ENVIRONMENTAL REPORT
REVISION 21

LES, PO Box 1789, Eunice, New Mexico 88231, USA T: +1 575 394 4646 F: +1 575 394 4545 W: www.urenco.com

Summary of Changes for Revision 20		
Issue / Date	**Change**	**Description of Change**
20a 1-9-2012	LBDCR-12-0001 1-3-2012	LAR-11-02 replaces IROFS for the UF6 process systems located in the Cascade Halls in all SBMs with new IROFSc23 an dchanges the application of IROFS27e
20b 1-25-2012	LBDCR-12-0005 1-3-2012	LAR 11-02 Addendum A has been revised to change cascades 1.1 though 1.8 to 1.1 to 1.7 and License Amendment 60 to 50
20c 5-7-2012	LBDCR-12-0012 3-14-2012	Replace Section 6.1 with the correct regulatory requirement for a Semi Annual Radiological Release Report per 10 CFR 70.59 CC-EN-2012-0001; 70.72 = 2012-0123
	LBDCR-12-0014 3-29-2012	Update to describe final GEVS lineup including Pumped Extract GEVS (PXGEVS), Local Extract GEVS (LXGEVS) and CRDB GEVS. Various editorial changes throughout. CC-EG-2011-0059; 70.72 = 2012-0164
	LBDCR-12-0015 4-4-2012	Update long term Ecological Monitoring requirements CC-EN-2012-0002; 70.72 = 2012-0175
20d 7-19-2012	LBDCR-12-0022 5-2-2012	Describe SBM-1001 extension (SBM-1001X) in applicable sections; eliminate reference to specific facility SWU capacity; and minor editorial changes. CC-EG-2011-0129; 70.72 = 2012-0221
20e 8-30-2012	LBDCR-12-0028 7-27-2012	Update tails assay range from “0.2 to 0.34 $^{w}/_{o}$ ^{235}U” “0.10 to 0.50 $^{w}/_{o}$ ^{235}U” CC-OP-2012-0002; 70.72 = 2012-0269
20f 10-1-2012	LBDCR-12-0044 924-2012	Concrete sealer coating in the CRDB CC-EG-2011-0101; 70.72 = 2012-0494
	LBDCR-12-0032 8-29-2012	Change in Phased Operatin Descriptions CC-OP-2012-0001; 70.72 = 2012-0424
21 1-7-2013	N/A	Submittal to NRC for non substantial changes previously approved by LES.

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1.0 INTRODUCTION OF THE ENVIRONMENTAL REPORT

This Environmental Report (ER) constitutes one portion of an application submitted by Louisiana Energy Services (LES) to the Nuclear Regulatory Commission (NRC) for a license to construct and operate a gas centrifuge uranium enrichment facility. The proposed facility, the National Enrichment Facility (NEF) will be located near Eunice, New Mexico, in Lea County. The ER for this proposed facility serves two primary purposes. First, it provides information that is specifically required by the NRC to assist it in meeting its obligations under the National Environmental Policy Act (NEPA) of 1969 (Pub. Law 91-190, 83 Stat. 852) (USC, 2003a) and the agency's NEPA-implementing regulations. Second, it demonstrates that the environmental protection measures proposed by LES are adequate to protect both the environment and the health and safety of the public.

LES has prepared this ER to meet the requirements specified in 10 CFR 51, Subpart A, particularly those requirements set forth in 10 CFR 51.45(b)-(e) (CFR, 2003a). The organization of this ER is generally consistent with the format for environmental reports recommended in NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs.

This ER evaluates the environmental impacts of the LES proposed facility. Accordingly, this document discusses the proposed action, the need for and purposes of the proposed action, and applicable regulatory requirements, permits, and required consultations (ER Chapter 1, Introduction of the Environmental Report); considers reasonable alternatives to the proposed action (Chapter 2, Alternatives); describes the proposed NEF and the environment potentially affected by the proposed action (Chapter 3, Description of the Affected Environment); presents and compares the potential impacts resulting from the proposed action and its alternatives (Chapter 4, Environmental Impacts); identifies mitigation measures that could eliminate or lessen the potential environmental impacts of the proposed action (Chapter 5, Mitigation Measures); describes environmental measurements and monitoring programs (Chapter 6, Environmental Measurements and Monitoring Programs); provides a cost benefit analysis (Chapter 7, Cost Benefit Analysis); and summarizes potential environmental consequences (Chapter 8, Summary of Environmental Consequences). A list of references and preparers is also provided in Chapter 9, References, and Chapter 10 List of Preparers, respectively.

It is not practical to refer to a specific edition of each code, standard, NRC document, etc throughout the text of this document. Instead, the approved edition of each reference that is applicable to the applicable to the design, construction, or operation of the NEF is listed in ISAS Table 3.0-1.

The effective date of this ER is December 2003.

<u>The LES Organizational Structure</u>

Louisiana Energy Services (LES), L.L.C.. is a Delaware limited liability company. It has been formed solely to provide uranium enrichment services for commercial nuclear power plants. The President of LES reports to the LES Board of Managers. Section 1.2.1 of the SAR describes the corporateidentity.

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1.1 Need for and Purpose of the Proposed Action

As set forth in Section 1.1, Proposed Action, the proposed action is the issuance of an NRC license under 10 CFR 70 (CFR, 2003b), 10 CFR 30 (CFR, 2003c) and 10 CFR 40 (CFR, 2003d) that would authorize LES to possess and use special nuclear material (SNM), source material and byproduct material, and to construct and operate a uranium enrichment facility at a site located in Lea County, New Mexico. The LES facility will produce enriched Uranium-235 (^{235}U) up to a nominal 5 $^{w}/_{o}$ by the gas centrifuge process, with a nominal production of 3,000,000 separative work units (SWUs) per year. The enriched uranium will be used primarily in domestic commercial nuclear power plants in the United States.

