1993	2	28	-102.41	31.22			1.50	M	149.3	92.8	NMTR
1993	3	8	-103.33	30.87			1.60	M	175.9	109.3	NMTR
1993	3	21	-102.37	31.43			1.50	M	130.4	81.0	NMTR
1993	4	23	-102.47	31.21			1.70	M	147.8	91.9	NMTR
1993	5	5	-105.16	32.29			2.10	M	195.3	121.4	NMTR
1993	5	16	-105.06	30.44			2.20	M	290.1	180.2	NMTR
1993	5	17	-102.33	31.42			2.30	M	133.3	82.9	NMTR
1993	5	23	-102.42	31.42			1.60	M	128.7	80.0	NMTR
1993	5	28	-103.12	32.75			2.50	M	34.6	21.5	NMTR
1993	6	17	-102.56	31.80			1.70	M	86.5	53.8	NMTR
1993	6	23	-102.44	31.51			1.40	M	119.5	74.2	NMTR
1993	6	23	-102.54	31.43			2.50	M	123.2	76.6	NMTR
1993	6	23	-102.52	31.43			2.80	M	123.2	76.5	NMTR
1993	6	23	-102.52	31.43			2.10	M	123.2	76.5	NMTR
1993	6	23	-102.54	29.66			1.90	M	312.3	194.0	NMTR
1993	6	23	-102.51	31.35	5.0	3.1	2.80	un	132.5	82.3	ANSS
1993	6	24	-102.45	31.48			2.10	M	121.9	75.7	NMTR
1993	7	3	-102.43	31.44			1.50	M	126.7	78.7	NMTR
1993	7	3	-102.34	31.50			2.20	M	125.5	78.0	NMTR
1993	7	3	-102.38	31.54			1.60	M	119.3	74.1	NMTR
1993	8	13	-102.52	31.89			1.30	M	80.1	49.8	NMTR
1993	8	29	-102.91	32.35			2.50	M	19.0	11.8	NMTR
1993	9	5	-100.96	32.28			2.00	M	200.1	124.4	NMTR
1993	9	6	-100.91	32.48			1.80	M	203.6	126.5	NMTR
1993	9	11	-103.76	34.72			1.50	M	260.9	162.1	NMTR
1993	9	26	-103.52	35.08			1.50	M	296.6	184.3	NMTR
1993	9	30	-103.80	33.64			1.90	M	149.0	92.6	NMTR
1993	10	3	-103.84	33.61			1.70	M	148.5	92.3	NMTR
1993	11	6	-102.19	31.75			1.50	M	113.6	70.6	NMTR
1993	11	24	-104.74	32.34			1.30	M	156.2	97.1	NMTR
1993	11	25	-102.10	34.27			2.60	M	223.0	138.5	NMTR
1993	11	25	-104.38	30.49			1.30	M	248.6	154.5	NMTR
1993	12	2	-102.34	31.27			1.30	M	147.3	91.5	NMTR
1993	12	3	-102.23	31.68			1.60	M	115.6	71.8	NMTR

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site Coordinates: Longitude -103.0820, Latitude 32.4360

Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	Distance (mi)	Data Sources[4]
1993	12	10	-102.29	31.74			1.60	M	106.8	66.4	NMTR
1993	12	18	-103.41	30.21			1.80	M	249.5	155.0	NMTR
1993	12	22	-105.68	33.33	10.0	6.2	3.20	un	261.9	162.8	ANSS
1994	1	6	-105.09	31.95			2.40	M	196.3	122.0	NMTR
1994	1	7	-102.32	31.24			1.70	M	151.0	93.8	NMTR
1994	3	15	-103.56	30.11			2.00	M	261.9	162.8	NMTR
1994	4	21	-103.12	32.31			1.40	M	14.1	8.8	NMTR
1994	4	25	-104.62	30.60			1.90	M	250.5	155.7	NMTR
1994	5	23	-102.64	32.11			1.60	M	55.0	34.2	NMTR
1994	6	30	-102.33	31.36			1.30	M	138.6	86.2	NMTR
1994	8	22	-102.21	33.34			1.60	M	129.0	80.2	NMTR
1994	8	30	-102.32	31.38			1.40	M	137.3	85.3	NMTR
1994	8	30	-102.32	31.34			1.50	M	141.5	87.9	NMTR
1994	8	30	-102.30	31.42			1.30	M	135.1	84.0	NMTR
1994	9	24	-102.36	31.43			2.00	M	131.1	81.4	NMTR
1994	11	24	-100.80	32.39			2.70	M	214.3	133.2	NMTR
1995	1	1	-102.45	31.77			1.40	M	94.7	58.8	NMTR
1995	1	4	-102.38	31.48			1.30	M	125.0	77.6	NMTR
1995	2	1	-104.09	34.51			1.80	M	248.7	154.6	NMTR
1995	3	19	-104.21	35.00	5.0	3.1	3.30	un	303.1	188.4	ANSS
1995	4	14	-103.35	30.28			5.70	M	240.7	149.5	UTIG
1995	4	18	-102.27	31.44			1.90	M	134.5	83.6	NMTR
1995	4	18	-105.34	31.10			1.60	M	259.8	161.4	NMTR
1995	4	21	-103.35	30.30	10.0	6.2	2.90	un	238.5	148.2	ANSS
1995	5	11	-105.20	32.71			2.40	M	200.4	124.5	NMTR
1995	5	15	-102.42	31.40			1.80	M	131.1	81.5	NMTR
1995	5	27	-102.34	31.34			2.30	M	140.1	87.0	NMTR
1995	5	30	-105.21	32.71			2.10	M	200.9	124.8	NMTR
1995	7	11	-105.06	30.87			1.80	M	255.5	158.8	NMTR
1995	7	17	-104.94	31.15			1.40	M	226.0	140.4	NMTR
1995	8	1	-105.27	33.14			1.30	M	218.9	136.0	NMTR
1995	8	2	-103.36	30.31			1.80	M	237.2	147.4	NMTR
1995	8	12	-103.07	30.79			1.90	M	183.1	113.8	NMTR
1995	8	14	-102.96	30.41			1.50	M	225.3	140.0	NMTR
1995	10	19	-104.84	32.05			2.00	M	170.4	105.9	NMTR
1995	10	25	-103.42	30.35			2.20	M	233.6	145.2	NMTR
1995	11	12	-103.35	30.30	10.0	6.2	3.60	ML	238.5	148.2	ANSS

Table 3.3-3Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

NEF Site			Longitude	Latitude							
Coordinates			-103.0820	32.4360							
Year	Month	Day	Longitude	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral	Distance	Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1995	12	3	-104.90	31.93			1.50	M	180.1	111.9	NMTR
1995	12	4	-104.90	31.93			1.40	M	180.1	111.9	NMTR
1995	12	4	-104.90	31.93			1.30	M	180.1	111.9	NMTR
1996	3	15	-105.69	33.59	10.0	6.2	2.90	ML	274.6	170.6	ANSS
1998	4	15	-103.30	30.19	10.0	6.2	3.60	ML	250.4	155.6	ANSS
1999	3	1	-104.66	32.57	1.0	0.6	2.90	ML	148.1	92.0	ANSS
1999	3	14	-104.63	32.59	1.0	0.6	4.00	ML	145.9	90.7	ANSS
1999	3	17	-104.67	32.58	1.0	0.6	3.50	Mc	149.7	93.0	ANSS
1999	5	30	-104.66	32.58	10.0	6.2	3.90	ML	148.9	92.5	ANSS
1999	8	9	-104.59	32.57	5.0	3.1	2.90	Mc	142.0	88.3	ANSS
2000	2	2	-104.63	32.58	5.0	3.1	2.70	ML	145.7	90.5	ANSS
2000	2	26	-103.61	30.24	5.0	3.1	2.80	ML	248.6	154.5	ANSS
2001	6	2	-103.14	32.33	5.0	3.1	3.30	ML	12.6	7.8	ANSS
2001	11	22	-102.63	31.79	5.0	3.1	3.10	ML	83.7	52.0	ANSS
2002	9	17	-104.63	32.58	10.0	6.2	3.50	ML	145.8	90.6	ANSS
2002	9	17	-104.63	32.58	10.0	6.2	3.30	ML	145.8	90.6	ANSS
2003	6	21	-104.51	32.67	5.0	3.1	3.60	ML	135.5	84.2	ANSS

Notes:

[1] Focal depth information only available for events reported in ANSS Catalog

[2] MAG - Magnitude

[3] MAG Type

M – Moment Magnitude

mb – Body – wave Magnitude

un – Unspecified Magnitude

ML – Local Magnitude

Mc – Coda – wave Magnitude

[4] Data Sources

UTIG – University of Texas Institute for Geophysics

NMTH – New Mexico Tech Historical Catalog

NMTR – New Mexico Tech Regional Catalog, Exclusive of Socorro NM Events

ANSS – Advanced National Seismic System

Table 3.3-4Earthquakes of Magnitude 3.0 and Greater Within 322 Kilometers (200 Miles) of the NEF Site

Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	(mi)	Data Sources[4]
1931	8	16	-104.60	30.70			6.00	M	240.3	149.3	UTIG
1949	5	23	-105.20	34.60			4.50	M	310.0	192.6	NMTH
1955	1	27	-104.50	30.60			3.30	M	244.0	151.6	UTIG
1962	3	6	-104.80	31.20			3.50	M	212.3	131.9	UTIG
1963	12	19	-104.27	34.82			3.40	M	287.0	178.3	NMTR
1964	11	8	-103.10	31.90			3.00	M	59.5	37.0	UTIG
1964	11	21	-103.10	31.90			3.10	M	59.5	37.0	UTIG
1965	2	3	-103.10	31.90			3.30	M	59.5	37.0	UTIG
1965	8	30	-103.00	31.90			3.50	M	60.0	37.3	UTIG
1966	8	14	-103.00	31.90			3.40	M	60.0	37.3	UTIG
1966	11	26	-105.44	30.95			3.50	M	277.5	172.4	NMTR
1971	7	30	-103.00	31.72	10.0	6.2	3.00	mb	79.9	49.6	ANSS
1971	7	31	-103.06	31.70	10.0	6.2	3.40	mb	81.4	50.6	ANSS
1971	9	24	-103.20	31.60			3.20	M	93.5	58.1	UTIG
1972	7	26	-104.01	32.57			3.10	M	88.3	54.9	NMTR
1973	8	2	-105.56	31.04			3.60	M	280.7	174.5	NMTR
1973	8	4	-103.22	35.11			3.00	M	296.6	184.3	NMTR
1974	11	28	-104.14	32.31	5.0	3.1	3.90	mb	100.4	62.4	ANSS
1974	12	30	-103.10	30.90			3.70	M	170.5	106.0	UTIG
1975	2	2	-103.19	35.05			3.00	M	290.7	180.6	NMTR
1975	8	1	-104.00	31.40			3.00	M	143.9	89.4	UTIG
1975	12	12	-102.31	31.61			3.00	M	117.5	73.0	NMTR
1976	1	19	-103.09	31.90			3.50	M	59.5	37.0	UTIG
1976	1	25	-103.08	31.90	2.0	1.2	3.90	un	59.3	36.8	ANSS
1976	8	5	-103.00	31.60			3.00	M	93.1	57.9	UTIG
1976	9	17	-102.50	31.40			3.10	M	127.4	79.2	UTIG
1977	4	26	-103.08	31.90	4.0	2.5	3.30	un	59.3	36.8	ANSS
1977	6	7	-100.75	33.06	5.0	3.1	4.00	un	228.5	142.0	ANSS
1977	7	22	-102.70	31.80			3.00	M	79.2	49.2	UTIG
1977	11	28	-100.84	32.95	5.0	3.1	3.50	un	217.4	135.1	ANSS
1978	3	2	-102.38	31.58			3.30	M	115.4	71.7	NMTR
1978	3	2	-102.56	31.55			3.50	M	109.9	68.3	UTIG
1978	6	16	-100.80	33.00			3.40	M	222.1	138.0	UTIG
1978	6	16	-100.77	33.03	10.0	6.2	5.30	un	226.1	140.5	ANSS
1978	6	29	-102.42	31.08			3.20	M	163.1	101.4	NMTR
1982	1	4	-102.49	31.18	5.0	3.1	3.90	un	149.9	93.2	ANSS
1982	11	28	-100.84	33.00	5.0	3.1	3.30	un	218.4	135.7	ANSS
1983	9	15	-104.43	34.92			3.10	M	302.6	188.1	NMTR
1984	5	21	-102.23	35.07	5.0	3.1	3.10	un	302.5	188.0	ANSS

Table 3.3-4Earthquakes of Magnitude 3.0 and Greater Within 322 Kilometers (200 Miles) of the NEF Site

Year	Month	Day	Longitude	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
1984	9	11	-100.70	31.99	5.0	3.1	3.20	un	229.4	142.5	ANSS
1984	9	19	-100.69	32.03	5.0	3.1	3.00	un	229.3	142.5	ANSS
1986	1	30	-100.69	32.07	5.0	3.1	3.30	un	228.0	141.7	ANSS
1990	8	3	-100.69	32.21			3.40	M	225.6	140.2	NMTR
1992	1	2	-103.19	32.30			5.00	M	17.8	11.0	NMTR
1992	8	26	-102.71	32.17	5.0	3.1	3.00	un	45.6	28.4	ANSS
1993	12	22	-105.68	33.33	10.0	6.2	3.20	un	261.9	162.8	ANSS
1995	3	19	-104.21	35.00	5.0	3.1	3.30	un	303.1	188.4	ANSS
1995	4	14	-103.35	30.28			5.70	M	240.7	149.5	UTIG
1995	11	12	-103.35	30.30	10.0	6.2	3.60	ML	238.5	148.2	ANSS
1998	4	15	-103.30	30.19	10.0	6.2	3.60	ML	250.4	155.6	ANSS
1999	3	14	-104.63	32.59	1.0	0.6	4.00	ML	145.9	90.7	ANSS
1999	3	17	-104.67	32.58	1.0	0.6	3.50	Mc	149.7	93.0	ANSS
1999	5	30	-104.66	32.58	10.0	6.2	3.90	ML	148.9	92.5	ANSS
2001	6	2	-103.14	32.33	5.0	3.1	3.30	ML	12.6	7.8	ANSS
2001	11	22	-102.63	31.79	5.0	3.1	3.10	ML	83.7	52.0	ANSS
2002	9	17	-104.63	32.58	10.0	6.2	3.50	ML	145.8	90.6	ANSS
2002	9	17	-104.63	32.58	10.0	6.2	3.30	ML	145.8	90.6	ANSS
2003	6	21	-104.51	32.67	5.0	3.1	3.60	ML	135.5	84.2	ANSS

Notes:

[1] Focal depth information only available for events reported in ANSS Catalog

[2] MAG - Magnitude

[3] MAG Type

M – Moment Magnitude

mb – Body – wave Magnitude

un – Unspecified Magnitude

ML – Local Magnitude

Mc – Coda – wave Magnitude

[4] Data Sources

UTIG – University of Texas Institute for Geophysics

NMTH – New Mexico Tech Historical Catalog

NMTR – New Mexico Tech Regional Catalog, Exclusive of Socorro NM Events

ANSS – Advanced National Seismic System

Table 3.3-5Earthquake Data Sources for New Mexico and West Texas

Data Source	Time Span	Number of Events Within a 322-Kilometer (200-Mile) Radius
New Mexico Tech, Regional Catalog (NMIMT, 2002)	1962 - 1995	504
New Mexico Tech, Historical Catalog (NMIMT, 2002)	1869 - 1992	2
Univ. of Texas Institute of Geophysics (UTIG, 2002)	1931 - 1998	42
Advanced National Seismic System (USGS, 2003a)	1962 - 2003	64

Table 3.3-6 Modified Mercalli Intensity Scale

Intensity Value	Description
I	Not felt except by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibration like passing of truck.
IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing automobiles rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes, windows, and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster and damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown in the air.

Table 3.3-7Comparison of Parameters for the January 2, 1992, Eunice, New Mexico Earthquake

Year	Month	Day	Longitude	Latitude	Magnitude	Data Source[1]
1992	1	2	-103.1863	32.3025	5.0	NMTR
1992	1	2	-102.97	32.36	4.6	UTIG
1992	1	2	-103.2	32.3	5.0	NMTH
1992	1	2	-103.101	32.336	5.0	ANSS

[1]Data Sources:

UTIG, University of Texas Institute for Geophysics (UTIG, 2002)

NMTH, New Mexico Tech Historical Catalog (NMIMT, 2002)

ANSS, Advanced National Seismic System (USGS, 2003a)

NMTR, New Mexico Tech Regional Catalog, Exclusive of Socorro, New Mexico Events (NMIMT, 2002)

Table 3.3-8NEF Site Soil Sample Locations

Soil Sample No.	Location Description	Latitude	Longitude
SS-2	Uranium Byproduct Cylinders (UBC) Storage Pad	32° 26' 18"	103° 04' 53"
SS-6	Cascade Halls 3 & 4	32° 26' 06"	103° 04' 45"
SS-9	Treated Effluent Evaporative Basin	32° 26' 02"	103° 04' 55"
SS-11	Technical Services Building	32° 26' 02"	103° 04' 47"
SS-12	UBC Storage Pad Stormwater Retention Basin	32° 25' 59"	103° 05' 03"
SS-13	Site Stormwater Detention Basin	32° 25' 51"	103° 04' 37"
SS-15	Northwest quadrant	32° 26' 28"	103° 05' 11"
SS-16	Northeast quadrant	32° 26' 28"	103° 04' 33"

Note:

Refer to Figure 3.3-12 for the approximate locations of the soil samples on the NEF site.

Table 3.3-9Non-Radiological Chemical Analyses of NEF Site Soil

Analytical Results (mg/kg)									New Mexico Soil Screening Level (mg/kg)[1]
Sample No.	SS-2	SS-6	SS-9	SS-11	SS-12	SS-13	SS-15	SS-16	
Parameter [2],[3]									
Barium	22	15	53	19	19	16	17	24	1,440
Chromium	5.9	3.1	3.4	3.4	3.5	3	3.1	3.7	180
Lead	2.8	2.2	3.3	2.8	2.7	2.6	2.5	2.9	400

Notes:

1. Source: Technical Background Document for Development of Soil Screening Levels (Revision 2, February 2004), New Mexico Environment Department (NMED) Hazardous Waste Bureau, Ground Water Quality Bureau and Voluntary Remediation Program. The most conservative soil screening level is listed from the levels indicated for residential, industrial/occupational and construction worker exposures. For chromium, the soil screening level for Chromium VI is listed since it controls over that for Chromium III.
2. Other parameters analyzed (volatiles, semi-volatiles, metals (arsenic, cadmium, mercury, selenium, silver and mercury), organochlorine pesticides, organophosphorous compounds, chlorinated herbicides and fluoride) were not detected above the laboratory reporting limits.
3. Analytical methods were performed in accordance with Environmental Protection Agency (EPA) publication SW846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, November 1986, and Updates I, II, IIA, IIB, III, and IIIA.

3.3.5 Section 3.3 Figures

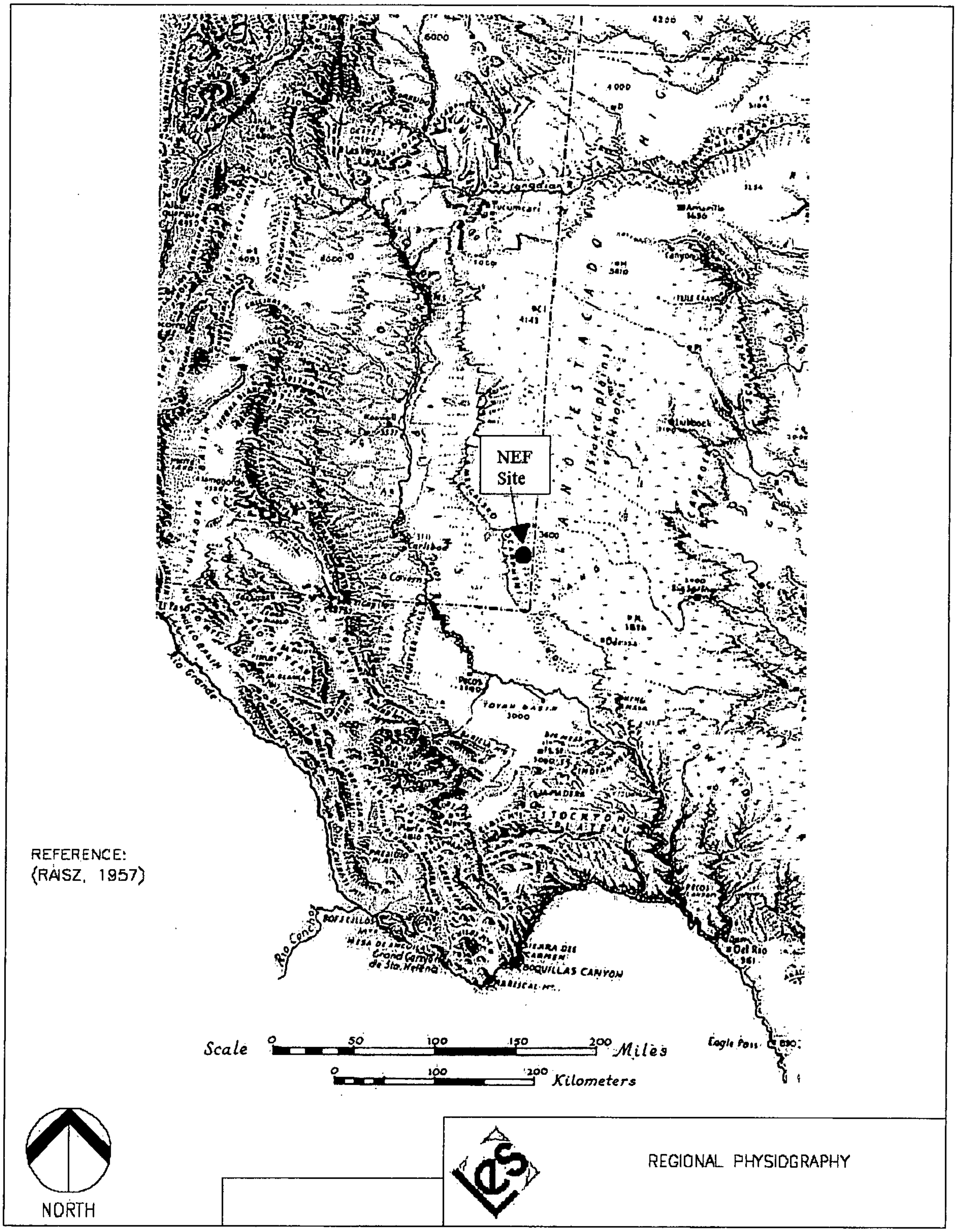


Figure 3.3-1 Regional Physiography

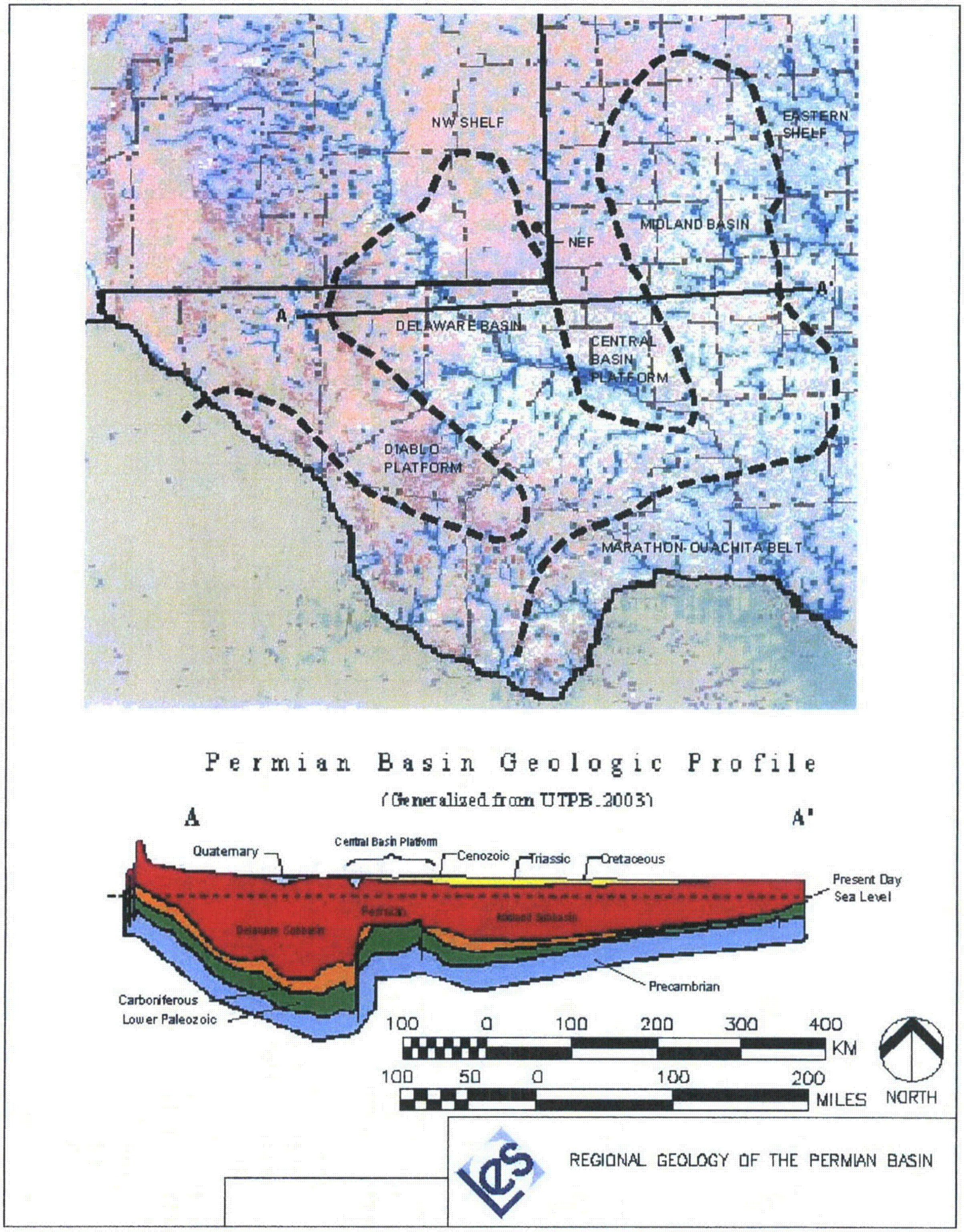


Figure 3.3-2Regional Geology of the Permian Basin

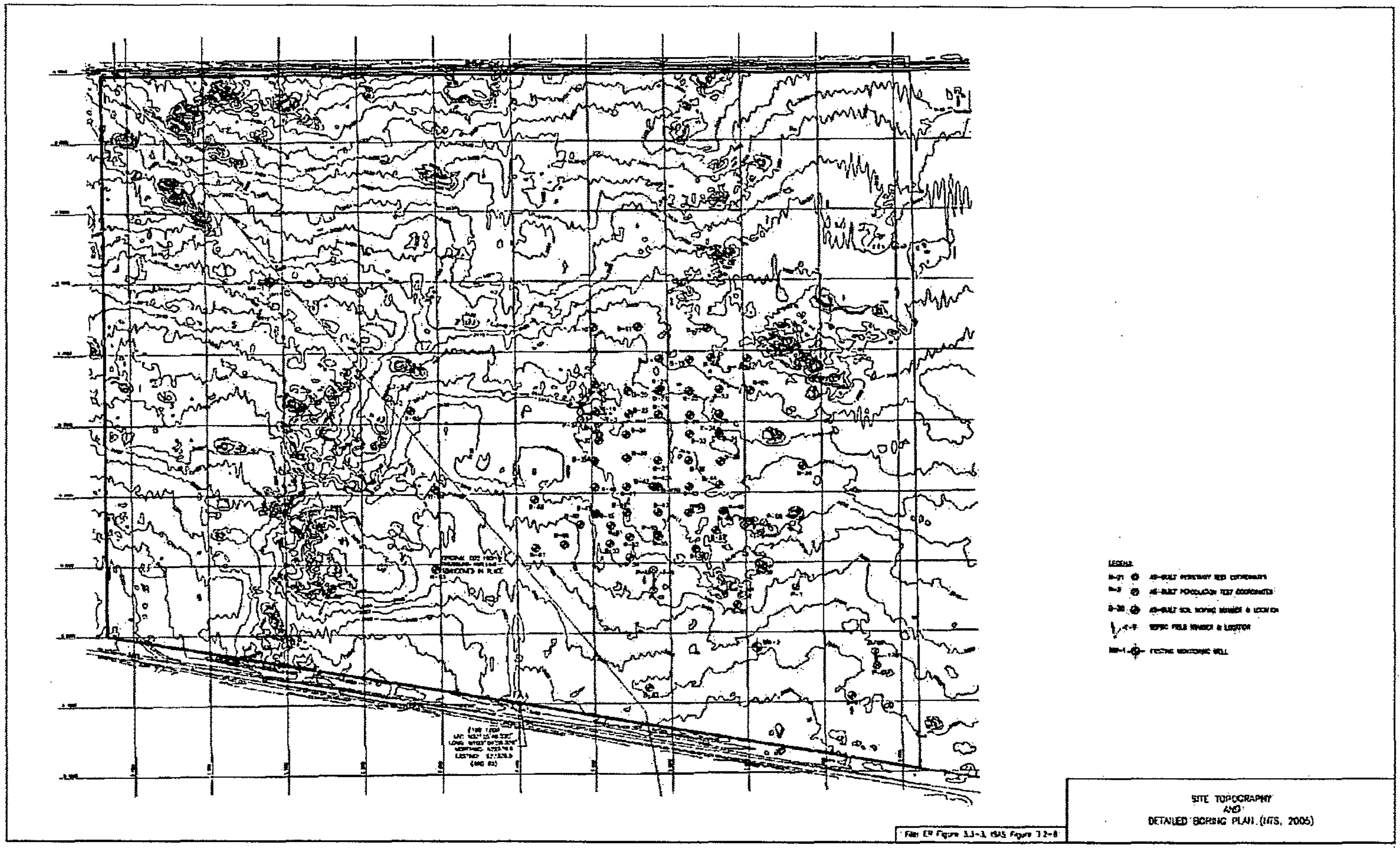


Figure 3.3-3Site Topography

LEGEND

ca — CALICHE — Partly indurated zone of calcium carbonate accumulation formed in upper layers of surficial deposits; 2 to 10 ft thick, commonly overlain by windblown sand. Much caliche shown on the map consists of tough, slabby surface layers underlain by calcium carbonate nodules that grade downward to fibers and veinlets. Especially well developed in Basin and Range and Great Plains parts of the state. Thick caliches (locally >20 ft) associated with undissected High Plains surfaces of the Great Plains commonly comprise an upper sequence of several carbonate-cemented zones interlayered with reddish loamy paleosol horizons over a basal caprock zone developed on Ogallala (To) sediments. Forms on various types of parent formations, indicated by subscripts. The extensive caliche along Rio Salado northwest of Socorro is partly a travertine deposit. Where buried by sand, the caliche is identified by subscript ca. A distinctive unit; boundaries are well defined where the caliche forms rimrock and approximate where exposed in deflation hollows. Where thick and well indurated, caliche is quarried for road metal and other aggregate, subject to minimal erosion

al_2 — FLOODPLAIN AND CHANNEL DEPOSITS ALONG GENERALLY DRY ARROYOS AND WASHES — Includes deposits along some perennial mountain streams. Extent exaggerated to emphasize drainage patterns. Sandier than al_1, gradients 5 to 15 percent. Arroyos 10 ft deep common. Surface flat where deposit was formed by stream overflowing its banks; hummocky where built of coalescing fans at mouths of tributaries that crowd the main stream against its far bank; or V-shaped where alluvium grades laterally into fan sand washed from adjoining hillsides. Ephemeral perched water tables under some deposits. Width of deposits represented has been exaggerated but total area probably about right because small deposits had to be omitted

fs — SAND FACIES — Sandy alluvium with subordinate amounts of fine gravel, silt, and clay. Forms at least four kinds of ground: 1) On short, steep fans sloping from the mountains of granitic or gneissic rock (e.g., parts of the Florida Mountains), this facies may form a smooth sandy layer a few feet thick covering gravel below; slopes 5 to 20 percent; washes 1 to 10 ft deep may expose underlying gravel. 2) On other short fans, sand facies may form arcuate belt at toe of fan with slopes averaging 10 percent, commonly reworked into coppice dunes 3 to 7 ft high (sm). 3) Other belts of smooth sandy ground commonly slope 5 percent or less and consist of sand mounds approximately 1 ft high over caliche (fs_2). 4) Gypsiferous sand (fs_3), especially in the Jornada del Muerto, Tularosa Valley and east side of the Pecos Valley. Sand facies absent on the broad Las Palomas surface. Thin fan sand covering pediments is denoted by fs over subscript that identifies underlying formation. Boundary with residual sand, fan gravel, and fan silt is approximate

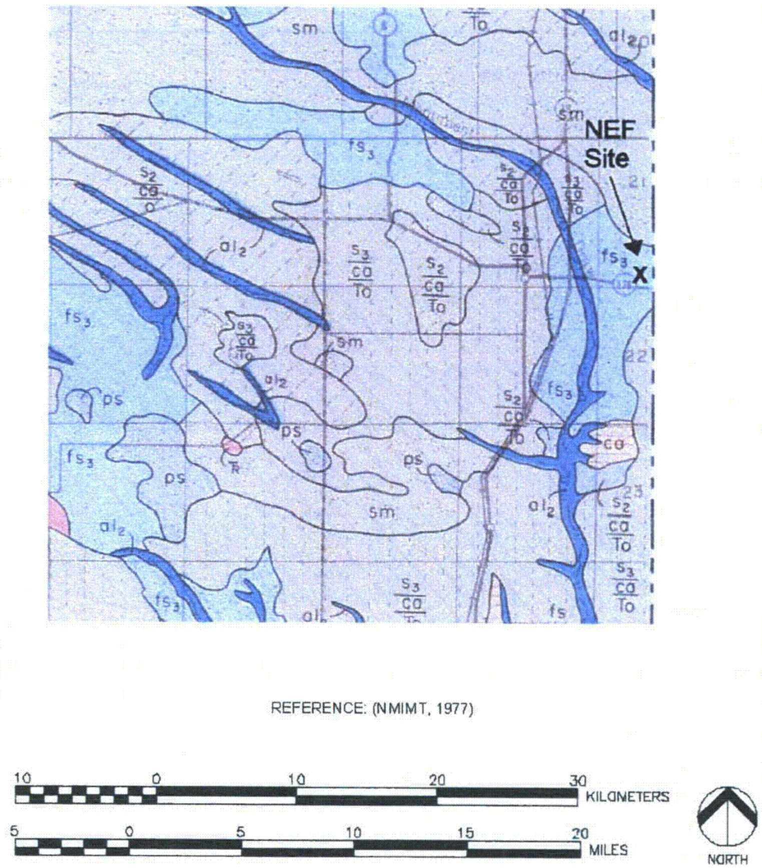
s_2/ca/To — MODERATELY THICK SAND ON CALICHE ON OGALLALA FORMATION — Sand 1 to 3 ft thick. Surface layers noncalcareous over reddish loam. Local sand mounds. Ground favored for farming. Boundaries approximate

s_3/ca/To — THICK SAND ON CALICHE ON OGALLALA FORMATION — Sand 3 to 5 ft thick. Local mounds. Brownish-red, fine sandy loam over reddish-brown, sandy clay loam; noncalcareous to depths of 3 ft; calcareous subsoil contains filaments of lime carbonate. Where farmed, ground is subject to wind erosion. Boundaries approximate

sm — LOOSE SAND IN MOUNDS — Coppice dunes, commonly 3 to 7 ft high and 25 to 50 ft in diameter; generally elongated north of east but a local exception lies east of Columbus where elongation is south of east. Age is Holocene. Boundaries fairly accurate

ps — SANDY LAKE OR PLAYA DEPOSITS — Gypsiferous deposits labeled ps_2

₨ — OTHER BEDROCK — Colluvium or other cover amounts to less than half the area. Only extensive areas are shown; age and rock type keyed by symbol to State geologic map (e.g., Kd, Cretaceous Dakota Sandstone, ₨s Triassic Santa Rosa Sandstone). Many small areas omitted; indicated boundaries are approximate. ₨ – Triassic, undifferentiated



REFERENCE: (NMIMT, 1977)

SURFICIAL GEOLOGIC MAP OF THE NEF SITE AREA

Figure 3.3-4Surficial Geologic Map of the NEF Site Area

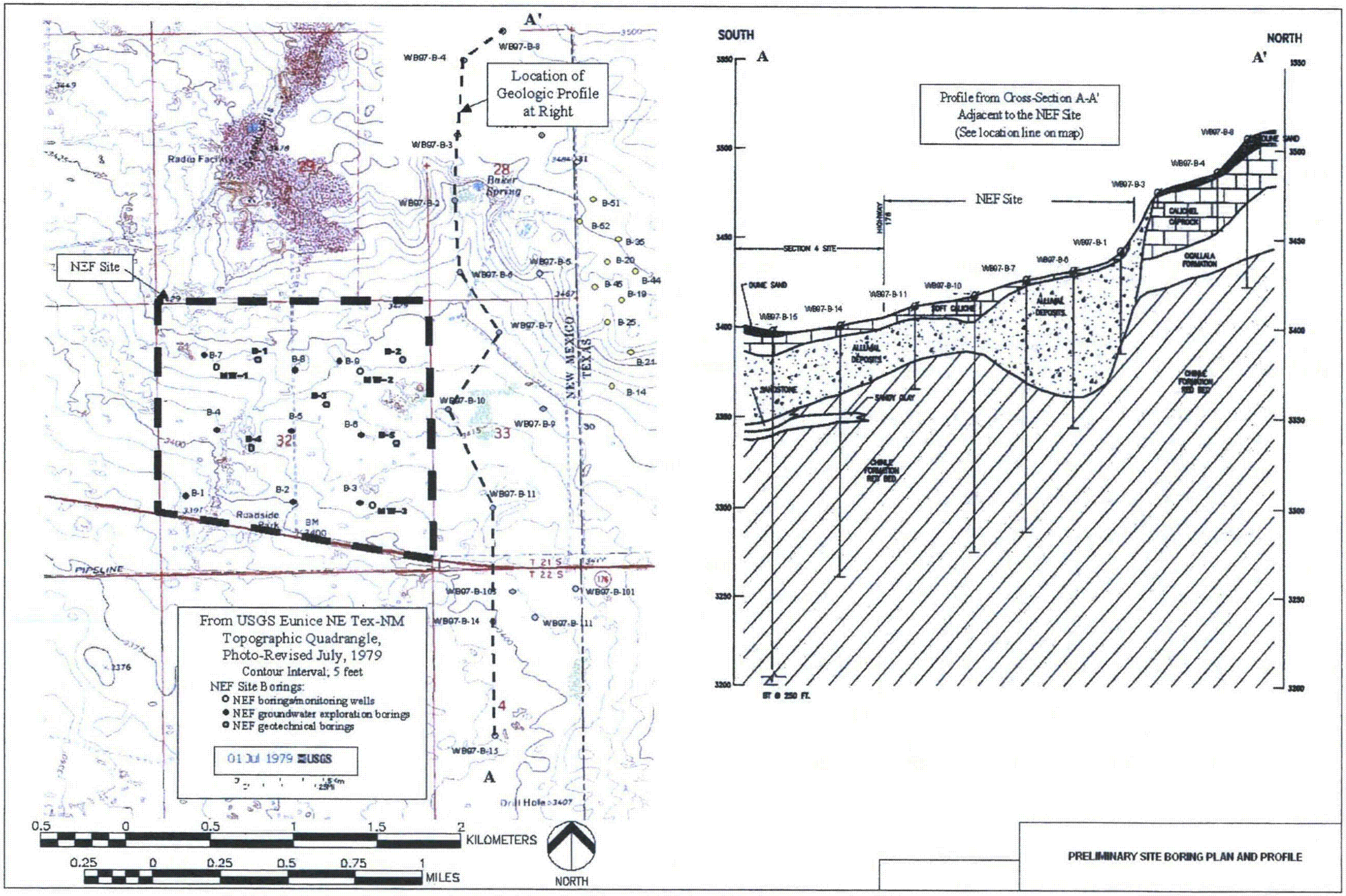
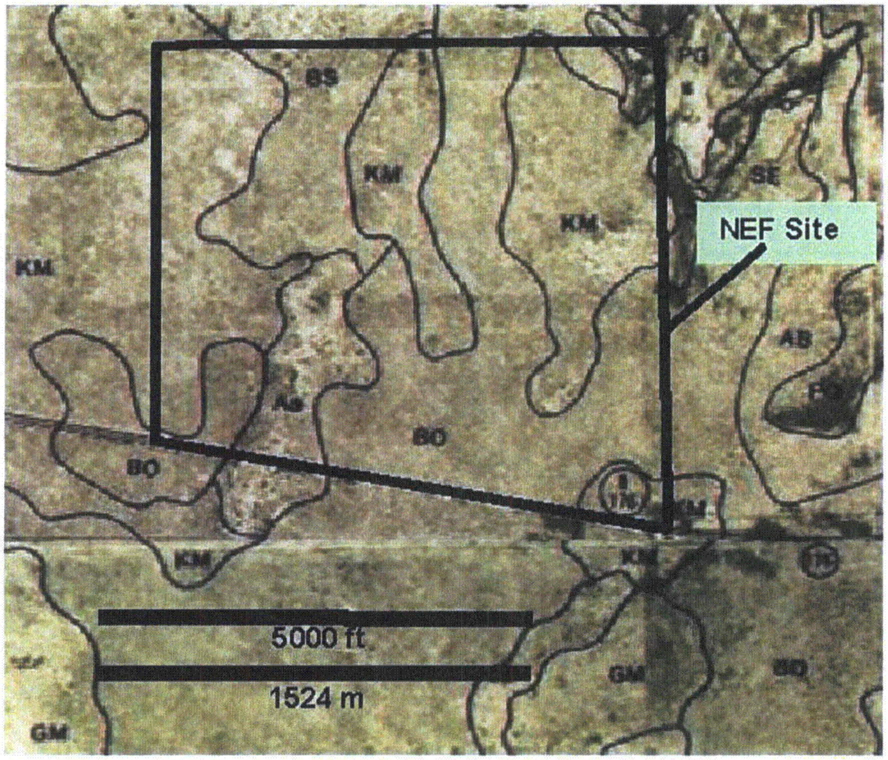


Figure 3.3-5Preliminary Site Boring Plan and Profile



USDA SOIL DESIGNATION	SOIL NAME/DESCRIPTION	UNIFIED SOIL CLASSIFICATION DESIGNATION(S)
Aa	ACTIVE (SAND) DUNE LAND.	SP
BO	BROWNFIELD-SPRINGER ASSOCIATION: MOSTLY FINE SAND WITH LOAM FINE SAND; LEVEL TO UNDULATING TOPOGRAPHY; MODERATELY RAPID PERMEABLILITY AND SLOW RUNOFF.	SM
BS	BROWNFIELD-SPRINGER ASSOCIATION: MOSTLY FINE SAND WITH LOAM FINE SAND; DUNES AND HUMMOCKS FOR CONCAVE AND CONVEX ROLLING TERRAIN; DRAINAGE SIMLAR TO BO.	SM
KM	KERMIT SOILS AND DUNE LAND: EXCESSIVELY-DRAINED NON-CALCAREOUS SOILS; HUMMOCKY AND UNDULATING TOPOGRAPHY DUE TO EOLIAN PROCESSES.	SP-SM OR SM
MU	MIXED ALLUVIAL LANDS: UNCONSOLIDATED, STRATIFIED ALLUVIUM WITH VARIED TEXTURES OCCURRING INTERMITTENTLY IN DRAINAGE-WAYS A FEW FEET IN THICKNESS; MODERATE TO RAPID PERMEABILITY WITH SLOW RUNOFF.	VARIABLE
PG	PORTALES AND GOMEZ FINE SANDY LOAMS: LIGHT CLAY LOAM, WELL-DRAINED.	VARIABLE

SOURCE: (USDA, 1974)