Uranium enrichment is critical to the production of fuel for U.S. commercial nuclear power plants, which currently supply approximately 20% of the nation's electricity requirements. In recent years, however, domestic uranium enrichment has fallen from a capacity greater than domestic demand to a level that is less than half of domestic requirements (DOE, 2002a). In fact, at present, less than 15% of U.S. enrichment requirements are being met by enrichment plants located in the U.S. (DOE, 2003a). Notwithstanding, forecasts of installed nuclear generating capacity suggest a continuing demand for uranium enrichment services, both in the U.S. and abroad.The current lack of domestic enrichment capacity relative to domestic requirements has prompted concern within the U.S. government. Indeed, in a July 25, 2002 letter to the NRC commenting on general policy issues raised by LES in the course of its preapplication activities, William D. Magwood, IV, Director of the DOE Office of Nuclear Energy, Science and Technology, stressed the importance of promoting and developing additional domestic enrichment capacity. In this letter, DOE noted that "[i]n interagency discussions, led by the National Security Council, concerning the domestic uranium enrichment industry, there was a clear determination that the U.S. should maintain a viable, competitive, domestic uranium enrichment industry for the foreseeable future. In addition to identifying the policy objective of encouraging private sector investment in new uranium enrichment capacity, DOE has emphasized that "[t]he Department firmly believes that there is sufficient domestic demand to support multiple enrichers and that competition is important to maintain a health industry (DOE, 2002a).

This recent DOE letter to the NRC is consistent with prior DOE statements concerning the importance from a national energy security perspective of establishing additional reliable and economical uranium enrichment capacity in the U.S. In DOE's annual report, "Effect of U.S./Russia Highly Enriched Uranium Agreement 2001, dated December 31, 2001, DOE noted that "[w]ith the tightening of world supply and the closure of the Portsmouth Gaseous Diffusion Plant by USEC, in May 2001, the reliability of U.S. supply capability has become an important energy security issue." With respect to national energy security, DOE further stated:

> "The Department believes that the earlier than anticipated cessation of plant operations at Portsmouth has serious domestic energy security consequences, including the inability of the U.S. enrichment supplier USEC to meet all its enrichment customers' contracted fuel requirements, in the event of a supply disruption from either the Paducah plant production or the Highly Enriched

> Uranium (HEU) Agreement deliveries. The energy security concerns are due, in large part, to the lack of available replacement for the inefficient and non-competitive gaseous diffusion enrichment plants. These concerns highlight the importance of identifying and deploying an economically competitive replacement domestic enrichment capability in the near term."

As reflected in DOE's July 25, 2002 letter to the NRC, the Department of State has similarly recognized that "[m]aintaining a reliable and economical U.S. uranium enrichment industry is an important U.S. energy security objective." (Magwood letter, citing unclassified excerpt from U.S. Department of State cable SECSTATE WASHDC 212326Z DEC 01 (NOTAL)). Importantly, the letter emphasized that "the U.S. Government supports the deployment of Urenco gas centrifuge technology in new U.S. commercial enrichment facilities as a means of maintaining a reliable and economical U.S. uranium enrichment industry." Thus, current U.S. energy security concerns and policy objectives establish a clear need for additional domestic uranium enrichment capacity, a need that also has been recognized by Congress for some time. See e.g., S. Rep. No. 101-60, 101st Congress, 1st Session 8, 20 (1989) ("some domestic enrichment capability is essential for maintaining energy security"); H.R. Rep. No. 102-474, pt. 2, at 76 (1992) ("a healthy and strong uranium enrichment program is of vital national interest").

National security concerns and policy objectives also underscore the need for an additional reliable and economical domestic source of enrichment services. Congress has characterized uranium enrichment as a "strategically important domestic industry of vital national interest," essential to the national security and energy security of the United States" and necessary to avoid dependence on imports." S. Rep No. 101-60, 101st Congress, 1st Session 8, 43 (1989); Energy Policy Act of 1992, 42 U.S.C. Section 2296b-6. National security and defense interests require assurance that "the nuclear energy industry in the United States does not become unduly dependent on foreign sources of uranium or uranium enrichment services." S. Rep. No. 102-72, 102d Congress 1st Session 144-45 (1991). Indeed, in connection with the Claiborne Enrichment Center (CEC) proposed by LES in 1991 (LES, 1991a), the NRC recognized "[t]he fact that USEC already exists to serve national security interests does not entirely obviate a role for LES in helping to ensure a reliable and efficient domestic uranium enrichment industry, particularly when USEC is the only domestic supplier." Louisiana Energy Services (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 96 n. 15 (1998) citing H.R. Rep. No. 102-474, 102d Congress, 2d Session, pt. 1 at 143 (1992) (emphasis in original). Indeed, the NRC stated that "it might fairly be said that national policy establishes a need for a reliable and economical domestic source of enrichment services," and that "congressional and NRC policy statements" articulating such considerations of national policy "bear in [its] view, on any evaluation of the need for the facility and its potential benefits." CLI-98-3, 47 NRC at 95-96.

During 2002, two companies that offer uranium enrichment services worldwide announced plans to license and build new centrifuge based uranium enrichment plants in the U.S. (NRC, 2002a).

The NEF would further attainment of the foregoing energy and national security policy objectives. The enriched uranium produced by the NEF would constitute roughly one-fourth of the current U.S. enrichment services demand. This is a significant addition to current U.S. enrichment capacity.

Operation of the NEF would foster greater security and reliability with respect to the U.S. low-enriched uranium supply. Of equal importance, it would provide for more diverse domestic suppliers of enrichment services. At present, U.S. enrichment requirements are being met principally through enriched uranium produced at USEC's 50-year old Paducah gaseous diffusion plant (GDP) and at foreign enrichment facilities. Much of the foreign-derived enriched uranium being used in the U.S. comes from the downblending of Russian high-enriched uranium (HEU), pursuant to a 1993 agreement between the U.S. and Russian governments that is administered by USEC. This agreement, however, is currently scheduled to expire in 2013, and is not unsusceptible to disruptions caused by both political and commercial factors.

In the license application for its proposed lead cascade facility, USEC, which is currently the only domestic provider of enriched uranium to U.S. purchasers, explicitly recognized that the age of its Paducah facility, coupled with production cost considerations and the expiration of the HEU agreement in 10 years, necessitates deployment of more modern, lower-cost domestic enrichment capacity by the end of this decade. The NEF, which would begin production in 2008 and achieve full nominal production output by 2013, would help meet this need. Indeed, USEC is pursuing the development and deployment of its own centrifuge technology. The presence of multiple enrichment services providers in the U.S., each with the capability to increase capacity to meet potential future supply shortfalls, would enhance both diversity and security of supply for generators and end-users of nuclear-generated electricity in the U.S. As discussed in ER Section 1.1.2, Market Analysis of Enriched Uranium Supply and Requirements, purchasers of enrichment services view diversity and security of supply as vital from a commercial perspective as well.

The reliability and economics of the Urenco-owned centrifuge technology to be deployed in the NEF are well-established. This technology has been in use for over 30 years, and is currently deployed at Urenco's three European enrichment facilities. These facilities are located in Gronau, Germany; Almelo, Netherlands; and Capenhurst, United Kingdom. These facilities had a combined production capability of 6 million SWU at the end of 2002 (URENCO, 2003). This capability is scheduled to increase to 6.5 million SWU by the end of 2003. The duration of operations at these facilities and their collective SWU output confirms the operational reliability and commercial viability of the centrifuge technology that LES will install in the NEF.

Notwithstanding its initial development over three decades ago, the gas centrifuge technology to be deployed by LES remains a state-of-the-art technology. As a result of its longstanding use in Europe, the Urenco centrifuge enrichment process has undergone numerous enhancements, which have increased the efficiency of the process, as well as yielded significant safety and environmental benefits. The advantages of the Urenco-owned centrifuge technology relative to other extant enrichment technologies are discussed further in ER Section 2.1.3.1, Alternative Technologies. Chief among these is that the Urenco centrifuge enrichment process requirements approximately 50 times less energy than the gas diffusion processes still in use in France and the U.S. In this regard, the French company Areva plans to deploy Urenco centrifuge technology in a new enrichment facility to be constructed in France.

It is noteworthy that the U.S. government has previously expressed support for consideration by Urenco to partner with a U.S. company or companies for the purpose of transferring Urenco technology to new U.S. commercial uranium enrichment facilities (DOE, 2002a). Because it would deploy commercially viable and advanced centrifuge enrichment technology in the near term, the NEF would further important U.S. energy and national security objectives. Specifically, it would provide additional, reliable, and economical domestic enrichment capacity in a manner that would enhance the diversity and security of the U.S. enriched uranium supply.

1.1.2 Market Analysis of Enriched Uranium Supply and Requirements

Consistent with the guidance contained in NUREG-1520 concerning the need for and purpose of the proposed action, this section sets forth information on the quantities of enriched uranium used for domestic benefit, domestic and foreign requirements for enrichment services, and potential alternative sources of supply for the NEF's proposed services for the period 2002 to 2020. ER Section 1.1.2.1, Forecast of Installation Nuclear Power Generating Capacity, presents a forecast of installed nuclear power generating capacity during the specified period: ER Section 1.1.2.2, Uranium Enrichment Requirements Forecast, presents a forecast of uranium enrichment requirements; ER Section 1.1.2.3, Current and Potential Future Sources of Uranium Enrichment Services, discusses current and potential future sources of uranium enrichment services throughout the world; ER Section 1.1.2.4, Market Analysis of Supply and Requirements, discusses market supply and requirements under alternative scenarios and ER Section 1.1.2.5, Commercial Considerations and Other Implications of Each Scenario, discusses various commercial considerations and other implications associated with each scenario.

1.1.2.1 Forecast of Installation Nuclear Power Generating Capacity

LES has prepared forecasts of installed nuclear power generating capacity by country and categorized them into the following five world regions: (i) U.S., (ii) Western Europe, (iii) Commonwealth of Independent States (CIS) and Eastern Europe, (iv) East Asia, and (v) remaining countries are grouped as Other.

Eastern Europe consists of the following emerging market economy countries that were in the past classified as Communist Bloc countries and are operating nuclear power plants: Bulgaria, the Czech Republic, Slovakia, Hungary, Lithuania, and Romania. Of the 12 CIS countries that were part of the former Soviet Union (FSU), the three with nuclear power plants still operating are Russia, Ukraine and Armenia.

East Asia includes Japan, the Republic of Korea (South Korea), Taiwan, the People's Republic of China (PRC) and North Korea. It is the only region forecast to increase nuclear power capacity significantly from current levels.