NORTH

SITE SOILS MAP PER USDA DATA

Figure 3.3-6Site Soils Map Per USDA Data

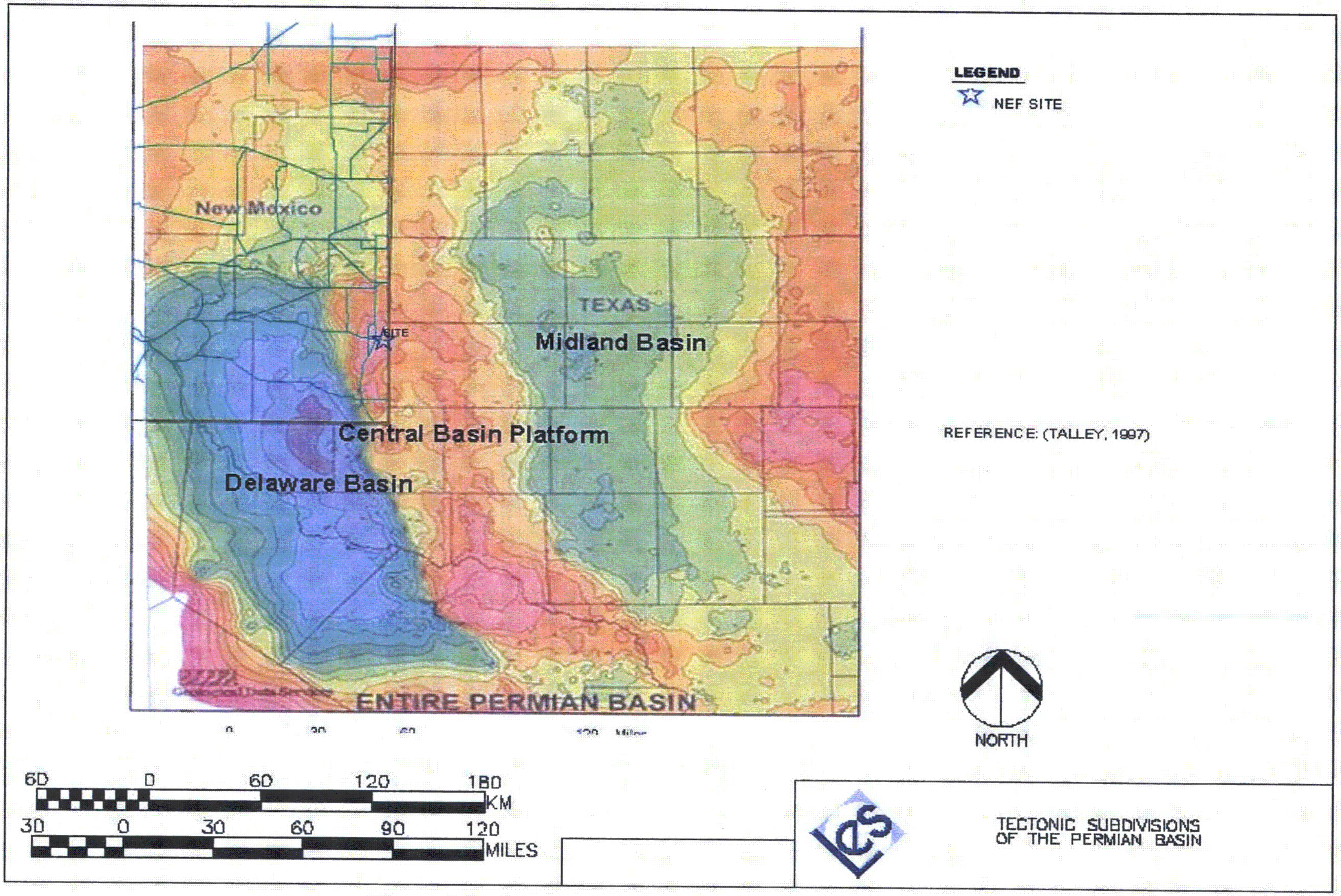


Figure 3.3-7Tectonic Subdivisions of the Permian Basin

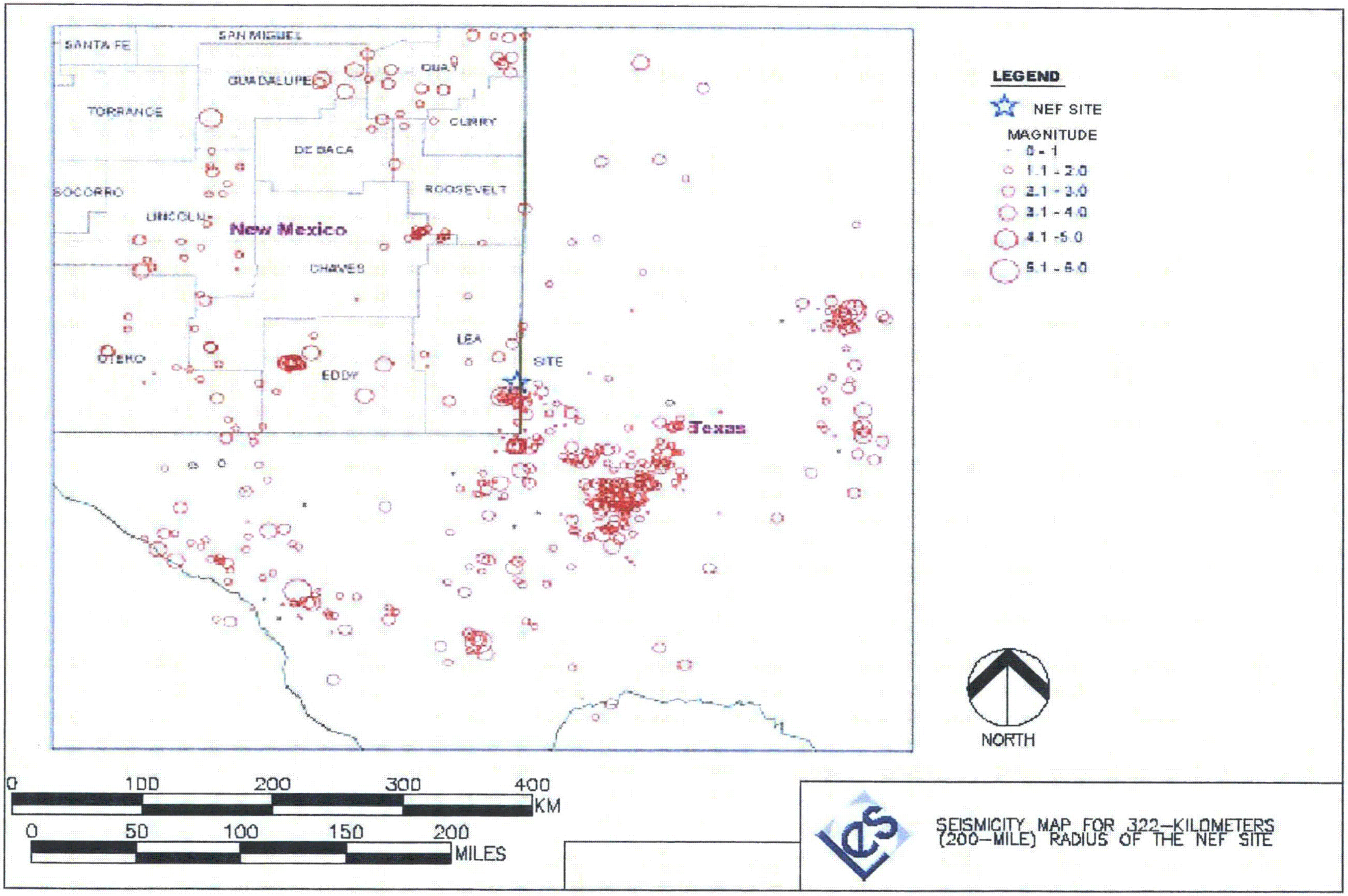


Figure 3.3-8 Seismicity Map for 322-Kilometer (200-Mile) Radius of the NEF Site

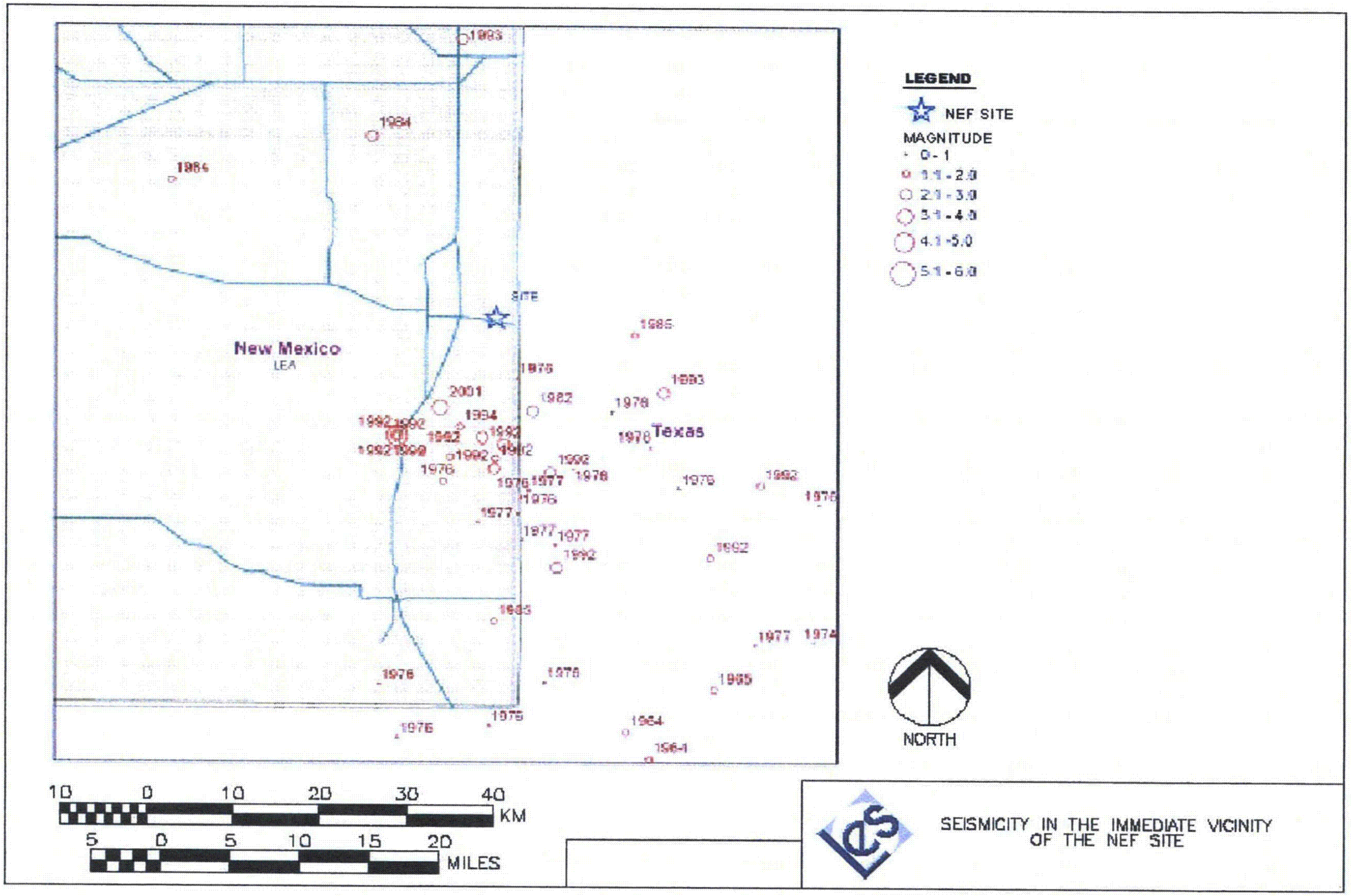


Figure 3.3-9 Seismicity in the Immediate Vicinity of the NEF Site

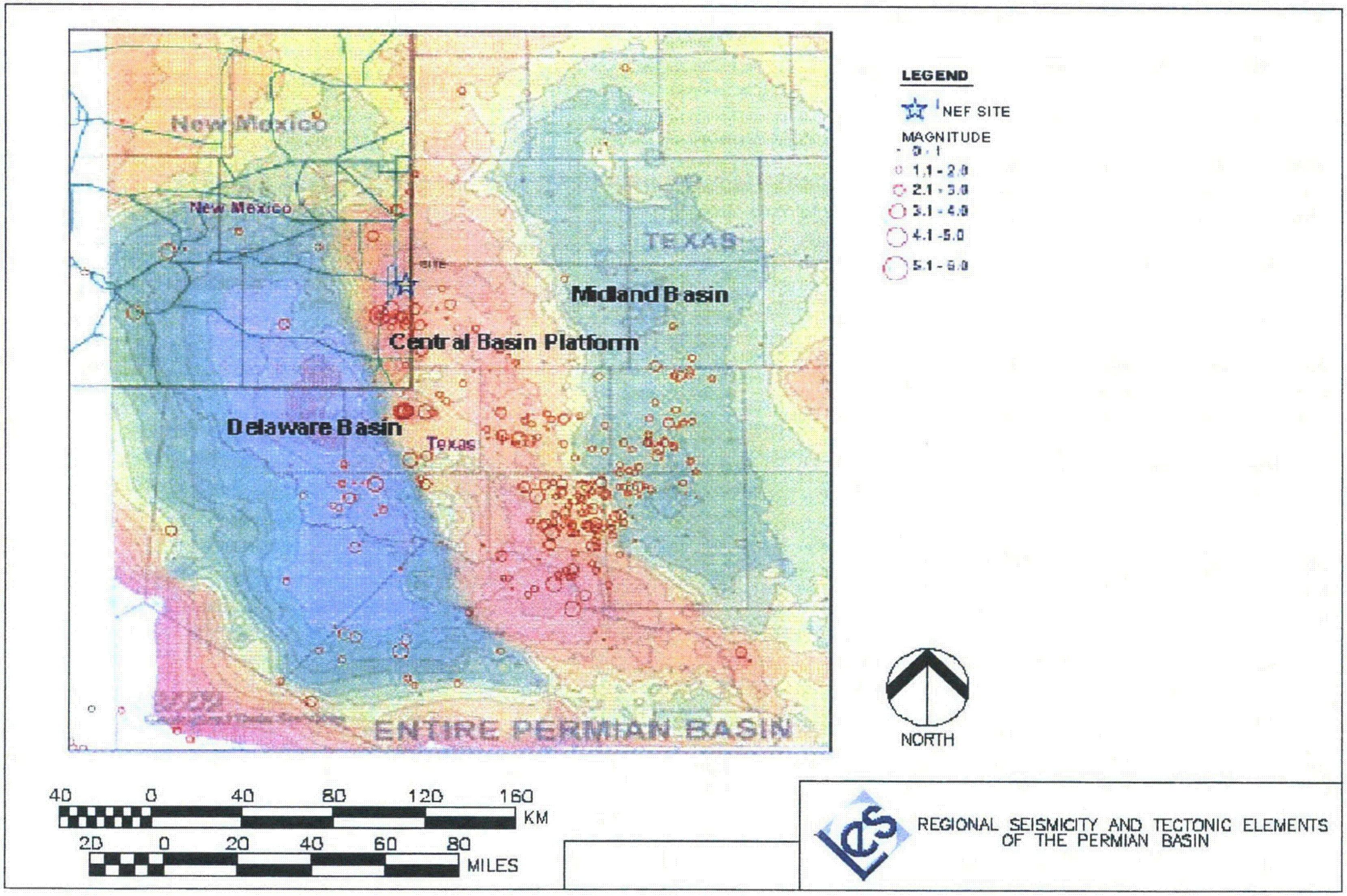


Figure 3.3-10Regional Seismicity and Tectonic Elements of the Permian Basin

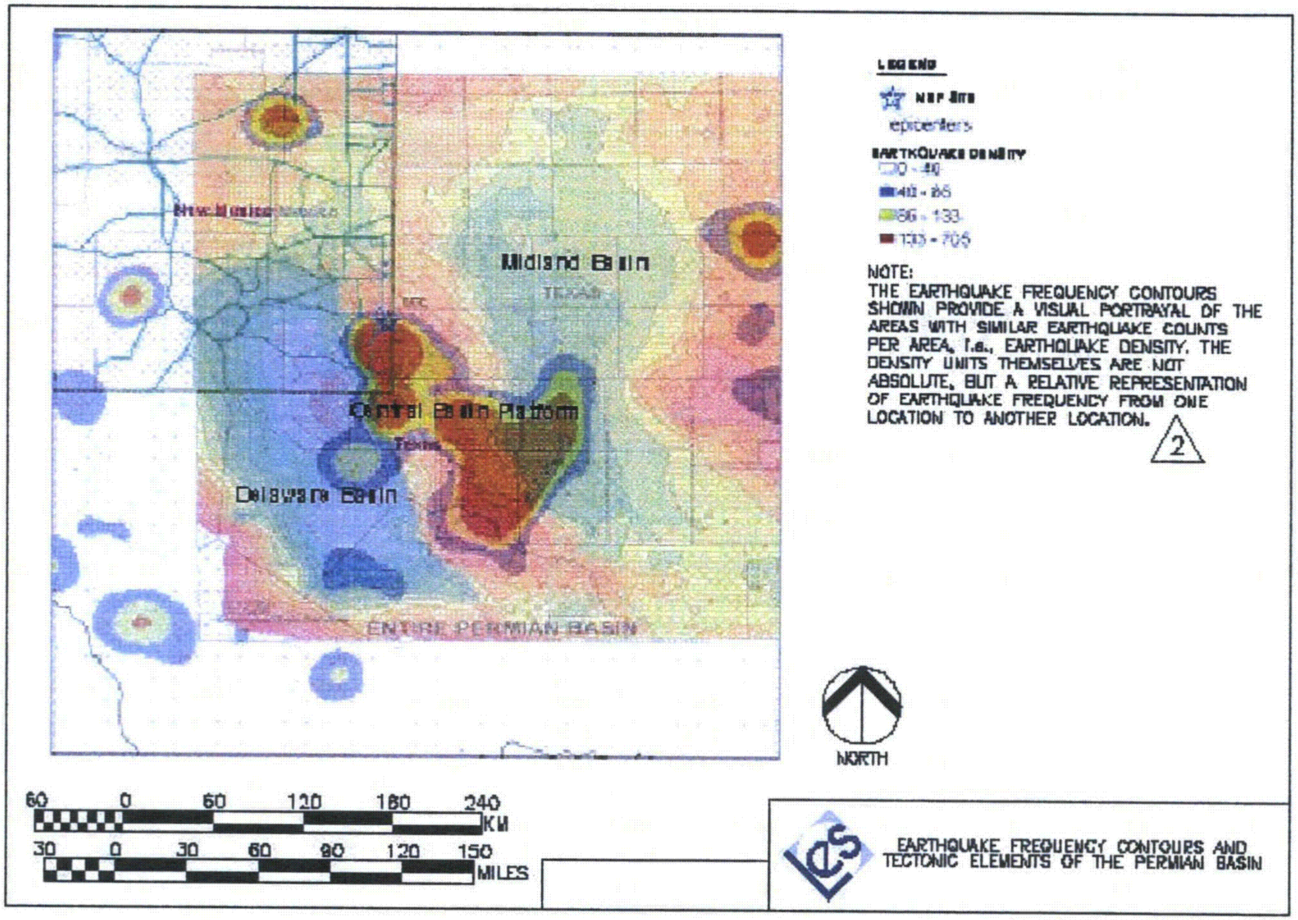


Figure 3.3-11Earthquake Frequency Contours and Tectonic Elements of the Permian Basin

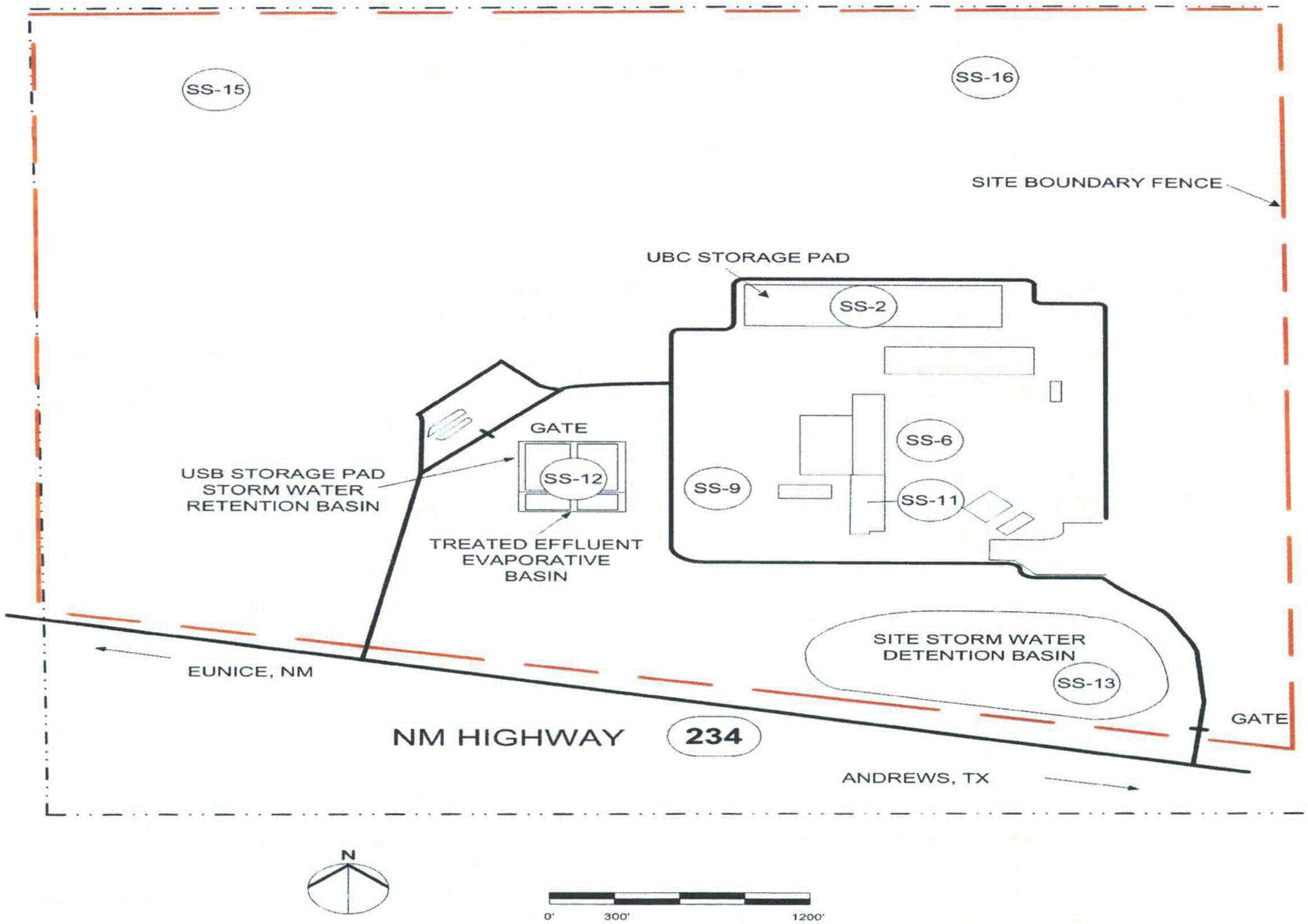


Figure 3.3-12Soil Sample Locations

3.4 WATER RESOURCES

This section describes the National Enrichment Facility (NEF) site's surface water and groundwater resources. Data are provided for the NEF site and its general area, and the regional associations of those natural water systems are described. This information provides the basis for evaluation of any potential facility impacts on surface water, groundwaters, aquifiers, water use and water quality. Subsections address surface hydrology, water quality, pre-existing environmental conditions, water rights and resources, water use, contamination sources, and groundwater characteristics.

The information included in this section was largely obtained from prior site studies including extensive subsurface investigations for a nearby facility, Waste Control Specialists (WCS) located about 1.6 km (1 mi) to the east of the NEF site. In addition, literature searches were conducted to obtain additional reference material. Some of the WCS data has been collected on Section 33 located immediately east of the NEF site. These data are being supplemented by a groundwater exploration and sampling program on Section 32 initiated by LES in September 2003.

The NEF will make no use of either surface water or groundwater from the site. The collection and storage of runoff from specific site areas will be controlled. No significant adverse changes are expected in site hydrology as a result of construction or operation of the NEF. ER Section 4.4.7, Control of Impacts to Water Quality, addresses potential for impacts onsite water resources as a result of activities on the NEF site including runoff and infiltration changes due to plant construction and fill placement.

3.4.1 Surface Hydrology

The NEF site itself contains no surface water bodies or surface drainage features. Essentially all the precipitation that occurs at the site is subject to infiltration and/or evapotranspiration. More information on the movement and fate of surface water and groundwater at the site is provided in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems. Regional and local hydrologic features are shown on Figure 3.4-1, Local Hydrologic Features and Figure 3.4-2, Regional Hydrologic Features, respectively. These features are discussed in the following sections. These features include Baker Spring, Monument Draw and several ponds on the adjacent Wallach Concrete, Inc. property. There are also several intermittent surface features in the vicinity of the NEF site that may collect water for short periods of times following heavy rainfall events.

3.4.1.1 Major Surface and Subsurface Hydrological Systems

The climate in southeast New Mexico is semi-arid. Precipitation in the NEF area averages only 33 to 38 cm/yr (13 to 15 in/yr). Evaporation and transpiration rates are high. This results in minimal, if any, surface water occurrence or groundwater recharge.

The NEF site contains no surface drainage features. The site topography is relatively flat, with the average slope only 0.0064 m/m (0.0064 ft/ft). Some localized depressions exist, due to eolian processes, but the size of these features is too small to be of significance with respect to surface water collection.

Most precipitation is contained onsite due to infiltration and/or evapotranspiration. The vegetation on the site is primarily shrubs and native grasses. The surface soils are predominantly of an alluvial or eolian origin. The texture of the surface soils is generally silt to silty sands. Therefore, the surface soils are relatively low in permeability, and would tend to hold moisture in storage rather than allow rapid infiltration to depth. Water held in storage in the soil is subsequently subject to evapotranspiration. Nine preliminary subsurface borings were drilled at the site during September 2003. Only one of the borings produced cuttings that were slightly moist at 1.8 to 4.2 m (6 to 14 ft) below ground surface; other cuttings were very dry. Also, ground water was not encountered during drilling at any of the additional 59 NEF site borings, which are documented in Appendices A and C of the Geotechnical Report (NTS Report No. 114489-G-01, Rev. 00) and some were drilled as deep as 30.5 m (100 ft) below grade. Evapotranspiration processes are significant enough to short-circuit any potential groundwater recharge.

There is some evidence for shallow (near-surface groundwater occurrence in areas to the north and east of the site. These conditions are intermittent and limited. A quarry operated by Wallach Concrete, Inc. is located just north of the NEF site. Wallach has extensively mined sand and gravel from the quarry. The typical geologic cross section at that site consists of a layer of caliche at the surface, referred to as the "caprock," underlain by a sand and gravel deposit, which in turn overlies a thick clay unit of the Dockum Group, referred to as red beds, and part of the Chinle Formation. Table 3.3-1, Geological Units Exposed At, Near, or Underlying the Site and Figure 3.3-5, Preliminary Site Boring Plan and Profile depict this stratigraphy. Figure 3.4-3, View of a Pit Wall in a Wallach Sand & Gravel Excavation to the North of the NEF Site, shows a pit wall in one of Wallach's excavations, where the caprock (caliche) overlies sand and gravel, with the red bed clay Chinle Formation at the base of the pit. In some areas the caprock is missing and the sand and gravel is exposed at the surface. The caprock is generally fractured and, following precipitation events may allow infiltration that quickly bypasses any roots from surface vegetation. In addition, the areas where the sand and gravel outcrop may allow rapid infiltration of precipitation. These conditions have led to instances of minor amounts of perched groundwater at the base of the sand and gravel unit, atop the red bed Chinle Formation. The Chinle red bed clay has a very low permeability, about 1×10^{-8} cm/s (4×10^{-9} in/s) (Rainwater, 1996), and serves as a confining unit arresting downward percolation of localized recharge.

Figure 3.4-4, Groundwater Seep at the Base of a Wallach Sand & Gravel Excavation to the North of the NEF Site, shows a shallow surface depression filled with water in the base of one of Wallach's gravel pits. The water is present perennially due to a seep at the base of the sand and gravel unit at the top of the Chinle clay. Occasionally the water is pumped out of this depression for use on site. The rate of replenishment has not been quantified, but it is relatively slow. The amount of water in the pit is insufficient to fully supply the quarry operations. This shallow perched zone is not likely to be pervasive throughout the area; not all of Wallach's excavations encounter this horizon. It is not considered to be an aquifer.

Conditions at the NEF site are different than at the Wallach site. Two conditions are of particular importance. First, the caprock is not present at the NEF site. Therefore, rapid infiltration through fractured caliche does not contribute to localized recharge at the NEF site. Second, the surface soils at the NEF site are finer-grained than the sand and gravel at the Wallach site. There is a thin layer of sand and gravel just above the red bed Chinle clay unit on the NEF site, but based on recent investigations, it is not saturated. Further, that horizon at the NEF site is very dry or at a residual saturation level based on information from the nine recent soil borings.

Another instance of saturation above the Chinle clay may be seen at Baker Spring, just to the northeast of the NEF site. Baker Spring is located at the edge of an escarpment, where the caprock ends. The location of Baker Spring is shown on Figure 3.4-1, Local Hydrologic Features. A photograph of Baker Spring is provided in Figure 3.4-5, View of Baker Spring Area to the Northeast of the NEF Site. The surface water feature is intermittent. Water typically flows into Baker Spring after precipitation events. There may be some water seeping from the sand and gravel unit beneath the caprock into Baker Spring. The area where Baker Spring is located is underlain by the Chinle clay. Deep infiltration of water is impeded by the low permeability of the clay. Therefore, seepage and/or precipitation/runoff into the Baker Spring area appear to be responsible for the intermittent localized flow and ponding of water in this area. Flows from this feature are intermittent, unlike those supplying the Wallach's pits. This condition does not exist at the NEF site due to the absence of the caprock and the low permeability surface soils.

A pedestrian survey, personal interviews, and a search of historical aerial photographs were used to investigate the origin of the area identified as Baker Spring on USGS topographic maps.

During the pedestrian survey, a surface engineering control or diversion berm, was identified just north of Baker Spring and it is believed that the berm had been constructed to divert surface water from the north and cause it to flow to the east of the Baker Spring area. Stockpiles of the overburdened slit and very fine sand material, which are typically not suitable for sand or gravel use were identified in the area south of Baker Spring. In addition, the area around Baker Spring is littered with debris such as thick cable and scrap metal components that appear to be parts of excavation equipment. The Baker Spring area appears to have been excavated to the top of the redbed through the removal of the overlying sand and gravel reserves. The area is at a lower elevation than the natural drainage features that flow from the northwest and the northeast, and merge in the area of Baker Spring and formerly ran to the south. Both of these drainage features now allow surface water to flow into Baker Spring. Ground surface at Baker Spring is several feet below the outlet that would otherwise flow to the south. Therefore, the results of past quarrying activities allow surface water that formerly flowed through the natural drainage features to be diverted and now pond in Baker Spring.

Based on personal interviews, it appears that mining operations of the sand and gravel materials above the redbed began in the 1940s and continued into the 1950s. An aerial photograph from 1949 shows what appears to be a clean fresh face of the excavation. In the area of the excavation, a network of roads are visible in the aerial, including a main road which leads south towards New Mexico Highway 234. Based on enlargements of the aerial, the quarry floor appears to have regularly shaped excavation patterns on the top of the redbed material.

Based on the investigation of the Baker Spring area, it is concluded that the feature is man-made and results from the historical excavation of gravel and caprock materials that are present above the redbed clay. As a result of the excavation, Baker Spring is topographically lower than the surrounding area. Following rainfall events, ponding on the excavation floor occurs. Because the excavation floor consists of very low permeability clay of the redbed, limited vertical migration of the ponded water occurs. Shading from the high wall and trees that have flourished in the excavated area retard the natural evaporation rates and water stands in the pond for sometime. It is also suspected that during periods of ponding, surface water infiltrates into the sands at the base of the excavated wall and is retained as bank storage. As the surface water level declines, the bank storage is discharged back to the excavation floor.

A third instance of localized shallow groundwater occurrence exists to the east of the NEF site where several windmills on the WCS property were used to supply water for stock tanks; they are no longer in use. These windmills tap small saturated lenses above the Chinle Formation red beds. The amount of groundwater in these zones is limited. The source of recharge for these localized perched zones is likely to be "buffalo wallows," (playas) depressions located near the windmills. The buffalo wallows are substantial surface depressions that collect surface water runoff. Water collecting in these depressions is inferred to infiltrate below the root zone due to the ponding conditions. WCS has drilled monitoring wells in these areas to characterize the nature and extent of the saturated conditions. Some of these wells are dry, owing to the localized nature of the perched conditions. When water is encountered in the sand and gravel above the Chinle Formation red beds its level is slow to recover following sampling events, due to the low permeability of the perched saturated zones. The discontinuity of this saturated zone and its low permeability argue against its definition an aquifer. No buffalo wallows or related groundwater conditions occur on or near the NEF site.

The NEF is located in an area with little to no surface water or runoff. Monument Draw is an intermittent stream and the closest surface water conveyance feature. Flow data are presented in ER Section 3.4.12.9, Design-Basis Flood Elevation.

Walvoord et al,. 2002 (Walvoord, 2002) best describes the hydrologic conditions that occur in the shallow surface regime at the NEF site. This reference uses field investigations including geochemical and soil-physics based techniques, as well as computer modeling, to show that there is no recharge occurring in thick, desert vadose zones with desert vegetation. Precipitation that infiltrates into the subsurface is efficiently transpired by the native vegetation. Vapor-phase movement of soil-moisture may occur, but it is also intercepted by the vegetation. In a thick vadose zone, such as at the NEF site, the deeper part of that zone has a natural thermal gradient that induces upward vapor diffusion. As a result, a small flux of water vapor rises from depth to the base of the root zone, and any infiltration coming from the land surface is captured by the roots of the plants within the top several meters (feet) of the profile. Effectively there is a maximum negative pressure potential at the base of the root zone that acts like a sink, where water is taken up by the plants and transpired. These deep desert soil systems have functioned in this manner for thousands of years, essentially since the time of the last glacial period when precipitation rates fell dramatically. It is expected that these conditions will remain for several thousand more years (until the next glacial period), unless the hydrology and vegetation is altered dramatically.

3.4.1.1.1 Site Groundwater Investigations

A subsurface investigation was initiated at the NEF site in September 2003 to delineate specific hydrologic conditions. Figure 3.3-5, Preliminary Site Boring Plan and Profile and Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour, show the locations of the preliminary subsurface borings and the monitoring wells.

The WCS facility is located directly to the east of the NEF site in Texas. It has had numerous subsurface investigations performed for the purpose of delineating and monitoring site subsurface hydrogeologic conditions. Much of this information is directly pertinent to the NEF site. The WCS hydrogeologic data was used in planning the recent NEF site investigations. A recent evaluation of potential groundwater impacts in the area provides a good overview of the investigations performed for the WCS facility (Rainwater, 1996).

The NEF site investigation initiated in September 2003 had two main objectives: 1) delineate the depth to the top of the Chinle Formation red beds to assess the potential for saturated conditions above the red beds, and 2) complete three monitoring wells in the siltstone layer beneath the red beds to monitor water level and water quality within this thin horizon of perched intermittent saturation.

Nine preliminary boreholes oriented on a three-by-three grid were drilled to the top of the Chinle red beds (Figure 3.4-6). Only one of the borings produced cuttings that were slightly moist at 1.8 to 4.2 m (6 to 14 ft) below ground surface; other cuttings were very dry. Left open for at least a day, no groundwater was observed to enter any of these holes. Also, ground water was not encountered during drilling in any of the additional 59 NEF site borings, which are documented in Appendices A and C of the Geotechnical Report (NTS Report No. 114489-G-01, Rev. 00) and some of which were drilled as deep as 30.5 m (100 ft) below grade.

The land surface elevation was surveyed at each of the nine borehole locations and the elevation of the top of the red beds was computed. This information was combined with similar information from the WCS facility to produce an elevation map of the top of the red beds (see Figure 3.4-6). The dry nature of the soils from each of these borings supports a conclusion that there is no recharge from the ground surface at the site (Walvoord, 2002).

Three monitoring wells were installed at the end of September 2003 (Figures 3.3-5 and 3.4-6). Through the first month of monitoring only one well, MW-2, located at the northeast corner of the site, produced water. Several water samples have been taken from that well. It was anticipated that the other two wells would provide water over lengthy time periods, based on information from the WCS site. Groundwater quality is discussed in ER Section 3.4.2, Water Quality Characteristics. In 2007, fifteen additional ground water monitoring wells were drilled at locations depicted on Figure 6.1-2A, and monitoring well MW-3 was plugged and abandoned because of its location in the footprint of the Storm Water Basin. In 2008, eight more ground water monitoring wells were drilled adjacent to the UBC Storage Pad and UBC Storage Pad Storm Water Retention Basin. Monitoring well locations are depicted on Figure 6.1-2A.

Another factor to consider relative to hydrologic conditions at the NEF site is the presence of the Triassic Chinle Formation red bed clay. This clay unit is approximately 323 to 333 m (1,060 to 1,092 ft) thick beneath the site. With an estimated hydraulic conductivity on the order of $2x10^{-8}$ cm/s ($7.9x10^{-9}$ in/s), the unit is very tight (Table 3.3-2, Measured Permeabilities on the NEF Site). This permeability is of the same order prescribed for engineered landfill liner materials. One would expect vertical travel times through this clay unit to be on the order of thousands of years, based on this permeability and the thickness of the unit.

The first presence of saturated porous media beneath the site appears to be within the Chinle red bed clay where there exists a low-permeability silty sandstone or siltstone. Borings and monitor wells at the WCS facility directly to the east of the NEF site have encountered this zone approximately 61 to 91 m (200 to 300 ft) below land surface. Wells completed in this unit are very slow to produce water. This makes sampling quite difficult. It is arguable whether this zone constitutes an aquifer, given the low permeability of the unit. Similarly, there is a 30.5 meter (100-foot) thick water-bearing layer at about 183 m (600 ft) below ground surface (CJI, 2004). As discussed above, three monitoring wells were installed on the NEF site in September 2003 with screened intervals within this siltstone unit. These wells are approximately 73 m (240 ft) deep.

The first occurrence of a well-defined aquifer is approximately 340 m (1,115 ft) below land surface, within the Santa Rosa formation (CJI, 2004). Because of the depth below land surface to this unit, and the fact that the thick Chinle clay unit would limit any potential migration to depth, this aquifer has not been investigated. No impacts are expected to the Santa Rosa aquifer.

Figure 3.4-7, Water and Oil Wells in the Vicinity of the NEF Site, is a map of wells and surface water features in the vicinity of the NEF plant site. The figure also includes oil wells. No water wells are located within 1.6 km (1 mi) of the site boundary.

3.4.1.2 Facility Withdrawals and/or Discharges to Hydrologic Systems

The NEF plant will receive its water supply from one or more municipal water systems and thus no water will be drawn from either surface water or groundwater sources at the NEF site. Supply of nearby groundwater users will thus not be affected by operation of the NEF. NEF water supply requirements are discussed in ER Section 4.4, Water Resources Impact.

The NEF design precludes operational process discharges from the plant to surface or groundwater at the site other than into engineered basins. Discharge of routine plant liquid effluents will be to the Treated Effluent Evaporative Basin on the site. The Treated Effluent Evaporative Basin is utilized for the collection and containment of waste water discharge from the Liquid Effluent Collection and Treatment System. The ultimate disposal of waste water will be through evaporation of water and impoundment of the residual dry solids byproduct of evaporation. Total annual discharge to that basin will be approximately 2,535 m^3 per year (669,844 gal/yr). The location of the basin is shown in Figure 4.12-2, Site Layout for NEF. Evaporation will provide the only means of liquid disposal from this basin. The Treated Effluent Evaporative Basin will include a double membrane liner and a leak detection system. A summary of liquid wastes volumes accumulated at the NEF is provided in Table 3.4-1, Summary of Potentially Contaminated Liquid Wastes for the NEF. Of the wastes listed in Table 3.4-1, only uncontaminated liquid wastes are released to the Treated Effluent Evaporative Basin for evaporation without treatment. Contaminated liquid waste is neutralized and treated for removal of uranium, as required. Effluents unsuitable for the evaporative disposal will be removed off-site by a licensed contractor in accordance with US EPA and State of New Mexico regulatory requirements. The State of New Mexico has adopted the US EPA hazardous waste 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 20.4.1 NMAC, "Hazardous Waste Management".

Stormwater from parts of the site will be collected in a retention or detention basin. The design for this system includes two basins as shown in Figure 4.12-2, Site Layout for NEF. The Site Stormwater Detention Basin at the south side of the site will collect runoff from various developed parts of the site including roads, parking areas and building roofs. It is unlined and will have an outlet structure to control discharges above the design level. The normal discharge will be through evaporation/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. The basin will have approximately 123,350 m^3 (100 acre-ft) of storage capacity. Area served includes about 39 ha (96 acres) with the majority of that area being the developed portion of the 220 ha (543 acres) NEF site. In addition, the basin has 0.6 m (2 ft) of freeboard 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 site area.

The Uranium Byproduct Cylinder (UBC) Storage Pad Stormwater Retention Basin is utilized for the collection and containment of water discharges from two sources: (1) cooling tower blowdown discharges and (2) stormwater runoff from the UBC Storage Pad. The ultimate disposal of basin water will be through evaporation of water and impoundment of the residual dry solids after 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 plus an allowance for cooling tower blowdown water . The UBC Storage Pad Stormwater Retention Basin is designed to contain a volume of approximately 77,700 m^3 (63 acre-ft). Area served by the basin includes 9.2 ha (22.8 acres), the total area of the UBC Storage Pad. This basin is designed with a membrane lining to minimize any infiltration into the ground.

Sanitary waste will be sent to the City of Eunice Wastewater Treatment Plant or may be discharged as a backup to a standard septic system, as described in ER Section 4.1.2, Utilities Impacts.

3.4.2 Water Quality Characteristics

As discussed in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems, water resources in the area of the NEF site are minimal. Runoff from precipitation at the site is effectively collected and contained by detention/retention basins and through evapotranspiration. It is highly unlikely that any groundwater recharge occurs at the site.

The first occurrence of groundwater beneath the NEF site is in a silty sandstone or siltstone horizon in the Chinle Formation, approximately 67 m (220 ft) below the surface. This unit is low in permeability and does not yield water readily. Groundwater quality in monitoring wells in the Chinle Formation, the most shallow saturated zone, is poor due to natural conditions. Samples from monitoring wells within this horizon on the WCS facility have routinely been analyzed with Total Dissolved Solids (TDS) concentrations between about 2,880 and 6,650 mg/L.

Table 3.4-2, Groundwater Chemistry, contains a summary of metal analyses from four background monitoring wells at the WCS site for 1997-2000. Essentially all results are below maximum contaminant limits (MCL) for EPA drinking water standards. The tightness of the formation, the limited thickness of saturation, and the poor water quality, support the argument that this zone does not constitute an aquifer.

Three monitoring wells were initally drilled and installed on the NEF site, i.e., MW-1, MW-2, and MW-3 shown on Figure 3.3-5, Preliminary Site Boring Plan and Profile and Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour, and yielded several water quality samples. The results of the water quality analyses are summarized in Table 3.4-3, Chemical Analyses of NEF Site Groundwater. Water quality characteristics are similar to those for WCS site samples. No local groundwater well sites and, as a result, groundwater data are available with the exception of groundwater well sites on the WCS site and those that have been installed on the NEF site. Additional groundwater sampling and analysis of the onsite monitoring wells will be conducted on a frequency needed to establish a baseline.

In 2008, eight more ground water monitoring wells were drilled adjacent to the UBC Storage Pad and UBC Storage Pad Storm Water Retention Basin. Monitoring well locations are depicted on Figure 6.1-2A.

In 2007, fifteen additional ground water monitoring wells were drilled at locations depicted on Figure 6.1-2A, and monitoring well MW-3 was plugged and abandoned because of its location in the footprint of the Storm Water Detention Basin.

Table 3.4-3 presents a summary of results from analyses of a groundwater sample from NEF monitoring well MW-2 which is adjacent to the location of NEF groundwater exploration of boring B-9 on the NEF site (Figure 3.4-6). Standard protocols (ASTM, 1992) were used for sampling.

The data listed for ^{238}U and below in Table 3.4-3 is from the analysis of site ground water for radionuclides. Some of the radionuclide results given in Table 3.4-3 are negative. It is possible to calculate radioanalytical results that are less than zero, although negative radioactivity is physically impossible. This result typically occurs when activity is not present in a sample or is present near background levels. Laboratories sometimes choose not to report negative results or results that are near zero. The EPA does not recommend such censoring of results (EPA, 1980).

The laboratory performing the radioanalytical services for the NEF site follows the recommendations given by the EPA in the report "Upgrading Environmental Radiation Data; Health Physics Society Committee Report HPSR-1" (EPA, 1980). This report recommends that all results, whether positive, negative, or zero, should be reported as obtained.

Groundwater analyses included routine groundwater including: standard inorganic components, Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SOCs), pesticides, PCB and radiological constituents. The table includes the parameter, NEF sample result, and two regulatory limits. The first limit is the New Mexico Water Quality Control Commission (NMWQCC) standard for discharges to surface and groundwater (NMWQCC, 2002). The second limit is the EPA Safe Drinking Water Act (SDWA) maximum contaminate levels (MCLs) for potable water supplies. These MCLs include both the Primary and Secondary Drinking Water Standards (CFR, 2003h). In general, the water is of low quality compared to drinking water standards. Total dissolved solids are 2,500 mg/L, higher than the New Mexico and EPA limits of 1,000 and 500 mg/L, respectively. Also high are chlorides at 1,600 mg/L compared to regulatory limits of 250 mg/L, and sulfate at 2,200 mg/L compared to regulatory limits of 250 to 600 mg/L. A very minor level of a pesticide was detected in the sample, likely due to field or laboratory contamination. Gross alpha activity was detected at a level just slightly above the screening level of 0.6 Bq/L (15 pCi/L).