This forecast was based on LES's country-by-country and unit-by-unit review of current nuclear power programs and plans for the future. The resulting LES projections of future world nuclear generation capacity are dependent on the following factors:

- Nuclear generating units currently in operation and retirements among these units that occur during the forecast period;
- Capacity that is created by extending the operating lifetimes of units currently in operation beyond initial expectations through license renewal;

- Units under construction, already ordered, or firmly planned with likely near-term site approval; and
- Additional new capacity that will require site approval and will be ordered in the future.

LES believes that world nuclear capacity will be dominated by plants currently in operation over the forecast period of this report, accounting for 76% of the total in 2015 and 63% in 2020. A small but significant contribution of 3% in 2015 and 2020 is obtained from capacity uprates and restarts of previously shutdown units. The growing importance of license renewal is also highlighted, reaching 7% in 2015 and 14% in 2020. Units currently under construction, firmly planned or proposed will account for 11% in 2015 and 12% in 2020, while additional new capacity will account for 4% in 2015 and 8% in 2020. Cumulative retirements over the same period will amount to 9% of total operable capacity in the year 2015 and 15% in 2020, offsetting the amount of capacity currently under construction or firmly planned with site approval. Figure 1.1-1, Forecast and Composition of World Nuclear Generation Capacity, presents LES's forecast and composition of world nuclear generation capacity in these five categories.

In the U.S., it is expected that a significant portion of existing units with operating licenses scheduled to expire by 2020 will find license renewal to be technically, economically and politically feasible. In fact, the Nuclear Regulatory Commission (NRC) granted the first license extension in the U.S. to the two unit Calvert Cliffs Nuclear Station in March 2000. By June 2003 a total of 16 units had been granted license extensions in the U.S. Applications for the renewal of operating licenses for 14 additional units have been submitted to the NRC for review, and the NRC has been notified of operator plans to submit applications for at least an additional 28 units during the next three years (NEI, 2003; NRC, 2003c). This accounts for more than 50% of the installed nuclear generating capacity in the U.S. As of March 2002, the NRC expected "that virtually the entire operating fleet will ultimately apply" to renew their operating licenses (NRC, 2002c). The transition to a competitive electric generation market has not led to the early retirement of additional U.S. operating capacity, but instead has resulted in further plant investment in the form of plant power uprates. These have included more than 50 power uprates, representing approximately two Gigawatts electric (GWe) of total power increases that have been approved by the NRC during the last three years (mid 2000 through mid 2003), six applications for power uprates that are currently under review by the NRC, and an additional 31 applications for power uprates that are expected by the NRC over the next five years (NRC, 2003d). LES's forecast of installed nuclear power generating capacity is summarized in Table 1.1-1, Summary of World Nuclear Power Installed Capacity Forecast (GWe).

As shown in Figure 1.1-2, Comparison of Forecasts of U.S. Nuclear Generation Capacity and Figure 1.1-3, Comparison of Forecasts of World Nuclear Generation Capacity for the U.S. and world, respectively, these LES forecasts are consistent with the most recently published forecasts of installed nuclear generation capacity prepared by the U.S. Department of Energy/Energy Information Administration (EIA) (DOE, 2003b) and the World Nuclear Association (WNA) (WNA, 2003).

On a world basis, LES's forecast is consistent with an average annual nuclear power installed capacity growth rate of 1.0% through 2010, and a very low annual rate of growth, 0.1%, thereafter, as the effects of plant retirements begin to offset the introduction of new plants. World installed nuclear power capacity is forecast to rise a total of 8.7% from 356.8 GWe at the end of 2002 to 387.7 GWe by 2010, and to rise an additional 0.6% to 390.1 GWe by 2020. The corresponding annual average rate of change in installed nuclear power capacity by world region is presented in Table 1.1-2, Forecast of Annual Average Rate of Change in Installed Nuclear Power Capacity.

The period through 2010 generally includes existing construction and some firmly planned additions minus early retirements. The period after 2010 is governed by the retirement of existing capacity, mitigated by license renewal, and additional new capacity which is not yet firmly planned. Nuclear capacity in Western Europe declines at a rate that increases noticeably after the year 2010 as the terms of existing operating licenses are reached and longer lifetimes are thwarted by phase out plans in some countries and only limited new capacity additions are made. Capacity in the U.S. increases through 2010 through uprates and the restart of Browns Ferry 1, but a few plant retirements then cause a slight decline before installed capacity recovers as new plants are introduced after 2015. There is a small increase for nuclear power in the CIS and Eastern Europe through 2010, as many nuclear units using first generation Soviet technology are not retired as quickly as some forecasters in Western Europe initially hoped would be the case. However, retirements result in a small decline after 2010. Ambitious plans in Russia to double nuclear generation capacity by the year 2020 are assumed to go mostly unrealized. East Asia shows strong growth through 2010 and beyond, as nuclear continues to expand to fill a portion of growing energy needs in this resource-limited part of the world. Countries in the other region undergo modest growth through 2010 as existing projects are completed and some units placed on extended standby return to service, but little net growth thereafter.