3.4.3 Pre-Existing Environmental Conditions

There is no documented history of manufacturing, storage or significant use of hazardous chemicals on the NEF property. Historically the site has been used to graze cattle.

The WCS facility is a nearly 541-ha (1,338-acre) property located in Texas. WCS possesses a radioactive materials license from Texas, an NRC agreement state. The facility is licensed to treat and temporarily store low-level and mixed low-level radioactive waste. WCS is also permitted to treat and dispose of hazardous, toxic waste in landfills. While a potential source for release, this disposal site is also a well-monitored facility.

The DD Landfarm, a petroleum contaminated soil treatment facility is adjacent to the west. To the south, across New Mexico Highway 234, is the Lea County Landfill.

To the north of the NEF site about 0.5 km (0.3 mi) a series of man-made ponds contain water and sludge used by petroleum industry contractors to assist with oil and gas drilling and extraction. Unlined, these ponds have some potential for input of hydrocarbon chemicals to the subsurface, but due to the considerable depth to groundwater and the great thickness of the underlying and highly impermeable red bed clay of the Chinle Formation, this arrangement is not likely to impact any natural water systems. Analytes expected from such activities have not been detected during the analysis of groundwater samples taken from monitoring wells at the WCS facility or at the NEF.

3.4.4 Historical and Current Hydrological Data

The NEF is located in an area with little to no surface water or runoff. There are no rivers or streams in the area that would be impacted by the facility. The occurrence of groundwater is also limited at the site. Flow data for Monument Draw, an intermittent stream and the closest surface water conveyance feature are presented in ER Section 3.4.12.9.

3.4.5 Statistical Inferences

No statistical parameters are used to provide or interpret hydrologic data for the NEF.

3.4.6 Water Rights and Resources

The NEF site will obtain water for operational purposes from one or more municipal water systems. Memoranda of Understanding (see entry for HNM and LG in ISAS Table 3.0-1) have been signed with the City of Eunice, New Mexico, and the City of Hobbs, New Mexico, for the supply of water to NEF. Any water rights potentially required for this arrangement will be negotiated with the municipalities. A description of the available municipal water supply systems, the source of plant water, is provided in ER Section 4.1.2.

3.4.7 Quantitative Description of Water Use

No subsurface or surface water use, such as withdrawals and consumption are made at the site by the NEF. All water used at the facility will be provided through the Eunice Municipal Water Supply System, as described in ER Section 4.1.2. This system obtains water from groundwater sources in or near the city of Hobbs, approximately 32 km (20 mi) north of the site. Water use by the facility is shown in Table 3.4-4, Anticipated Normal Plant Water Consumption and Table 3.4-5, Anticipated Peak Plant Water Consumption. Water supply is sufficient for operation and maintenance of the NEF. See ER Section 4.4.5, Ground and Surface Water Use, for detailed information concerning the capacity of the Eunice, New Mexico water supply system and the expected NEF average and peak usage.

3.4.8 Non-Consumptive Water Use

The NEF makes no non-consumptive use of water. Non-consumptive water use is water that is used and returned to its source and made available for other uses. An example is a once-through cooling system.

3.4.9 Contaminant Sources

There will be no discharges to natural surface waters or groundwaters from the NEF. The EPA reports (EPA, 2003a) that no Superfund (CERCLA) sites exist in the area near the NEF site in either Lea County, New Mexico or Andrews County, Texas.

Water intake for the NEF plant will be made from one or more municipal supply systems. There is sufficient capacity available to provide water supply for the NEF, as discussed in ER Section 4.4.

Stormwater runoff from the NEF site will be controlled during construction and operation. Appropriate stormwater construction runoff permits for construction activities will be obtained before construction begins. Design of stormwater run-off controls for the operating plant are described in Section 4.4. Appropriate routine erosion control measures best management practices (BMPs), will be implemented, as is normally required by such permits.

During operation stormwater will be collected from appropriate site areas and routed to detention/retention basins. These basins and the site stormwater system are described in ER Section 3.4.1.2.

3.4.10 Description of Wetlands

An evaluation of the site and of available wetlands information has been used to determine that the site does not contain jurisdictional wetlands.

3.4.11 Federal and State Regulations

ER Section 1.3 describes all applicable regulatory requirements and permits. ER Section 4.4 describes potential site impacts as they relate to environmental permits regarding water use by the facility.

Applicable regulations for water resources include:

- NPDES: 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: Construction General Permit for stormwater discharge is required because construction of the NEF will involve the grubbing, clearing, grading or excavation of one or more acres of land. This permit is administered by the EPA Region 6 with oversight review by the New Mexico Water Quality Bureau. Various land clearing activities such as offsite borrow pits for fill material have also been covered under this general permit. Construction activities, including permanent plant structures and temporary construction facilities, could potentially disturb or impact the entire 543 acre site. LES will develop a Storm Water Pollution Prevention Plan (SWPPP) and file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the commencement of construction activities.
- Groundwater Discharge Permit/Plan is required by the New Mexico Water Quality Bureau for facilities that discharge an aggregate waste water volume of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems. This requirement is based on the assumption that these discharges have the potential of affecting groundwater. NEF will discharge treated process water, stormwater, and cooling tower blowdown water to surface impoundments. Sanitary wastewater will be sent to the Eunice Wastewater Treatment plant for processing. This does not remove the possibility for standard site septic system as a backup to the sewage system.

3.4.12 Surface Water Characteristics for Relevant Water Bodies

No offsite surface water runoff will occur from the NEF site. There are no drainage features that would transport surface water offsite. Precipitation onsite is either subject to infiltration, natural evapotranspiration, or facility system collection and evaporation.

3.4.12.1 Freshwater Streams, Lakes, Impoundments

The NEF site includes no freshwater streams or lakes. Impoundments to contain stormwater runoff and process water will be constructed as part of the facility. These components are described in ER Section 3.4.1.2 Facility Withdrawals and/or Discharges to Hydrologic Systems.

3.4.12.2 Flood Frequency Distributions, Including Levee Failures

Site grade will be above the elevation of the 100-year and the 500-year flood elevations (WBG, 1998; FEMA, 1978).

3.4.12.3 Flood Control Measures (Reservoirs, Levees, Flood Forecasting)

No flood control measures are proposed for the NEF. Site grade will be above the elevation of the 100-year and the 500-year flood elevations, as discussed in ER Section 3.4.12.2.

3.4.12.4 Location, Size, and Elevation of Outfall

The NEF includes no direct outfall to a surface water body.

3.4.12.5 Outfall Water Body

The NEF includes no direct outfall to a surface water body. Runoff volume will not change from present levels due to site development or facility operation.

3.4.12.6 Bathymetry Near any Outfall

The NEF includes no outfall to a surface water body.

3.4.12.7 Erosion Characteristics and Sediment Transport

The NEF includes no outfall to a surface water body.

3.4.12.8 Floodplain Description

The NEF site is located above the 100-year or 500-year flood elevation (WBG, 1998; FEMA, 1978). There are no detailed floodplain maps available for the site since the site is not located near any floodplains.

3.4.12.9 Design-Basis Flood Elevation

Flooding for the NEF site is not a credible event. The NEF site is contained within the Landreth-Monument Draw Watershed. The closest water conveyance is Monument Draw, a typically dry, intermittent stream located about 4 km (2.5 mi) west of the site. The location of Monument Draw is shown on Figure 3.4-1, Local Hydrologic Features. The maximum historical flow for Monument Draw is 36.2 m^3/s (1,280 cfs) measured on June 10, 1972. All other historical maximum measurements are below 2.0 m^3/s (70 cfs) (USGS, 2003c). Therefore, no special design considerations, other than those described in ISA Summary Sections 3.2.4.3, Floods, and 3.3, Facility Description, for local intense precipitation, are needed for flooding at the site.

3.4.13 Freshwater Streams for the Watershed Containing the Site

The NEF includes no perennial freshwater streams in its watershed.

3.4.13.1 Drainage Areas

There are no major drainage areas associated with the NEF.

3.4.13.2 Historical Maximum and Minimum River Flows

The NEF includes no rivers within the site or its watershed.

3.4.13.3 Historical Drought River Flows

The NEF includes no rivers within the site or its watershed.

3.4.13.4 Important Short Duration Flows

The NEF includes no rivers within the site or its watershed.

3.4.14 Water Impoundments

Impoundments to contain stormwater runoff and process water will be constructed as part of the facility. These features are described in ER Section 3.4.1.2.

3.4.14.1 Elevation-Area-Capacity Curves

Impoundments to contain stormwater runoff and process water will be constructed as part of the facility. These features are described in ER Section 3.4.1.2.

3.4.14.2 Reservoir Operating Rules

The NEF will not make use of any reservoir.

3.4.14.3 Annual Yield and Dependability

The NEF will not take or discharge process water from any local water body; thus it will not affect water availability for any water body.

3.4.14.4 Inflow/Outflow/Storage Variations

The NEF will not take or discharge process water to any local water body; thus it will not affect water storage in any water body.

3.4.14.5 Net Loss, Including Evaporation and Seepage

The NEF will not take or discharge process water from any local water body; thus it will not affect water flow or storage in any water body.

3.4.14.6 Current Patterns

The NEF will not take or discharge process water to any local water body; thus it will not affect current patterns in any water body.

3.4.14.7 Temperature Distribution

The NEF will not take or discharge process wastewater or non-contact cooling water to any local water body; thus it will not affect temperature in any water body.

3.4.15 Groundwater Characteristics

Groundwater resources at the proposed NEF site are limited. There are no major water-producing units beneath the site. The site is not located within the recharge area of any sole-source or major aquifer. In the near subsurface, the soils are dry due to low rainfall rates and a very effective evapotranspiration process by the native vegetation. Natural recharge to groundwater is not inferred to be taking place at the site. In the upper 0.3 to 17 m (1 to 55 ft), the soils are relatively fine grained, silts, sands and silty sands, grading to a sand and gravel base layer. The sand and gravel horizon overlays a thick clay formation. In areas to the north and east of the site, this sand and gravel layer has some localized saturation. The processes that lead to these localized saturated areas are not present at the NEF site (see discussion in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems). The soils above the Chinle Formation clay horizon are dry, and, under natural conditions, contain no saturated horizons.

The Chinle Formation consists of a thick expanse of clay beneath the site. It is part of the Triassic Dockum Group, and is 323 to 333 m (1,060 to 1,092 ft) thick. The hydraulic conductivity of the clay is on the order of 1×10^{-8} cm/s (3.9×10^{-9} in/s). Clay with this permeability is typically specified for engineered landfill liners. Ground-water travel times through a unit with this permeability and thickness would be on the order of thousands of years. It provides hydraulic isolation for groundwater at depth.

Within the Chinle at a depth of about 65 to 68 m (214 to 222 ft) below the surface is a small siltstone or silty sandstone unit that has some local saturation. This unit is the shallowest occurrence of groundwater beneath the site. The permeability of this unit is fairly low, and monitor wells completed in this unit at the NEF and at the WCS facilities to the east of the NEF site are slow to produce water. The water quality in this unit is poor, based on the sampling and analysis performed. TDS values typically range from 2,880 to 6,650 mg/L. Three monitor wells were installed on the NEF site to monitor this unit. One well was sampled and analyzed and the results are provided in Table 3.4-3, Chemical Analyses of NEF Site Groundwater. Due to the low permeability of this unit, and its limited ability to yield water, it is not considered to be an aquifer. This siltstone layer is hydraulically isolated from the near surface hydrologic conditions due to the presence of a thick clay sequence above it. There is also a 30.5-meter (100-foot) thick water-bearing layer at about 183 m (600 ft) below ground surface within the Chinle Formation clay.

The first occurrence of a defined aquifer beneath the site is the Triassic-aged Santa Rosa Formation, almost 340 m (1,115 ft) below the land surface at the NEF site. Given the depth to this formation, and the fact that the Chinle Formation clay separates it hydraulically from surface discharges at the site, and no potential for recharge from site basins, the Santa Rosa will not be investigated.

Preliminary NEF site groundwater investigations included nine soil borings and the installation of three monitoring wells. These have confirmed anticipated site stratigraphy and groundwater conditions. Borings done in the near-surface alluvial sand and gravel, above the red beds of the Chinle clay showed that no shallow groundwater occurs in that unit. During drilling, only one of the borings produced cuttings that were slightly moist at 1.8 to 4.2 m (6 to 14 ft) below ground surface; other cuttings were very dry. Also, ground water was not encountered during drilling in any of the addition 59 NEF site borings, which are documented in Appendices A and C of the Geotechnical Report (NTS Report No. 114489-G-01, Rev. 00) and some of which were drilled as deep as 30.5 m (100 ft) below grade. Based on this, it was concluded that a continuous groundwater aquifer does not exist in this layer under the NEF site. The lack of groundwater in this layer is supported by information from the adjacent WCS groundwater investigations. The top of the clay in site borings was found at depths from 7 to 17 m (23 to 55 ft) below the ground surface.

Three monitoring wells were initially installed at the site (Figure 3.4-6). These three monitoring wells were designated MW-1 through MW-3. Screens for those wells were placed in a siltstone layer within the Chinle clay based on resistivity logs at depths of about 70 m (230 ft) below the ground surface. The water bearing zone, referred to as the 230-zone, is approximately 4.6 m (15 ft) thick and is encountered at depths ranging from 65 to 68 m (214 to 222 ft) below ground level. Only one well, MW-2, adjacent to B-9 and near the northeast corner of the site, has produced water. Measured head for groundwater in the well is at an approximate elevation of 1,009 m (3,311 ft) msl. Results of chemical and radiological analyses of water samples from that well are provided in Table 3.4-3, Chemical Analyses of NEF Site Groundwater.

In 2007, fifteen additional ground water monitoring wells were drilled at locations depicted on Figure 6.1-2A, and monitoring well MW-3 was plugged and abandoned because of its location in the footprint of the Storm Water Detention Basin.

In 2008, eight more ground water monitoring wells were drilled adjacent to the UBC Storage Pad and UBC Storage Pad Storm Water Retention Basin. Monitoring well locations are depicted on Figure 6.1-2A.

Based on groundwater levels in MW-2 and data from the adjacent WCS site, a groundwater gradient of 0.011 m/m (0.011 ft/ft) was determined, generally sloping towards the south. Hydraulic conductivity of the saturated layer, based on slug tests is estimated to be approximately 3.7 x 10^{-6} cm/s (3.8 ft/yr). Based on the data collected at the NEF and WCS, the groundwater gradient in the siltstone unit at NEF is estimated to range from approximately 0.011 to 0.017 m/m (0.011 to 0.017 ft/ft).

3.4.15.1 Groundwater Elevation Trends

Three monitoring wells were initially installed at the NEF site, i.e., MW-1, MW-2 and MW-3 shown on Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour. They were monitored for inflow of groundwater. The well screens were located at the first occurrence of groundwater beneath the site, some 65 to 68 m (214 to 222 ft) below land surface. They wereset in a siltstone or silty sandstone that has very low permeability. Monitor wells tapping the same unit to the east of the site on the WCS property are also slow to recover after drilling and sampling operations. Some of the wells never appear to equilibrate between sampling events.

In 2007, fifteen additional ground water monitoring wells were drilled at locations depicted on Figure 6.1-2A, and monitoring well MW-3 was plugged and abandoned because of its location in the footprint of the Storm Water Detention Basin.

In 2008, eight more ground water monitoring wells were drilled adjacent to the UBC Storage Pad and UBC Storage Pad Storm Water Retention Basin. Monitoring well locations are depicted on Figure 6.1-2A.

Groundwater levels in the 70-m (230-ft) zone siltstone unit at the NEF is approximately at an elevation of 1,009 m (3,311 ft) msl which is consistent with data from the nearby WCS site. Levels do not fluctuate much over time.

3.4.15.2 Water Table Contours

Information relative to water table gradients in the siltstone at the base of the Chinle Formation unit is available from the WCS site to the east of the NEF. Based on the data collected at the NEF and WCS, the groundwater gradient in the siltstone unit at the NEF is estimated to range from approximately 0.011 to 0.017 m/m (0.011 to 0.017 ft/ft). The groundwater gradient was estimated based on interpretation of data collected at the NEF and WCS in the 70 m (230-ft) groundwater zone. The groundwater gradient generally slopes south beneath the NEF site. Water table contour maps will be produced for the NEF site as the data from the monitoring wells becomes available to supplement the contour maps for the nearby WCS site.

3.4.15.3 Depth to Water Table for Unconfined Aquifer Systems

The depth to the first occurrence of groundwater beneath the site is on the order of 65 to 68 m (214 to 222 ft). This same geologic unit has been investigated beneath the WCS facility to the east of the NEF site. The information available from the WCS site suggests that this saturated unit, which is just below the red bed clay, may be under confined or semi-confined conditions. The unit is low in permeability, however, and does not produce water very quickly. It is not formally considered an aquifer, as discussed in ER Section 3.4.15.6, Interactions Among Different Aquifiers.

3.4.15.4 Soil Hydrologic Properties

The top 0.3 to 17 m (1 to 55 ft) of soil is comprised of a silts, sands, and silty sands, grading to a sand and gravel base layer just above the red bed clay unit. Based on this characterization, the porosity of the surface soils is on the order of 25% to 50% (Freeze, 1979). The saturated hydraulic conductivity of the surface soils is likely to range from 10^{-5} to 10^{-1} cm/s (3.9×10^{-6} to 3.9×10^{-2} in/s) (Freeze, 1979). Estimates of the hydraulic conductivity of the Chinle clays are on the order of 10-8 cm/s (3.9×10^{-9} in/s) (Rainwater, 1996). Given the low permeability of the underlying red bed clay, this unit serves as a barrier for any hydraulic connection between the surficial hydrologic processes and any subsurface occurrence of groundwater beneath the Chinle clay.

3.4.15.5 Flow Travel Time: Groundwater Velocity

Groundwater flow velocities are dependent on the groundwater gradient and soil or bedrock permeabilities. WCS and NEF have wells in the saturated unit that constitutes the first occurrence of groundwater beneath the site. The groundwater velocity in this unit has been estimated to be very low, on the order of 0.002 m/yr (0.007 ft/yr). Based on the data collected at the NEF and WCS, the groundwater velocity at the NEF is estimated to range from approximately 0.002 to 0.09 m/yr (0.007 to 0.3 ft/yr).

3.4.15.6 Interactions Among Different Aquifers

As discussed in ER Section 3.4.1.1, there are occurrences of shallow groundwater in a thin saturated stratum just above the Chinle Formation red bed clays in various locations to the north and east of the NEF site. These localized zones of saturation are due to local infiltration mechanisms, such as fractures in the caprock caliche leading to underlying sand and gravel deposits, and infiltration through "buffalo wallow" depressions that pond surface water runoff. None of these shallow saturated unit occurrences are laterally continuous and none extend to the NEF site. Conditions at the NEF site are markedly different. It is probable that no recharge is actively occurring at the NEF site due to infiltration of precipitation. The native vegetation is quite efficient with evapotranspiration processes to intercept all infiltration before it gets to depth, a process that has probably been in progress for thousands of years. Therefore, no interaction exists between the shallow saturated units to the north and east of the site and the site itself.

The presence of the thick Chinle clay beneath the site essentially isolates the deep and shallow hydrologic systems. Groundwater occurring within the red bed clay occurs at three distinct and distant elevations. Approximately 65 to 68 m (214 to 222 ft) beneath the land surface, within the red bed unit, is a siltstone or silty sandstone unit with some saturation. It is a low permeability formation that does not yield groundwater very readily. It is not considered an aquifer. ER Figure 3.3-5, Preliminary Site Boring Plan and Profile shows the locations of three monitoring wells (MW-1, MW-2 and MW-3) installed at the NEF site in September 2003 with screens at the depth of this horizon. Two of these wells have yielded no water. Well MW-2 produced a minimal amount of water suitable for sampling purposes several weeks after installation. Based on this information and the lack of groundwater encountered in other site borings, this unit is not interpreted to meet the definition of an aquifier (Freeze, 1979) which requires that the unit be able to transmit "significant quantities of water under ordinary hydraulic gradients."

In 2007, fifteen additional ground water monitoring wells were drilled at locations depicted on Figure 6.1-2A, and monitoring well MW-3 was plugged and abandoned because of its location in the footprint of the Storm Water Detention Basin.

In 2008, eight more ground water monitoring wells were drilled adjacent to the UBC Storage Pad and UBC Storage Pad Storm Water Retention Basin. Monitoring well locations are depicted on Figure 6.1-2A.

The next water bearing unit below the saturated siltstone horizon is a saturated 30.5-meter (100-foot) thick sandstone horizon approximately 183 m (600 ft) below land surface, overlying the Santa Rosa formation. The Santa Rosa formation, is the third water bearing unit and is located about 340 m (1,115 ft) below land surface. Between the siltstone and sandstone saturated horizons and the Santa Rosa formation lie a number of layers of sandstones, siltstones, and shales. Hydraulic connection between the siltstone and sandstone saturated horizons and the Santa Rosa formation is non-existent.

No withdrawals or injection of groundwater will be made as a result of operation of the NEF facility. Thus, there will be no affect on any inter-aquifer water flow.

3.4.16 Section 3.4 Tables

Table 3.4-1 Summary of Potentially Contaminated Liquid Wastes for the NEF

Source/System	**Annual Volume: L (gal)**
Treated Plant Effluent[1]	29,570 (7,811)
Showers and Handwash	2,100,000 (554,820)
Laundry	405,800 (107,213)
Total Liquid Effluents	2,535,370 (669,844)

[1]Floor washings, laboratory effluent, miscellaneous condensates, degreaser water, and spent citric acid

Table 3.4-2Groundwater Chemistry

Constituent	Maximum Result	MCL (EPA)
Arsenic	0.007 mg/L or < Detection Limit	0.05 mg/L
Barium	0.018 mg/L or < Detection Limit	2.0 mg/L
Cadmium	0.005 mg/L or < Detection Limit	0.005 mg/L
Chromium	0.011 mg/L or < Detection Limit	0.1 mg/L
Cobalt	0.0022 mg/L or < Detection Limit	-
Copper	0.02 mg/L or < Detection Limit	1.3 mg/L
Lead	0.054 mg/L or < Detection Limit	0.015 mg/L
Mercury	< Detection Limit	0.002 mg/L
Nickel	0.006 mg/L or < Detection Limit	-
Selenium	0.021 mg/L or < Detection Limit	0.05 mg/L
Silver	0.0026 mg/L or < Detection Limit	0.05 mg/L
Vanadium	0.07 mg/L or < Detection Limit	-
Zinc	0.014 mg/L or < Detection Limit	5 mg/L

*Action level **Secondary standard

Notes:

MCL – Maximum Contaminant Level

Data are derived from four background monitoring wells at the WCS site: MW-3A, MW-3B, MW-4A, and MW-4B. These wells produce samples from the siltstone layer within the Chinle Formation at depths of about 61 to 73 m (200 to 240 ft).

Data are from unfiltered samples (required by the state of Texas) and include some qualified data due to sample sediment and low volume samples.

Results for organic components generally include no detectable analytes except for isolated samples with concentrations of analytes consistent with sampling or laboratory contamination.

Table 3.4-3Chemical Analyses of NEF Site Groundwater

PARAMETER	NEF Sample (mg/L, or as noted)	Existing Regulatory Standards: NEW MEXICO (mg/L, or as noted)	Existing Regulatory Standards: EPA MCL (mg/L, or as noted)
General Properties			
Total Dissolved Solids (TDS)	**2500 (k)**	1000	500 (a)
Total Suspended Solids	6.2	NS	NS
Specific Conductivity	6800 (µmhos/L)	NS	NS
Inorganic Constituents			
Aluminum	0.480 (c)	5.0 (i)	0.05 – 0.2 (a)
Antimony	<0.0036	NS	0.006
Arsenic	<0.0049	0.1	0.05
Barium	0.021	1	2
Beryllium	<0.00041	NS	0.004
Boron	**1.6**	0.75 (i)	NS
Cadmium	<0.00027	0.01	0.005
Chloride	**1600**	250	250 (a)
Chromium	0.043	0.05	0.1
Cobalt	<0.00067	0.05 (i)	NS
Copper	0.0086	NS	1.3 (al)
Cyanide	<0.0039	0.2	0.2
Fluoride	<0.5	1.6	4
Iron	0.51	1	0.3 (a)
Lead	<0.0021	0.05	0.015 (al)
Manganese	**1.0**	0.2	0.05 (a)
Mercury	<0.000054	0.002	0.002
Molybdenum	0.04	1.0 (i)	NS
Nickel	0.034	0.2 (i)	0.1
Nitrate	<0.25	10	10
Nitrite	<1	NS	1
Selenium	<0.0046	0.05	0.05
Silver	<0.0007	0.05	0.05
Sulfate	**2200**	600 (a)	250 (a)
Thallium	<0.0081	NS	0.002
Zinc	0.016	10	5 (a)
Radioactive Constituents			
Gross Alpha (pCi/L)*	**0.6 Bq/L (15.1 pCi/L)**	NS	0.6 Bq/L (15 pCi/L)
Gross beta	1.2 Bq/L (31.4 pCi/L)	NS	4 (mrem/yr)

Table 3.4-3Chemical Analyses of NEF Site Groundwater

		Existing Regulatory Standards	
PARAMETER	**NEF Sample (mg/L, or as noted)**	**NEW MEXICO (mg/L, or as noted)**	**EPA MCL (mg/L, or as noted)**
Radium 224	<4.88 Bq/L (<130 pCi/L)	NS	NS
Radium 226**	0.24 Bq/L (6.5 pCi/L)	NS	0.2 Bq/L (5 pCi/L)
Uranium		0.005	0.030
U-234	(0.00695 mg/L) (4.75 pCi/L)	0.005	0.030
U-235	(0.000231 mg/L) (0.158 pCi/L)	0.005	0.030
U-238	(0.001551 mg/L) (1.06 pCi/L)	0.005	0.030
	Bq/L (pCi/L (j)		
Ag-108m	-0.044 (-1.20)	NS	***
Ag-110m	-0.03 (-0.8)	NS	***
Ba-140	0.093 (2.5)	NS	***
Be-7	0.2 (6)	NS	***
Ce-141	0.12 (3.3)	NS	***
Ce-144	-0.12 (-3.3)	NS	***
Co-57	0.04 (1)	NS	***
Co-58	-0.004 (-0.1)	NS	***
Co-60	-0.004 (-0.1)	NS	***
Cr-51	-1.3 (-34)	NS	***
Cs-134	0.02 (0.6)	NS	***
Cs-137	0.03 (0.8)	NS	***
Fe-59	0.041 (1.1)	NS	***
I-131	0.063 (1.7)	NS	***
K-40	1.6 (44)	NS	***
La-140	0.11 (2.9)	NS	***
Mn-54	0.004 (0.1)	NS	***
Nb-95	-0.03 (-0.7)	NS	***
Ra-228	0.22 (5.9)	NS	***
Ru-103	-0.044 (-1.2)	NS	***
Ru-106	0.3 (9)	NS	***
Sb-124	-0.21 (-5.6)	NS	***
Sb-125	-0.10 (-2.7)	NS	***
Se-75	-0.0037 (-0.1)	NS	***
Zn-65	-0.052 (-1.4)	NS	***
Zr-95	-0.056 (-1.5)	NS	***
Miscellaneous Constituents			
Other VOCs and Pesticides	<MDLs	Various	Various

Table 3.4-3Chemical Analyses of NEF Site Groundwater

		Existing Regulatory Standards	
PARAMETER	**NEF Sample (mg/L, or as noted)**	**NEW MEXICO (mg/L, or as noted)**	**EPA MCL (mg/L, or as noted)**
Semi-Volatile Organic Compounds (SOCs)	<MDLs	Various	Various
Polychlorinated biphenyls, PCBs	<MDLs	0.001	0.0005

Notes:

Highlighted values exceed a regulatory standard

(a): EPA Secondary Drinking Water Standard

(al): Action Level requiring treatment

(c): Results of lab or field-contaminated sample

(i): Crop irrigation standard

(j) See ER Section 3.4.2, Water Quality Characteristics, for explanation of negative values

(k) Reported TDS sample value of 2,500 mg/L is likely inaccurate since three subsequent samples produced TDS values from 6,000 mg/L to 6,400 mg/L

* The proposed standard excludes 222Rn, 226Ra and uranium activity

** This standard excludes 228Ra activity. Units for the existing standard are mrem/yr. U.S.

*** EPA MCL Goal (mg/L, or as noted) 0.04 mSv/yr (4 mrem/yr). EPA has proposed to change the units to mrem Effective Dose Equivalent per year

**** Minimum Detection Level

NS: No standard or goal has been defined

MCL: Maximum Contaminant Level

MDL: Minimum Detection Limit

Table 3.4-4Anticipated Normal Plant Water Consumption

Building	Total Personnel	Usage Rate (GPD)	Daily Use (GPD)	Yearly Use (GPY)
TSB (1500)	95	35	3,325	1,213,625
Admin. (1700)	137	25	3,425	1,250,125
CUB (1600)	17	35	595	217,175
CRDB (1100)	17	35	595	217,175
CAB (1300)	81	25	2,025	739,125
Guard House (2200)	5	25	125	45,625
Security/Visitors (2000)	48	25	1,200	438,000
Operations/Security Personnel not on Shift	40	25	1,000	365,000
Total Personnel Water Use	440		12,290	4,485,850

Additional Potable Water Use			Daily Use (GPD)	Yearly Use (GPY)
AC Units Humidification	8 GPM	1 hr/day	480	175,200
Water Softener Backwash	45 GPM	10 min/day	450	164,250
Misc. Minor Leaks			5	1,825
Total Additional Usage			935	341,275

Total Potable Water Useage		13,225	4,827,125
	Safety Factor	1.25	
		16,531	6,033,906

Table 3.4-5 Anticipated Peak Plant Water Consumption	
Area/Usage	**GPM**
Domestic Water	290.0
Cooling Tower Make Up	56.2
Deionized Water Make Up	40.0
Fire Protection	375.0

3.4.17 Section 3.4 Figures

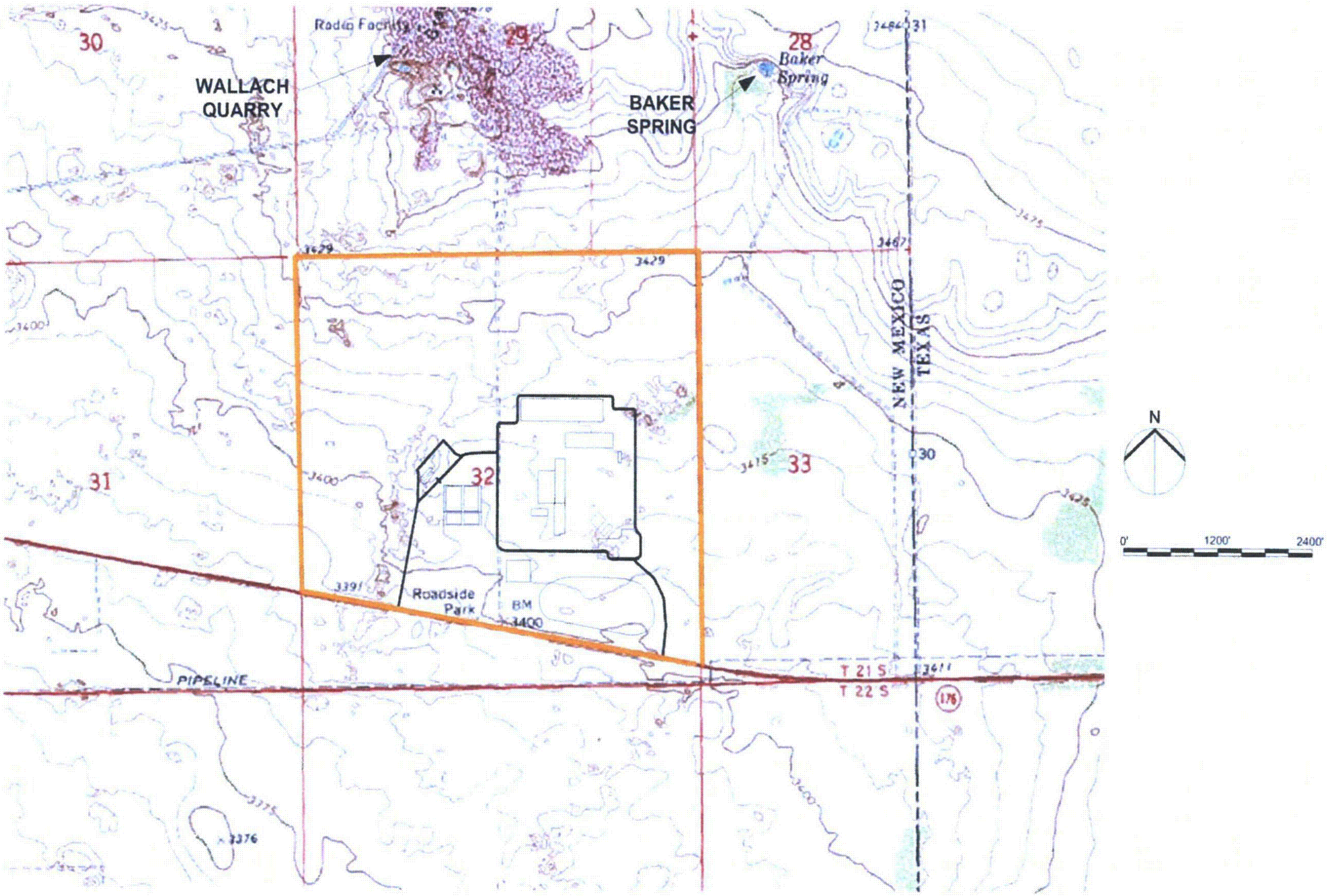


Figure 3.4-1 Local Hydrologic Features

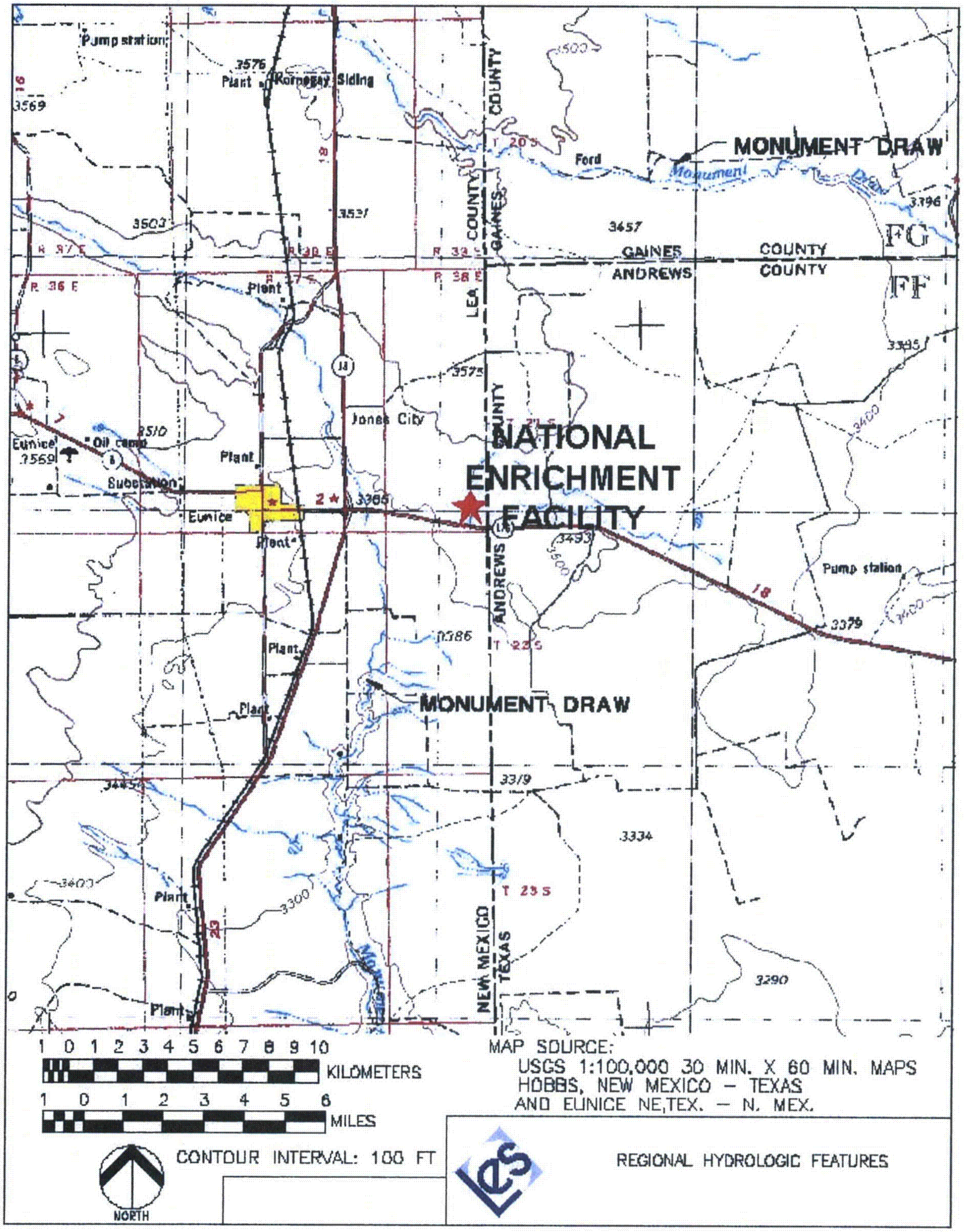


Figure 3.4-2Regional Hydrologic Features

VIEW OF A PIT WALL IN A WALLACH SAND & GRAVEL EXCAVATION TO THE NORTH OF THE NEF SITE

Figure 3.4-3View of a Pit Wall in a Wallach Sand & Gravel Excavation to the North of the NEF Site

GROUNDWATER SEEP AT THE BASE OF A WALLACH SAND & GRAVEL EXCAVATION TO THE NORTH OF THE NEF SITE

Figure 3.4-4 Groundwater Seep at the Base of a Wallach Sand & Gravel Excavation to the North of the NEF Site

VIEW OF BAKER SPRING AREA
TO THE NORTHEAST OF THE NEF SITE

Figure 3.4-5View of Baker Spring Area to the Northeast of the NEF Site

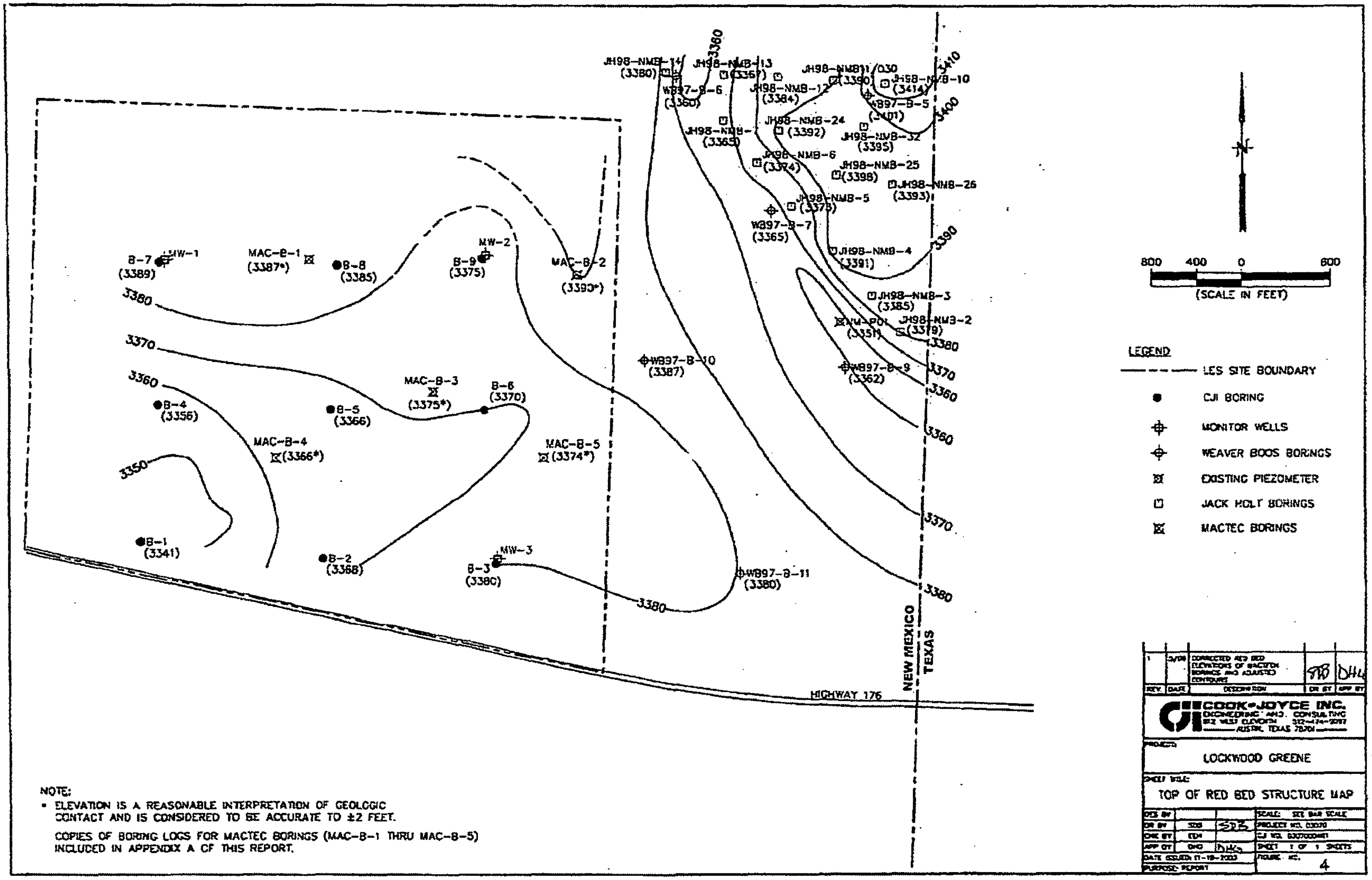


Figure 3.4-6Dockum Group (Chinle Formation) Surface Contour

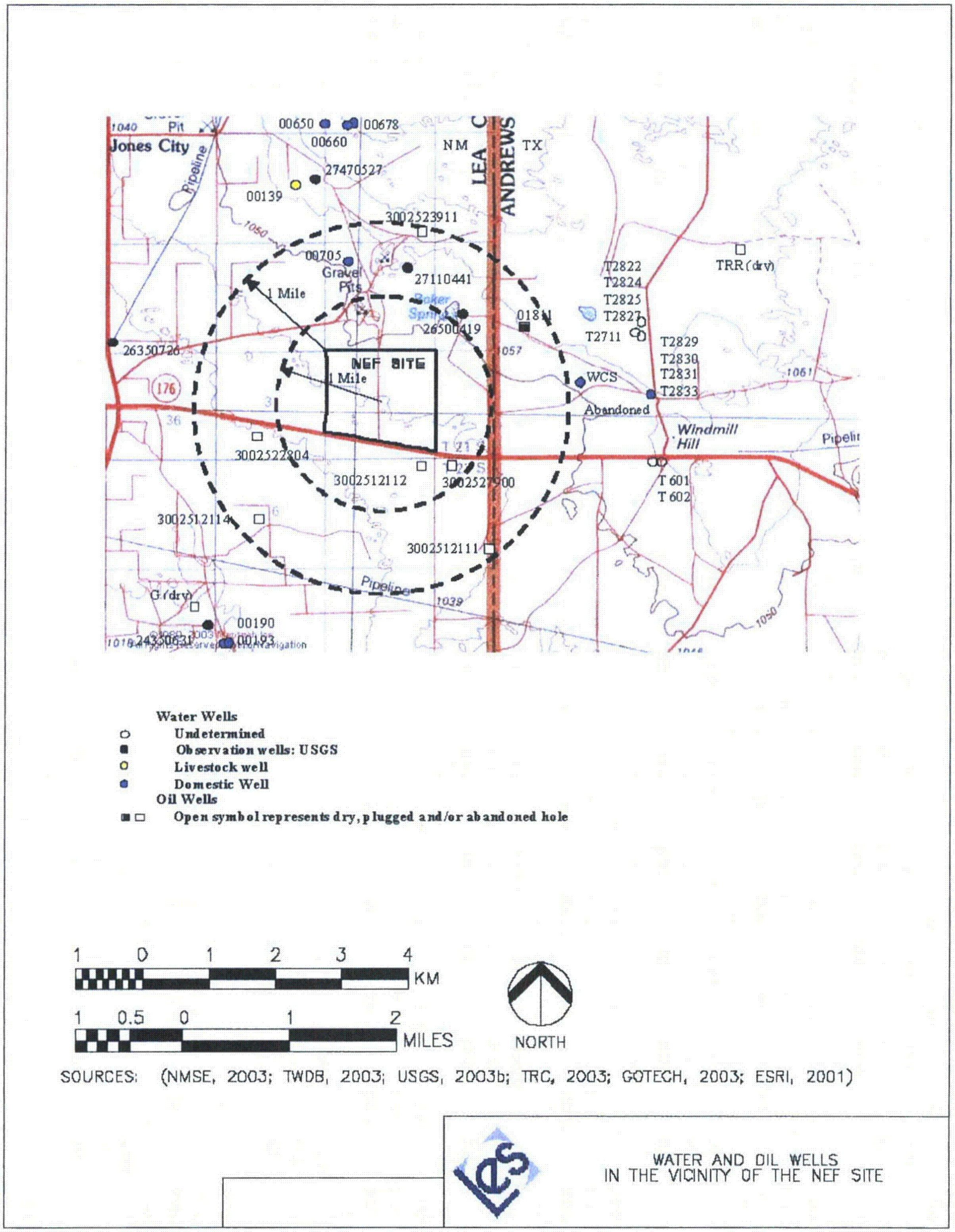


Figure 3.4-7Water and Oil Wells in the Vicinity of the NEF Site

3.5 ECOLOGICAL RESOURCES

This section describes the terrestrial and aquatic communities of the proposed National Enrichment Facility (NEF) site. This section is intended to provide a baseline characterization of the site's ecology prior to any disturbances associated with construction or operation of the NEF. Prior environmental disturbances (e.g., roads and pipeline right-of-ways) not associated with the facility and their impacts on the site ecology, are considered when describing the baseline condition.

A single major community has been identified at the NEF site. The plant and animal species associated with this major community are identified and their distributions are discussed. Those species that are considered important to the ecology of the site are described in detail.

Once the significant species were identified, their interrelationship with the environment was described. To the extent possible, these descriptions include discussions of the species' habitat requirements, life history, and population dynamics. Also, as part of the evaluation of important species at the site, pre-existing environmental conditions, that may have impacted the ecological integrity of the site and affected important species, are considered.

Unless otherwise indicated, the information provided in this section is based on surveys conducted by LES.

3.5.1 Maps

Figures 3.5-1, County Map Proposed Area of Critical Environmental Concern (ACEC) Lesser Prairie Chicken, and 3.5-2, NEF Site Vegetation Survey Transect Locations

3.5.2 General Ecological Conditions of the Site

Lea County is located in the Pecos Valley Section of the Great Plains Province, very near the boundary between the Pecos Valley Section to the west; and the Southern High Plains Section to the east and north. The boundary between the two sections is the Mescalero Escarpment, locally referred to as Mescalero Ridge. The escarpment is located approximately 6.2 to 9.3 km (10 to 15 mi) northwest of the proposed NEF site. Mescalero Ridge abruptly terminates Pecos Plains along the east. The ridge is a nearly vertical cliff with a relief of approximately 46 m (150 ft) in northwestern Lea County. In southeastern Lea County, the Ridge is partially covered by wind deposited sand and therefore is less prominent, typically exhibiting 9 to15 m (30 to 50 ft) of relief. Locally, the Southern High Plains Section is referred to as the Llano Estacado. The Llano Estacado is an isolated mesa that covers a large part of western Texas and eastern New Mexico. East of the Mescalero Ridge, on the Southern High Plains, the topography is relatively flat to gently undulating. Drainage on the Southern High Plains (Llano Estacado) is poor, with larger regional drainages along northwest to southeast lineaments. Where lineaments are absent, local drainage is via ephemeral streams into playa lakes.

The primary difference between the Pecos Valley and the Southern High Plains physiographic sections is the change in topography. The Llano Estacado is a large flat mesa which uniformly slopes to the southeast. In contrast, the Pecos Valley section is characterized by its very irregular erosional topographic expression, sloping westerly in its northern reaches and southerly in the southern reaches (NMBMMR, 1961).

The proposed NEF site is located on the Eunice Plain just northwest of Rattlesnake Ridge in Section 32, Township 21 South, Range 38 East. The Eunice Plain gently slopes towards Monument Draw, a north to south traversing arroyo. Monument Draw begins north of the city of Eunice following a southeasterly trend, and then turns southerly presumably diverted by the Red Bed Ridge. Refer to ER Section 3.3, Geology and Soils, for further discussion on the Red Bed Ridge.

Along Red Bed Ridge, approximately 1.6 km (1 mi) northeast of the site is Baker Spring. Baker Spring is an intermittent surface water feature that contains water seasonally (see ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems).

The 220-ha (543-acre) NEF site slopes gently to the south southwest with a maximum relief of about 12 m (40 ft) The highest elevation is approximately 1,045 m (3,430 ft) msl in the northeast corner of the property. The lowest site elevation is approximately 1,033 m (3,390 ft) msl along the southwest corner of the site. No defined drainage features are evident on the subject property.

The NEF site is located in an extensive deep sand environment west of the Llano Estacado caprock and east of the Pecos River in southeastern New Mexico. The vegetation in this area is dominated by deep sand tolerant or deep sand adapted plant species. The area is a transitional zone between the short grass prairie of the Southern High Plains and the desert communities of the Chihuahuan Desert Scrub (Dick-Peddie, 1993). The site is located in one of the more unique sand scrub areas of New Mexico because of the dominance of the oak shinnery community.

The Plains Sand Scrub vegetation community at the NEF site has probably remained stable over the past 150 years since the introduction of domestic livestock grazing in the area by settlers from the eastern plains. By the mid-nineteenth century, there had already been a reduction of grasslands in the region by livestock herds associated with Spanish settlements along the Rio Grande River and Pecos River valleys. The site has not been impacted by farming or oil and gas development which is prevalent in the region.

The species composition of the wildlife community at the NEF site is a direct function of the type, quality, and quantity of habitat that exists at the site and in the surrounding area. Based on initial field surveys of wildlife at the site and with information on regional and local distribution of wildlife species and on species-specific habitat preferences, the wildlife species likely to occur at the NEF can be identified. The mammals, birds, amphibians and reptiles known or expected to occur on the NEF are discussed below.

Because the NEF site is in a transitional zone, wildlife species at the NEF site are typical of species that occur in grassland habitats and desert habitats. Mammalian species common to this area of southeastern New Mexico include mule deer (Odocoileus hemionus), pronghorn antelope (Antilocapra americana), desert cottontail (Sylvilagus audubonii), black-tailed jackrabbit (Lepus californicus), plains pocket gopher (Geomys bursarius), deer mouse (Peromyscus maniculatus), prairie vole (Micortus ochrogaster), kangaroo rat (Dipodomys ordii), coyote (Canis latrans), black-tailed prairie dog (Cynomys ludovicianus), collared peccary or javelina (Dicotyles tajacus), striped skunk (Mephitis mephitis), and gray fox (Urocyon cinereoargentues). Several species of bats that occur in the area include the Mexican free-tailed bat (Tadarida mexicana) and the pallid bat (Antrozous pallidus) (See Table 3.5-1, Mammals Potentially Using the NEF Site.)

Common game birds include the mourning dove (Zinaida macroura), bobwhite quail (Colinus virginianus), and scaled quail (callipepla squamata). Other birds common to the area include scissor-tailed flycatcher (Tyrannus forficatus), nighthawk (Chordeiles minor), roadrunner (Geococcyx californianus), and the turkey vulture (Carthartes aura). Raptors include red-tailed hawk (Buteo jamaicensis) and barn owl (Tyto alba). Reptiles include the western diamondback rattlesnake (Crotalus atrox), eastern fence lizard (Sceloporus undulates), western box turtle (Terrapene ornate), and the Great Plains Skink (Eumeces obsoletus) (Benyus, 1989). (See Table 3.5-2, Birds Potentially Using the NEF Site.)

The mammalian species potentially occurring on the site are listed in Table 3.5-1. A field survey to identify mammals at the NEF site was conducted in September 2003. Small mammal capture and release was not conducted during the field survey.

Table 3.5-1 also lists the general habitat requirements of each mammalian species potentially occurring at the site as well as qualitative estimates of its probable distribution and abundance at the site. These estimates are derived from knowledge of the species-specific habitat preferences and the current composition, structure, and extent of the vegetative communities at the site. Because the vegetative community at the site is in a stable, near climax, successional stage significant changes in habitat or mammalian species are not anticipated.

Table 3.5-2 (Benyus, 1989; Peterson, 1961; Brown, 1985), lists the bird species that may occur on the site along with their migratory and nesting status. All water fowl and water birds have been excluded from this list due to the lack of suitable water-related habitat on the NEF site. The 34 species listed were mostly, selectively chosen from the sources cited above as those likely to live in or visit the region. Of these, approximately 18 species are likely to be summer residents, many of which may nest on the site. These species are denoted with the letter "C" under the column "Resident" in Table 3.5-2. Approximately 15 of the species are probable winter residents of the site. A site-specific avian survey was not conducted on the site because of the time of the season (summer). Future site-specific avian surveys will be conducted at appropriate times of the coming years.

The amphibians and reptiles potentially occurring on the site are listed in Table 3.5-3, Amphibians/Reptiles Potentially Using the NEF Site. Table 3.5-3 also lists the general habitat requirements for each amphibian or reptile species potentially occurring at the site as well as estimates of each species' probable distribution at the site. Because the occurrence of amphibian species is closely related to water and the NEF site contains no permanent water, there are very few associated amphibian species. A site-specific herpetology survey was conducted in October 2003.

3.5.3 Description of Important Wildlife and Plant Species

Based on information from New Mexico Department of Game and Fish, the U.S. Fish and Wildlife Service, and the Bureau of Land Management-Carlsbad Field Office, the NEF site is located within the known range of three species of concern. The lesser prairie chicken (Tympanuchus pallidicintus) is currently on the federal candidate list for listing as a threatened species. The nearest known breeding area or "lek" is located approximately 6.4 km (4 mi) north of the NEF site. There have been no known sightings of the lesser prairie chicken on the site. Field surveys of the NEF site in September 2003 and April 2004, did not locate any lesser prairie chickens. The sand dune lizard (Sceloporus arenicolus) is currently listed as a threatened species on the New Mexico State Threatened and Endangered list. A survey of the NEF site did not identify any sand dune lizard habitats. The black-tailed prairie dog (Cynomys ludovicianus) was listed as a candidate species under the Endangered Species Act by the U.S. Fish and Wildlife Service in 2000. No sightings or evidence of prairie dogs were found during a field survey of the NEF site.

The lesser prairie chicken, the sand dune lizard and the black-tailed prairie dog are discussed in detail based on their special status and potential proximity to the NEF site. Other species are selected based on their importance for recreation or commercial value. The other species listed in Table 3.5-1 through Table 3.5-3 are considered less important in terms of protected status, recreation or commercial value.

LESSER PRAIRIE CHICKEN

Habitat Requirements. The lesser prairie chicken requires relatively large areas of native prairie mixed shrub lands for cover, food, water and breeding. In the area of the NEF, the presence of a sand/shinnery oak habitat type meets the requirements for suitable habitat for the lesser prairie chicken. Mesquite shrubs provide needed protective cover from raptors and the short grass prairie vegetation meets the requirements for the breeding areas known as "booming grounds" or leks. Though the NEF site contains suitable lesser prairie chicken habitat, this type of habitat is not uncommon in the general area.

A nomination has been submitted (Stinnett, 2002) to the Bureau of Land Management (BLM) to designate two public land parcels within Lea County as an Area of Critical Environmental Concern (ACEC) for the lesser prairie chicken (Tympanuchus pallidicinctur). Refer to

Figure 3.5-2, County Map Proposed Area of Critical Environmental Concern (ACEC) Lesser Prairie Chicken. The nearest nominated ACEC straddles Lea and Eddy Counties and is about 48 km (30 mi) northwest of the proposed NEF site. The other nominated ACEC, which is further north, borders the northwest corner of Lea County. Currently, the BLM is evaluating this nomination and expects to make a decision within the next several years.

A member of the grouse family, the adult lesser prairie chicken is 38-41 cm (15-16 in) tall, a smaller and paler version of the greater prairie chicken. The male has reddish colored air sacs on the neck that are inflated and deflated to create a "booming" sound during courtship. The lesser prairie chicken diet consists of insects and seeds of wild plants and grains such as sorghum, oats and wheat when available. During periods of below average precipitation, water distribution can be become a limiting factor for lesser prairie chicken habitat in southeastern New Mexico. The NEF site could provide suitable food sources for the lesser prairie chicken, though there are limited water sources on the site.

Life History. The lesser prairie chickens are considered to be an R-selected species, which means that natural selection operates on traits that increase fecundity, with density regulated primarily through mortality (survival) and dispersal. R-selected species tend to be short-lived and exhibit high fecundity and emigration rates.

In southeastern New Mexico, lesser prairie chicken begin breeding in the early spring and continue through May. They produce 12-14 eggs per clutch with the average incubation period from 23-26 days in a ground nest. Due to nest failure and mortality the number of young reaching maturity is relatively low. The brood remains with the mother for 6-8 weeks and then gradually disperse. A reorganization of old and young birds into fall flocks occurs, with a gradual movement to suitable winter cover.

Population Dynamics. The lesser prairie chicken are found in mixed-sex flocks during the late fall and winter, but by early spring the males return to their traditional display grounds, where they reestablish old territories or, in the case of young birds, try to acquire new ones. The older males tend to hold central territories, while the younger males establish peripheral ones. Territorial display consist of the "booming" behavior, where the male inflates the bare yellow to orange skin area (skin sacs) on the sides of his neck, erects the feathered pinnae above his head, drops his wings, stamps his feet and calls. Females visit the display grounds when ready for breeding, and after breeding move off the lek to begin nesting (Campbell, 1972; NMDGB, 1998).

MULE DEER

Habitat Requirements. Throughout much of its range, mule deer habitat consists of arid, open terrain with mid-height trees such as juniper or pinion pine. In southeastern New Mexico in the vicinity of the NEF site, habitat consists of mesquite/oak scrub and the desert grasslands of the Chihuahuan desert. The mule deer diet consists of forbs, browsing of mesquite/oak shrub and flowering stalks of yucca plants. The NEF contains suitable food vegetation for mule deer, but generally lacks sufficient hiding and escape cover. Higher quality habitat exists in the vicinity surrounding the NEF than exists on the site.

Water distribution during periods of below average precipitation can be a limiting factor in mule deer habitat, although, the mule deer is adapted to getting moisture from succulent plants such as various species of cactus. The lack of a consistent water source on the NEF site lessens the quality of the habitat. Space requirements for mule deer are larger than those of whitetail and are based on population densities, home range areas, and the carrying capacity of the habitat.

Life History. Mule deer are considered to be K-selected species, which means that natural selection operates on traits that influence survivorship and competitive ability at population densities near the carrying capacity of the environment (K), rather than selection on traits that favor rapid population growth at low population densities. K-selected species tend to be long-lived and exhibit low fecundity and emigration rates.

Mule deer reach sexual maturity at 18-20 months, with some females breeding as yearlings. However, young bucks may not be allowed to participate in breeding activity until they are 3 or 4 years old. The breeding season extends from November to February, but varies with locality and climatic conditions. Gestation is approximately 210 days with the fawning period extending over several weeks in June, July and August. Females typically have one fawn, but two are not uncommon in areas of good habitat. Fawns typically remain with the mother for a year, but are weaned within 60 to 75 days following birth (Davis, 1974).

Population Dynamics

Mule deer herd behavior consists of small groups of mature females and fawns in the summer joined by yearlings in late fall. Mature bucks are typically solitary or in small groups in summer and early fall, but become territorial during the late fall breeding season. During winter, following the breeding season, mule deer form herds that consist of both sexes and all age classes.

SCALED QUAIL

Habitat Requirements. The scaled, or blue, quail has a large distribution range throughout the western U.S. occupying a wide range of habitat types. In southeastern New Mexico in the general vicinity of the NEF site, scaled quail are associated with the desert grasslands and mixed grasslands. The sand-shinnery oak scrub vegetation community is not as valuable as habitat as the desert grasslands, but the mesquite and shinnery oak provide sources of food and cover that are important components of scaled quail habitat. This specie has the best survival rate where there is a combination of annual weeds, some shrubby or spiny ground cover, and available surface water. Scaled quail require a source of midday shade and loafing cover in the hot summer months, but the cover must not be so thick as to prevent escape by running (Johnsgard, 1975).

The NEF site has several components of scaled quail habitat including cover, food sources, and nesting cover. Surface water is a limiting factor at the site. Scaled quail eat a large variety of seeds of annual forbs, grasses, shrubs, and trees. They also eat insects depending of the availability. During winter months, mesquite seeds and broom snakeweed seeds are major components of their diet. Shinnery oak acorns appear to be a minor component (Peterson, 1961).

Life History. Scaled quail are considered to be an R-selected species, which means that natural selection operates on traits that increase fecundity, with density regulated primarily through mortality (survival) and dispersal. R-selected species tend to be short-lived and exhibit high fecundity and emigration rates.

In southeastern New Mexico, scaled quail form breeding pairs in the spring. In spite of a long potential nesting season, actual egg laying by females may be deferred until the start of the summer rainy season. Incubation requires 15 to 28 days with clutch sizing ranging form 11 to 15 eggs. It is not uncommon for the female to have a second clutch of eggs during the same year. There is a high rate of nest losses from various causes, and during years of extreme drought the birds may not attempt to nest.

Population Dynamics. It has been found that spring-summer rainfall is positively and significantly correlated with scaled quail population density in eastern New Mexico. During the summer nesting season, the males and females form pairs that are maintained until the young have hatched. During the rest of the year the scaled quail form coveys that range from 20 to 50 birds. The chicks join these coveys as they mature in the late summer and fall. Local climatic conditions, such as spring/summer precipitation and habitat manipulation such as moderate livestock grazing and creating early vegetative successional stages have significant impacts on the population distribution and density of scaled quail.

SAND DUNE LIZARD

Habitat Requirements. The sand dune lizard populations are mostly confined to shinnery oak-sand dune habitats of southeastern New Mexico and West Texas. This lizard occurs only in areas with open sand, but forages and takes refuge under shinnery oak and is seldom more than 1.2 to 1.8 m (4 to 6 ft) form the nearest plant. The sand dune lizard is restricted to areas where sand dune blow-outs, topographic relief, or shinnery oak occur (Sena, 1985). Dunes that have become completely stable by vegetation appear to be unsuitable habitat. The NEF site contains areas of sand dunes in the eastern central area of the site, southwestern quadrant, and a small area in the northwestern corner of the site. Surveys of the NEF site did not identify any sand dune lizard habitats.

The sand dune lizard diet consists primarily of insects such as ants, crickets, grasshoppers, beetles, spiders, ticks and other arthropods. Most feeding appears to take place with or immediately adjacent to patches of vegetation. It is likely that the NEF provides an adequate food source for the sand dune lizard.

Life History. The sand dune lizard breeds in spring/summer from April to June. Typically, the female lays 3-7 eggs and may have two clutches of eggs a year. The young are hatched from July to September. Eggs are deposited in underground burrows in sand or directly on the sand. The lizards reach sexual maturity within one year.

Population Dynamics. The sand dune lizard has a limited and often spotty distribution throughout its range in southeastern New Mexico (Fitzgerald, 1997). Estimated population densities are low, e.g., only 7.5 to 12 lizards/ha (3 to 4.9 lizards/acre) in good habitat east of Roswell, Chaves County New Mexico. One of the documented primary threats to lizard populations is habitat removal by chemical brush control program that eliminate shinnery oak on and around the shinnery oak-sand dune areas.

BLACK-TAILED PRAIRIE DOG

Habitat Requirements. Throughout much of its range, black-tailed prairie dog habitat consists of short grass plains, mid-grass prairies, and grass-shrub habitats. Historically, they were widespread and abundant east of the Rio Grande River and in the grasslands of southwestern New Mexico. Though they have expanded their range into oak shinnery and other grass-shrub habitats, they typically avoid areas with tall grass, heavy sagebrush, and other thick vegetation cover. Colonies of black-tailed prairie dogs have been reported in the Plains-Mesa Grasslands vegetation type of southeastern New Mexico. They are not dependent on free water, getting adequate water from plants and precipitation events in arid and semi-arid habitats.

Black-tailed prairie dogs depend on grass as their dominant food source, and usually establish colonies in short grass vegetation types that allow them to see and escape predators. The predominant vegetation type, plains-mesa sand scrub, on the NEF site is not optimal black-tailed prairie dog habitat because of the high density of shrubs.

Shrubs comprise 36% of the relative vegetative cover and are present on the site at density levels of 16,549 individuals per hectare (6700 individuals per acre). Tall grass and shrubs provide hiding cover for predators such as coyotes and badgers. Shrubs provide perching locations for raptors that also prey on prairie dogs.

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, or prairie dogs at the NEF site.

Life History. Black-tailed prairie dogs are large rodents weighing 0.5 to 1.4 kg (1 to 3 lb) and are 25 to 41 cm (10 to 16 in) long. They live in well-organized colonies or "towns" with family subgroups. Prairie dogs dig extensive, deep and permanent burrows with a dome-shaped mound at the entrance. Nest cavities are in the deeper parts of burrows for protection of the young and to mitigate temperature fluctuations. Black-tailed prairie dogs are diurnal, being active primarily during daylight hours. In southeastern New Mexico, they may remain active throughout the year, although they may remain below ground during adverse winter weather.

Historically, black-tailed prairie dog towns on the mixed grass plains ranged in size from a few individuals to several thousand. Currently, large concentrations are rare due to extensive poisoning and loss of habitat during the last century. Typically, in southeastern New Mexico, prairie dog towns range in size from 8 to 40 hectares (20 to 100 acres), though some towns are smaller than 8 hectares (20 acres) and are larger than 40 hectares (100 acres).

Population Dynamics. Black-tailed prairie dogs breed from January to March, with a 29-60 day gestation period. Young are live-born with litter size ranging from 3 to 5. Normally, there is one litter per year. At about six weeks of age, the young appear above ground and are able to walk, run, and eat green food. The family units remain intact for almost another month, but the ties are gradually broken and the family disperses. Sexual maturity is reached in the second year.

Formerly, the chief predators of black-tailed prairie dogs were black-footed ferrets, badgers, and raptors. Because of their competition with domestic livestock for grass, prairie dogs were extensively poisoned, trapped, and hunted during the late 19th century and throughout the 20th century. Consequently, the prairie dog numbers have been reduced by 98-99% of their former numbers across the West.

PLANT SPECIES

The vegetative community at the NEF site plays an important role in providing suitable habitat for wildlife at the site and in the area with habitat conditions fluctuating with the relative abundance of individual plant species. Certain plant species that are better adapted to soil and climatic conditions of a given area occur at higher frequencies and define the vegetation community. The vegetation community that occupies the NEF site is generally classified as Plains Sand Scrub. The dominant shrub species associated with the Plains Sand Scrub Community at the NEF site is Shinoak (Quercus havardii) with a lesser amount of Sand Sage (Artemesia filifolia). Significant amounts of the shrub species Honey Mesquite (Prosopis glandulosa) are also present. The dominant perennial grass species at the NEF site is Red Lovegrass (Eragrostis oxylepis). Significant amounts of Dropseed species (Sporobolus Sp.) are also present. Numerous other grass species are present in low densities. Table 3.5-4, Plant Cover, Frequency and Shrub Data lists plant species, percent cover, diversity and production.

Shrubs provide habitat and seeds for bird and small mammal species. Perennial grasses provide forage for large grazing mammals and seeds for small mammals. The dominant plant species listed in Table 3.5-4 are distributed uniformly across the site, such that no one area of the site contains that specie exclusively.

3.5.4 RTE Species Known or Potentially Occurring in the Project Area

Information on RTE species known or potentially occurring in the project area is provided below (Common Name, Scientific Name, New Mexico Status, Federal Status):

Lesser Prairie Chicken (Tympanchus pallidicinctus), Imperiled, Candidate

The lesser prairie chicken is discussed in detail in ER Section 3.5.3, Description of Important Wildlife and Plant Species. The closest known occurrence of this specie to the NEF site is a breeding ground or lek, located approximately 6.4 km (4 mi) north of the NEF site. Field surveys for the lesser prairie chicken that were conducted in September 2003 and April 2004, indicated the specie does not occur on the NEF site. No visual sightings or aural detections were made and there is little potential habitat in the survey area. In addition, high human disturbance and predator potential in the area make it unlikely that lesser prairie chickens will colonize the area. Based on these findings, no mitigation measures are planned to reduce the impacts on or to protect the lesser prairie chicken at the NEF site.

Sand Dune Lizard (Sceloporus arenicolus), Threatened, Candidate

The sand dune lizard is discussed in detail in ER Section 3.5.3. Field surveys for the sand dune lizard, conducted in October 2003 and June 2004, indicated that the specie does not occur on the NEF site. The field survey for the sand dune lizard, conducted in October 2003, concluded that the habitat of the NEF site is unsuitable for sand dune lizards for several primary reasons. The high frequency of mesquite and grassland associations on the site is associated with environmental conditions that do not support the specie. In addition, the frequency and extent of shinoak dunes and large blowouts on the site, which provide the habitat and microhabitats necessary for sand dune lizard survival are low and the shinnery dune habitats that exist on the site are isolated from occupied shinnery dunes. Lastly, the ecotonal characteristics of the site are in contrast to the primary habitat of sand dune lizards. The primary habitat of the specie is sand dunes dominated by shinoak, with scattered sand sage, yucca and grasses, and notable for an absence of mesquite. Considering that no sand dune lizards were detected during the 2003 survey and that there is little potential habitat in the survey area, no mitigation measures are planned at this time to reduce impacts on or protect the sand dune lizard at the NEF site.

Black-Tailed Prairie Dog (Cynomys ludovicianus), No State Listing, Candidate

The black-tailed prairie dog is discussed in detail in ER Section 3.5.3. No prairie dogs were observed and no evidence of past or present prairie dog activities was identified during a field survey of the NEF site conducted in September 2003. Based on the survey findings, no mitigation measures are planned to reduce the impacts on or to protect the black-tailed prairie dog at the NEF site.

Consultation with the New Mexico Department of Game and Fish, U.S. Fish and Wildlife Service, and the New Mexico State Forestry Department indicated that there are no threatened or endangered plant species on the NEF site.

3.5.5 Major Vegetation Characteristics

The general vegetation community type that the subject property is located in is classified as Plains Sand Scrub. The specific vegetation community of the subject property is characterized by the presence of significant amounts of the indicator species Shinoak (Quercus havardii), a low growing shrub. The community is further characterized by the presence of forbs, shrubs, and grasses that are adapted to the deep sand environment that occurs in parts of southeastern New Mexico.

Data from the NEF site was collected during field studies on September 6 through September 7, 2003. A total of 20 species were observed in cover transects. Species present in cover transects consisted of the following life forms: five forb species, 10 grass species, and five shrub species. See Figure 3.5-2 for location of the transects.

Total vegetative cover represents the percentage of ground that has vegetation above it, as opposed to bare ground or litter. The total vegetative cover for the NEF site was approximately 26.5% cover. Herbaceous plants covered approximately 16.7% of the total ground area and shrubs covered approximately 9.6% of the total ground area. The largest herbaceous contributor to vegetative cover was Eragrostis oxylepis (Red Lovegrass) with approximately 12.6% total cover, followed by Sporobolus sp. (Dropseed Species) with approximately 1.5% total cover. The next two largest contributors were Aristida purpurea (Purple Three Awn) with approximately 1.1% total cover and Paspalum stramineum (Sand Paspalum) with approximately 0.67% total cover.

Forbs comprised approximately 0.44% total cover. Forbs did not contribute significantly to cover transects.

Five shrub species occurred in the cover transects. Shrubs comprised approximately 9.6% of the total vegetative cover. Prosopis glandulosa (Honey Mesquite) and Querqus havardii (Shinoak) were the dominant shrub with approximately 3.7% and 3.2% of the total cover, respectively.

Relative cover is the fraction of total vegetative cover that is composed of a certain species or category of plants. Perennial grasses account for 63.1% of the relative cover and forbs accounted for 0.8% of the relative cover. Shrubs accounted for 36.1% of the relative cover. The estimated productivity of palatable grasses of the subject property was 237 kg/ha (211 lbs/acre).

Several factors should be taken into account when considering the production value. Production values are normally sampled after the growing season has concluded. Depending on the presence of precipitation, the growing season in southeastern New Mexico can continue beyond the time this survey was conducted. Also, the subject property has been moderately grazed. This is evident from the presence of cattle and grazed vegetation. Given these factors actual production may be higher. Subsequent LES surveys will determine if actual production values change over time.

Total shrub density for the subject property was 16,660 individuals/ha (6,748 individuals/ acre). Five shrub species were observed in density belt transects. Querqus havardii (Shinoak) was the most abundant with 14,040 individuals/ha (5,688 individuals/acre). Yucca glauca (Soapweed yucca) was the second most abundant shrub species with 1,497 individuals/ha (606 individuals/acre). The high density of shrubs per acre is due primarily to the presence of Querqus havardii (Shinoak). High densities of Querqus havardii are common in communities where it occurs. (See Table 3.5-5, Shrub Density.)

3.5.6 Habitat Importance

The importance of the habitat for most threatened, endangered, and other important species relative to the habitat of those species throughout their entire range is rather low. Most of these species have little or no suitable habitat on the NEF site and the habitats present on the site are not rare or uncommon in the local area or range wide for these species.

A field survey conducted in October, 2003, revealed that the NEF site does not support sand dune lizard habitat. The primary reasons that the NEF site is unsuitable habitat for the sand dune lizard are the high frequency of mesquite and grassland vegetation association, which are associated with environmental conditions that do not support sand dune lizards. Also, there is a low frequency and extent of shinnery oak dunes and large blowouts, which provide the habitat and micro-habitats necessary for sand dune lizard survival.

A field survey for the lesser prairie chicken and the black-tailed prairie dog was conducted in September 2003 that indicated these species do not occur on the NEF site. A subsequent survey performed for the lesser prairie chicken in April 2004, supports the initial findings. The NEF site could provide suitable food sources for the lesser prairie chicken, though there are limited water sources on the site. Due to the high density of shrubs, the NEF site is not optimal prairie dog habitat.

The potential for habitat contained within the NEF site to attract other species of interest has been evaluated and summarized below.

SWIFT FOX

The proposed NEF site contains habitat that has the potential to attract swift fox. The swift fox is known to inhabit Plains-Mesa Sand Scrub and Plains-Mesa Grasslands vegetation types that occur at or in the immediate vicinity of the NEF site. However, this small fox is more closely associated with grasslands. The swift fox preys primarily on rodents such as kangaroo rats and rabbits, and is closely associated with prairie dogs and other burrowing animals. Breeding habitat requires burrows in relative soft soils that the fox digs or alternatively, it may occupy existing burrows of other animals such as prairie dogs or badgers. Given the existing facilities in the immediate area of the NEF site and the low population density of the swift fox, 0.19 fox/km^2 (0.49 fox/mi^2) the NEF site is marginally attractive to the swift fox.

AMERICAN PEREGRINE FALCON

The proposed NEF site has no potential to attract breeding american peregrine falcons. In the Rocky Mountain States, peregrine falcons require cliffs for breeding, and there are no cliffs in the area. The species uses a variety of open habitats, potentially like those on the NEF site, for foraging, but the closest breeding sites make it unlikely that birds would travel to the area for foraging. Transient birds may use the area during migration but the species is unlikely to winter in the area.

ARCTIC PEREGRINE FALCON

The proposed NEF site has no potential to attract breeding arctic peregrine falcons. Arctic peregrine falcons are not known to breed in New Mexico. Transient birds may use the area during migration but they are unlikely to winter in the area.

BAIRD'S SPARROW

The proposed NEF site is outside of the breeding range of the baird's sparrow and does not include typical breeding habitat. Baird's sparrows may utilize the area during migration, but the species is not likely to winter in the area. In winter, baird's sparrows prefer dense grassy habitats and are generally found to the south of the NEF site.

BELL'S VIREO

The proposed NEF site is unlikely to attract bell's vireos. In New Mexico, the species generally uses dense riparian woodland habitats for breeding. Although dense mesquite thickets may be used by the species, they generally will use areas only near water. The dense mesquite stands on the NEF site are therefore unlikely to attract bell's vireos. Transient birds may use the area during migration but they are very unlikely to winter in the area.

WESTERN BURROWING OWL

The proposed NEF site has the potential to attract burrowing owls. The site is within the range of burrowing owls and harbors habitats (open grass and shrub habitats with sparse cover) used by burrowing owls. The species requires burrows (natural or human-constructed) for nesting. If there are burrowing mammals such as prairie dogs or badgers in the area, then it is likely that the area may be attractive to burrowing owls. However, the lack of existing burrows at the NEF site reduces the potential impact on this species.

YELLOW-BILLED CUCKOO

The proposed NEF site has no potential to attract breeding yellow-billed cuckoos. Cuckoos require riparian woodlands and, in the southwest, are generally not found using other habitats. There are no areas on the NEF site that would qualify as riparian woodland suitable for breeding yellow-billed cuckoos. It is possible that a cuckoo might use the site during migration, but wintering here would be very unlikely.

3.5.7 Location of Important Travel Corridors

None of the important wildlife species selected for the NEF site are migratory in this part of their range, therefore, these species do not have established migratory travel corridors. However, three of the species, mule deer, lesser prairie chicken, and scaled quail, are highly mobile and utilize a network of diffuse travel corridors linking base habitat requirements (i.e., food, water, cover, etc.). These travel corridors may change from season-to-season as well as from year to year for each specie and can occur anywhere within the species home range.

Mule deer and scaled quail utilize and often thrive in altered habitats and can and do live in close proximity to man and human activities. For these two species, any travel corridors that would potentially be blocked by the proposed action would easily and quickly be replaced by an existing or new travel corridor linking base habitat requirements for these two species.

The NEF site does not provide optimal habitat for the lesser prairie chicken and has not been identified as an important travel corridor for this specie. Field surveys for the lesser prairie chicken that were conducted in September 2003 and April 2004 indicated the specie does not occur on the NEF site.

The sand dune lizard is not a highly mobile specie and is confined to small home ranges within the active sand dune-shinnery oak habitat type. Travel corridors are not important features of the lizard habitat. A field survey confirmed that the sand dune lizard is not present at the site. The primary reasons that the NEF site is unsuitable habitat for the sand dune lizard are the high frequency of mesquite and grassland vegetation association, which are associated with environmental conditions that do not support sand dune lizards. Also, there is a low frequency and extent of shinnery oak dunes and large blowouts, which provide the habitat and micro-habitats necessary for sand dune lizard survival and the shinnery dune habitats that do exist on the site are isolated from occupied shinnery oak dunes. Lastly, the ecotonal characteristics of the NEF site are in contrast to the primary habitat of sand dune lizards which is sand dunes dominated by shinoak and notable for an absence of mesquite.

The black-tailed prairie dog is not a highly mobile specie. Considering that prairie dogs dig extensive, deep and permanent burrows (i.e. they do not migrate) and are not dependent on free water, travel corridors are not important features of the prairie dog habitat. A field survey found no evidence of black-tailed prairie dogs at the NEF site.

3.5.8 Important Ecological Systems

The NEF site contains fair to poor quality wildlife habitat. The Plains Sand Scrub vegetative community has been impacted by past land use practices. The site has been grazed by domestic livestock for over a hundred years, has a New Mexico state highway along the southern boundary, a carbon dioxide (CO2) pipeline right-of-way bisects the site now relocated, and a gravel access road runs north to south through the center of the site. The degraded habitat generally lacks adequate cover and water for large animal species, and the annual grazing by domestic livestock impacts ground nesting bird species.

Based on recent field studies and the published literature, there are no onsite important ecological systems 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 for the site are all highly mobile species, with the exception of the sand dune lizard and the black-tailed prairie dog, and are not confined to the site nor dependent on habitats at the site. The Plains Sand Scrub vegetation type covers hundreds of thousands of acres in southeastern New Mexico and is not unique to the NEF site.

Critical habitat for the lesser prairie chicken is approximately 6.4 km (4 mi) north of the NEF site. There are no reported observations of lesser prairie chickens occupying the NEF site. Field surveys for the lesser prairie chicken that were conducted in September 2003 and April 2004, indicated the specie does not occur on the NEF site. Although the site does contain sand dune-oak shinnery communities, that could be potential sand dune lizard habitat, field surveys conducted in October 2003 and June 2004 revealed that the sand dune lizards are not present on the site. The field survey conducted in June 2004 identified the closest occupied sand dune lizard habitat as occurring approximately 4.8 km (3 mi) north of the NEF site. The high density of shrubs on the NEF site is not optimal prairie dog habitat. No prairie dogs were found onsite during the September 2003 survey.

3.5.9 Characterization of the Aquatic Environment

The NEF site contains no aquatic habitat. There is a shallow, domestic livestock watering area that contains a small amount of water for several days following a major precipitation event. This feature does not support aquatic life, and no rare, threatened and endangered species. There are no intermittent or perennial water bodies or jurisdictional wetlands on the site. There is no hydrological/chemical monitoring station onsite, and no data have been recorded in the past.

3.5.10 Location and Value of Commercial and Sport Fisheries

Due to the lack of aquatic habitat (no surface water), there are no commercial and/or sport fisheries located on the NEF site or in the local area. The closest fishery, the Pecos River and Lake McMillan located on the Pecos River near Carlsbad, New Mexico, is approximately 121 km (75 mi) west of the NEF site.

3.5.11 Key Aquatic Organism Indicators

Due to the lack of aquatic life known to exist on the NEF site, no key aquatic indicator organisms expected to gauge changes in the distribution and abundance of species populations that are particularly vulnerable to impacts from the proposed action can be identified.

3.5.12 Important Ecological Systems

There are no important aquatic ecological systems onsite or in the local area that are especially vulnerable to change or that contain important species habitats, such as breeding areas, nursery areas, feeding areas, wintering areas, or other areas of seasonably high concentrations of individuals of important species.

3.5.13 Significance of Aquatic Habitat

The NEF site contains no aquatic habitat; therefore, the relative regional significance of the aquatic habitat is low.

3.5.14 Description of Conditions Indicative of Stress

Pre-existing environmental stresses on the plant and animal communities at NEF consist of road and pipeline right-of-ways and domestic livestock grazing. The impact of pipeline installation and maintenance of the right-of-way has been mitigated by the colonization of the disturbed areas by local plant species. However, the access road through the middle of the site is maintained and used by gravel trucks on a regular basis. The disturbed areas immediately adjacent to the road are being invaded by lower successional stage species (i.e., weeds). This pattern is expected to continue as long as the road is maintained.

Historical and current domestic livestock grazing and fencing of the site constitute a pre-existing and continuing environmental stress. Heavily grazed native grasslands tend to exhibit changes in vegetation communities that move from mature, climax conditions to mid-successional stages with the invasion of woody species such as honey mesquite and sagebrush. The NEF site has large stands of mesquite indicative of long-term grazing pressure that has changed the vegetative community dominated by climax grasses to a sand scrub community and the resulting changes in wildlife habitat.

Another periodic environmental stress is changes in local climatic and precipitation patterns. The NEF site is located in an area of southeastern New Mexico that experiences shifts in precipitation amounts that can effect plant community diversity and production on a short-term seasonal basis and also on a long-term basis that may extend for several years. Below average precipitation that negatively impacts the plant community also directly alters wildlife habitat and may severely reduce wildlife populations.

Past and present livestock grazing, fencing and the maintenance of access roads and pipeline right-of-ways represent the primary pre-existing environmental stress on the wildlife community of the site.

The probable result of the past and current use of the NEF site is a shift from wildlife species associated with mature desert grassland to those associated with a grassland shrub community. Large herbivore species such as the pronghorn antelope (Antilocapra Americana) that require large, open prairie areas with few obstructions such as fences, have decreased. Other mammalian species that depend on open grasslands such as the black-tailed prairie dog (Cynomys ludovicianus) also are no longer present in the immediate area. Bird species that depend on the mature grasslands for habitat such as the lesser prairie chicken (Tympanuchus pallidicinctus) have decreased in the region and at the NEF site. Other species that thrive in a mid-successional plant community such as the black-tailed jackrabbit (Lepus californicus), desert cottontail (Sylvilagus audubonii), and mule deer (Odocoileus hemionus) probably have increased.

No other environmental stresses on the terrestrial wildlife community (e.g., disease, chemical pollutants) have been documented at the NEF site.

3.5.15 Description of Ecological Succession

Long-term ecological studies of the NEF site are not available for analysis of ecological succession at this specific location. The property is located in a Plains Sand Scrub vegetation community, which is a climax community that has been established in southeastern New Mexico for an extended period. The majority of the subject property is a mid-successional stage due primarily to historic and contemporary grazing of domestic livestock and climactic conditions.

Development of the property is limited to an access road for a neighboring property and faded two-track roads along the perimeter of the property are probably used for fence maintenance. These areas contain some colonizing plants that are common to disturbed ground. An example of a disturbed ground colonizing species in southeastern New Mexico is Broom Snakeweed (Gutierrezia sarothrae).

The NEF site has been grazed for an unknown period of time, although regional grazing by domestic livestock has occurred for 150 years. Cattle were present at the time of vegetation surveys conducted September 6 through September 7, 2003. Evidence of grazing was also apparent from reduced amounts of standing vegetation

Moderately high densities of Honey Mesquite (Prosopis glandulosa) seedlings were observed during the vegetation survey. Reduced grass canopy from historic and contemporary livestock grazing may be contributing to the colonization of Prosopis glandulosa due to reduced competition. Prosopis glandulosa is considered noxious on rangeland because of its ability to compete for soil moisture and its reproductive ability.

3.5.16 Description of Ecological Studies

A vegetation survey of the NEF site was conducted from September 6, 2003 through September 7, 2003. Several vegetation data collection methods were employed to obtain empirical information about the amount of vegetative cover, production of palatable grasses, and the density of trees and shrubs present at the subject property. (See Figure 3.5-2, NEF Site Vegetation Survey Transect Locations.)

For the vegetation survey, an inventory of vegetative cover, diversity and shrub density in the subject property was obtained through a series of 100-ft transects. Twenty transects were randomly located on a map of the property before the survey was conducted. The transects were then positioned on the ground.

Production of palatable grasses was determined through ocular estimation of randomly located square test plots as well as actual clipping and weighing of all palatable grass species within test plots.

Transect locations were determined randomly from a grid system overlay placed over the most current map showing areas to be sampled. A 100-ft tape, subdivided into 1.0-ft intervals, was then stretched between two points at the position found on the map. The sampler moved the line, and for each interval, recorded the plant species found and the distance it covered along that portion of the line intercept. Measurements of individual plants were read to the nearest inch. The sampler considered only those plants or seedlings touched by the line or lying under or over it. For floral canopies below eye level, the distance each species covered along the line at ground level was measured. For canopies above eye level, the distance covered by the downward projection of the foliage was measured. Multiple vegetation levels were included for cover measurements.

This survey method provides objective and accurate results. Bias is reduced since the survey results are based on actual measurements of the plants growing in randomly located and clearly defined sampling units. The survey method results are accurate in mixed plant communities and suited for measuring low vegetation. By direct measurement of small samples, the method allows estimates of known reliability to be obtained concerning the vegetation, its composition and ecological structure.

Initial field survey for mammals consisted of walking random linear transects parallel and immediately adjacent to the vegetation transects. Sightings of mammalian species were recorded and incorporated into the species tables. Trapping or capture and release surveys were not conducted during the September survey. Initial bird surveys were also conducted along withy the vegetation transects. Primary information for avian species that may occur at the site are referenced.

Many habitat studies have been conducted on the Plains Sand Scrub areas because of it's association with lesser prairie chicken habitat, however, studies specific to the NEF site are limited to the vegetation and wildlife studies by LES. Ecological information of the Plains Sand Scrub is contained in regional studies by:

- Ahlborn, G. G., 1980. Brood-rearing habitat and fall-winter movements of lesser prairie chickens in Eastern New Mexico. Thesis, New Mexico State University, Las Cruces.

This study describes habitat types and vegetative communities selected for rearing young in southeastern New Mexico. Fall and winter movements are also described with observations of habitat types selected.

- Candelaria, M. A., 1979. Movements and Habitat-use by lesser prairie chickens in Eastern New Mexico. Ecology, 19: 572-577.

This study focused on bird movements in association with various habitat types. Preferred habitats included the shinoak and to a lesser degree sand sagebrush.

- Suminski, R. H., 1977. Habitat evaluation for lesser prairie chickens in Eastern Chavez County, New Mexico. Thesis, New Mexico State University, Las Cruces.

This study contains detailed vegetation analysis of bird habitat in an area of southeastern New Mexico with similar plant communities as those at the NEF site.

- Weaver-Boos Consultants, Inc. 1998. Application for Permit, Lea County Landfill. Vols. 1-4. Submitted to the New Mexico Environment Department, Santa Fe, New Mexico.

The Lea County Landfill Permit Application contains wildlife (particularly T/E) information for the landfill site which is located less than a mile from the NEF site. A limited amount of vegetation information is also presented.

- Wilson, D. L., 1982. Nesting of lesser prairie chickens in Roosevelt and Lea Counties, New Mexico. Thesis, New Mexico State University, Las Cruces.

Vegetation communities and habitat types are described in this study of bird nesting behavior in areas of Lea County, New Mexico. Useful descriptions of the plant communities in the Plains Sand Scrub vegetation type are included.