1.1.2.2 Uranium Enrichment Requirements Forecast

A forecast of uranium enrichment services requirements was prepared by LES consistent with its nuclear power generation capacity forecasts, which were presented in ER Section 1.1.2.1, Forecast of Installation Nuclear Power Generating Capacity. A summary of the nuclear fuel design and management parameters that were used in developing the forecast of uranium enrichment requirements is as follows:

Country-by-country average capacity factors rising with time from a world average of 82% in 2003 to 84% by 2007. The average capacity factor for the U.S. is 90% for the long-term;

- Individual plant enriched product assays based on plant design, energy production, design burnup, and fuel type (note that Russian designed fuel has a 0.30 weight percent ($^{w}/_{o}$) uranium isotope 235 (^{235}U) margin when compared to Western fuel design, while typical Japanese practice includes a 0.20 $^{w}/_{o}$ ^{235}U margin that is assumed to decline over time);
- Enrichment tails assays of 0.30 $^{w}/_{o}$ ^{235}U, except for the U.S. and U.K. where the assay has increased to 0.32 $^{w}/_{o}$; Japan (0.28 $^{w}/_{o}$, increasing to 0.30 $^{w}/_{o}$ over time); France (0.27 $^{w}/_{o}$); and the CIS and Eastern Europe where tails assays of 0.11 $^{w}/_{o}$ are assumed;
- Current plant specific fuel discharge burnup rates for the U.S., and country and reactor type- specific fuel burnup rates elsewhere, generally increasing in the future;

- Country (for some non-U.S. countries) and plant specific fuel cycle lengths (for the U.S. and other countries), collectively averaging approximately 20 months in the case of the U.S., and 16 months for all light water reactors (includes U.S. reactors);
- Equivalent uranium enrichment requirement savings resulting from plutonium recycle in some Western European countries (France, Germany, Belgium, Switzerland, and possibly Sweden) and Japan. The projections assume that the previously planned Japanese implementation of recycle will continue to be delayed and that the rate of implementation will also be slowed initially; and
- Equivalent enrichment requirements savings resulting from the recycle of excess weapons plutonium in the U.S. and Russia are also included. Total equivalent enrichment services requirements savings associated with recycling of commercial and military plutonium are in the range of 2% and 3% over the long term.

Table 1.1-3, World Average Annual Uranium Enrichment Requirements Forecast After Adjustment for Plutonium Recycle in MOX Fuel (Million SWU) provides a forecast of average annual enrichment services requirements by world region that must be supplied from world sources of uranium enrichment services. These requirements reflect adjustment for the use of recycled plutonium in mixed oxide (MOX) fuel. It should be recognized that on a year to year basis, there can be both upward and downward annual fluctuations that reflect the various combinations of nominal 12-month, 18-month and 24-month operating/refueling cycles that occur at nuclear power plants throughout the world. Therefore, interval averages are provided in this table.

As shown in Table 1.1-3, World Average Annual Uranium Enrichment Requirements Forecast After Adjustment for Plutonium Recycle in MOX Fuel (Million SWU), during the 2003 to 2005 period, world annual enrichment services requirements are forecast to be 40.2 million separative work units (SWU), which is a 3.3% increase over the estimated 2002 value of 38.9 million SWU. LES forecasts that annual enrichment services requirements will rise very gradually with the average annual requirements during the 2006 to 2010 period reaching 41.6 million SWU, an increase of 3.5% over the prior five year period. Annual requirements for enrichment services are forecast to be virtually flat thereafter, averaging 41.5 million SWU per year throughout the period 2011 through 2020.

These LES forecasts of uranium enrichment requirements in the U.S. and world are generally consistent with the most recently published forecasts by both the EIA and WNA (WNA, 2003; DOE, 2001g; DOE, 2003c). Figure 1.1-4, Comparison of Forecast of World Average Annual Uranium Enrichment Requirements Forecasts, Unadjusted for Plutonium Recycle in MOX Fuel and Figure 1.1-5, Comparison of Forecast of U.S. Average Annual Uranium Enrichment Requirements Forecast, Unadjusted for Plutonium Recycle in MOX Fuel, provide comparisons of the LES forecasts with those published by these two organizations for world and U.S. requirements. Since both EIA and WNA present their uranium enrichment requirements forecasts prior to adjustment for the use of recycled plutonium in MOX fuel, LES has presented its forecasts in the same manner.

Since the EIA does not publish a forecast of plutonium recycle in MOX fuel, LES has compared its forecast of plutonium recycle in MOX fuel, which is developed based in part on published information (NEA 2003), against that of WNA (WNA, 2003) and finds the forecasts to be in general agreement. LES's assumptions, as reflected in Table 1.1-3, for the adjustment to uranium enrichment requirements associated with the utilization of commercial and military plutonium recycle in MOX fuel are summarized in Table 1.1-4.

In the context of the analysis that is presented in subsequent sections of this report, it may be useful to note that LES's uranium enrichment requirements forecasts, which are presented in Table 1.1-3, suggest U.S. requirements for uranium enrichment services (Figure 1.1-5) that are 14.6% lower than the average of the EIA and WNA forecasts during the period 2011 through 2020 and 8.5% lower worldwide than the average of the EIA and WNA forecasts (Figure 1.1-4) during this same period. If the higher EIA or WNA forecasts for uranium enrichment requirements were used by LES in the analysis that is presented in this report, then an even greater need would be forecast for newly constructed uranium enrichment capability.

1.1.2.3 Current and Potential Future Sources of Uranium Enrichment Services

Table 1.1-5, Current and Potential Future Sources of Uranium Enrichment Services, summarizes current and potential future sources and quantities of uranium enrichment services. These sources include existing inventories of low enriched uranium (LEU), production from existing uranium enrichment plants, enrichment services obtained by blending down Russian weapons grade highly enriched uranium (HEU), as well as new enrichment plants and expansions in existing facilities, together with enrichment services that might be obtained by blending down U.S. HEU. The distinction is made in this table between current annual "physical capability," and current annual "economically competitive and physically usable capability," both of which may be less that the facility's "nameplate rating." In the case of facilities that are in the process of expanding their capability, the annual production that is available to fill customer requirements during the year is listed, not the end of year capability.

The nameplate rating is characterized as the annual enrichment capability of the enrichment cascades if all auxiliary systems were physically capable of supporting that level of facility operation, which is not always the situation in an older facility. The physical capability is characterized as the annual enrichment capability of the entire facility, taking into account whatever limits may be imposed by auxiliary systems, but independent of the economics associated with operation at that level of production. The economically competitive and physically usable capability refers to that portion, which may be all or part, of the physical capability that is capable of producing enrichment services that can be competitively priced. For instance, the cost of firm power during the summer months which can be several times higher than the cost of non-firm power that may be purchased under contract during the remainder of the year. In practice this limits the annual enrichment capability of electricity intensive gaseous diffusion enrichment plants. In addition, physically usable requires that the enriched uranium product that can be obtained from the enrichment plant that is not subject to international trade restrictions and will meet appropriate material specifications for its use in commercial nuclear power plants that operate in countries outside the CIS and Eastern Europe.

Current total world annual supply capability from all available sources, independent of physical suitability of material or economics is presently estimated by LES to be approximately 49.6 million SWU, as shown in Table 1.1-5. However, the total world annual supply capability of enrichment services that are used to meet CIS and Eastern European requirements, plus those which are economically competitive and meet material specifications for use by Western customers, and are not constrained by international trade restrictions amounts to only 40.7 million SWU, as also shown in Table 1.1-5. This is only 1.8 million SWU greater than the estimated 2002 requirements of 38.9 million SWU and nearly identical to the 2003 to 2005 average requirements of 40.2 million SWU, which were presented in Table 1.1-3, World Average Annual Uranium Enrichment Requirements Forecast After Adjustment for Plutonium Recycle in MOX Fuel (Million SWU). These conclusions are consistent with other recently published analyses of the market for uranium enrichment services (NEIN, 2003; NMR, 2002b; Van Namen, 2000; Grigoriev, 2002).

The Inventories (Table 1.1-5, Ref. 1) refer to existing inventories of LEU that are held primarily by owners and operators of nuclear power plants in Europe and East Asia, those that are present in Kazakhstan, and to a limited extent elsewhere. LES expects that most such inventories will be used internally in the near term and will decline from just under one million SWU in 2003 to 0.5 million SWU by 2007.

The Urenco centrifuge enrichment capability (Table 1.1-5, Ref. 2) refers to capability from machines that are presently in operation or in the process of being installed at Urenco's three European enrichment plants, which are located in Gronau, Germany, Almelo, Netherlands and Capenhurst, United Kingdom. These plants had a combined production capability of approximately 6.0 million SWU at the end of 2002 (URENCO, 2003) scheduled to increase to 6.5 million SWU per year by the end of 2003. LES estimates that by the end of 2008 the combined Urenco production capability will be approximately 8 million SWU per year. Urenco is expected to provide 6.0 million SWU of enrichment services during 2003. While Urenco is expected to replace older capacity that reaches its design lifetime, remaining centrifuge manufacturing capability is then projected to be devoted to the LES and Cogema centrifuge plants discussed below. Urenco has the capability to react to increase in demand as envisioned by other forecasts (EIA and WNA) as shown in Figure 1.1-5 and, in this case, Urenco's product capability may exceed 8 million SWU per year in the long term.

The existing Eurodif enrichment capability (Table 1.1-5, Ref. 3) refers to capability from the 10.8 million SWU per year (nameplate rating) Georges Besse gaseous diffusion plant (GDP) (NEIN, 2002) that is located near Pierrelatte, France. It should be noted that about 2.8 million SWU per year of the physically available Eurodif enrichment capability is not economically competitive due to very high electric power costs at that higher operating range (FF, 1999). According to the schedule that was announced by Areva (which is the holding company for Cogema - the majority owner of Eurodif and the company responsible for marketing its enrichment services), it is expected that the 8 (=10.8-2.8) million SWU per year in GDP enrichment capability may be split between customer deliveries and pre-production beginning in 2007, as the new replacement centrifuge plant begins operations. This will enable Eurodif to build up a surplus of enrichment services that it can use to supplement centrifuge production following the planned shut down of the Georges Besse GDP in 2012 (NF, 2002a). Accordingly, during the period 2005 through 2010 Eurodif is forecast to be able to supply to the market 7.1 million SWU on an average annual basis from the Georges Besse GDP, with the balance used to create the previously mentioned stockpile. Eurodif's ability to supply the market from this plant will drop to an average annual capability of 3 million SWU during the period 2011 through 2015, based on LES forecasts for the Georges Besse GDP's last two years of operation.

The existing USEC enrichment capability (Table 1.1-5, Ref. 4) refers to capability from the 8 million SWU per year GDP, which is located in Paducah, Kentucky (USEC, 2002a). The annual nameplate capability of 11.3 million is not physically attainable without capital upgrades to the plant, which are not expected. LES estimates that approximately 1.5 million SWU per year of the 8 million SWU capability is not economically competitive due to very high electric power costs in that operating range (Sterba, 1999). This is similar to the situation described previously for the Eurodif GDP. The commercial centrifuge plant construction schedule originally announced by USEC called for the first increment of production from its new commercial centrifuge enrichment plant by 2010, followed by a rapid ramp up to full production by 2013 (Spurgeon, 2002). Recent USEC statements suggest that it now expects to beat this original schedule by one year, as reflected in Table 1.1-5 (USEC, 2003a). To optimize economic operation of its plants, LES assumes that USEC would operate the Paducah GDP at the full 6.5 million SWU per year through the second year of commercial centrifuge operations, and then shut down at the end of that year (TPS, 2002). In so doing, it is assumed that USEC would be able to supply up to 4.5 million SWU to the market during the second year of commercial centrifuge operation from the Paducah GDP, stockpiling the balance to be used to supplement centrifuge plant production as it continues to be ramped up to full production capability.