3.5.17 Information on RTE Sightings

A population of lesser prairie chickens, a Federal Candidate species, has been sighted in an area approximately 6.4 km (4 mi) north of the NEF site. The sighting occurred during the Spring of 2002. A field survey for the lesser prairie chicken that was conducted in September 2003 indicated the specie does not occur on the NEF site.

Field surveys of the NEF site, conducted in October 2003 and June 2004, concluded that the sand dune lizard, a New Mexico State Threatened species, was not present on the site. The field survey conducted in June 2004 identified the closest sand dune lizard habitat as occurring approximately 4.8 km (3 mi) north of the NEF site.

No black-tailed prairie dogs, a Federal Candidate species, were sighted during the September 2003 field survey.

3.5.18 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.

3.5.19 RTE Effects by Other Federal Projects

The proposed NEF is not expected to negatively affect any rare, threatened and endangered species or their habitats. LES is not aware of other Federal and State projects within the region that are or could potentially affect the same threatened and endangered species or their habitats.

3.5.20 Section 3.5 Tables

Table 3.5-1 Mammals Potentially Using the NEF Site

Common Name	Scientific Name	Preferred Habitat	Probable Occurrence at NEF Site
Mule Deer	*Odocoileus hemionus*	Desert shrubs, chaparral and rocky uplands	Probably occurs at site in limited numbers due to limited water resources
Pronghorn Antelope	*Antilocapra americana*	Sagebrush flats, plains and deserts	Probably occurs at site in limited numbers due to limited habitat
Desert Cottontail	*Sylvilagus audubonii*	Arid lowlands, brushy cover and valleys	Likely occurs at site in brushy areas and areas providing cover
Black-Tailed Jackrabbit	*Lepus californicus*	Grasslands and open areas	Likely occurs at site
Plains Pocket Gopher	*Geomys bursarius*	Deep soils of the plains	Probably occurs at site in limited numbers due to limited habitat
Deer Mouse	*Peromyscus maniculatus*	Grasslands, prairies, and mixed vegetation	Likely occurs at site
Prairie Vole	*Micortus ochrogaster*	Prairies	Unlikely to occur due to lack of suitable habitat
Ord's Kangaroo Rat	*Dipodomys ordii*	Hard desert soils	Likely occurs at site
Badger	*Taxidea taxus*	Dry open country	Unlikely due to human disturbance of the area
Coyote	*Canis latrans*	Open space, grasslands and brush country	Likely occurs at site
Black-Tailed Prairie Dog	*Cynomys ludovicianus*	Short grass prairie	Unlikely due to lack of optimal habitat
Collared Peccary	*Dicotyles tajacu*	Brushy, semi-desert, chaparral, mesquite and oaks	Likely occurs at site
Gray Fox	*Urocyon cinereoargentues*	Brush, chaparral and lowlands	Unlikely due to human disturbance of the area
Kit Fox	*Vulpes macrotis*	Deserts, dry foothills and plains	Unlikely due to human disturbance of the area
Swift Fox	*Vulpes velox*	Grasslands	Unlikely due to human disturbance of the area and low population density
Striped Skunk	*Mephitis mephitis*	All land habitats	Likely occurs at site

Table 3.5-1Mammals Potentially Using the NEF Site

Common Name	Scientific Name	Preferred Habitat	Probable Occurrence at NEF Site
Desert Cottontail	*Sylvilagus audubonii*	Deserts, brush, chaparral and lowlands	Likely occurs at site
Spotted Ground Squirrel	*Spermophilus spilosoma*	Brushy, semi-desert, chaparral, mesquite and oaks	Likely occurs at site
Rock Squirrel	*Spermophilus variegates*	Rocky outcrops, desert hill	Unlikely occurs at site due to lack of habitat
Raccoon	*Procyon lotor*	Brushy, semi-desert, chaparral and mesquite	Likely occurs at site
Porcupine	*Erethizon dorsatum*	Brush, chaparral and lowlands	Unlikely occurs at site due to lack of habitat
Spotted Bat	*Euderma maculatum*	Caves, mine tunnels and rocky habitat	Unlikely occurs at site due to lack of habitat
Mexican Free-Tailed Bat	*Tadarida mexicana*	Caves, mine tunnels and rocky habitat	Unlikely occurs at site due to lack of habitat
Western Mastiff Bat	*Eumops perotis*	Cracks, manmade structures and small holes	Unlikely occurs at site due to lack of habitat
Pallid Bat	*Antrozous pallidus*	Unlikely occurs at site due to lack of habitat	Unlikely occurs at site due to lack of habitat
Yellow-Faced Pocket Gopher	*Pappogeomys castanops*	Deep soils of the plains	Probably occurs at site in limited numbers due to limited habitat
Southern Plains Woodrat	*Neotoma micropus*	Grasslands, prairies, and mixed vegetation	Likely occurs at site
Cactus Mouse	*Peromyscus eremicus*	Grasslands, prairies, and mixed vegetation	Likely occurs at site
Mexican Ground Squirrel	*Spermophilus mexicanus*	Brush, chaparral and lowlands	Unlikely due to human disturbance of the area
White-Throated Woodrat	*Neotoma albigula*	Grasslands, prairies, and mixed vegetation	Likely occurs at site
Beaver	*Castro canadensis*	Prairies, desert water holes and creeks	Unlikely occurs at site due to lack of habitat

Table 3.5-2Birds Potentially Using the NEF Site

Common Name	Scientific Name	Summer Breeder	Wintering	Resident	Migrant
Mourning Dove	*Zenaida macroura*	C	C	C	
White-Winged Dove	*Zenaida asiatica*				
Bobwhite Quail	*Colinus virginianus*	C	C	C	
Gambel's Quail	*Lophortyx gambelii*		R	R	U
Scaled Quail	*Callipepla squamata*	C	C	C	
Scissor-Tailed Flycatcher	*Muscivora forficate*				C
Common Nighthawk	*Chordeiles minor*		C	C	
Roadrunner	*Geococcyx californianus*		C	C	
Turkey Vulture	*Cathartes aura*		C		U
Red-Tailed Hawk	*Buteo jamaicensis*		C	C	
Common Raven	*Corvus corax*		C	C	
Chichuahuan Raven	*Corvus cryptoleucus*		R		U
Loggershrike	*Lanius ludovicianus*				U
Northern Mockingbird	*Mimus polyglottos*			C	U
Crissal Thrasher	*Toxostoma dorsale*		C	C	
Green-Tailed Towhee	*Pipilo chlorurus*				U
Ash-Throated Flycatcher	*Myiarhus cinerascens*	R		C	
Vermilion Flycatcher	*Pyrocephalus rubinis*		C		C
American Kestrel	*Falco sparverius*			C	C
Swainson's Hawk	*Buteo swainsoni*			C	U
Harris' Hawk	*Parabuteo unicinctus*		R		U
Zone-Tailed Hawk	*Buteo albonotatus*		R		R
Black-Chinned Hummingbird	*Archilochus alexandri*			C	C
Sage Sparrow	*Amphispiza belli*	C	C	C	
House Finch	*Carpodacus mexicanus*	C	C	C	
Horned Lark	*Eremophilia alpestris*	U			C

Table 3.5-2Birds Potentially Using the NEF Site

Common Name	Scientific Name	Summer Breeder	Wintering	Resident	Migrant
Northern Cardinal	*Cardinalis cardinalis*	R			U
Long-Eared Owl	*Asio otus*		C	C	
Western Burrowing Owl	*Athene cunicularia hypugea*	U	U	U	C
Pyrrhuloxia	*Cardinalis sinuatus*	U			U
Scott's Oriole	*Icterus parisorum*	C	C	C	
Blue Grosbeak	*Guiraca caerulea*	C	C	C	
Varied Bunting	*Passerina versicolor*				U
Lesser Prairie Chicken	*Tympanuchus pallidicinctus*	R*	R*	R*	

R - Species Rarely Seen On-Site

U - Species Uncommonly Seen On-Site

C - Species Commonly Seen On-Site

* - Field surveys conducted at the site indicated the specie does not occur on the NET site

Table 3.5-3Amphibians/Reptiles Potentially Using the NEF Site

Common Name	Scientific Name	Preferred Habitat	Probable Occurrence at NEF Site
New Mexico Spadefoot Toad	*Scapiopus multiplicatus*	Shallow watering holes and standing pools of water	Likely occurs at site
Plains Spadefoot Toad	*Scahiopus bombifrons*	Shallow to standing pools of water	Likely occurs at site
Couch's Spadefoot Toad	*Scaphiopus couchii*	Shallow to standing pools of water	Likely occurs at site
Woodhouse's Toad	*Bufo wood-housei*	Shallow watering holes and springs	Unlikely occurs at site due to lack of habitat
Green Toad	*Bufo debilis*	Shallow watering holes and springs	Unlikely occurs at site due to lack of habitat
Ornate Box Turtle	*Terrapene ornata*	Desert grasslands and short grass prairie	Likely occurs at site
Snapping Turtle	*Chelydra serpentina*	Tallgrass and mixed prairie	Unlikely occurs at site due to lack of habitat
Tiger Salamander	*Ambystoma tigrinum*	Tallgrass and mixed prairie	Likely occurs at site
Great Plains Skink	*Eumeces obsoletus*	Desert grasslands and short grass prairies	Unlikely occurs at site due to lack of habitat
Eastern Fence Lizard	*Sceloporus undulates*	Mixed grass prairie and desert grasslands	Likely occurs at site
Leopard Lizard	*Gambelia wislizenii*	Mixed grass prairie and desert grasslands	Likely occurs at site
Western Whiptail Lizard	*Cnemidophorus tigris*	Mixed grass prairie and desert grasslands	Likely occurs at site
Lesser Earless Lizard	*Holbrookia maculata*	Mixed grass prairie and desert grasslands	Likely occurs at site
Six-Lined Racerunner	*Cnemidophorus sexlineatus*	Mixed grass prairie and desert grasslands	Likely occurs at site
Collared Lizard	*Crotaphytus collaris*	Desert grasslands	Probably occurs at site in limited numbers due to limited habitat
Sand Dune Lizard	*Sceloporus arenicolus*	Sand dune-shinnery oak	Does not occur at site due to lack of habitat
Texas Horned Lizard	*Phyrynosoma cornutum*	Desert grasslands	Likely occurs at site

Table 3.5-3Amphibians/Reptiles Potentially Using the NEF Site

Common Name	**Scientific Name**	Preferred Habitat	**Probable Occurrence at NEF Site**
Plains Garter Snake	*Thamnophis radix*	Short grass prairie and desert grasslands	Probably occurs at site in limited numbers due to limited habitat
Checkered Garter Snake	*Thamnophis marcianus*	Desert grasslands	Likely occurs at site
Pine-Gopher Snake	*Pituophis melanoleucus*	Short grass prairie and desert grasslands	Probably occurs at site in limited numbers due to limited habitat
Western Diamondback Rattlesnake	*Crotalus atrox*	Desert grasslands	Likely occurs at site
Western Rattlesnake	Crotalus viridis	Short grass prairie and desert grasslands	Likely occurs at site
Longnosed Snake	*Rhinocheilus lecontei*	Desert grasslands	Likely occurs at site
Ground Snake	*Sonora semiannulata*	Desert grasslands	Likely occurs at site
Coachwhip	*Masticophis flagellum*	Mixed grass prairie and desert grasslands	Likely occurs at site
Plains Blackhead Snake	*Tantilla nigriceps*	Short grass prairie and desert grasslands	Likely occurs at site

Table 3.5-4Plant Cover, Frequency and Shrub Data

Species	Mean % Cover	Relative Cover	Mean % Freq	Relative Freq
Forbs				
Aster sp. Aster sp.	0.155	0.006	0.600	0.008
Brassica Sp. Brassica Species	0.045	0.002	0.200	0.003
Croton texensis Croton	0.015	0.001	0.150	0.002
Eriogonum rotundilolium Roundleaf Buckwheat	0.09	0.003	0.450	0.006
unk forb unk forb	0.13	0.005	0.550	0.008
Sub-total	**0.435**	**0.016**	**1.950**	**0.027**
Grasses				
Aristida purpurea Purple Three Awn	1.05	0.039	3.600	0.050
Buchloe dactyloides Buffalo Grass	0.15	0.006	0.600	0.008
Bouteloua hirsuta Hairy Grama	0.135	0.005	0.550	0.008
Cenchrus incertus Puncture Vine	0.01	0.000	0.100	0.001
Eragrostis oxylepis Red Lovegrass	12.57	0.470	31.400	0.436
Paspalum stramineum Sand Paspalum	0.67	0.025	3.150	0.044
Scleropogon brevifolius Burro Grass	0.51	0.019	1.950	0.027
Setaria leucopila Plains Bristlegrass	0.125	0.005	0.550	0.008
Sporobolus giganteus Giant Dropseed	0.03	0.001	0.050	0.001
Sporobolus sp. Dropseed Species	1.475	0.055	5.450	0.076
sub-total	**16.725**	**0.626**	47.400	0.658

Table 3.5-4Plant Cover, Frequency and Shrub Data

Species	Mean % Cover	Relative Cover	Mean % Freq	Relative Freq
Shrubs				
Artemesia filifolia Sand Sage	0.77	0.029	2.050	0.028
Gutierrezia sarothrae Snakeweed	0.16	0.006	0.350	0.005
Prosopis glandulosa Honey Mesquite	3.69	0.138	5.600	0.078
Querqus havardii Shinoak	3.22	0.121	10.600	0.147
Yucca glauca Soapweed yucca	1.72	0.064	4.100	0.057
Sub-total	**9.56**	**0.358**	**22.700**	**0.315**
Total	**26.28**	**1.000**	**72.050**	**1.000**

Table 3.5-5Shrub Density

	Mean	
Species	**Density per Transect**	**Individuals per Ha (per Acre)**
Artemesia filifolia Sand Sage	4.7	842 (341)
Oppuntia polyacantha Plains Pricklypear	0.05	9.9 (4)
Prosopis glandulosa Honey Mesquite	1.5	2.69 (109)
Querqus havardii Shinoak	78.35	14,040 (5688)
Yucca glauca Soapweed yucca	8.35	1,497 (606)
Total	**92.95**	**16,660 (6,748)**

3.5.21 Section 3.5 Figures

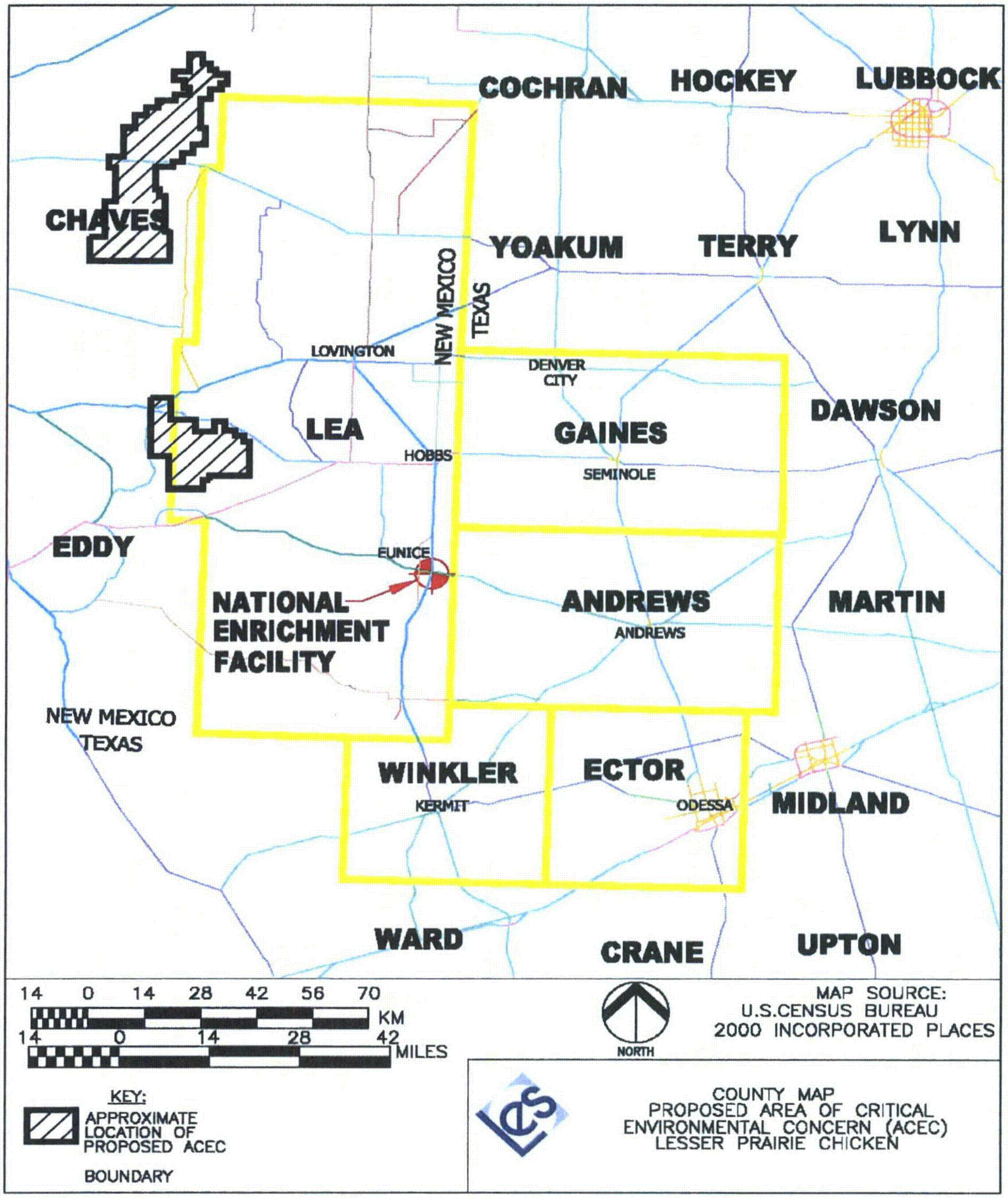


Figure 3.5-1 County Map Proposed Area of Critical Environmental Concern (ACEC) Lesser Prairie Chicken

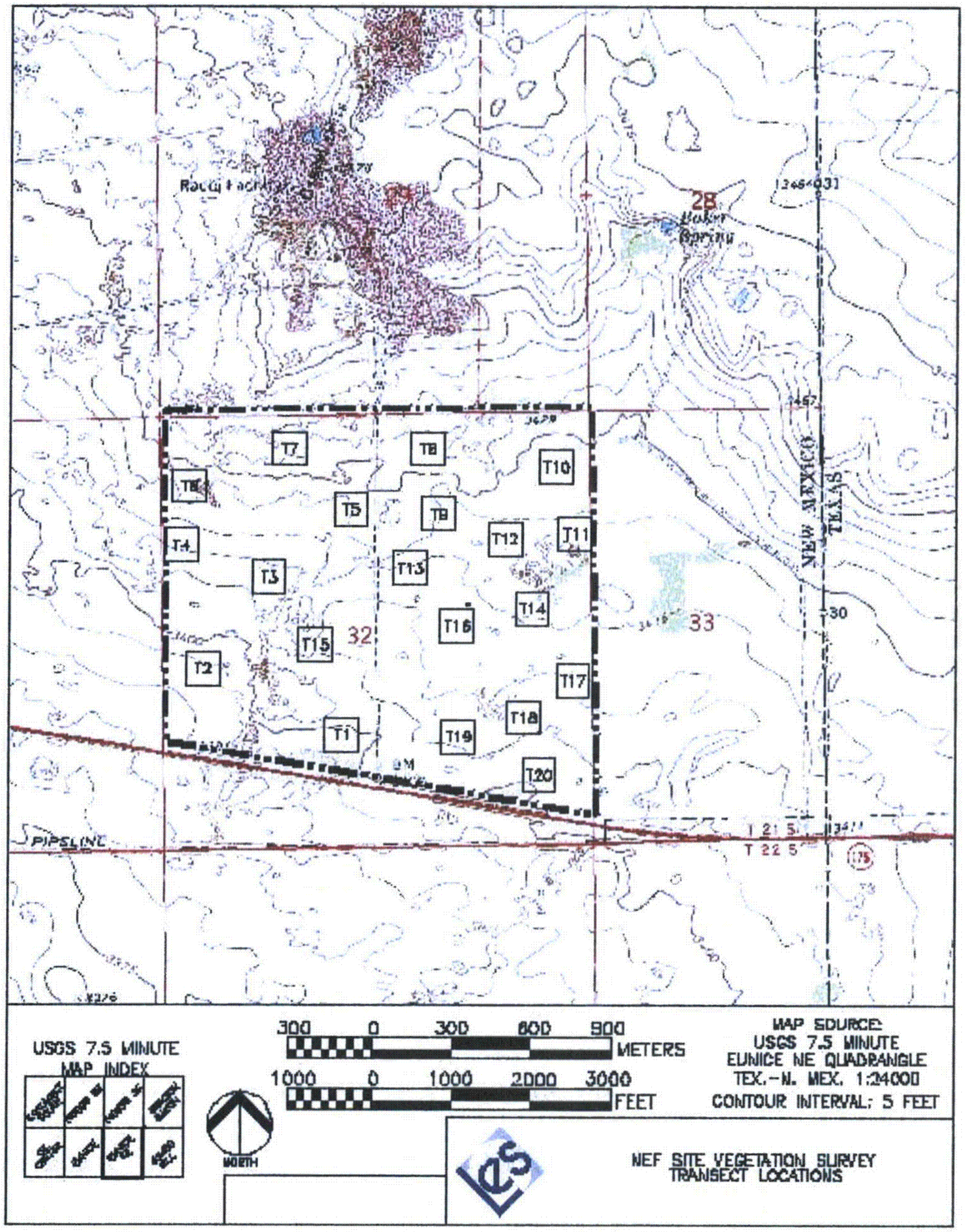


Figure 3.5-2NEF Site Vegetation Survey Transect Locations

3.6 METEOROLOGY, CLIMATOLOGY AND AIR QUALITY

In this section, data characterizing the meteorology (e.g., winds, precipitation, and temperature) for the proposed National Enrichment Facility (NEF) site are presented along with discussions on severe storms, ambient air quality, and the impact of local terrain features on site meteorology.

3.6.1 Onsite Meteorological Conditions

The meteorological conditions at the NEF have been evaluated and summarized in order to characterize the site climatology and to provide a basis for predicting the dispersion of gaseous effluents. No onsite meteorological data were available, however, Waste Control Specialists (WCS) have a meteorological monitoring station within approximately 1.6 km (1 mi) from the proposed NEF site.

Climate information from Hobbs, New Mexico, 32 km (20 mi) north of the site, obtained from the Western Regional Climate Center, was used. In addition, National Oceanic and Atmospheric Administration (NOAA) Local Climatological Data (LCD) recorded at Midland-Odessa Regional Airport, Texas, 103 km (64 mi) southeast of the site and at Roswell, New Mexico, 161 km (100 mi) northwest of the site were used. In the following summaries of meteorological data, the averages are based on:

- Hobbs station (WRCC, 2003) averages are based on a 30-year record (1971 to 2000) unless otherwise stated,
- Midland-Odessa station (NOAA, 2002a) averages are based on a 30-year record (1961 to 1990) unless otherwise stated,
- Roswell station (NOAA, 2002b) averages are based on a 30-year record (1961 to 1990) unless otherwise stated.

The meteorological tower in use at WCS is 10 m (32.8 ft) tall with ambient temperature measurements at 10 m and 2 m (32.8 ft and 6.6 ft) above ground level. Although there are wind speed and direction measurements, there are no data to determine atmospheric stability. WCS provided unvalidated hourly meteorological data from January 2000 through December 2001. These were the only full years of data available from WCS at the time of the analysis.

The WCS meteorological data were reviewed and analyzed for the specific purpose of determining the prevailing wind direction in the vicinity of the proposed NEF site. Use of the WCS data for this purpose is acceptable because it was consistent with the Midland-Odessa and Roswell data, although the WCS data was not from a first-order source. This analysis indicates that the prevailing wind direction in the vicinity of the NEF site is consistent with the prevailing wind directions at Midland-Odessa and Roswell. The WCS data, however, were not used for the purpose of characterizing atmospheric transport and diffusion processes at the NEF site because these data have not been fully verified by WCS. Instead, the Midland-Odessa data were used for this purpose. Use of the Hobbs, Midland-Odessa, and Roswell observations for a general description of the meteorological conditions at the NEF was deemed appropriate as they are all located within the same region and have similar climates. Use of the Midland-Odessa data for predicting the dispersion of gaseous effluents was deemed appropriate. It is the closest first-order National Weather Service (NWS) station to the NEF site and both Midland-Odessa and the NEF site have similar climates. In addition, wind direction frequency comparisons between Midland-Odessa and the closest source of meteorological measurements (WCS) to the NEF site show good agreement as reflected in Table 3.6-22, Wind Frequency Distribution, and Figure 3.6-12, Comparison of WCS and Midland-Odessa Wind Direction Data. There are five years of data from Midland-Odessa (five years of data is considered to be a minimum when using EPA air dispersion codes to perform air quality analyses), and the EPA had filled in all missing data values in the Midland-Odessa data set, as required for use with EPA air dispersion models. Midland-Odessa and Roswell data were compiled and certified by the National Climatic Data Center. Hobbs data were compiled and certified by the Western Regional Climate Center.

The information for Midland-Odessa and Roswell did not contain monthly and annual dewpoint temperature summaries, number of hours with precipitation, hourly rainfall rate distribution, description of local airflow patterns and characteristics, hourly averages of wind speed and direction, and estimated monthly mixing height data.

3.6.1.1 Regional Climate

The NEF site is located in the Southeast Plains of New Mexico close to the border with Texas. The climate is typical of a semi-arid region, with generally mild temperatures, low precipitation and humidity, and a high evaporation rate. Vegetation consists mainly of native grasses and some mesquite trees. During the winter, the weather is often dominated by a high pressure system located in the central part of the western United States and a low pressure system located in north-central Mexico. During the summer, the region is affected by a low pressure system normally located over Arizona.

3.6.1.2 Temperature

A summary of 30 years of temperature data (Table 3.6-1A, Hobbs, New Mexico, Temperature Data (1971-2000)) collected at the Hobbs, New Mexico, Cooperative Observer's Station shows a mean annual temperature of 16.8°C (62.2°F) with the mean monthly temperature ranging from 6.1°C (42.9°F) in January to 26.7°C (80.1°F) in July. The highest mean maximum temperature on record is 38.9°C (102.1°F) and the lowest mean minimum temperature is -5.1°C (22.8°F).

Mean monthly temperatures in Midland-Odessa (NOAA, 2002a) range from 5.8°C (42.5°F) in January to 27.8°C (82.0°F) in July. The lowest daily minimum temperature was -23.9°C (-11.0°F) in February 1985 and the highest daily maximum temperature was 46.7°C (116.0°F) in June 1994. The average relative humidity ranges approximately from 45% to 61%. Highest humidities occur mainly during the early morning hours (NOAA, 2002a). For the Midland-Odessa data, the daily and monthly mean values and extremes of temperature, and the monthly averages of mean relative humidity, are listed in Table 3.6-2, Midland-Odessa, Texas Temperature Data and Table 3.6-3, Midland-Odessa, Texas Relative Humidity Data, respectively. The temperature summaries are based on 30-year records.

Mean monthly temperatures in Roswell (NOAA, 2002b) range from 4.2°C (39.5°F) in January to 27.1°C (80.7°F) in July. The lowest daily minimum temperature was -22.8°C (–9.0°F) in January 1979 and the highest daily maximum temperature was 45.6°C (114.0°F) in June 1994. The average relative humidity of observations taken every 6 hours ranges approximately from 22% to 76%. Highest humidities occur mainly during the early morning hours (NOAA, 2002b). For the Roswell data, the daily and monthly mean values and extremes of temperature, and the monthly averages of mean relative humidity, are listed in Table 3.6-4, Roswell, New Mexico Temperature Data and Table 3.6-5, Roswell, New Mexico Relative Humidity Data, respectively. These temperature summaries are based on 30-year records.

3.6.1.3 Precipitation

The normal annual total rainfall as measured in Hobbs is 46.1 cm (18.2 in). Precipitation amounts range from an average of 1.2 cm (0.5 in) in March to 8 cm (3.1 in) in September. Record maximum and minimum monthly totals are 35.1 cm (13.8 in) and zero. Table 3.6-1B, Hobbs, New Mexico, Precipitation Data (1971-2000) lists the monthly averages and extremes of precipitation for the Hobbs data. These precipitation summaries are based on 30-year records.

The normal annual total rainfall in Midland-Odessa is 37.6 cm (14.8 in). Precipitation amounts range from an average of 1.1 cm (0.4 in) in March to 5.9 cm (2.3 in) in September. Record maximum and minimum monthly totals are 24.6 cm (9.7 in) and zero, respectively. The highest 24-hr precipitation total was 15.2 cm (6.0 in) in July 1968 (NOAA, 2002a). Table 3.6-6, Midland-Odessa, Texas Precipitation Data lists the monthly averages and extremes of precipitation for the Midland-Odessa data. These precipitation summaries are based on 30-year records.

The normal annual rainfall total in Roswell, New Mexico, is 33.9 cm (13.3 in). Record maximum and minimum monthly totals are 17.5 cm (6.9 in) and zero, respectively (NOAA, 2002a, 2002b). The highest 24-hr precipitation total was 12.5 cm (4.91 in) in July 1981 (NOAA, 2002b). Table 3.6-7, Roswell, New Mexico Precipitation Data, lists the monthly averages and extremes of precipitation for the Roswell data. These precipitation summaries are based on 30-year records.

Snowfall in Midland-Odessa, Texas, averages 13.0 cm (5.1 in) per year. Maximum monthly snowfall/ice pellets of 24.9 cm (9.8 in) fell in December 1998. The maximum amount of snowfall/ice pellets to fall in 24 hours was 24.9 cm (9.8 in) in December 1998 (NOAA, 2002a). Table 3.6-8, Midland-Odessa, Texas Snowfall Data, lists the monthly averages and maximums of snowfall/ice pellets. These snowfall summaries are based on 30-year records.

Snowfall in Roswell, New Mexico, averages 30.2 cm (11.9 in) per year. Maximum monthly snowfall/ice pellets of 53.3 cm (21.0 in) fell in December 1997. The maximum amount of snowfall/ice pellets to fall in 24 hours was 41.9 cm (16.5 in) in February 1988 (NOAA, 2002b). Table 3.6-9, Roswell, New Mexico Snowfall Data, lists the monthly averages and maximums of snowfall/ice pellets. These snowfall summaries are based on 30-year records.

There was no snowfall information for Hobbs, New Mexico, presumably because snowfall events are extremely rare.

3.6.1.4 Wind

Monthly mean wind speeds and prevailing wind directions at Midland-Odessa are presented in Table 3.6-10, Midland-Odessa, Texas Wind Data. The annual mean wind speed was 4.9 m/sec (11.0 mi/hr) and the prevailing wind direction was 180 degrees with respect to true north. The maximum five-second wind speed was 3.13 m/s (70 mi/hr).

Monthly mean wind speeds and prevailing wind directions at Roswell are presented in Table 3.6-11, Roswell, New Mexico Wind Data. The annual mean wind speed was 3.7 m/sec (8.2 mi/hr) and the prevailing wind direction was wind from 160 degrees with respect to true north. The maximum five-second wind speed 27.7 m/s (62.0 mi/hr).

Five years of data (1987-1991) from the Midland-Odessa NWS were used to generate joint frequency distributions of wind speed and direction. This data summary, for all Pasquill stability classes (A-F) combined, is provided in Table 3.6-12, Midland-Odessa Five Year (1987-1991) Annual Joint Frequency Distribution for All Stability Classes Combined.

Cooperative station meteorological wind data are available for Hobbs, New Mexico, but the data were not included in this ER because the data was not from a first-order source. A first-order weather data source is one obtained from a major weather station staffed by the NWS personnel, whereas, a cooperative source is one that cooperates with NWS, but not supervised by NWS staff.

3.6.1.5 Atmospheric Stability

Five years of data (1987-1991) from the Midland-Odessa NWS were used to generate joint frequency distributions of wind speed and direction as a function of Pasquill stability class (A-F). Stability class was determined using the solar radiation/cloud cover method. These data are given in Tables 3.6-13 through 3.6-18. The most stable classes, E and F, occur 18.3% and 13.6% of the time, respectively. The least stable class, A, occurs 0.4% of the time. Important conditions for atmospheric dispersion, stable (Pasquill Class F) and low wind speeds 0.4 to 1.3 m/s (1.0 to 3.0 mi/hr), occur 2.2% of the time. The highest occurrences of Pasquill Class F and low wind speeds, 0.4 to 1.3 m/s (1.0 to 3.0 mi/hr), with respect to wind direction are 0.28% and 0.23% with south and south-southeast winds.

The same data set was used to generate wind rose plots, Figures 3.6-1 through 3.6-5. These figures show wind speed and direction frequency for each year. Figure 3.6-6, Midland, Texas 1987-1991 Wind Rose shows wind speed and direction for all years combined.

3.6.1.6 Storms

Thunderstorms occur during every month but are most common in the spring and summer months. Thunderstorms occur an average of 36.4 days/year in Midland-Odessa (based on a 54-year period of record as indicated in (NOAA, 2002a). The seasonal averages are: 11 days in spring (March through May); 17.4 days in summer (June through August); 6.7 days in fall (September through November); and 1.3 days in winter (December through February).

J. L. Marshall (Marshall, 1973) presented a methodology for estimating lightning strike frequencies which includes consideration of the attractive area of structures. His method consists of determining the number of lightning flashes to earth per year per square kilometer and then defining an area over which the structure can be expected to attract a lightning strike. Assuming that there are 4 flashes to earth per year per square kilometer (10.36 flashes to earth per year per square mile) in the vicinity of the NEF (conservatively estimated using Figure 3.6-7, Average Lightning Flash Density, which is taken from the National Weather Service (NWS, 2003). Marshall defines the total attractive area, A, of a structure with length L, width W, and height H, for lightning flashes with a current magnitude of 50 percent of all lightning flashes as:

$$A = LW + 4H (L + W) + 12.57 H^2$$

The following building complex dimensions, including the UBC Storage Pad, were used to estimate conservatively the attractive area of the NEF. The building complex dimensions are determined by taking the length (L) and width (W) of the ground rectangle that would encompass the entire disturbed area of the site, whereas the height (H) is the height of the tallest building in the complex.

$L = 534$ m (1,752 ft), $W = 534$ m (1,752 ft), $H = 20^1/_4$ m ($66^1/_2$ ft)

The total attractive area is therefore equal to 0.34 km^2 (0.1455 mi^2). Consequently, the lightning strike frequency computed using Marshall's methodology is given as 1.51 flashes per year.

Tornadoes occur infrequently in the vicinity of the NEF. Only two significant tornadoes (i.e., F2 or greater) were reported in Lea County, New Mexico, (Grazulis, 1993) from 1880-1989. Across the state line, only one significant tornado was reported in Andrews County, Texas, (Grazulis, 1993) from 1880-1989.

Tornadoes are commonly classified by their intensities. The F-Scale classification of tornados is based on the appearance of the damage that the tornado causes. There are six classifications, F0 to F5, with an F0 tornado having winds of 64 to 116 km/hr (40 to 72 mi/hr) and an F5 tornado having winds of 420 to 512 km/hr (261-318 mi/hr) (AMS, 1996). The two tornadoes reported in Lea County were estimated to be F2 tornadoes (Grazulis, 1993).

Hurricanes, or tropical cyclones, are low-pressure weather systems that develop over the tropical oceans. These storms are classified during their life cycle according to their intensity:

- Tropical depression – wind speeds less than 63 km/hr (39 mi/hr)
- Tropical storm – wind speed between 63 and 118 km/hr (39 and 73 mi/hr)
- Hurricane – wind speeds greater than 118 km/hr (73 mi/hr)

Hurricanes are fueled by the relatively warm tropical ocean water and lose their intensity quickly once they make landfall. Since the NEF is sited about 805 km (500 mi) from the coast, it is most likely that any hurricane that tracked towards it would have dissipated to the tropical depression stage, that is, wind speeds less than 63 km/hr (39 mi/hr), before it reached the NEF.

3.6.1.7 Mixing Heights

Mixing height is defined as the height above the earth's surface through which relatively strong vertical mixing of the atmosphere occurs. Holzworth developed mean annual morning and afternoon mixing heights for the contiguous United States (EPA, 1972). This information is presented in Figure 3.6-8, Annual Average Morning Mixing Heights and Figure 3.6-9, Annual Average Afternoon Mixing Heights. From these figures, the mean annual morning and afternoon mixing heights for the NEF are approximately 450 m (1,476 ft) and 2,300 m (7,544 ft), respectively.

3.6.1.8 Sandstorms

Blowing sand or dust may occur occasionally in the area due to the combination of strong winds, sparse vegetation, and the semi-arid climate. High winds associated with thunderstorms are frequently a source of localized blowing dust. Dust storms that cover an extensive region are rare, and those that reduce visibility to less than 1.6 km (1 mi) occur only with the strongest pressure gradients such as those associated with intense extratropical cyclones which occasionally form in the area during winter and early spring (DOE, 2003d).

3.6.2 Existing Levels Of Air Pollution And Their Effects On Plant Operations

The United States Environmental Protection Agency (EPA) uses six criteria pollutants as indicators of air quality. Maximum concentrations, above which adverse effects on human health may occur, have been set. These concentrations are referred to as the National Ambient Air Quality Standards (NAAQS). Areas either meet the national primary or secondary air quality standards for the criteria pollutants (attainment) or do not meet the national primary or secondary air quality standards for the criteria pollutants (nonattainment). The criteria pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead.

Ozone is a photochemical (formed in chemical reactions between volatile organic compounds and nitrogen oxides in the presence of sunlight) oxidant and the major component of smog. Exposure to ozone for several hours at low concentrations has been shown to significantly reduce lung function and induce respiratory inflammation in normal, healthy people during exercise. Other symptoms include chest pain, coughing, sneezing, and pulmonary congestion.

Carbon monoxide is an odorless, colorless, poisonous gas produced by incomplete burning of carbon in fuels. Exposure to carbon monoxide reduces the delivery of oxygen to the body's organs and tissues. Elevated levels can cause impairment of visual perception, manual dexterity, learning ability, and performance of complex tasks.

Nitrogen dioxide is a brownish, highly reactive gas that is present in all urban environments. It is an important precursor to both ozone and acid rain. Exposure to nitrogen dioxide can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections.

Sulfur dioxide results largely from stationary sources such as coal and oil combustion, steel and paper mills, and refineries. It is a primary contributor to acid rain and contributes to visibility impairments in large parts of the country. Exposure to sulfur dioxide can affect breathing and may aggravate existing respiratory and cardiovascular disease.

Particulate matter, such as dust, dirt, soot, smoke, and liquid droplets, are emitted into the air by sources such as factories, power plants, cars, construction activity, fires, and natural windblown dust. Exposure to high concentrations of particulate matter can effect breathing, cause respiratory symptoms, aggravate existing respiratory and cardiovascular disease, alter the body's defense systems against foreign materials, damage lung tissue, and cause premature death.

Lead can be inhaled, ingested in food, water, soil, or dust. High exposure to lead can cause seizures, mental retardation, and/or behavioral disorders. Low exposure to lead can lead to central nervous system damage.

According to information from the EPA (EPA, 2003a), both Lea County, New Mexico, and Andrews County, Texas, are in attainment for all of the criteria pollutants (see Figure 3.6-10, EPA Criteria Pollutant Nonattainment Map). Air quality in the region is very good and should have no impact on plant operations. Air emissions during site preparation and plant construction could include particulate matter and other pollutants; these potential emissions are also addressed in ER Section 4.6. Table 3.6-19, National Ambient Air Quality Standards lists the National Ambient Air Quality Standards (EPA, 2003b).

The closest monitoring station operated to the site by the Monitoring Section of the New Mexico Air Quality Bureau is about 32 km (20 mi) north of the site in Hobbs, New Mexico. This station monitors particulate matter, particles 2.5 μm or less in diameter. Summary readings from this monitor are presented in Table 3.6-20, Hobbs, New Mexico Particulate Matter Monitor Summary. No instances of the particulate matter National Ambient Air Quality Standards being exceeded have been measured by this monitoring station.

There are 54 sources of criteria pollutants in Lea County, New Mexico, and six sources in Andrews County, Texas, listed in the EPA AirData data base for emissions year 1999 (EPA, 2003b). Table 3.6-21, Existing Sources of Criteria Air Pollutants (1999), lists the AirData Monitor Summary Report. Readers are cautioned not to infer a qualitative ranking order of geographic areas based on AirData reports. Air pollution levels measured in the vicinity of a particular monitoring site may not be representative of the prevailing air quality of a county or urban area. Pollutants emitted from a particular source may have little impact on the immediate geographic area, and the amount of pollutants emitted does not indicate whether the source is complying with applicable regulations.

3.6.3 The Impact Of The Local Terrain And Bodies Of Water On Meteorological Conditions

Local terrain in the form of hills, valleys, and large water bodies can have a significant impact on meteorological conditions. The NEF site lies in a semi-arid region of the southwestern corner of the High Plains. The site is at approximately 1,037 m (3,400 ft) above mean sea level. The site is relatively flat, with elevations varying only about 15 m (50 ft). Figure 3.6-11, Topographic Map of Site shows the topography near the NEF site. Therefore, LES expects that there will be no impacts on meteorological conditions from local terrain and bodies of water onsite or nearby. For land use information, see ER Section 3.1, Land Use.