Of the Russian 20 million SWU in total annual uranium enrichment plant capability (Korotkevich, 2003; Shidlovsky, 2001) (Table 1.1-5, Refs. 5, 14, 15 and 16), Russia claims that approximately 10 million SWU of its annual uranium enrichment capability is available for use in Western nuclear power plants (NF, 1991; NEIN, 1994). However, current U.S. and European trade policies (FR, 2000; FR ,1992; EUB, 2002) effectively limit the quantity of Russian enrichment services that can be sold directly to Western customers to approximately 3 million SWU annually, of which 2.7 million SWU is the estimated level of Western exports for 2002. Approximately 4.2 million SWU per year of the remaining 7.3 (=10.0-2.7) million SWU per year of enrichment services that are constrained by trade policy are used to create HEU blendstock. This is estimated by LES based on enriching 0.3 $^{w}/_{o}$ ^{235}U tails material as feed up to 1.5 $^{w}/_{o}$ ^{235}U product to be used as blendstock, at a tails assay of 0.11 $^{w}/_{o}$ ^{235}U, in the amount required to blend 30 MT (33 tons) of Russian HEU annually. Approximately 1.6 million SWU per year of it is used to recycle tails material (i.e., enrich tails to natural uranium assay or higher) for Urenco and Eurodif (WNA, 2002; NMR, 2002a). This is estimated by LES based on enriching 0.3 $^{w}/_{o}$ tails to produce 2,000 MT (2,205 tons) of uranium at a natural enrichment equivalent assay of 0.711 $^{w}/_{o}$ ^{235}U at an operating tails of 0.2 $^{w}/_{o}$ ^{235}U. This leaves approximately 1.5 (=7.3-4.2-1.6) million SWU per year of trade policy constrained, but otherwise available, Russian enrichment capacity available for potential export. Enrichment exports are forecast to have the potential to increase to 3.5 million SWU annually over the next five years within the existing trade constraints, reducing the excess to 0.7 million SWU. The excess capacity may be used to recycle Russia's own tails material or to further enrich the European tails in order to create the equivalent of natural uranium feed for export.

Russia has an additional 10 million SWU of annual uranium enrichment capacity that does not meet material specifications for use in Western nuclear power plants. Approximately 1.6 million SWU of this additional annual Russian capacity is excess to the approximately 8.4 million SWU per year in CIS and Eastern European requirements, but due to its material properties it cannot be exported to the Western world. This excess annual capacity is instead utilized by Russia for the recycling of Russian tails material. Given the complexity of the Russian situation, Table 1.1-6, Summary of Current Russian Sources and Uses of Enrichment Services, provides a summary of the sources and uses of Russian enrichment services as described above.

As older centrifuges reach their design lifetimes, Russia reportedly plans to replace them with newer designs that have higher outputs. As a result, total Russian centrifuge enrichment capacity could potentially increase by as much as 30% or 6 million SWU over the next ten or more years (Korotkevich, 2003). It is assumed that one-half of the increase would take place at the exportable enrichment plant site, while the other half would take place at the enrichment plant sites devoted to meeting the needs of Russian designed reactors. The potential increase in Russian enrichment export capabilities to the Western world is considered speculative at this time, particularly given the fact that trade constraints prevent the full use of already existing Russian enrichment export capability. Russia is assumed to replace retiring centrifuges to maintain the current total annual physical capability of 20 million SWU. If Russia is able to significantly increase its domestic nuclear generation capacity, the enrichment plant capacity devoted to internal needs could be increased as needed.

The other existing capability (Table 1.1-5, Ref. 6) is dominated by just under 1 million SWU of annual centrifuge and diffusion enrichment capability in the Peoples Republic of China (PRC) just over 0.8 million SWU of annual Japanese centrifuge enrichment capability, and just under 0.1 million SWU of annual capability from other countries, for a current total of 1.9 million SWU of annual capacity. The majority of this capability is used internally, although the PRC exports small amounts to the U.S. The PRC has replaced its small diffusion enrichment capability with centrifuge capability that is imported from Russia. The Japanese capability is expected to gradually decline, reaching zero by about 2010, due to high failure rates that have limited centrifuge operating lifetimes. Brazil has recently announced its plans to begin operation of a small uranium enrichment facility, which will be gradually ramped up to meet its internal requirements (NEA, 2003; RNS, 2002a; NTI, 2002; NF, 1999b; JNCDI, 2002; JNFL, 1998; JNFL, 2000a; JNFL, 2000b).

The Russian HEU-derived LEU (Table 1.1-5, Ref. 7a) while expected to average just over 6 million SWU per year for three years starting sometime after 2003 to allow for catch up on previous deliveries, is expected to return to an annual level of 30 MT (33 tons) HEU or approximately 5.5 million SWU through 2013, when the term of the current U.S.-Russian Agreement for 500 MT (551 tons) HEU concludes (USEC, 2002b). Ongoing discussions continue between the U.S. and Russia regarding additional quantities of Russian HEU-derived LEU for the post 2013 time period (NF, 2002b). While recognizing a very high level of uncertainty, one might postulate that this arrangement may continue beyond the term of the present agreement, and possibly at the current level of 5.5 million SWU per year. It is important to note, as explained below, that in order to create and utilize the 5.5 million SWU contained in the LEU that is derived from the Russian HEU, 4.2 million SWU contained in blendstock is required. Therefore, the net addition to world supply is only 1.3 (=5.5-4.2) million SWU per year.