3.6.4 Section 3.6 Tables

Table 3.6-1AHobbs, New Mexico, Temperature Data (1971-2000)

Month	Mean Monthly Temperature °C (°F)	Highest Mean Temperature °C (°F)	Lowest Mean Temperature °C (°F)	Highest Mean Maximum Temperature °C (°F)	Lowest Mean Minimum Temperature °C (°F)
January	6.1 (42.9)	8.8 (47.8)	2.6 (36.6)	18.2 (64.7)	-5.1 (22.8)
February	8.9 (48.0)	12.6 (54.6)	5.8 (42.5)	21.8 (71.3)	-1.9 (28.5)
March	12.7 (54.8)	16.4 (61.6)	9.3 (48.7)	26.2 (79.1)	1.1 (33.9)
April	17.0 (62.6)	19.9 (67.8)	13.9 (57)	28.8 (83.8)	5.3 (41.5)
May	21.6 (70.9)	25.5 (77.9)	19.2 (66.6)	34.7 (94.5)	10.3 (50.5)
June	25.5 (77.9)	29.3 (84.8)	23.2 (73.7)	38.6 (101.5)	15.3 (59.5)
July	26.7 (80.1)	30.0 (86.0)	23.8 (74.8)	38.9 (102.1)	17.1 (62.7)
August	25.7 (78.3)	27.8 (82.0)	22.7 (72.9)	35.8 (96.4)	16.2 (61.1)
September	22.4 (72.3)	25.3 (77.5)	18.9 (66)	33.7 (92.6)	12.3 (54.2)
October	17.3 (63.2)	19.2 (66.6)	13.8 (56.9)	29.1 (84.4)	5.4 (41.7)
November	10.7 (51.3)	13.6 (56.4)	7.2 (44.9)	23.1 (73.5)	-0.7 (30.8)
December	6.7 (44.0)	9.4 (48.9)	3.1 (37.6)	18.6 (65.4)	-5.1 (22.8)
Annual	16.8 (62.2)	30.0 (86.0)	2.6 (36.6)	38.9 (102.1)	-5.1 (22.8)

(WRCC, 2003)

Table 3.6-1BHobbs, New Mexico, Precipitation Data (1971-2000)

Precip cm (in)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	1.3 (0.5)	1.7 (0.7)	1.2 (0.5)	2.0 (0.8)	6.6 (2.6)	5.2 (2.0)	6.1 (2.4)	6.4 (2.5)	8.0 (3.1)	3.7 (1.4)	2.2 (0.9)	1.8 (0.7)	46.1 (18.2)
Max	5.2 (2.0)	5.6 (2.2)	7.6 (3.0)	7.3 (2.9)	35.1 (13.8)	13.6 (5.4)	23.9 (9.4)	23 (9.1)	33 (13.0)	20.7 (8.2)	11 (4.3)	12.9 (5.1)	35.1 (13.8)
Min	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.6 (0.2)	0.3 (0.1)	0.2 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)

(WRCC, 2003)

Table 3.6-2Midland-Odessa, Texas, Temperature Data

Month	Mean Monthly Temperature °C (°F)	Mean Daily Maximum Temperature °C (°F)	Mean Daily Minimum Temperature °C (°F)	Highest Daily Maximum Temperature °C (°F)	Lowest Daily Minimum Temperature °C (°F)
January	5.8 (42.5)	13.9 (57.0)	-1.2 (29.9)	28.9 (84.0)	-22.2 (-8.0)
February	8.4 (47.1)	16.8 (62.3)	1.1 (33.9)	32.2 (90.0)	-23.9 (-11.0)
March	13.2 (55.7)	21.0 (69.8)	4.7 (40.5)	35.0 (95.0)	-12.8 (9.0)
April	18.1 (64.6)	26.0 (78.8)	9.7 (49.5)	38.3 (101.0)	-6.7 (20.0)
May	22.7 (72.8)	30.4 (86.6)	15.1(59.1)	42.2 (108.0)	1.1 (34.0)
June	26.4 (79.6)	33.7 (93.0)	19.4 (67.0)	46.7 (116.0)	8.3 (47.0)
July	27.8 (82.0)	34.6 (94.5)	20.8 (69.4)	44.4 (112.0)	11.7 (53.0)
August	27.1 (80.8)	33.8 (93.3)	20.2 (68.3)	41.7 (107.0)	12.2 (54.0)
September	22.9 (73.7)	30.1 (86.5)	16.6 (61.9)	41.7 (107.0)	2.2 (36.0)
October	17.8 (64.0)	25.2 (77.7)	10.8 (51.5)	38.3 (101.0)	-4.4 (24.0)
November	11.4 (52.6)	18.8 (65.9)	3.9 (39.1)	32.2 (90.0)	-11.7 (11.0)
December	7.0 (44.6)	14.7 (58.8)	-0.1 (31.8)	29.4 (85.0)	-18.3 (-1.0)
Annual	17.4 (63.3)	25.0 (77.0)	10.1 (50.2)	46.7 (116.0)	-23.9 (-11.0)

Source: (NOAA, 2002a)

Table 3.6-3Midland-Odessa, Texas, Relative Humidity Data

Relative Humidity (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	57	55	46	45	51	53	51	54	61	60	59	58	54
00 LST	63	62	54	52	60	61	57	60	69	70	68	65	62
06 LST	71	72	66	66	75	77	73	75	80	79	76	72	74
12 LST	46	44	36	34	38	42	42	43	50	46	45	45	43
18 LST	41	36	28	27	31	33	34	36	44	43	44	44	37

Time of Day, 24-Hour Clock

LST = Local Standard Time

Source: (NOAA, 2002a)

Table 3.6-4Roswell, New Mexico, Temperature Data

Month	Mean Monthly Temperature °C (°F)	Mean Daily Maximum Temperature °C (°F)	Mean Daily Minimum Temperature °C (°F)	Highest Daily Maximum Temperature °C (°F)	Lowest Daily Minimum Temperature °C (°F)
January	4.2 (39.5)	12.5 (54.5)	-3.1 (26.4)	27.8 (82.0)	-22.8 (-9.0)
February	6.9 (44.5)	15.8 (60.4)	-0.7 (30.8)	29.4 (85.0)	-16.1 (3.0)
March	11.2 (52.1)	19.9 (67.8)	2.8 (37.1)	33.9 (93.0)	-12.8 (9.0)
April	16.1 (61.0)	24.7 (76.5)	7.6 (45.7)	37.2 (99.0)	-5.0 (23.0)
May	20.9 (69.7)	29.6 (85.3)	13.0 (55.4)	41.7 (107.0)	1.1 (34.0)
June	25.5 (77.9)	34.2 (93.5)	17.8 (64.1)	45.6 (114.0)	8.3 (47.0)
July	27.1 (80.7)	34.6 (94.2)	19.3 (66.8)	43.9 (111.0)	NA
August	25.8 (78.4)	33.4 (92.2)	19.3 (66.7)	41.7 (107.0)	12.2 (54.0)
September	22.6 (72.6)	29.8 (85.7)	15.3 (59.5)	39.4 (103.0)	4.4 (40.0)
October	16.8 (62.2)	24.6 (76.2)	8.6 (47.4)	37.2 (99.0)	-10.0 (14.0)
November	10.3 (50.6)	17.7 (63.8)	1.6 (34.9)	31.1 (88.0)	-15.6 (4.0)
December	4.9 (40.8)	13.0 (55.4)	-2.8 (27.0)	27.2 (81.0)	-22.2 (-8.0)
Annual	16.0 (60.8)	24.2 (75.5)	8.2 (46.8)	45.6 (114.0)	-22.8 (-9.0)

Source: (NOAA, 2002b)

NA: Not available

Table 3.6-5Roswell, New Mexico, Relative Humidity Data

Relative Humidity (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	57	51	40	36	40	43	49	54	58	54	53	54	49
00 LST	71	66	56	53	59	64	68	74	76	70	66	66	66
06 LST	50	45	33	30	32	36	41	45	49	44	44	47	41
12 LST	40	34	24	22	24	27	32	37	41	36	38	40	33
18 LST	62	55	44	41	44	47	54	60	64	60	58	60	54

Time of Day, 24-Hour Clock

LST = Local Standard Time

Source: (NOAA, 2002b)

Table 3.6-6Midland-Odessa, Texas, Precipitation Data 1961-1990

Precipitation cm (in)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	1.3 (0.53)	1.5 (0.58)	1.1 (0.42)	1.9 (0.73)	4.5 (1.79)	4.3 (1.71)	4.8 (1.89)	4.5 (1.77)	5.9 (2.31)	4.5 (1.77)	1.7 (0.65)	1.7 (0.65)	37.6 (14.8)
Maximum	9.3 (3.66)	6.5 (2.55)	7.3 (2.86)	7.2 (2.85)	19.4 (7.63)	10.0 (3.93)	21.6 (8.50)	11.3 (4.43)	24.6 (9.70)	18.9 (7.45)	5.9 (2.32)	8.4 (3.30)	24.6 (9.70)
Minimum	0.0 (0.00)	0.0 (0.00)	T T	0.0 (0.00)	0.1 (0.02)	0.03 (0.01)	T T	0.1 (0.05)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	T T	0.0 (0.00)
Maximum in 24 hours	2.9 (1.15)	3.4 (1.32)	5.6 (2.2)	4.1 (1.62)	12.1 (4.75)	7.8 (3.07)	15.2 (5.99)	6.1 (2.41)	11.1 (4.37)	9.1 (3.59)	5.5 (2.16)	2.3 (0.9)	15.2 (5.99)

T = trace amount

Source: (NOAA, 2002a)

Table 3.6-7Roswell, New Mexico, Precipitation Data

Precipitation cm (in)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average	1.0 (0.39)	1.0 (0.41)	0.9 (0.35)	1.5 (0.58)	3.3 (1.30)	4.1 (1.62)	5.1 (1.99)	5.9 (2.31)	5.0 (1.98)	3.3 (1.29)	1.3 (0.53)	1.5 (0.59)	33.9 (13.34)
Maximum	2.6 (1.03)	5.1 (2.02)	7.2 (2.84)	6.3 (2.48)	11.6 (4.57)	12.8 (5.02)	17.5 (6.88)	16.5 (6.48)	16.7 (6.58)	15.0 (5.91)	5.4 (2.11)	7.8 (3.07)	17.5 (6.88)
Minimum	0.1 (0.03)	0.0 (0.00)	0.0 (0.00)	0.0 (0.01)	T T	0.1 (0.02)	0.0 (0.01)	0.2 (0.07)	0.1 (0.05)	T T	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Maximum in 24 hours	1.7 (0.67)	3.6 (1.41)	5.6 (2.22)	5.7 (2.24)	4.5 (1.77)	7.7 (3.05)	12.5 (4.91)	10.0 (3.94)	6.9 (2.71)	9.9 (3.89)	3.4 (1.33)	2.8 (1.10)	12.5 (4.91)

T = trace amount

Source: (NOAA, 2002b)

Table 3.6-8 Midland-Odessa, Texas, Snowfall Data 1961-1990

Snowfall cm (in)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	5.6 (2.2)	1.8 (0.7)	0.5 (0.2)	0.3 (0.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.* (0.*)	1.3 (0.5)	3.6 (1.4)	13.0 (5.1)
Maximum	22.9 (9.0)	9.9 (3.9)	15.0 (5.9)	5.1 (2.0)	T T	T T	T T	T T	T T	1.5 (0.6)	20.3 (8.0)	24.9 (9.8)	24.9 (9.8)
Maximum in 24 hours	17.3 (6.8)	9.9 (3.9)	12.7 (5.0)	5.1 (2.0)	T T	T T	T T	T T	T T	1.5 (0.6)	15.2 (6.0)	24.9 (9.8)	24.9 (9.8)

0.* indicates the value is between 0.0 and 1.3 cm (0.0 and 0.5 in)

Source: (NOAA, 2002a)

Table 3.6-9Roswell, New Mexico, Snowfall Data 1961-1990

Snowfall cm (in)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	7.9 (3.1)	6.6 (2.6)	2.3 (0.9)	1.0 (0.4)	0.* (0.*)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.8 (0.3)	3.3 (1.3)	8.4 (3.3)	30.2 (11.9)
Maximum	26.4 (10.4)	42.9 (16.9)	12.2 (4.8)	13.5 (5.3)	2.0 (0.8)	2.5 (1.0)	0.0 (0.0)	0.0 (0.0)	2.5 (1.0)	10.7 (4.2)	31.2 (12.3)	53.3 (21.0)	53.3 (21.0)
Maximum in 24 hours	18.5 (7.3)	41.9 (16.5)	12.2 (4.8)	10.2 (4.0)	5.1 (2.0)	2.5 (1.0)	0.0 (0.0)	0.0 (0.0)	2.5 (1.0)	7.9 (3.1)	16.0 (6.3)	24.6 (9.7)	41.9 (16.5)

0.* indicates the value is between 0.0 and 1.3 cm (0.0 and 0.5 in)

Source: (NOAA, 2002b)

Table 3.6-10Midland-Odessa, Texas, Wind Data
1961-1990

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Speed m/sec (mi/hr)	4.6 (10.4)	5.0 (11.2)	5.5 (12.4)	5.6 (12.6)	5.5 (12.4)	5.5 (12.2)	4.8 (10.7)	4.4 (9.9)	4.4 (9.9)	4.4 (9.9)	4.6 (10.3)	4.5 (10.1)	4.9 (11.0)
Prevailing Direction degrees from True North	180	180	180	180	180	160	160	160	160	180	180	180	180
Maximum 5-second speed m/sec (mi/hr)	22.8 (51.0)	23.2 (52.0)	24.1 (54.0)	26.4 (59.0)	24.6 (55.0)	21.9 (49.0)	26.4 (59.0)	28.6 (64.0)	31.3 (70.0)	20.6 (46.0)	20.1 (45.0)	21.9 (49.0)	31.3 (70.0)

Source: (NOAA, 2002a)

Table 3.6-11Roswell, New Mexico, Wind Data
1961-1990

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Speed m/sec (mi/hr)	3.1 (6.9)	3.6 (8.1)	4.2 (9.5)	4.4 (9.8)	4.3 (9.6)	4.3 (9.6)	3.8 (8.5)	3.4 (7.7)	3.4 (7.6)	3.3 (7.3)	3.2 (7.2)	3.1 (6.9)	3.7 (8.2)
Prevailing Direction degrees from True North	360	160		160	160	160	140	140	160	160	160	360	160
Maximum 5-second speed m/sec (mi/hr)	24.1 (54.0)	24.1 (54.0)	24.1 (54.0)	26.4 (59.0)	24.6 (55.0)	27.7 (62.0)	26.4 (59.0)	20.1 (45.0)	22.8 (51.0)	21.5 (48.0)	23.7 (53.0)	22.8 (51.0)	27.7 (62.0)

Source: (NOAA, 2002b)

Table 3.6-12Midland-Odessa Five Year (1987-1991) Annual Joint Frequency Distribution For All Stability Classes Combined

Jan. 1, 1987-Dec. 31, 1991
Wind Speed m/s (mi/hr)
Calm = 2.53%

Direction	0.5-1.3 (1-3)	1.8-3.1 (4-7)	3.6-5.4 (8-12)	5.8-8.1 (13-18)	8.5-10.7 (19-24)	≥11 (24.5)	Total
N	119	702	722	563	225	57	2388
NNE	71	291	509	556	207	58	1692
NE	64	285	645	776	272	61	2103
ENE	51	382	738	726	170	27	2094
E	69	623	1176	713	95	15	2691
ESE	72	589	1061	557	75	12	2366
SE	70	931	1266	818	134	18	3237
SSE	127	1156	1555	1391	371	48	4648
S	168	1755	2763	3178	820	100	8784
SSW	100	813	1276	807	133	7	3136
SW	61	446	943	757	115	23	2345
WSW	68	356	667	637	191	78	1997
W	84	331	577	517	207	171	1887
WNW	77	244	281	269	75	51	997
NW	91	332	350	224	69	38	1104
NNW	79	500	365	228	80	20	1272
SubTotal	1371	9736	14894	12717	3239	784	42741

Table 3.6-13Midland-Odessa Five Year (1987-1991) Annual Joint Frequency Distribution Stability Class A

Jan. 1, 1987-Dec. 31, 1991
Wind Speed m/s (mi/hr)
Calm = 0.06%

Direction	0.5-1.3 (1-3)	1.8-3.1 (4-7)	3.6-5.4 (8-12)	5.8-8.1 (13-18)	8.5-10.7 (19-24)	≥11 (24.5)	Total
N	3	16	0	0	0	0	19
NNE	3	7	0	0	0	0	10
NE	0	8	0	0	0	0	8
ENE	2	12	0	0	0	0	14
E	3	15	0	0	0	0	18
ESE	3	8	0	0	0	0	11
SE	2	10	0	0	0	0	12
SSE	0	10	0	0	0	0	10
S	3	16	0	0	0	0	19
SSW	2	9	0	0	0	0	11
SW	0	12	0	0	0	0	12
WSW	1	6	0	0	0	0	7
W	0	5	0	0	0	0	5
WNW	0	2	0	0	0	0	2
NW	1	7	0	0	0	0	8
NNW	0	5	0	0	0	0	5
SubTotal	23	148	0	0	0	0	171

Table 3.6-14Midland-Odessa Five Year (1987-1991) Annual Joint Frequency Distribution Stability Class B

Jan. 1, 1987-Dec. 31, 1991
Wind Speed m/s (mi/hr)
Calm = 0.11%

Direction	0.5-1.3 (1-3)	1.8-3.1 (4-7)	3.6-5.4 (8-12)	5.8-8.1 (13-18)	8.5-10.7 (19-24)	≥11 (24.5)	Total
N	20	43	22	0	0	0	85
NNE	17	25	19	0	0	0	61
NE	16	32	22	0	0	0	70
ENE	14	46	36	0	0	0	96
E	6	69	62	0	0	0	137
ESE	17	50	44	0	0	0	111
SE	9	48	45	0	0	0	102
SSE	15	54	64	0	0	0	133
S	25	96	138	0	0	0	259
SSW	12	53	59	0	0	0	124
SW	14	42	49	0	0	0	105
WSW	12	43	43	0	0	0	98
W	16	51	17	0	0	0	84
WNW	11	25	13	0	0	0	49
NW	18	21	14	0	0	0	53
NNW	15	27	9	0	0	0	51
SubTotal	237	725	656	0	0	0	1618

Table 3.6-15Midland-Odessa Five Year (1987-1991) Annual Joint Frequency Distribution Stability Class C

Jan. 1, 1987-Dec. 31, 1991
Wind Speed m/s (mi/hr)
Calm = 0.12%

Direction	0.5-1.3 (1-3)	1.8-3.1 (4-7)	3.6-5.4 (8-12)	5.8-8.1 (13-18)	8.5-10.7 (19-24)	≥11 (24.5)	Total
N	9	54	124	20	8	3	218
NNE	3	36	87	37	5	1	169
NE	5	37	95	46	11	3	197
ENE	0	52	93	43	4	1	193
E	2	54	164	50	7	0	277
ESE	4	41	147	60	7	0	259
SE	3	36	179	109	10	1	338
SSE	1	65	264	199	52	5	586
S	6	103	527	408	95	19	1158
SSW	5	82	266	124	13	1	491
SW	1	59	238	115	11	2	426
WSW	3	43	180	61	22	7	316
W	5	39	100	76	21	10	251
WNW	4	36	57	25	7	1	130
NW	7	21	51	21	4	0	104
NNW	4	32	48	8	8	3	103
SubTotal	62	790	2620	1402	285	57	5216

Table 3.6-16Midland-Odessa Five Year (1987-1991) Annual Joint Frequency Distribution Stability Class D

Jan. 1, 1987-Dec. 31, 1991
Wind Speed m/s (mi/hr)
Calm = 0.18%

Direction	0.5-1.3 (1-3)	1.8-3.1 (4-7)	3.6-5.4 (8-12)	5.8-8.1 (13-18)	8.5-10.7 (19-24)	≥11 (24.5)	Total
N	8	112	308	543	217	54	1242
NNE	14	65	302	519	202	57	1159
NE	7	79	389	730	261	58	1524
ENE	6	104	426	683	166	26	1411
E	7	108	550	663	88	15	1431
ESE	13	95	458	497	68	12	1143
SE	5	92	514	709	124	17	1461
SSE	11	98	618	1192	319	43	2281
S	13	151	949	2770	725	81	4689
SSW	3	74	369	683	120	6	1255
SW	1	46	259	642	104	21	1073
WSW	2	42	182	576	169	71	1042
W	4	49	177	441	186	161	1018
WNW	5	29	81	244	68	50	477
NW	3	30	95	203	65	38	434
NNW	7	47	121	220	72	17	484
SubTotal	109	1221	5798	11315	2954	727	22124

Table 3.6-17Midland-Odessa Five Year (1987-1991) Annual Joint Frequency Distribution Stability Class E

Jan. 1, 1987-Dec. 31, 1991
Wind Speed m/s (mi/hr)
Calm = 0.00%

Direction	0.5-1.3 (1-3)	1.8-3.1 (4-7)	3.6-5.4 (8-12)	5.8-8.1 (13-18)	8.5-10.7 (19-24)	≥11 (24.5)	Total
N	0	133	268	0	0	0	401
NNE	0	64	101	0	0	0	165
NE	0	66	139	0	0	0	205
ENE	0	81	183	0	0	0	264
E	0	143	400	0	0	0	543
ESE	0	131	412	0	0	0	543
SE	0	236	528	0	0	0	764
SSE	0	259	609	0	0	0	868
S	0	380	1149	0	0	0	1529
SSW	0	145	582	0	0	0	727
SW	0	65	397	0	0	0	462
WSW	0	60	262	0	0	0	322
W	0	42	283	0	0	0	325
WNW	0	36	130	0	0	0	166
NW	0	50	190	0	0	0	240
NNW	0	98	187	0	0	0	285
SubTotal	0	1989	5820	0	0	0	7809

Table 3.6-18Midland-Odessa Five Year (1987-1991) Annual Joint Frequency Distribution Stability Class F

Jan. 1, 1987-Dec. 31, 1991
Wind Speed m/s (mi/hr)
Calm = 2.07%

Direction	0.5-1.3 (1-3)	1.8-3.1 (4-7)	3.6-5.4 (8-12)	5.8-8.1 (13-18)	8.5-10.7 (19-24)	≥11 (24.5)	Total
N	79	344	0	0	0	0	423
NNE	34	94	0	0	0	0	128
NE	36	63	0	0	0	0	99
ENE	29	87	0	0	0	0	116
E	51	234	0	0	0	0	285
ESE	35	264	0	0	0	0	299
SE	51	509	0	0	0	0	560
SSE	100	670	0	0	0	0	770
S	121	1009	0	0	0	0	1130
SSW	78	450	0	0	0	0	528
SW	45	222	0	0	0	0	267
WSW	50	162	0	0	0	0	212
W	59	145	0	0	0	0	204
WNW	57	116	0	0	0	0	173
NW	62	203	0	0	0	0	265
NNW	53	291	0	0	0	0	344
SubTotal	940	4863	0	0	0	0	5803

Table 3.6-19National Ambient Air Quality Standards

POLLUTANT	STANDARD VALUE *		STANDARD TYPE
Carbon Monoxide (CO)			
8-hr Average	9 ppm	(10 mg/m^3)	Primary
1-hr Average	35 ppm	(40 mg/m^3)	Primary
Nitrogen Dioxide (NO_2)			
Annual Arithmetic Mean	0.053 ppm	(100 µg/m^3)	Primary and Secondary
Ozone (O_3)			
1-hr Average	0.12 ppm	(235 µg/m^3)	Primary and Secondary
8-hr Average **	0.08 ppm	(157 µg/m^3)	Primary and Secondary
Lead (Pb)			
Quarterly Average	1.5 µg/m^3		Primary and Secondary
Particulate (PM_{10}) *Particles with diameters of 10 µm or less*			
Annual Arithmetic Mean	50 µg/m^3		Primary and Secondary
24-hr Average	150 µg/m^3		Primary and Secondary
Particulate ($PM_{2.5}$) *Particles with diameters of 2.5 µm or less*			
Annual Arithmetic Mean **	15 µg/m^3		Primary and Secondary
24-hr Average **	65 µg/m^3		Primary and Secondary
Sulfur Dioxide (SO_2)			
Annual Arithmetic Mean	0.03 ppm	(80 µg/m^3)	Primary
24-hr Average	0.14 ppm	(365 µg/m^3)	Primary
3-hr Average	0.50 ppm	(1300 µg/m^3)	Secondary

* Parenthetical value is an approximately equivalent concentration.

**The ozone 8-hr standard and the $PM_{2.5}$ standards are included for information only.

Source: (EPA, 2003b)

Table 3.6-20Hobbs, New Mexico, Particulate Matter Monitor Summary

98% $PM_{2.5}$ μg/m^3	Annual Mean $PM_{2.5}$ μg/m^3	99% PM_{10} μg/m^3	Annual Mean PM_{10} μg/m^3	Year	County
18	6.6	57	17	2002	Lea
13	5.5	61	23	2003	Lea

Note: National Ambient Air Quality Standards for PM2.5 and PM10 are located in Table 3.6-19

Source: (EPA, 2003b)

Table 3.6-21Existing Sources of Criteria Air Pollutants (1999)

Plant Name	Plant Address	CO metric tons (tons)	NO_x metric tons (tons)	VOC metric tons (tons)	SO_2 metric tons (tons)	$PM_{2.5}$ metric tons (tons)	PM_{10} metric tons (tons)	NH_3 metric tons (tons)
MALJAMAR GAS PLANT	3 Mi S Of Maljamar, Maljamar, NM 88264	412 (454)	1610 (1775)	208 (230)	1157 (1275)	15 (17)	15 (17)	0 (0)
EUNICE A COMP ST	1 Mi N Of Oil Center, Oil Center, NM 88240	504 (555)	3272 (3607)	61 (67)	0 (0)	0 (0)	0 (0)	1.3 (1.4)
DENTON PLT	10.5 Mi Ne Of Lovington, Lovington, NM 88260	39 (43)	499 (550)	23 (25)	882 (972)	0 (0)	0 (0)	0 (0)
JAL #3	5 Mi N. Of Jal, Jal, NM 88252	330 (363)	2224 (2452)	79 (87)	1094 (1206)	0 (0)	0 (0)	0.4 (0.4)
JAL #4	11 Mi N Of Jal, Jal, NM 88252	484 (533)	2048 (2257)	44 (48)	0 (0)	0 (0)	0 (0)	0 (0)
MONUMENT COMP STA	5 Km E Of Monument W Of Hwy 8, Monument, NM 88265	144 (158)	1387 (1529)	39 (42)	0 (0)	0 (0)	0 (0)	0 (0)
CAPROCK COMP STA	13 Mi Nw Of Tatum, Tatum, NM 88213	44 (49)	338 (373)	0.7 (0.8)	0.1 (0.1)	0 (0)	0 (0)	0 (0)
KEMNITZ COMPRESSOR STATION	12 Mi W/sw Of Lovington, Lovington, NM 88260	61 (67)	205 (226)	20 (22)	0 (0)	0 (0)	0 (0)	0 (0)
MADDOX STATION	8 Mi W. Hobbs on US 62/180, Hobbs, NM 88240	106 (117)	613 (675)	6.4 (7.0)	1.9 (2.0)	36 (39)	36 (39)	12 (13)
LINAM RANCH GAS PLANT	11525 W Carlsbad Hwy/7mi W Hob, Hobbs, NM 88240	337 (371)	839 (925)	124 (136)	1181 (1302)	0 (0)	0 (0)	0 (0)
EUNICE COMPRESSOR STATION	5 Mi S Of Eunice On Hwy 207, Eunice, NM 88231	238 (263)	476 (525)	20 (22)	0 (0)	3.1 (3.5)	3.1 (3.5)	0 (0)
GOLFCOURSE COMPRESSOR STATION	3 Mi W OF Eunice Hwy 8/176, Eunice, NM 88231	94 (104)	1081 (1191)	105 (116)	0 (0)	0 (0)	0 (0)	0 (0)
MONUMENT COMPRESSOR STATION	1 Mi E Of Monument, Monument, NM 88265	958 (1056)	958 (1056)	35 (38)	0 (0)	3.0 (3.3)	3.0 (3.3)	0 (0)
EUNICE GAS PLANT	1mi W of Oil Center on NM Hwy, Eunice, NM 88231	129 (142)	844 (930)	26 (29)	2452 (2703)	0 (0)	0 (0)	0.1 (0.1)
LEE GAS PLANT	15 Mi Sw Of Lovington, Lovington, NM 88260	50 (55)	50 (55)	6.8 (7.5)	0 (0)	0 (0)	0 (0)	0.3 (0.3)
LUSK PLANT	15 Mi S Of Maljamar, Maljamar, NM 88264	191 (210)	521 (574)	54 (60)	0 (0)	0 (0)	0 (0)	0 (0)
EUNICE SOUTH GAS PLT	6 Mi S Of Eunice, Eunice, NM 88231	123 (135)	563 (620)	29 (31)	3188 (3515)	2.2 (2.4)	2.2 (2.4)	0.4 (0.4)
EUNICE NORTH GAS PLNT	0.5 Mi N Of Eunice, Eunice, NM 88231	211 (233)	958 (1056)	60 (67)	154 (170)	0 (0)	0 (0)	0 (0)
CUNNINGHAM	12.5 Mi West Of Hobbs, Hobbs, NM 88240	284 (313)	1493 (1645)	8.2 (9.0)	4.5 (5.0)	88 (97)	88 (97)	20 (22)
BUCKEYE NATL GAS PLNT	Nm 1, 13 Mi. Sw Of Lovington, Lovington, NM 88260	142 (156)	125 (138)	21 (23)	0 (0)	0 (0)	0 (0)	0 (0)
EUNICE GAS PLANT	1 Mi Se Of Eunice, Eunice, NM 88231	651 (718)	2559 (2821)	114 (126)	2611 (2879)	10.1 (11)	10.1 (11)	0.3 (0.3)

Table 3.6-21Existing Sources of Criteria Air Pollutants (1999)

Plant Name	Plant Address	CO metric tons (tons)	NO_x metric tons (tons)	VOC metric tons (tons)	SO_2 metric tons (tons)	$PM_{2.5}$ metric tons (tons)	PM_{10} metric tons (tons)	NH_3 metric tons (tons)
MONUMENT PLANT	3 Mi Sw Of Hwy 322 In Monument, Monument, NM 88265	675 (744)	2535 (2794)	81 (89)	864 (952)	0 (0)	0 (0)	0 (0)
SAUNDERS PLANT	20 Mi Nw Of Lovington, Lovington, NM 88260	173 (191)	1448 (1597)	56 (62)	219 (241)	0 (0)	0 (0)	0 (0)
VADA GAS PLANT	20 Mi Nw Of Tatum, Tatum, NM 88267	23 (25)	207 (228)	7.6 (8.4)	0 (0)	0 (0)	0 (0)	0.2 (0.2)
SKAGGS-MCGEE C. S.	7 Mi Se Of Monument, Monument, NM 88265	22 (24)	175 (193)	6.2 (6.9)	0 (0)	0 (0)	0 (0)	0 (0)
EPPERSON BOOSTER	15 Mi Wnw Of Tatum, Tatum, NM 88267	64 (71)	77 (85)	6.4 (7.1)	0 (0)	0 (0)	0 (0)	0 (0)
ANTELOPE RIDGE GAS PLANT	20 Mi Sw Of Eunice, Eunice, NM 88231	221 (243)	259 (285)	83 (91)	0 (0)	0 (0)	0 (0)	0 (0)
LEA REFINERY	5 Mi Se Of Lovingtion On Nm 18, Lovington, NM 88260	71 (78)	132 (146)	237 (261)	7.4 (8.2)	14 (15)	14 (15)	0 (0)
MCA TANK BATTERY #2	31 Mi East Of Artesia, Maljamar, NM 88264	6.2 (6.8)	3.7 (4.1)	10.1 (11)	33 (37)	0 (0)	0 (0)	0 (0)
KEMNITZ COMP STA	5 Mi Sw Of Maljamar, Maljamar, NM 88264	62 (68)	81 (89)	21 (23)	0 (0)	0 (0)	0 (0)	0 (0)
WT-1 COMP STA	22 Mi E Of Carlsbad On Us 180, Carlsbad, NM 88221	2.3 (2.5)	14 (15)	1.4 (1.6)	0 (0)	0.3 (0.3)	0.3 (0.3)	0 (0)
EAST VACUUM LIQUID RECOVERY	5 Mi E Of Buckeye, Buckeye, NM 88260	212 (234)	172 (190)	60 (66)	201 (221)	0 (0)	0 (0)	0 (0)
LYNCH BOOSTER STA	25 Mi Sw Of Hobbs, Hobbs, NM 88240	260 (287)	276 (304)	30 (33)	3.3 (3.7)	0 (0)	0 (0)	0 (0)
LLANO/GRAMA RIDGE #1 COMP STA	18 Mi Wnw Of Eunice, Eunice, NM 88231	84 (93)	63 (69)	34 (38)	0 (0)	0 (0)	0 (0)	0 (0)
HAT MESA COMPRESSOR STATION	33 Mi Sw Of Hobbs, Hobbs, NM 88240	276 (304)	158 (175)	27 (30)	0 (0)	0 (0)	0 (0)	0 (0)
COMP STA #167	8 Mi Ene Of Maljamar On Us 82, Maljamar, NM 88264	31 (34)	874 (963)	9.0 (10.0)	0 (0)	3.6 (4.0)	3.6 (4.0)	0 (0)
OIL CENTER COMPRESSOR STATION	5 Mi S Of Monument, Monument, NM 88265	312 (344)	801 (883)	86 (95)	0.1 (0.1)	0 (0)	0 (0)	0 (0)
GRAMA RIDGE FED #2 CS	28 Mi Sw Of Hobbs, Hobbs, NM 88240	1.4 (1.6)	16 (18)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SUNBRIGHT #1 COMP STA	30 Mi W Of Hobbs, Hobbs, NM 88240	3.6 (3.9)	20 (22)	3.6 (3.9)	0 (0)	0 (0)	0 (0)	0 (0)
QUAIL COMPRESSOR STATION	3 Mi Se Of Eunice, Eunice, NM 88231	302 (332)	772 (851)	27 (30)	0 (0)	0 (0)	0 (0)	0 (0)
NBR BOOTLEG COMP STA	27 Mi W Of Eunice, Eunice, NM 88231	21 (23)	21 (23)	145 (160)	0 (0)	0 (0)	0 (0)	0 (0)
LLANO/LEE COMP STA	15 Mi Nw Of Hobbs, Hobbs, NM 88240	9.4 (10.4)	20 (22)	80 (88)	0 (0)	0 (0)	0 (0)	0 (0)

Table 3.6-21Existing Sources of Criteria Air Pollutants (1999)

Plant Name	Plant Address	CO metric tons (tons)	NO_x metric tons (tons)	VOC metric tons (tons)	SO_2 metric tons (tons)	$PM_{2.5}$ metric tons (tons)	PM_{10} metric tons (tons)	NH_3 metric tons (tons)
JAL PUMPING STATION	1.5 Mi Sse Of Jal, Jal, NM 88252	22 (24)	30 (34)	94 (104)	1.9 (2.1)	0 (0)	0 (0)	0 (0)
MALJAMAR BOOSTER STA	25 Mi Nw Of Hobbs, Lovington, NM 88240	71 (78)	284 (313)	12 (13)	0 (0)	0 (0)	0 (0)	0 (0)
STATE 35 COMPRESSOR STATION	1.5 Mi Sw Of Buckeye, Buckeye, NM 88260	17 (19)	9.7 (10.7)	6.5 (7.1)	15 (17)	0 (0)	0 (0)	0 (0)
TRISTE PORTABLE	No Address, No City, NM 99999	26 (29)	33 (36)	14 (15)	0 (0)	0 (0)	0 (0)	0 (0)
TOWNSEND REMD	2 Mi W Of Lovington, Lovington, NM 88260	4.5 (5.0)	10.7 (12)	25 (28)	0 (0)	0 (0)	0 (0)	0 (0)
BUCKEYE CO2 PL	13 Mi Southeast Of Lovington, Lovington, NM 88260	3.6 (4.0)	10.9 (12)	19 (21)	0 (0)	13 (14)	15 (17)	0 (0)
BELL LAKE CS	21 Mi N/nw Of Jal, Jal, NM 88252	29 (32)	19 (21)	51 (56)	0 (0)	0 (0)	0 (0)	0 (0)
READ & STEVENS COMP STA	22.4 Mi Sw Of Hobbs, Nm, Hobbs, NM 99999	5.6 (6.2)	5.6 (6.2)	4.3 (4.7)	0 (0)	0 (0)	0 (0)	0 (0)
BUCKEYE STATION	1 Mi Se Of Buckeye, Buckeye, NM 99999	0 (0)	0 (0)	1.9 (2.1)	0 (0)	0 (0)	0 (0)	0 (0)
S. ANTELOPE RDG	30 Mi Sw Of Eunice, Eunice, NM 88321	7.8 (8.6)	11 (12)	13 (14)	0 (0)	0 (0)	0 (0)	0 (0)
CS	22.5 Mi Nw, Jal, NM 88252	21 (23)	21 (23)	22 (24)	16 (18)	0 (0)	0 (0)	0 (0)
TOWNSEND	6.5 Mi Ne Of Lovington, Lovington, NM 99999	17 (19)	11 (12)	2.6 (2.9)	0 (0)	0 (0)	0 (0)	0 (0)
DUKE ENERGYFIELD SERVICE LP	2 Mi W OF FRANKEL CITY ON FM 19, FRANKEL CITY, TX 79737	39 (43)	414 (457)	15 (17)	0 (0)	5.7 (6.3)	6.0 (6.6)	0 (0)
GPM GAS SERVICES CO	3 MI WEST OF US 385 ON FM 2, ANDREWS, TX 79714	77 (85)	479 (528)	165 (182)	0 (0)	4.7 (5.1)	4.9 (5.4)	0 (0)
DUKE ENERGY	5 MI N. OF THE INTX. OF HWYS., ANDREWS, TX 79714	720 (794)	1379 (1520)	166 (184)	1233 (1359)	1.5 (1.7)	1.5 (1.7)	0 (0)
PURE RESOURCES	22 MI S.W., S.H. 115; 14 MI., ANDREWS, TX 79714	100 (110)	109 (120)	49 (54)	0.1 (0.1)	1.0 (1.1)	1.1 (1.2)	0 (0)
PALMER OF TEXAS	U.S. 385 N. OF ANDREWS, ANDREWS, TX 79714	0 (0)	0 (0)	52 (57)	0 (0)	0 (0)	0 (0)	0 (0)
GPM GAS SERVICES CO	0.4 MI W., LSE. RD., ANDREWS, TX 79714	109 (120)	103 (114)	8.5 (9.4)	0 (0)	0.1 (0.1)	0.1 (0.1)	0 (0)

Source: (EPA, 2003b)

Table 3.6-22Wind Frequency Distribution

	WCS Data		Midland-Odessa Data	
Compass Sector	**Hours**	**Percent Frequency**	**Hours**	**Percent Frequency**
North (N)	549	3.2	2,388	5.6
North-Northeast (NNE)	788	4.5	1,692	4.0
Northeast (NE)	1,005	5.8	2,103	4.9
East-Northeast (ENE)	1,031	5.9	2,094	4.9
East (E)	1,158	6.7	2,691	6.3
East-Southeast (ESE)	1,071	6.2	2,366	5.5
Southeast (SE)	1,902	11.0	3,237	7.6
South-Southeast (SSE)	2,327	13.4	4,648	10.9
South (S)	2,038	11.8	8,784	20.6
South-Southwest (SSW)	1,280	7.4	3,136	7.3
Southwest (SW)	990	5.7	2,345	5.5
West-Southwest (WSW)	779	4.5	1,997	4.7
West (W)	768	4.4	1,887	4.4
West-Northwest (WNW)	624	3.6	997	2.3
Northwest (NW)	609	3.5	1,104	2.6
North-Northwest (NNW)	417	2.4	1,272	3.0
Total	17,336	100	42,741	100.1[1]

[1] The percent frequency total is greater than 100% due to round off.

3.6.5 Section 3.6 Figures

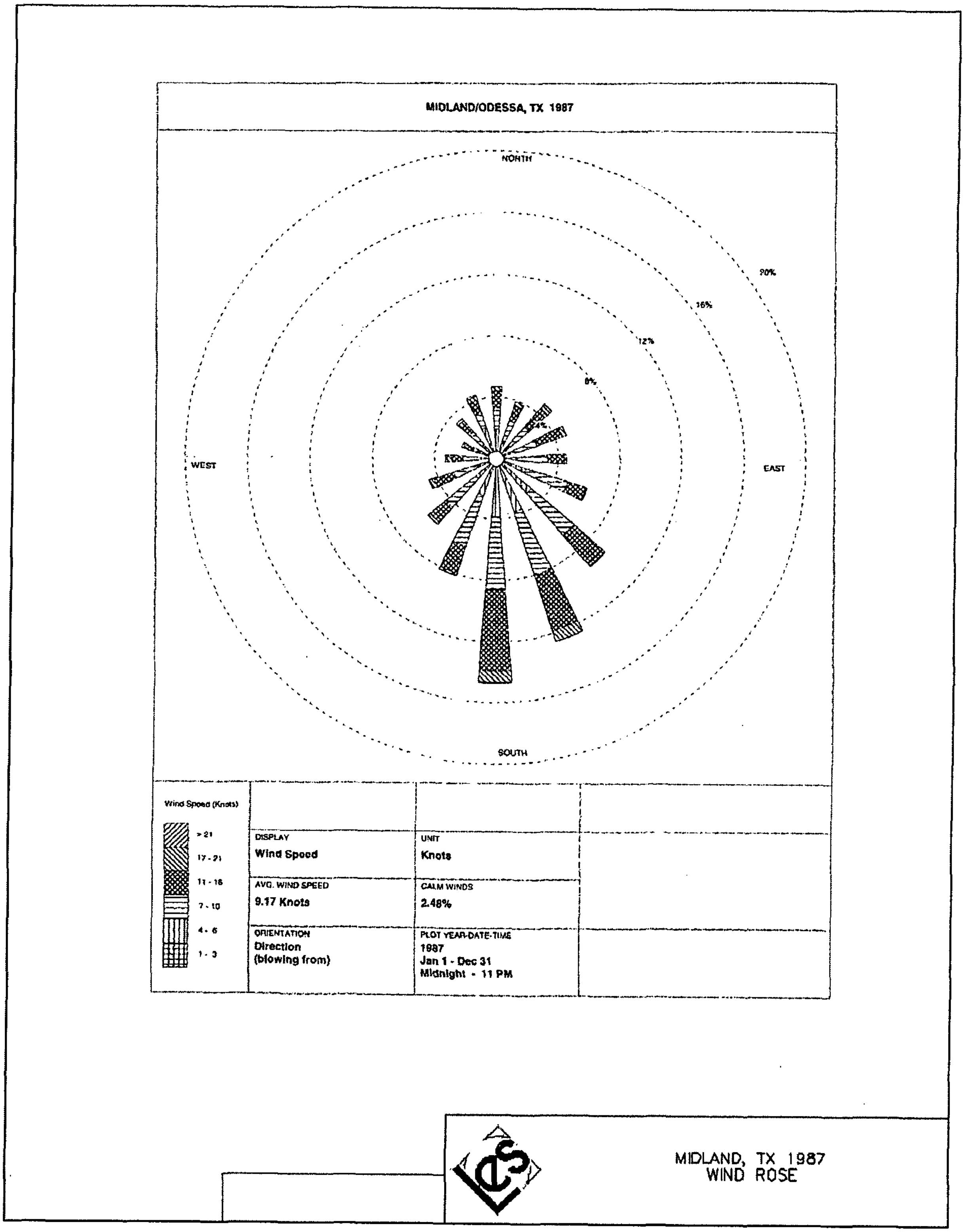


Figure 3.6-1 Midland, TX 1987 Wind Rose

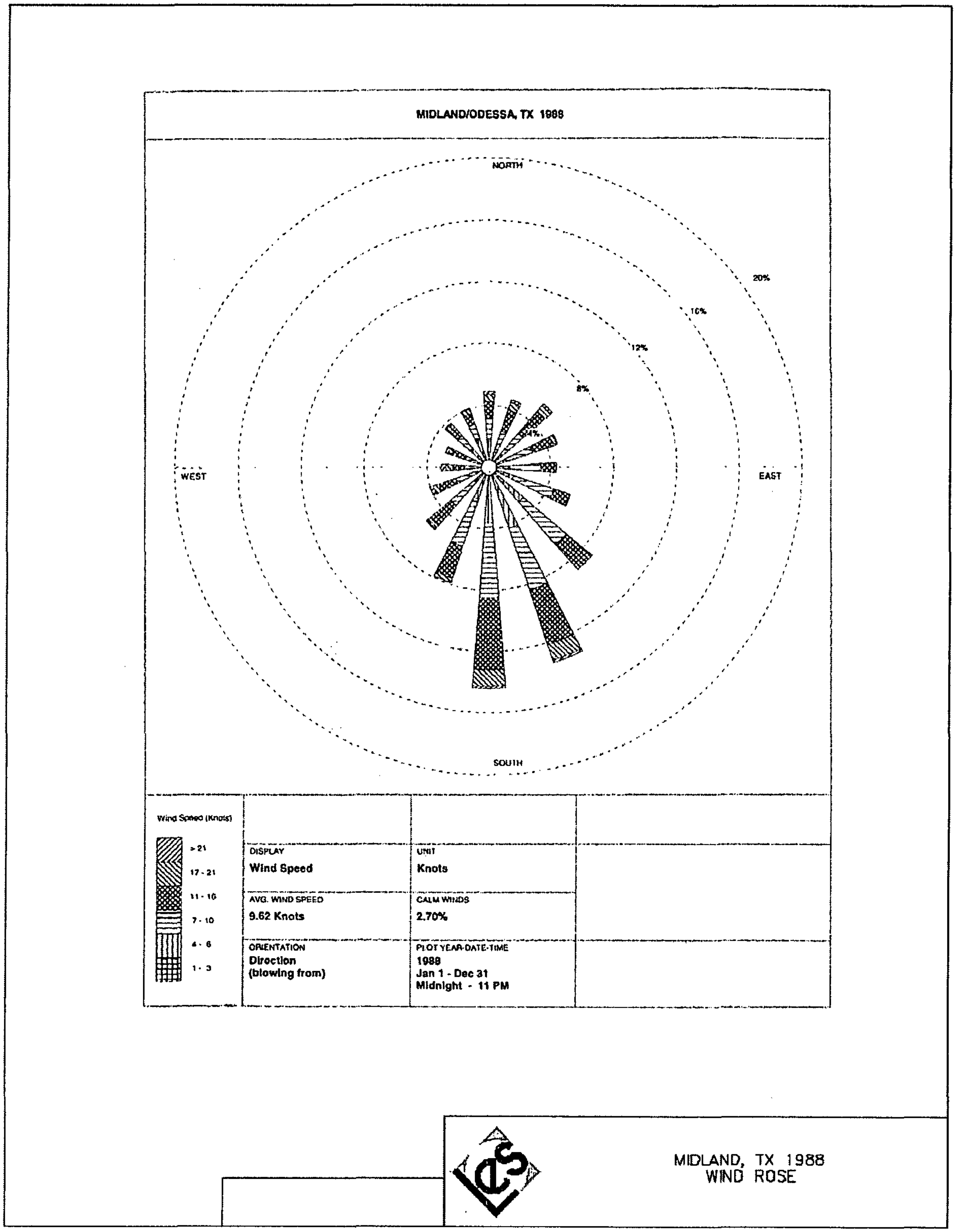


Figure 3.6-2Midland, TX 1988 Wind Rose

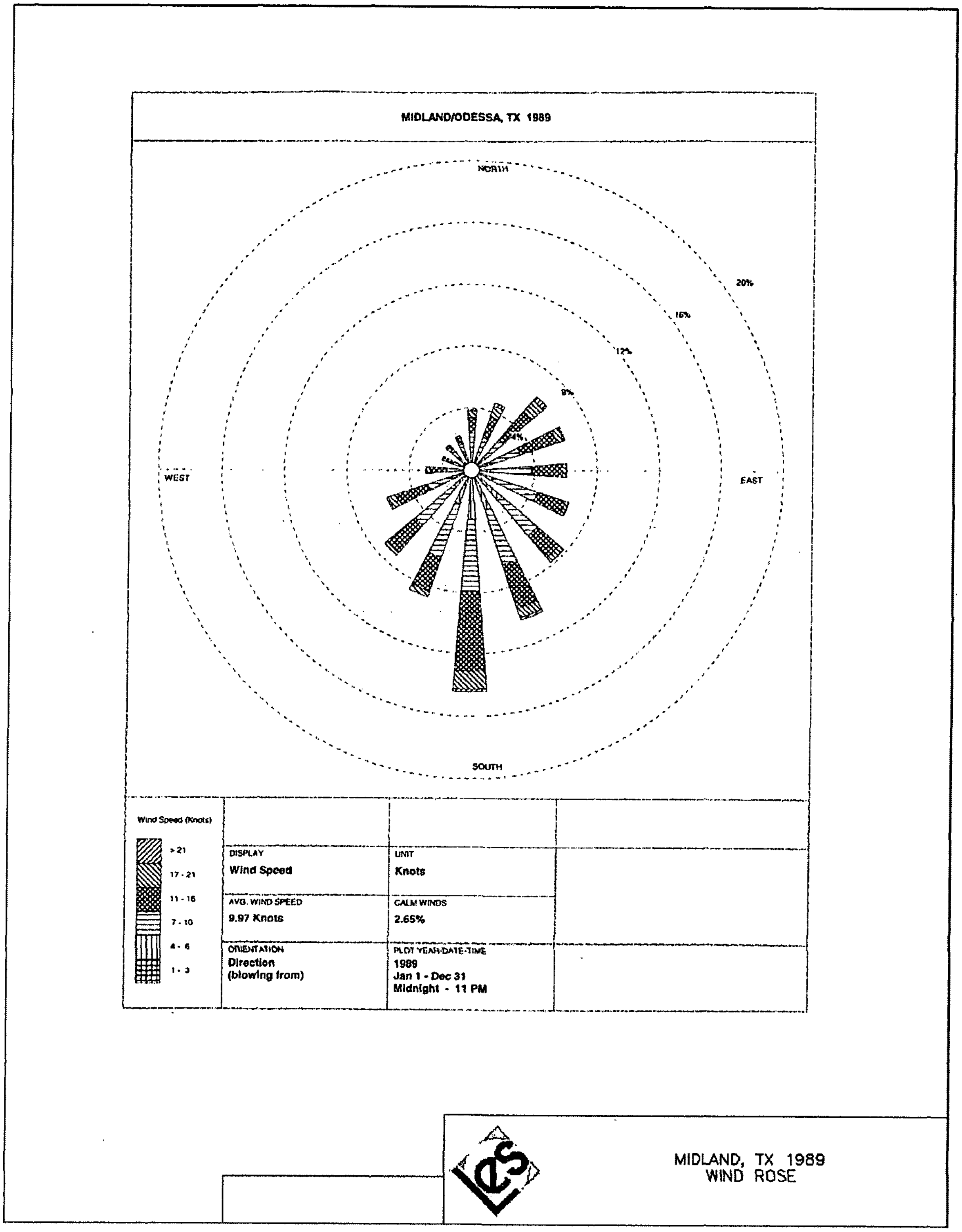


Figure 3.6-3Midland, TX 1989 Wind Rose

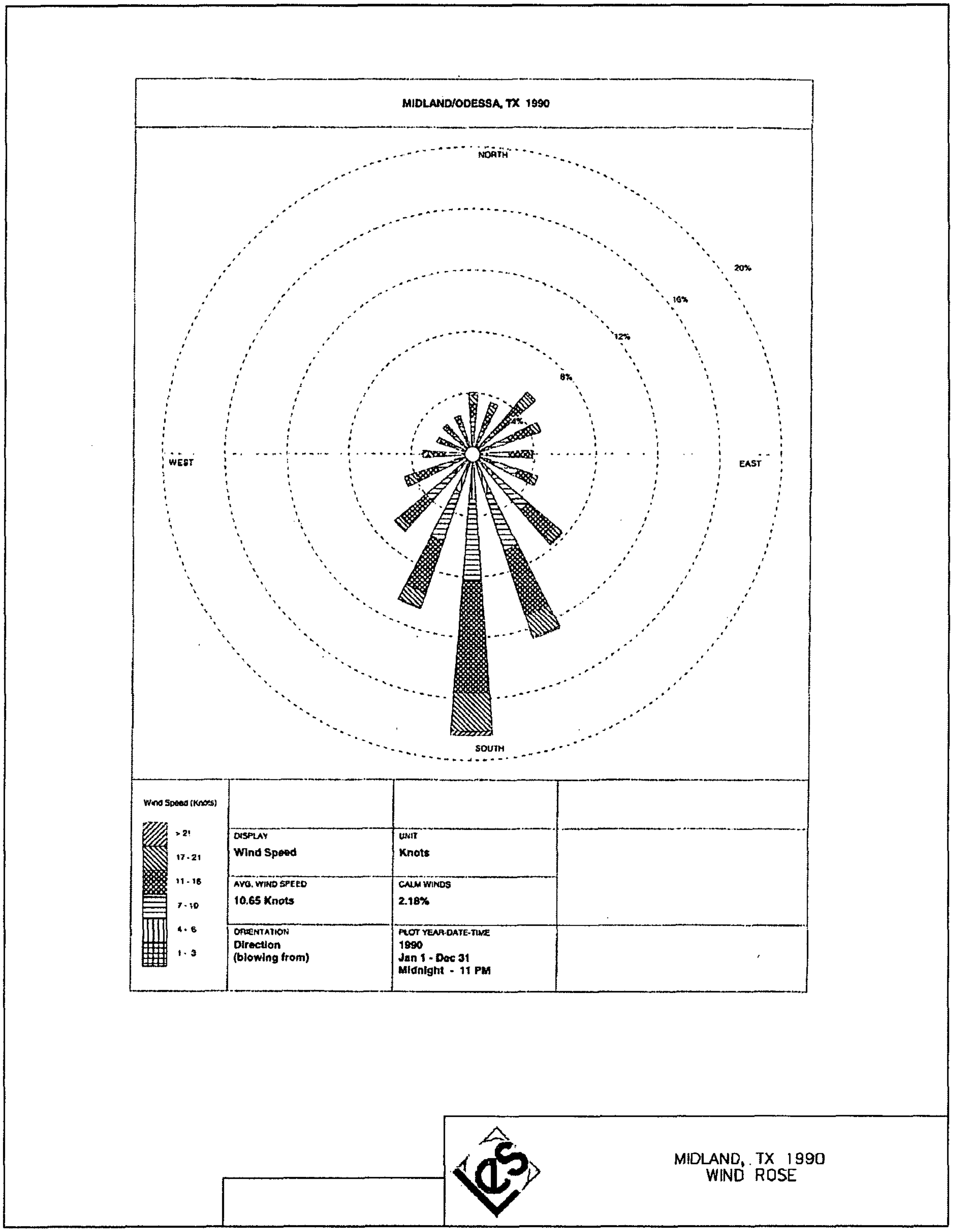


Figure 3.6-4Midland, TX 1990 Wind Rose

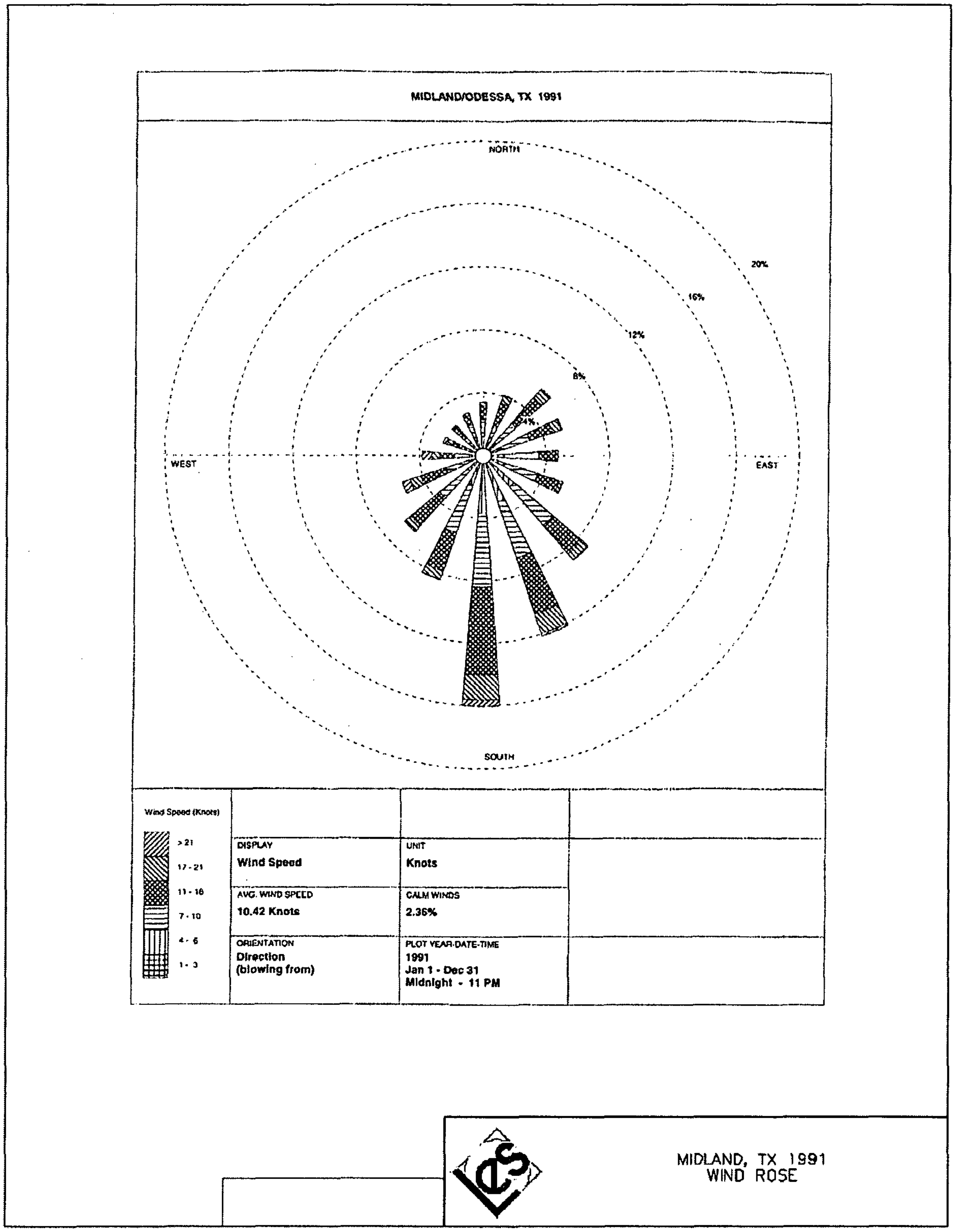


Figure 3.6-5Midland, TX 1991 Wind Rose

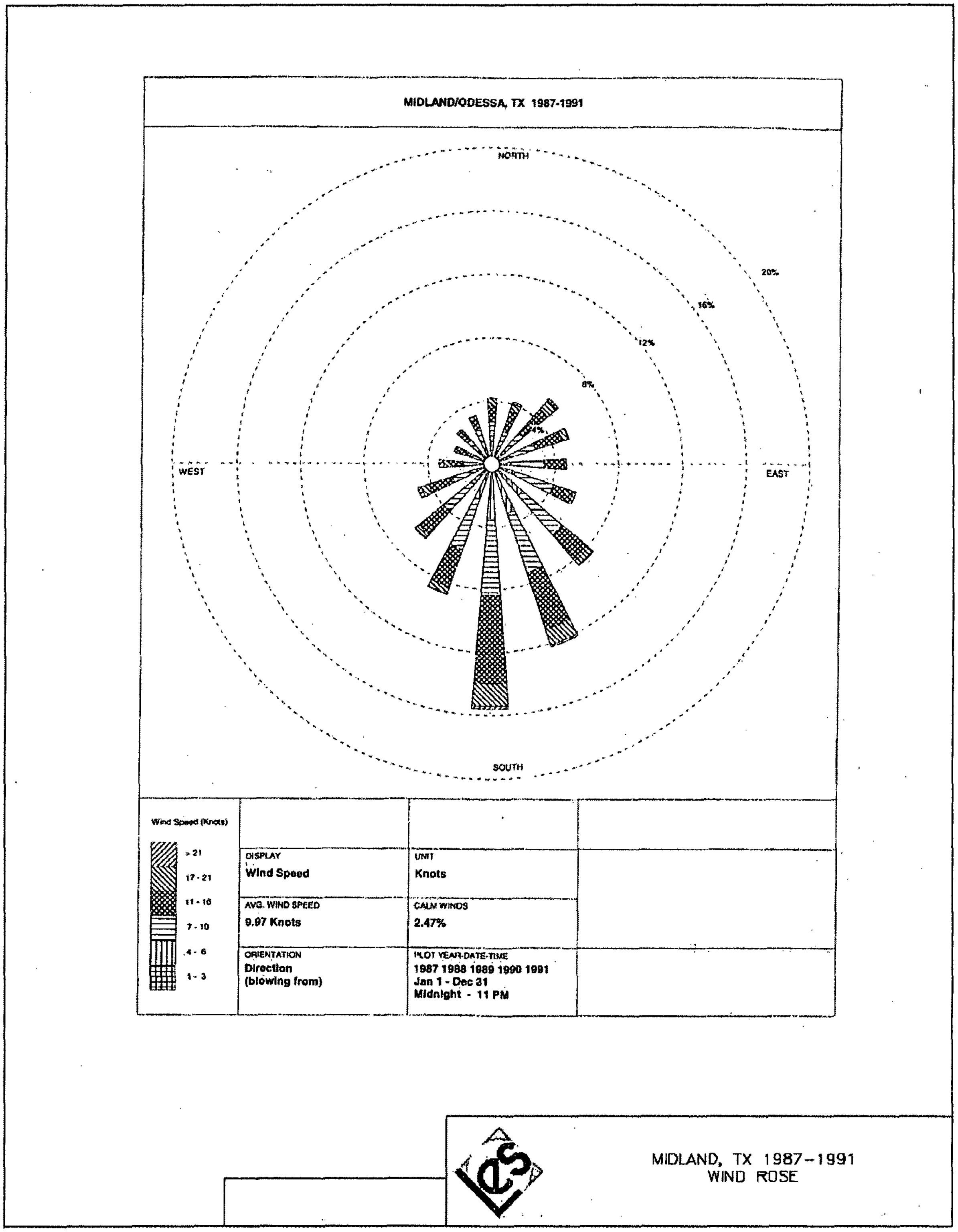
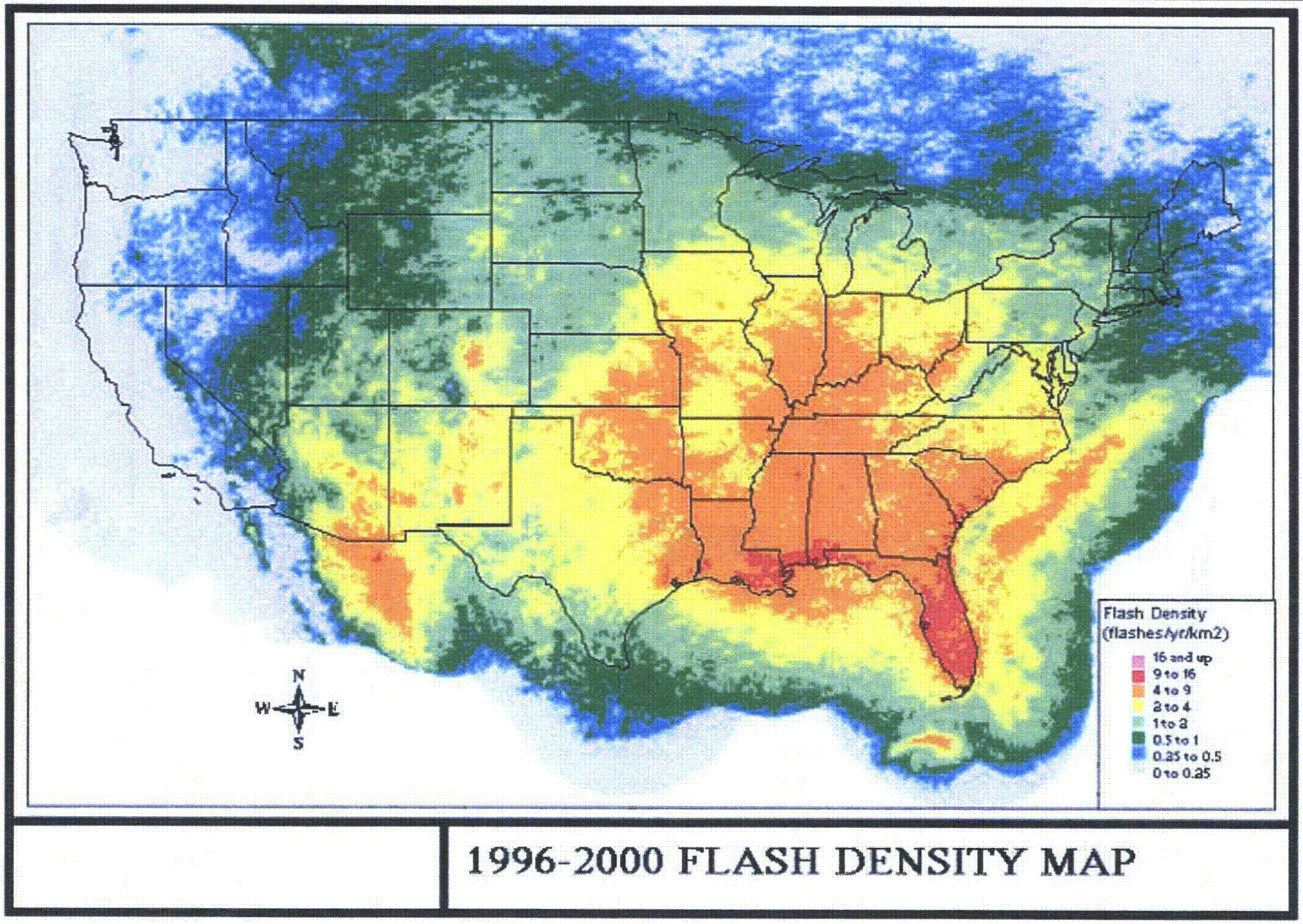


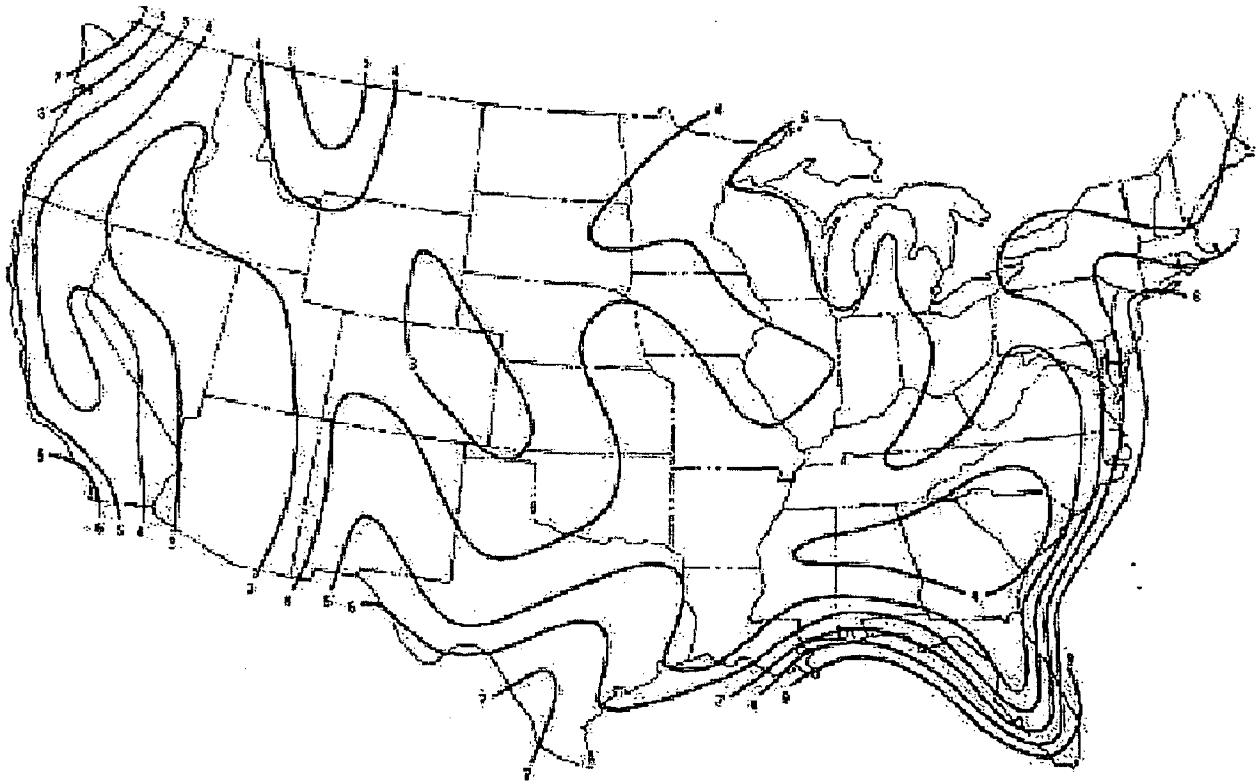
Figure 3.6-6Midland, TX 1987-1991 Wind Rose



(NWS, 2003)

AVERAGE LIGHTNING FLASH DENSITY

Figure 3.6-7 Average Lightning Flash Density

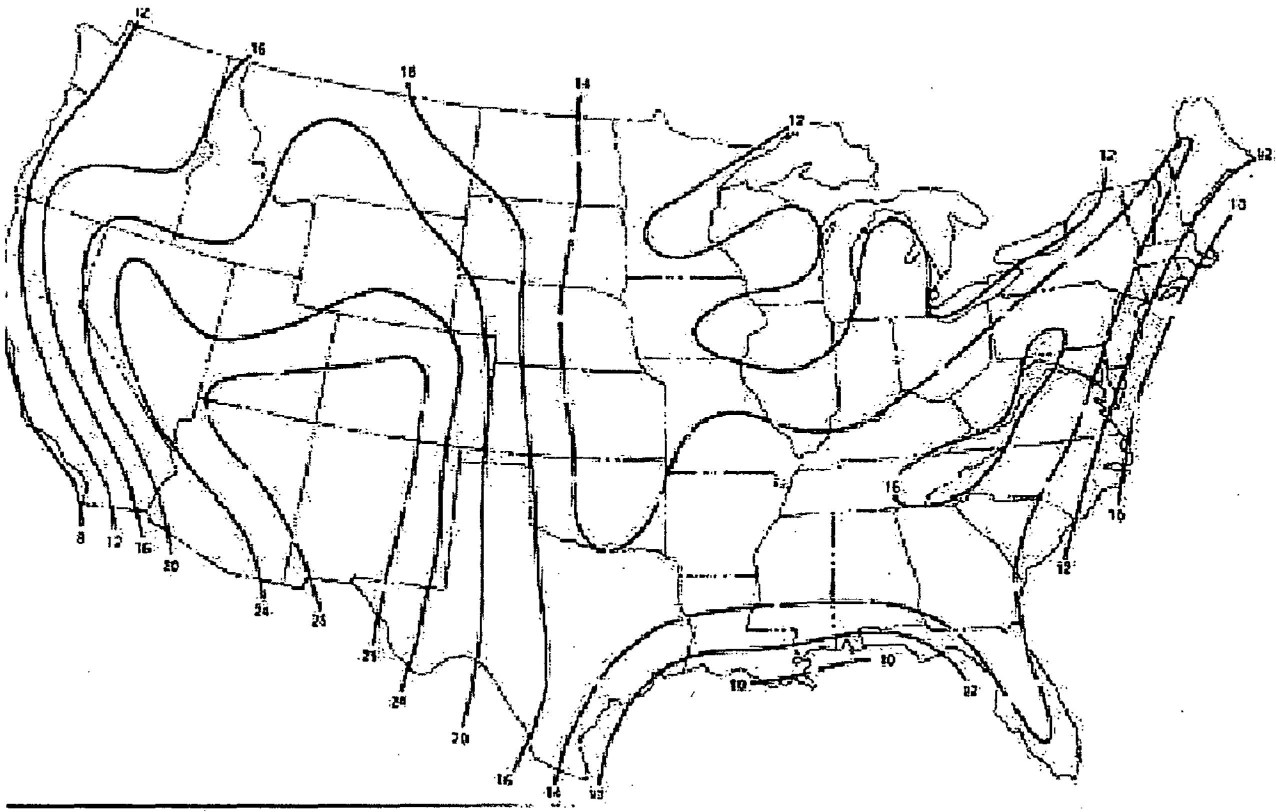


Isopleths (m x 10²) of mean annual morning mixing heights.

SOURCE: (EPA, 1972)

ANNUAL AVERAGE MORNING MIXING HEIGHTS

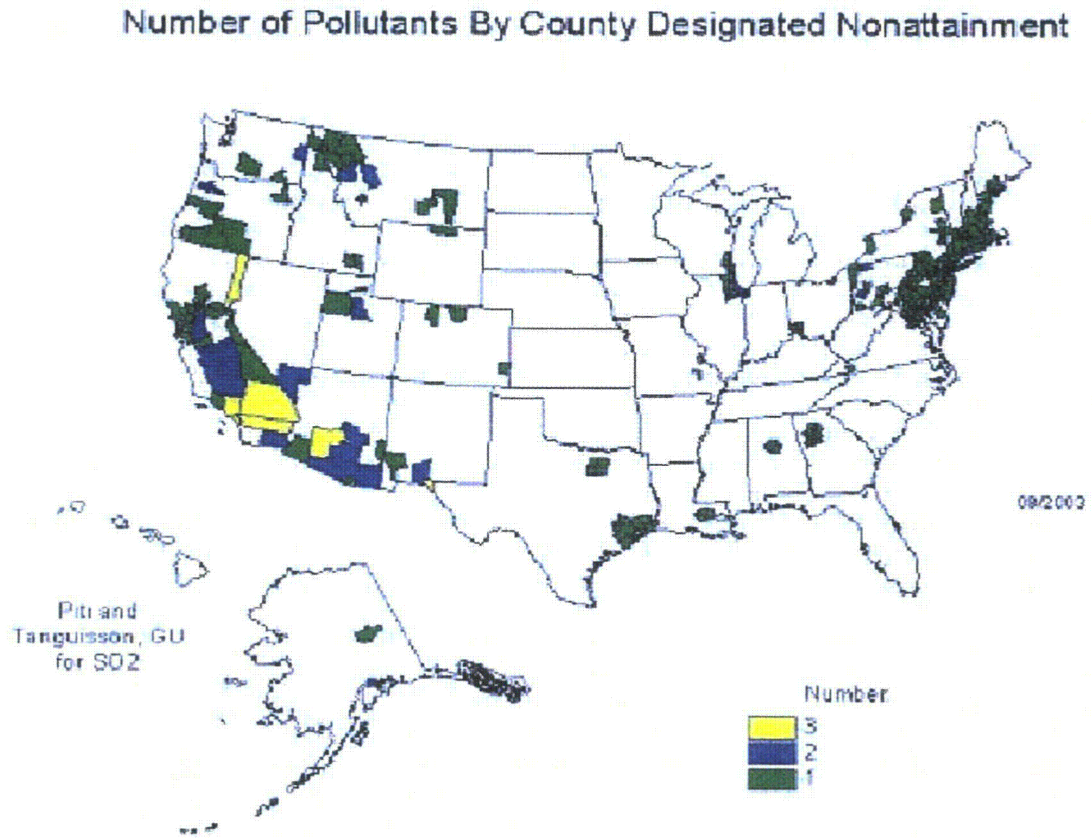
Figure 3.6-8Annual Average Morning Mixing Heights



SOURCE: (EPA, 1972) Isopleths (m x 10²) of mean annual afternoon mixing heights

ANNUAL AVERAGE AFTERNOON MIXING HEIGHTS

Figure 3.6-9Annual Average Afternoon Mixing Heights



(EPA 2003a)

EPA CRITERIA POLLUTANT
NONATTAINMENT MAP

Figure 3.6-10EPA Criteria Pollutant Nonattainment Map

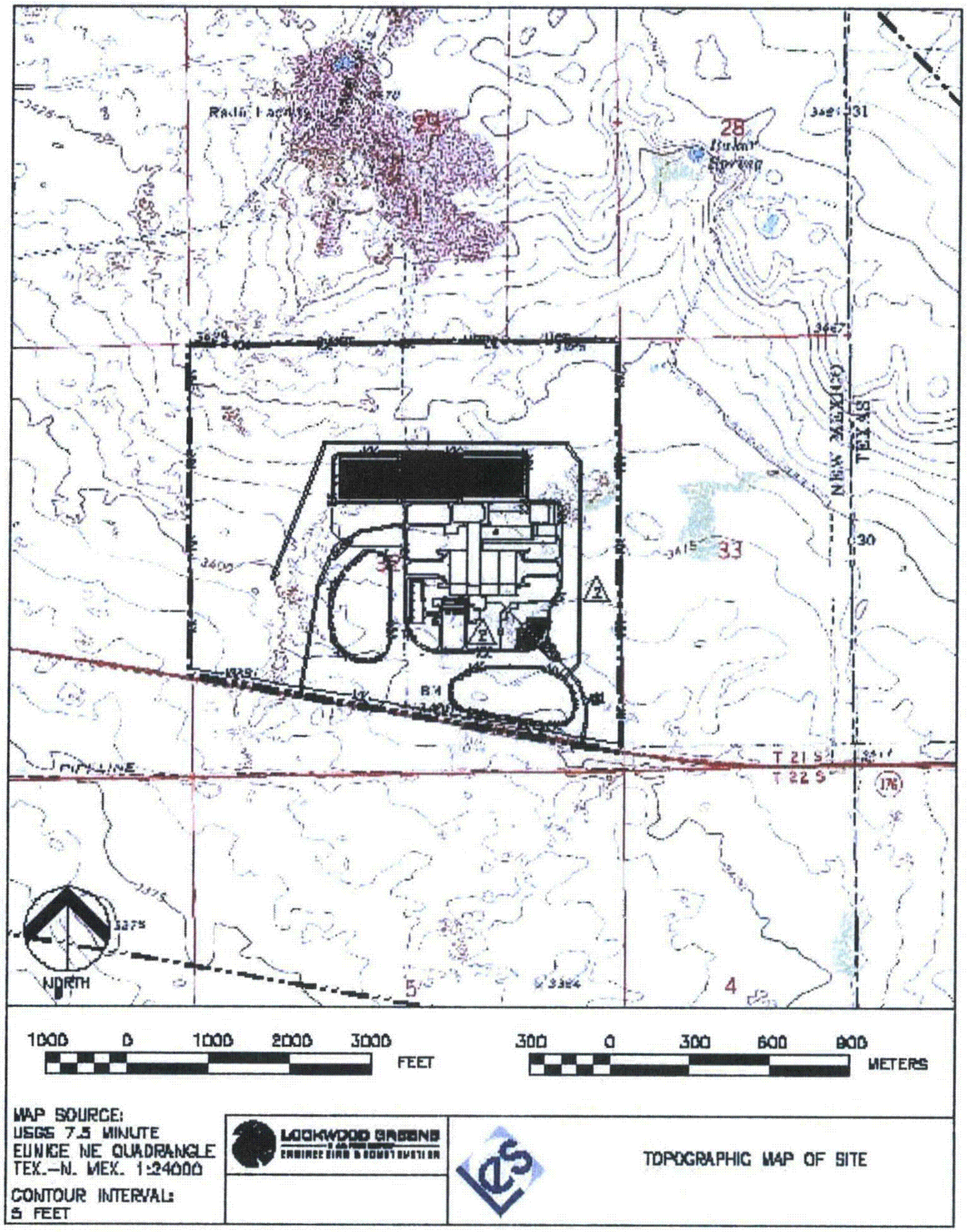


Figure 3.6-11Topographic Map of Site

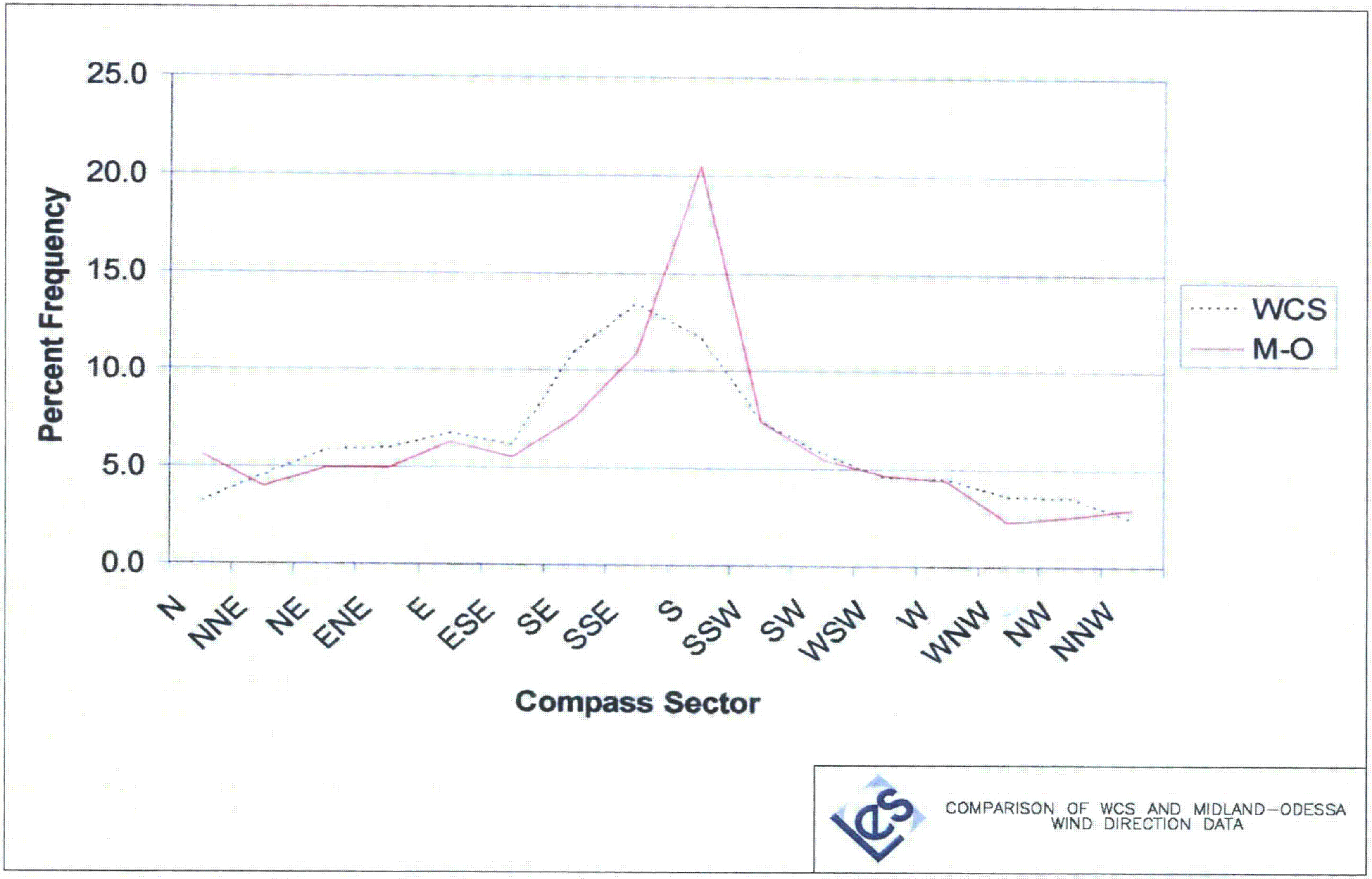


Figure 3.6-12Comparison of WCS and Midland-Odessa Wind Direction Data

3.7 NOISE

Noise is defined as "unwanted sound." At high levels noise can damage hearing, cause sleep deprivation, interfere with communication, and disrupt concentration. In the context of protecting the public health and welfare, noise implies adverse effects on people and the environment.

The sound we hear is the result of a source inducing vibration in the air, creating sound waves. These waves radiate in all directions from the source and may be reflected and scattered or, like other wave actions, may turn corners. Sound waves are a fluctuation in the normal atmospheric pressure, which is measurable. This sound pressure level is the instantaneous difference between the actual pressure produced by a sound wave and the average or barometric pressure at a given point in space. This provides us the fundamental method of measuring sound, which is in "decibel" (dB) units.

The dB scale is a logarithmic scale because the range of sound intensities is so great that it is convenient to compress the scale to encompass all the sound pressure levels that need to be measured. The sound pressure level is defined as 20 times the logarithm, to the base 10, of the ratio of the pressure of the sound measured to the reference pressure, which is 20 μPa (0.0002 dyne/cm2). In equation form, sound pressure level in units of dB is expressed as:

$$dB = 20 \, Log_{10} \frac{p}{p_r}$$

Where:

p = measured sound pressure level μPa (dyne/cm^2)

p_r = reference sound pressure level, 20 μPa (0.0002 dyne/cm^2)

Due to its logarithmic scale, if a noise increases by 10 dB, it sounds as if the noise level has doubled. If a noise increases by 3 dB, the increase is just barely perceptible to humans. Additionally, as a rule-of-thumb the sound pressure level from an outdoor noise source radiates out from the source, decreasing 6 dB per doubling of distance. Thus, a noise that is measured at 80 dB 15 m (50 ft) away from the source will be 74 dB at 30.5 m (100 ft), 68 dB at 61 m (200 ft), and 62 dB at 122 m (400 ft). However, natural and man-made sources such as trees, buildings, land contours, etc., will often reduce the sound level further due to dissipation and absorption of the sound waves. Occasionally buildings and other reflective surfaces may slightly amplify the sound waves, through reflected and reverberated sound waves.

The rate at which a sound source vibrates determines its frequency. Frequency refers to the energy level of sound in cycles per second, designated by the unit of measurement Hertz (Hz). The human ear can recognize sounds within an approximate range of 16 Hz to 20,000 Hz, but the most readily predominant sounds that we hear are between 1,000 Hz and 6,000 Hz (EPA/ONAC 550/9-74-004). To measure sound on a scale that approximates the way it is heard by people, more weight must be given to the frequencies that people hear more easily. The "A-weighted" sound scale is used as a method for weighting the frequency spectrum of sound pressure levels to mimic the human ear. A-weighting was recommended by the EPA to describe noise because of its convenience and accuracy, and it is used extensively throughout the world (EPA/ONAC 550/9-74-004). For the purpose and scope of this report and sound level testing, all measurements will be in the A-weighted scale (dBA).

3.7.1 Extent of Noise Analysis

Community noise levels are often measured by the Day-Night Average Sound Level (L_{dn}). The L_{dn} is the A-weighted equivalent sound level for a 24-hour period. Due to the potential for sleep disturbance, loud noises between 10 p.m. and 7 a.m. are normally considered more annoying than loud noises during the day. This is a psychoacoustic effect that can also contribute to communication interference, distraction, disruption of concentration and irritation. A 10 dB weighting factor is added to nighttime equivalent sound levels due to the sensitivity of people during nighttime hours (EPA/ONAC 550/9-74-004). For example, a measured nighttime (10 p.m. to 7 a.m.) equivalent sound level of 50 dBA can be said to have a weighted nighttime sound level of 60 dBA (50 + 10). For the purposes of this report, however, an Equivalent Sound Level (L_{eq}) is used to measure average noise levels during the daytime hours. The L_{eq} is a single value of sound level for any desired duration, which includes all of the time-varying sound energy in the measurement period. To further clarify the relationship between these two factors, the daytime sound level equivalent averaged with the nighttime sound level equivalent equals the Day-Night Average: L_{eq} (Day) averaged with L_{eq} (Night) = L_{dn}. Since the nighttime noise levels are significantly lower than the daytime noise levels, the daytime L_{eq} is used alone, without averaging the lower nighttime value, to provide a more conservative representation of the actual exposure.

3.7.2 Community Distribution

The area immediately surrounding the National Enrichment Facility (NEF) site is unpopulated and used primarily for intermittent cattle grazing. The nearest noise receptors are five businesses that are between 0.8 km (0.5 mi) and 2.6 km (1.6 mi) of the NEF site. WCS is due east of the site just over the Texas border. The Lea County Landfill is southeast, Sundance Specialists and Wallach Concrete are north, and DD Landfarm is just west of the site. The nearest homes are due west of the site in the city of Eunice, New Mexico, which is approximately 8 km (5 mi) away. The closest residence from the center of the NEF site is approximately 4.3 km (2.63 mi) away on the east side of Eunice, New Mexico.

3.7.3 Background Noise Levels

Since there were no previous measurements performed for noise levels, background noise was surveyed at four locations near the site borders of the NEF on September 16-18, 2003, using a Bruel & Kjaer 2236D Integrating Sound Level Meter. The A-weighted decibel scale (dBA) was used to record and weigh noise that is audible to the human ear. All of the measurements were taken during the day between 7 a.m. and 5 p.m. Measurement locations are shown in Figure 3.7-1, Noise Measurement Locations. Average background noise levels ranged from 40.1 to 50.4 dBA (see Table 3.7-1, Background Noise Levels for the NEF Site). The four locations selected for the noise measurements represent the nearest receptor locations (NEF site fence) for the general public and the locations of expected highest noise levels when the plant is operational. These noise levels are considered moderate, and are below the average range of speech of 48 to 72 dBA (HUD-953-CPD). See Figure 3.7-2, Sound Level Range Examples.

Data from September 18, 2003 has been excluded from the average background noise levels due to high winds that were of sufficient strength and consistency to cause the instruments to record anomalous readings. Instrument readings were in excess of 75 dBA during high winds due to the sensitivity of the microphones, which are not designed to account for direct wind shear. Noise instrumentation included foam windscreens that covered the microphones; however these are not designed to mitigate the types of high winds that were experienced at NEF that day. Meteorological data retrieved from the WCS nearby to the NEF site showed average wind speeds ranging from 9.0 to 11.6 m/s (20 to 26 mi/hr) during the period of the noise survey on September 18, 2003. Even with the September 18, 2003 data excluded, sufficient data was collected for the analyses.

Current point noise sources consist of operating equipment from Wallach Concrete, Inc. just north of the site, which include bulldozers, cranes, and heavy-duty dump trucks and tractor trailer trucks, heavy-duty truck traffic at Sundance Specialists also north of the site. The only line noise source is vehicle traffic along the southern border of the site on New Mexico Highway 234. Results from measurements taken at each southern corner of the site boundary near New Mexico Highway 234 produced noticeably higher results due to significant vehicle traffic, including multiple heavy-duty tractor-trailer trucks (line sources). Field measurements from the two southern locations were between 30.5 to 46 m (100 to 150 ft) from the road, which resulted in the upper sound pressure level of 50.4 dBA. Other noise sources included low flying small aircraft that operate out of the Eunice Airport approximately 6.4 km (4 mi) from the site, and sudden high wind gusts that would temporarily defeat the windscreen attachment to the noise instrumentation.

3.7.4 Topography and Land Use

The NEF site slopes gently to the south-southwest with a maximum relief of about 12 m (40 ft). The highest elevation is approximately 1,045 m (3,430 ft) msl in the northeast corner of the property. The lowest site elevation is approximately 1,033 m (3,390 ft) msl along the southwest corner of the site.

Rangeland comprises 98.5% of the area within an 8 km (5 mi) radius of the NEF site, encompassing 12,714 ha (31,415 acres) within Lea County, New Mexico and 7,213 ha (17,823 acres) in Andrews County, Texas. (See Figure 3.1-1. Land Use Map.) Rangeland is an extensive area of open land on which livestock wander and graze and includes herbaceous rangeland, shrub and brush rangeland and mixed rangeland. Built-up land and barren land constitute the other two land use classifications in the site vicinity, but at considerably smaller percentages. Land cover due to built-up areas, which includes residential and industrial developments, makes up 1.2% of the land use. This equates to a combined total of 243 ha (601 acres) for Lea and Andrews Counties. The remaining 0.3% of land area is considered barren land which consists of bare exposed rock, transitional areas and sandy areas. Refer to ER Section 3.1 for further discussion of land use.

With regard to noise mitigation, land contours that have changes in elevation will help to absorb sound pressure waves that travel outward from a noise source. A flat surface would allow noise from a source to travel a greater distance without losing its intensity (perceived volume). Wooded areas, trees, and other naturally occurring items will also mitigate noise sources, provided those items are located between the noise and the noise receptor. See ER Section 4.7.5, Mitigation, for further discussion of noise mitigation at the NEF site.

3.7.5 Meteorological Conditions

The meteorological conditions at the NEF have been evaluated and summarized in order to characterize the site climatology. See ER Section 3.6, Meteorology, Climatology and Air Quality, for a detailed discussion.

Monthly mean wind speeds and prevailing wind directions at Midland-Odessa, Texas, are presented in Table 3.6-10, Midland-Odessa, Texas, Wind Data. The annual mean wind speed was 4.9 m/s (11.0 mi/hr) and the prevailing wind direction was wind from the south, i.e., 180 degrees with respect to true north. Monthly mean wind speeds and prevailing wind directions at Roswell, New Mexico, are presented in Table 3.6-11, Roswell, New Mexico, Wind Data. The annual mean wind speed was 3.7 m/s (8.2 mi/hr) and the prevailing wind direction was wind from 160 degrees from true north. The maximum five-second wind speed was 31.3 m/s (70 mi/hr) at Midland-Odessa, Texas, and 27.7 m/s (62 mi/hr) from 270 at Roswell, New Mexico.

Five years of data (1987-1991) from the Midland-Odessa NWS were used to generate joint frequency distributions of wind speed and direction. This data summary is provided in Table 3.6-12, Midland/Odessa Five Year (1987-1991) Annual Joint Frequency Distribution for All Stability Classes Combined.

Noise intensities are affected by weather conditions for a variety of reasons. Snow-covered ground can absorb more sound waves than an uncovered paved surface that would normally reflect the noise. Operational noise can be masked by the sound of a rainstorm or high winds, where environmental noise levels are raised at the point of the noise receptor. Additionally, seasonal differences in foliage, as well as temperature changes, can affect the environmental efficiency of sound wave absorption (i.e., a fully leafed tree or bush will mitigate more sound than one without leaves). Because of those variables, the noise levels, both background and after the plant is built, will be variable. However, even when such variations are taken into consideration, the background noise levels are well within the specified guidelines.

3.7.6 Sound Level Standards

Agencies with applicable standards for community noise levels include the U.S. Department of Housing and Urban Development (HUD-953-CPD) and the Environmental Protection Agency (EPA 550/9). 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. In addition, there are no affected American Indian tribal agencies within the sensitive receptor distances from the site. Thus, the NEF site is not subject either to local, tribal, or state noise regulations. Nonetheless, anticipated NEF noise levels are expected to typically fall below the HUD and EPA standards and are not expected to be harmful to the public's health and safety, nor a disturbance of public peace and welfare.

The EPA has defined a goal of 55 dBA for Ldn in outdoor spaces, as described in the EPA Levels Document (EPA 550/9). HUD has developed land use compatibility guidelines for acceptable noise versus the specific land use (see Table 3.7-2, U.S. Department of Housing and Urban Development Land Use Compatibility Guidelines). All the noise measurements shown in Table 3.7-1, Background Noise Levels for the NEF Site are below both criterion for a daytime period (as defined above). If the Table 3.7-1 measurements had been averaged to reflect nighttime levels, the average ambient noise levels would be even lower.

3.7.7 Section 3.7 Tables

Table 3.7-1 Background Noise Levels for the NEF Site

Measurement Location	L_{eq}*
Receptor 1 (see Figure 3.7-1)	**40.2**
Receptor 2	**40.1**
Receptor 3	**47.2**
Receptor 4	**50.4**

* L_{eq} - Average A-weighted sound level (dBA)

Table 3.7-2 U.S. Department of Housing and Urban Development Land Use Compatibility Guidelines

	Sound Pressure Level (dBA L_{dn})			
Land Use Category	**Clearly Acceptable**	**Normally Acceptable**	**Normally Unacceptable**	**Clearly Unacceptable**
Residential	<60	60-65	65-75	>75
Livestock farming	<60	60-75	75-80	>80
Office buildings	<65	65-75	75-80	>80
Wholesale, industrial, manufacturing & utilities	<70	70-80	80-85	>85

Source: (HUD-953-CPD)

3.7.8 Section 3.7 Figures

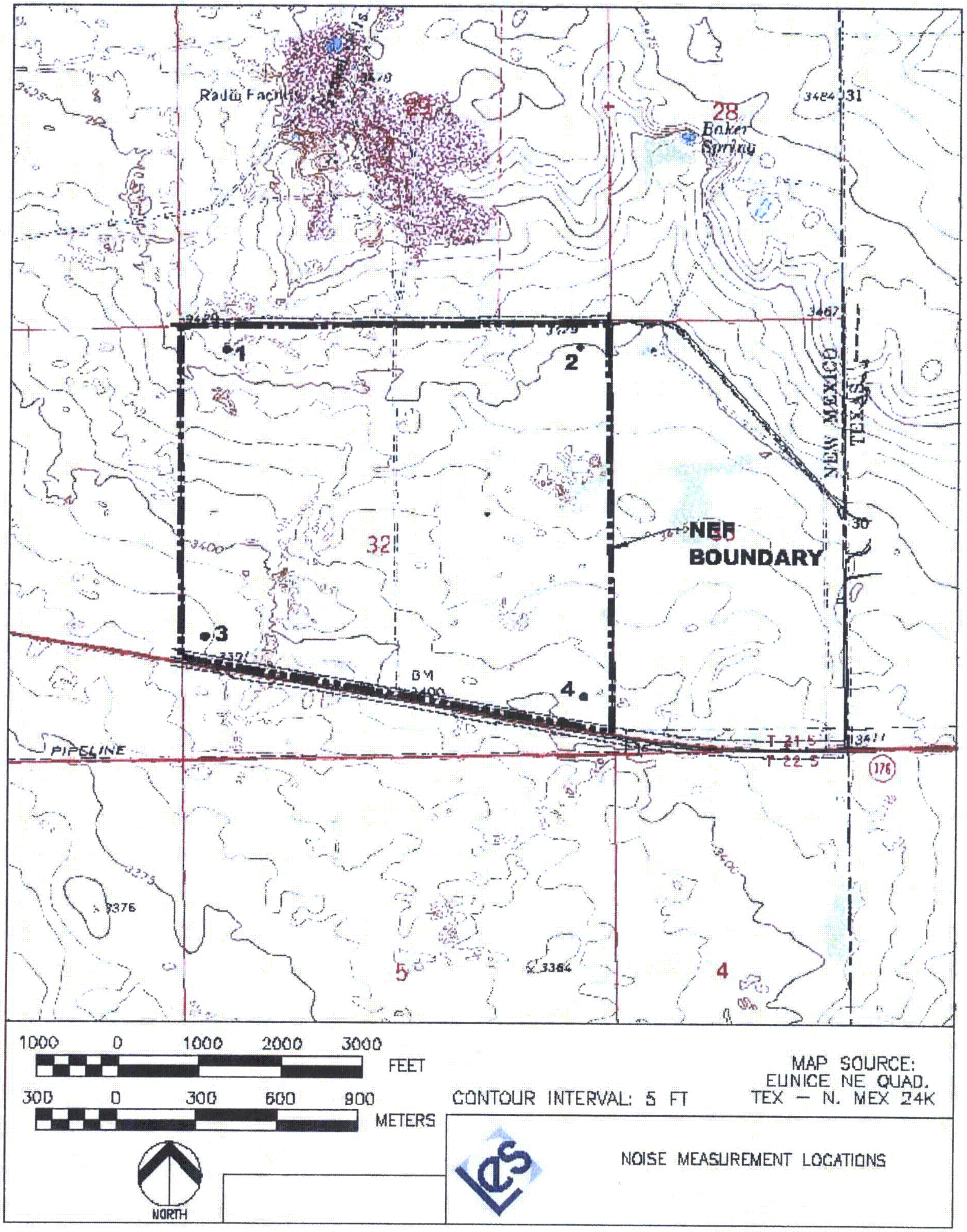


Figure 3.7-1 Noise Measurement Locations

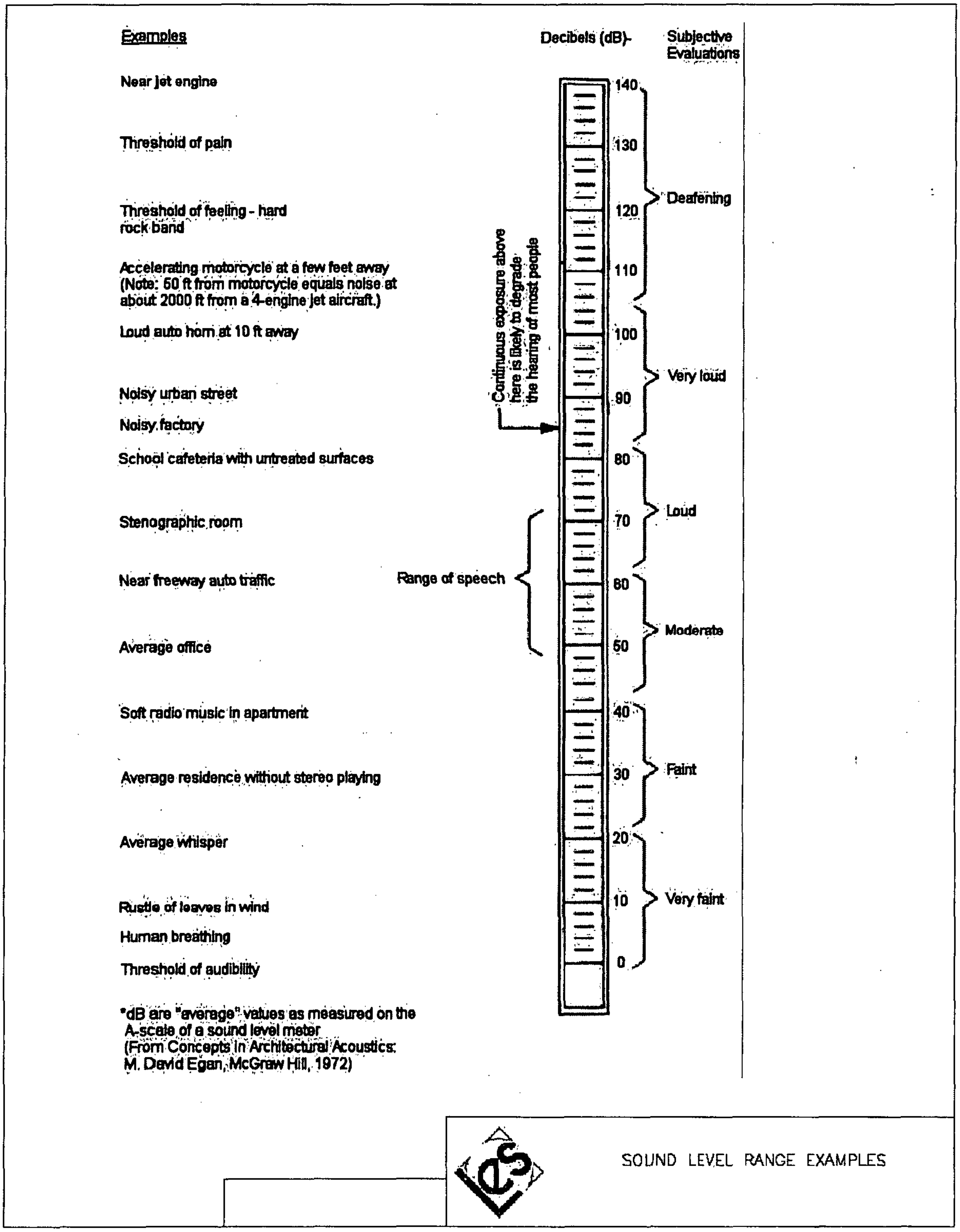


Figure 3.7-2Sound Level Range Examples

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

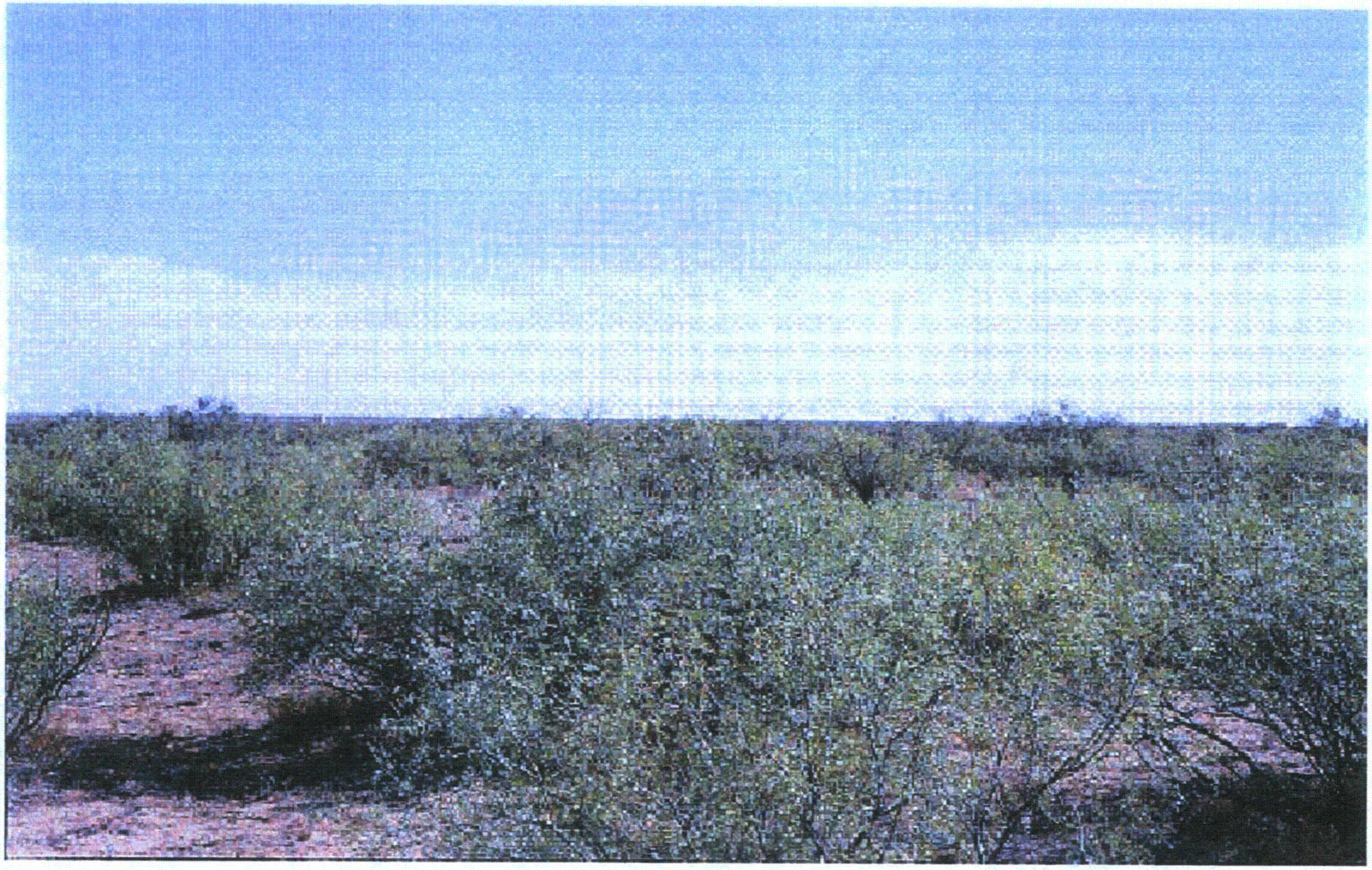
Scores in bold represent scores assigned to the NEF site.

[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 3.9-1AView of Proposed NEF Site Looking from the Southeast to the Northwest



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

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

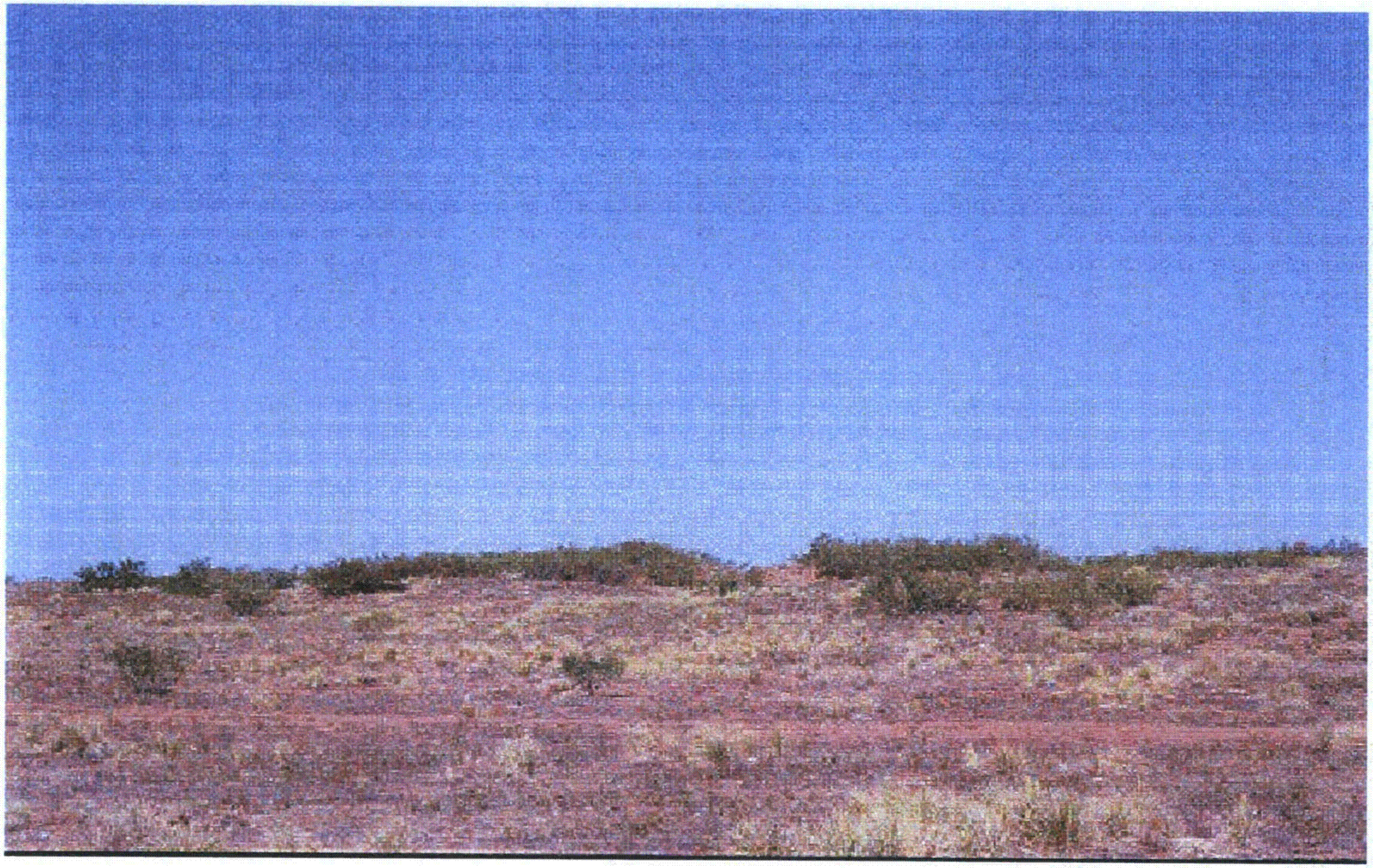
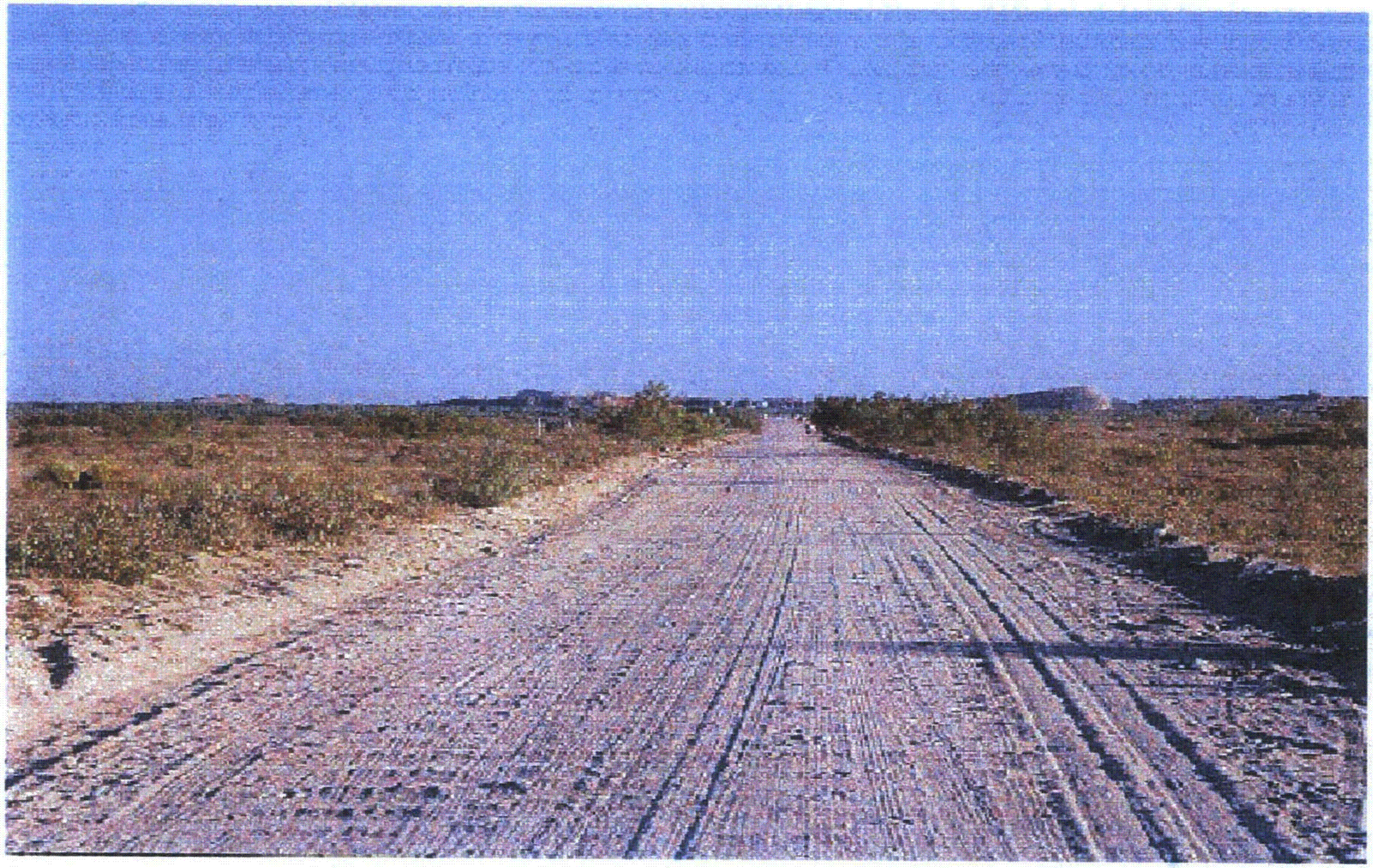


Figure 3.9-1CView of the Proposed NEF Site Looking From The Southwest To The Northeast

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

Figure 3.9-1DView 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 3.9-1EView of Center of the Proposed NEF Site from New Mexico Highway 234

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

LOOKING SOUTH TOWARDS PROPOSED NEF SITE
FROM ADJACENT QUARRY TO THE NORTH

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

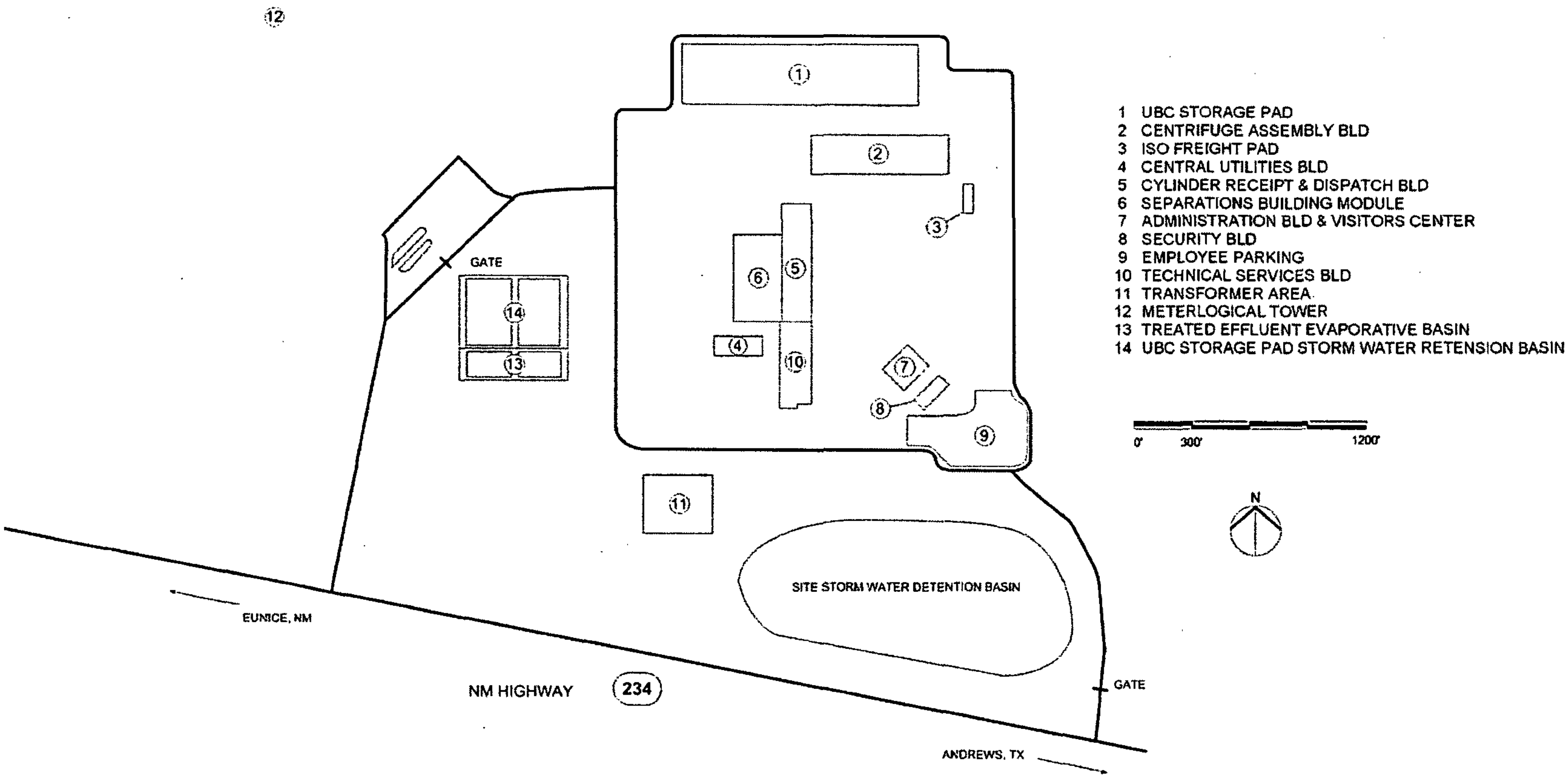


Figure 3.9-2Constructed Features (Site Plan)

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.

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 3.10-1Population 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 3.10-2General 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 3.10-3Civilian 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 3.10-3Civilian 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 3.10-4Area Income Data

Topic	Lea County, NM	Andrews County, TX	New Mexico	Texas
	Area			
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 3.10-5Housing 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 3.10-6Educational 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 3.10-7Educational 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

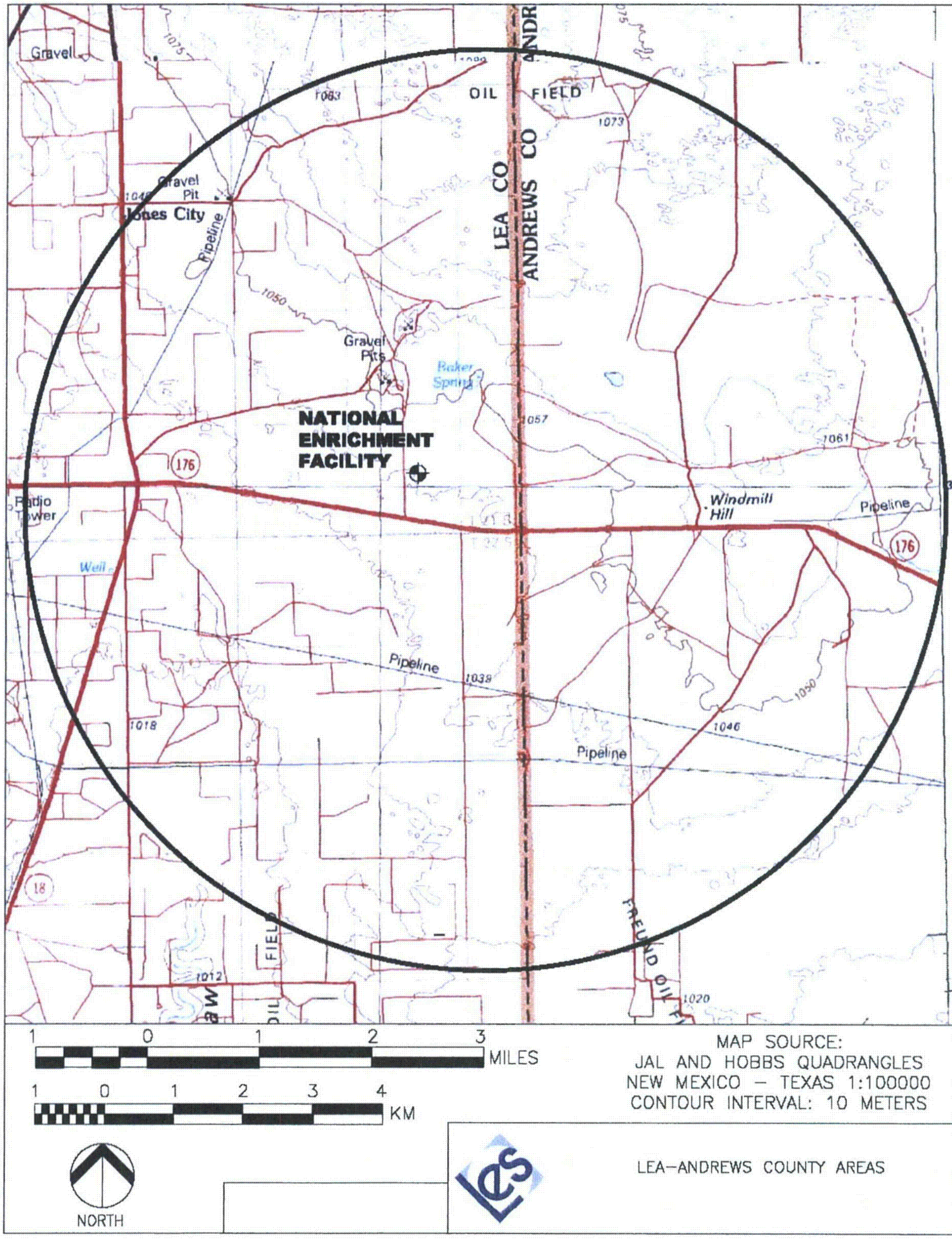


Figure 3.10-1Lea-Andrews County Areas

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 one year 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). LBDCR-09-0073

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.

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 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 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 $\mu g/m^3$ 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 $\mu g/m^3$, 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 $\mu g/m^3$ 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 3.11-1Lost 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 3.11-2Public 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 3.11-3Hydrogen 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 3.11-4Properties 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 3.11-5Chemical 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		
$UF_6 \Rightarrow U + 3F_2$	$+2.16x10^6$ $(+ 9.29x10^5)$	$+2.03x10^6$ $(+ 8.73x10^5)$
$UF_6 \Rightarrow UF_4 + F_2$	$+1.32x10^5$ $(+ 1.3x10^5)$	$+2.65x10^5$ $(+ 1.14x10^5)$
UF_6 Hydrolysis		
$UF_6(g) + 2H_2O(g) \Rightarrow UO_2F_2(s) + 4HF(g)$	$-2.11x10^5$ $(- 9.1x10^4)$	$-1.41 x10^5$ $(- 6.05x10^4)$
HF Reaction with Glass		
$HF + SiO_2 \Rightarrow SiF_4 + 2H_2O$	$-1.06x10^5$ $(- 4.58x10^4)$	$-8.37x10^4$ $(- 3.60x10^4)$

* 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 3.11-6Radiological 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

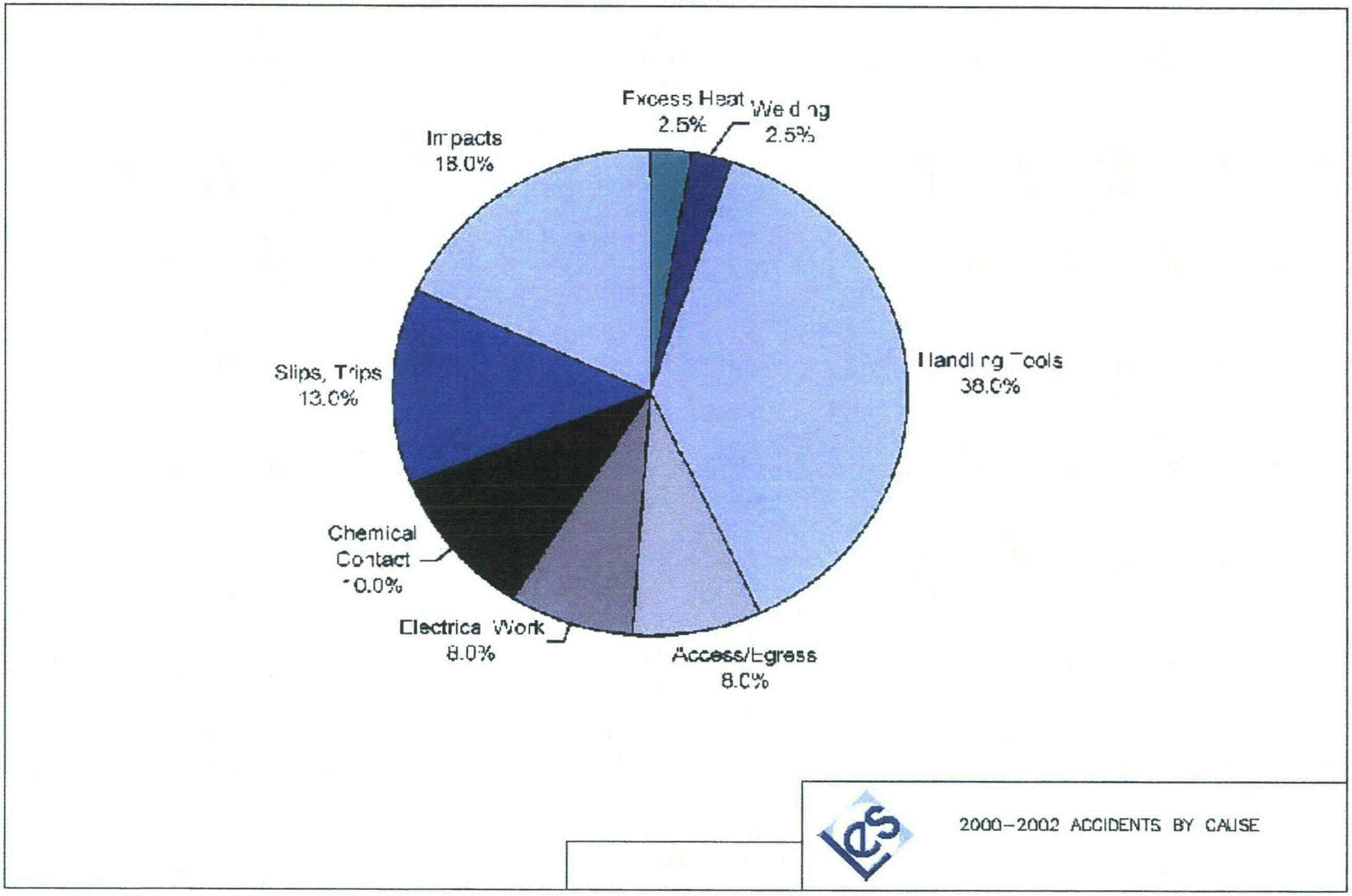


Figure 3.11-12000-2002 Accidents by Cause

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 *(See § 9.2.9)* Gaseous Effluent Vent Systems (GEVS)

The function of the GEVS is to remove particulates containing uranium and HF from potentially contaminated process gas streams. Prefilters and high efficiency particulate air (HEPA) filters remove particulates and impregnated activated carbon filters are used for the removal of HF. The systems produce solid wastes from the periodic replacement of prefilters, HEPA filters, and impregnated activated carbon 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) Pumped Extract GEVS and (2) the CRDB GEVS.

Note: The Heating Ventilation and Air Conditioning (HVAC) systems and Gaseous Effluent Vent Systems (GEVS) for the NEF are undergoing redesign. After these design changes are finalized the information in Section 3.12.1.1 (Gaseous Effluent Vent Systems), associated Sections 4.6.2.2 (Description of Gaseous Effluent Vent Systems), 4.6.5 (Mitigative Measures of Air Quality Impacts), 6.1.1.1 (Gaseous Effluent Monitoring), and other sections that reference GEVS will be revised as necessary and in accordance with 10 CRF 70.72. The final design will be evaluated in accordance with the requirements of 10 CFR 70.72 prior to requirements for operational readiness.

3.12.1.1.1 Functional Description

The design requirements 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 automatic or operator actions.

These requirements and operating conditions also assure "as low as reasonably achievable" (ALARA) personnel exposure to hazardous materials and compliance with environmental and safety criteria.

3.12.1.1.2 Major Components for GEVS

The Pumped Extract GEVS and CRDB GEVS each consist of the following major components.

A. Duct system

B. Pre-filter(s)

C. High Efficiency Particulate Air (HEPA) Filters

D. Impregnated activated carbon filter(s)

E. Centrifugal fans

F. Monitoring and controls (HF) before and after filter trains (with temperature indicating alarms on carbon filters)

G. Automatically controlled inlet and outlet isolation dampers or valves

H. Exhaust stack

I. Monitoring and controls (alpha and HF) in exhaust stack

J. Airflow monitors and airflow blender

3.12.1.1.3 Pumped Extract GEVS

The Pumped Extract GEVS, a Safe-By-Design[1] system, provides exhaust of potentially hazardous contaminants for the SBMs from all permanently connected vacuum pump and trap sets as well as temporary connections used by maintenance and sampling rigs. The Pumped Extract GEVS is located in the UF_6 Handling Area of SBM-1001. The system is monitored from the Control Room.

3.12.1.1.3.1 Design Description

A mimumum target velocity of 7 m/s (1380 ft/min) will be established in the piping system to convey particulate contaminants through the piping and minimize settling. Each section of the pipe system has an orifice plate to maintain a minimum air velocity.

The Pumped Extract GEVS piping connects to an inlet header. Off the inlet header are two parallel trains each with eight banks of filters. Each train is capable of handling 100% of the effluent during normal operations. One train is online and the other is a standby. Each bank of filters consists of a 60-65% efficient pre-filter which removes dust and protects the HEPA filter, a 99.97% efficient HEPA filter which removes uranium aerosols (mainly UO_2F_2 particles), a 99% efficient activated carbon filter for removal of HF, a position for an optional additional filter, and a final 99.97% HEPA filter which removes carbon fines and any additional uranium aerosols. Manual dampers are also located at the inlet and outlet of each of the eight banks of filters for testing and to allow isolation of a bank while the unit continues to operate. Flow balancing orifices are provided on each bank to assure balanced flows across each bank.

[1] Safe-by-design components are those components that by their physical size or arrangement have been shown to have a $k_{eff} < 0.95$.

Each filter train vents the clean gases through a variable speed centrifugal fan, which maintains the negative pressure upstream of the filter train by using input from a differential pressure controller. Finally, the clean gases are discharged through a roof top exhaust stack on the SBM. One exhaust stack is common to the operational system and the standby system. A switch between the operational and standby systems (trains) can be made using automatically controlled dampers. There are motorized and manually controlled dampers located at the inlet and outlet of each train to allow for different modes of operation of the system. The design flow rate is estimated to be 646 m^3/hr (380 cfm).

The Pumped Extract GEVS provides ventilation and hazardous contaminant removal and is connected via permanently piped locations for the following systems, equipment, and areas:

A. The UF_6 Feed System, the Product Take-off System, the Tails Take-off System, the Product Blending and Sampling Vent Subsystem and Contingency Dump System.

B. All Liquid Sampling System autoclaves.

C. All discharge lines from mobile vacuum pump sets.

D. In addition, local exhausts to the Pumped Extract GEVS are provided for initial plant operations via a temporary local extract connection to remove any releases from connections or disconnections of process equipment.

If the Pumped Extract GEVS stops operating, material within the piping will not be released into the building because each of the Pumped Extract GEVS connections is piped into the top of the header to prevent entrained material from falling back into the building from the piping during system failure.

Mobile vacuum pump units that vent to the Pumped Extract GEVS are available in the UF_6 Handling Area.

3.12.1.1.4 CRDB GEVS

The CRDB GEVS provides exhaust of potentially hazardous contaminants from rooms and services within the CRDB Bunkered Area. The system is located in the CRDB's GEVS Room and is monitored from the Control Room.

3.12.1.1.4.1 Design Description

The GEVS serving the CRDB 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 a roof top vent stack on the CRDB.

The unit will be located in a dedicated room in the CRDB. 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.

3.12.1.1.5 Design and Safety Features for all GEVS

The Pumped Extract GEVS and CRDB GEVS are designed to protect plant personnel, the public, and the environment against uranium and HF exposure.

These GEVS are designed to meet all applicable NRC requirements for public and plant personnel safety and effluent control and monitoring. The system designs also compy with applicable standards of OSHA, EPA, and state and local agencies.

The systems filter contaminated gases and continuously monitor exhaust gas flow to the atmosphere. HF monitors are installed upstream and downstream of the filter trains and in the exhaust stacks to monitor the release of hazardous materials to the environment. Alpha monitors are installed in the exhaust stacks to monitor the release of hazardous materials. A fault alarm is generated in the event of a fault occurring within any of the monitors. The alarms are monitored in the Control Room.

The filters are bag-in/bag-out. Carbon filter replacement will be based on the remaining absorption capacity. The remaining filters will be replaced based on differential pressure readings (i.e., filter loading). There is no fixed frequency for filter replacement. The materials of construction, corrosion allowances, and fabrication specifications for the equipment and piping/ductwork used in the GEVS are compatible with UF_6 and HF and are noncombustible.

The Pumped Extract GEVS is connected to standby diesel generators through the Short Break Load System. In the event of a failure of the electrical supply the units will be re-started automatically without the need for any manual reset when the power supply is restored.

For detailed information concerning GEVS Instrumentation and Criticality Safety, as well as regulatory testing and compliance see the Integrated Safety Analysis Summary in Section 3.4.9 Gaseous Effluent Vent Systems (GEVS).

3.12.1.1.6 Effluent Releases

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 Test and Post Mortem Facility is maintained at a negative pressure with respect to adjacent areas during contaminated or potentially contaminated processes. 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 adequate to maintain a negative pressure in the room.

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 a filter station that can handle 100% of the effluent. 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.

The Centrifuge Test and Post Mortem Exhaust Filtration System consist of an owner specified filter configuration consistent to meet the requirements of the this Plan. The basic filter arrangement consist of a prefilters, activated carbon filter, and HEPA filter, and is designed to remove dust/debris, HF, uranic particles, and any other hazardous material dictated by environmental requirements from the air stream while maintaining adequate air flow. 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 *(See § 9.2.12 L.)* 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 CRDB and in the Separations Building. The majority of all potentially radiologically contaminated aqueous liquid effluents are generated in the CRDB. All aqueous liquid effluents are collected in tanks that are located in the Liquid Effluent Collection and Treatment System in the CRDB. 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 are 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 CRDB and the SBMs goes to the Hand Wash/Shower Monitor Tanks in the Liquid Effluent Collection and Treatment Room. Water from the personnel hand wash and shower in the Centrifuge Test and Post Mortem Areas goes to the Hand Wash / Shower Monitor Tank in the Assembled Centrifuge Storage Area of the CAB. 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 later.

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 CRDB.

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. All effluents except sanitary waste 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.

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. A third unlined basin is used for the collection and monitoring of general site stormwater runoff.

Sanitary wastewater will be sent to the City of Eunice Wastewater Treatment Plant for processing via a system of lift stations and 8-inch sewage lines. Six septic systems may be used as a backup for the NEF site sanitary sewage system. Each septic system will consist of a septic tank with one or more leachfields.

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.

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 CRDB 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 CRDB. 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 CRDB. 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 and CTF/PMF Exhaust Filtration System 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 CRDB 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 ctivated 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 HF. Air filters, as a waste, consist of fiberglass or cellulose filters. Generally, only the GEVS 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 GEVS, 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 CRDB 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 CRDB. 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 save domestic wastewater. 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 3.12-1Estimated Annual Radiological and Mixed Wastes[6]

	Radiological Waste		Mixed Waste	
Waste Type	Total Mass Kg (lb)	Uranium Content Kg (lb)	Total Mass Kg/lb	Uranium Content Kg/lb
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.

6 Values were based on initial licensed facility design. More accurate forecasts of waste generation volumes will be based on operating history along with process knowledge.

Table 3.12-2Estimated Annual Non-Radiological Wastes[1]

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)

1 Values were based on initial licensed facility design. More accurate forecasts of waste generation volumes will be based on operating history along with process knowledge.

Table 3.12-3Estimated Annual Gaseous Effluent

Area	Quantity (yr^{-1})	Discharge Rate m^3/yr (SCF/yr) (STP)
GEVS (Note 1)	NA	2.3×10^8 (8.09×10^9)
HVAC Systems	NA	
Radiological Areas	NA	1.5×10^9 (max) (5.17×10^{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

NA – Not Applicable

Note 1. This includes the monitored gaseous discharges from Pumped Extract GEVS, CRDB GEVS, and the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System.

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:	8,168(2,119,278)	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 3.12-5Commodities 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 3.12-6Commodities 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