By way of background it should be understood that the HEU recovered from nuclear weapons, which is reported to have a ^{235}U assay of approximately 90 $^{w}/_{o}$, can be converted to LEU that is usable in commercial nuclear power plants by blending it with slightly enriched uranium; for example, 1.5 $^{w}/_{o}$ ^{235}U uranium blendstock. Since the mass difference enrichment technologies, which are gaseous diffusion and gas centrifugation, enrich the undesirable light isotope ^{234}U at a higher rate than they enrich ^{235}U, the 0.0054 $^{w}/_{o}$ trace concentration of ^{234}U in natural uranium (which might otherwise serve as the feed material to create the 1.5 $^{w}/_{o}$ blendstock) is amplified to on the order of 1.25 $^{w}/_{o}$ in 90 $^{w}/_{o}$ ^{235}U HEU. Fortunately, the reverse is also true and the ^{234}U isotope is depleted at a greater rate than ^{235}U in the enrichment plant tails streams; for example, down to 0.0014 $^{w}/_{o}$ in 0.30 $^{w}/_{o}$ ^{235}U tails. Because of this, enrichment plant tails provide a good starting point for the production of slightly enriched uranium blendstock (e.g., 1.5 $^{w}/_{o}$ ^{235}U) and are therefore used for blending down the 90 $^{w}/_{o}$ Russian HEU (Mikerin, 1995). In short, the two-step process, the enriching of tails to produce 1.5 $^{w}/_{o}$ LEU blendstock (assuming a tails assay of 0.11 $^{w}/_{o}$ ^{235}U) and the actual blending of the HEU with this LEU blendstock results in the dilution of ^{234}U to a level that conforms with the Western industry's nuclear fuel material specifications.

Figure 1.1-6, Relationship Among HEU, Blendstock, Product, illustrates this process and presents HEU to LEU conversion relationships that highlight the contribution of the enrichment services that are associated with creating the blendstock relative to the enrichment services that may be associated with the resulting product, which is available for use in commercial nuclear power plants.

As illustrated in Figure 1.1-6, 76% (=0.140/0.184) of the SWU that is available in the product must have been expended to produce the blendstock. Therefore, assuming that 30 MT (33 tons) HEU is processed each year to yield LEU that contains the equivalent of 5.5 million SWU, then 4.2 million SWU (=.76*5.5) of this amount is expended in producing the blendstock. The net amount of additional SWU resulting from the down blending of 30 MT (33 tons) HEU is only 1.3 million SWU (=.24*5.5). The SWU-to-product ratios and uranium feed-to-product ratios are calculated using standard equations for separative work and material balance (EEI, 1990).

Note that an additional 0.2 million SWU per year is derived from Russian HEU (Table 1.1-5, Ref. 7b) directly blended with European utility reprocessed uranium (RepU). The program is expected to expand, providing an estimated 0.6 million SWU by the year 2010 (NF, 1999b; NF, 2002c).

USEC is presently utilizing the balance of the Department of Energy (DOE) HEU-derived LEU originally 50 MT (55 tons) of HEU, later reduced to 48 MT (53 tons) (DOE, 2001b)) that was transferred to it at privatization (Table 1.1-5, Ref. 8) at an annual rate of approximately 0.6 million SWU. At the present rate of utilization it is expected to be exhausted by 2006.

There is also DOE HEU (Table 1.1-5, Ref. 9) that includes the 33 MT (36 tons) of HEU (MT HEU) (approximately 3.1 million SWU equivalent) that is being used by the Tennessee Valley Authority (TVA) (FR, 2001) and 10 MT (11 tons) HEU (DOE, 2000b) (approximately 1.8 million SWU equivalent) that is expected to become available beginning in 2009. The unit enrichment content varies among the sources of DOE HEU due to both the different HEU assays and the expected blend stock requirements. The TVA material is expected to be utilized at a rate of 0.25 million SWU per year over a twelve year period beginning in 2005. The 10 MT (11 tons) HEU is forecast to be used over a four year period, allowing DOE HEU-derived SWU to ramp up to 0.7 million SWU per year between 2009 and 2012, before dropping back to 0.25 million SWU per year. Approximately 45 MT (49.6 tons) of additional scrap, research reactor fuel and other HEU with a SWU content of 4.4 million SWU or less have been declared excess, but no formal disposition plan has been established. This material could result in a net addition of 0.1 to 0.4 million SWU to annual enrichment supply after the year 2010, but is considered too speculative to include at this time.

In addition, the U.S. defense establishment is reported to hold approximately 490 MT (540 tons) HEU in various forms (e.g., weapons, naval reactor fuel, reserves) (Albright, 1997). However, there has been no indication if some or all of this material may be made available for commercial use, and if so on what schedule. Any forecast that includes use of the enrichment services that may be associated with this material must be recognized as being highly speculative. Therefore, LES does not consider it to be prudent to include it in this market analysis. Furthermore, to the extent that some or all of the equivalent uranium enrichment services associated with this material were assumed to become available, it is important to remember that blendstock must be prepared, as previously discussed in the context of the Russian HEU.

Based on the down blending analysis of the Russian HEU that was summarized in Figure 1.1-6, it appears that 0.76 million SWU is required to create the blendstock in order to obtain each 1 million SWU in LEU product, which could be made available for commercial use in nuclear power plants. This means that the net increase in enrichment services that could be obtained from any additional DOE HEU-derived LEU would be only 24% of the SWU contained in the LEU. Therefore even if it were assumed that all 490 MT (540 tons) HEU were made available, at the present conversion rate of 0.184 million SWU per MT HEU, multiplied by 24%, then only an additional 22 million SWU in net new supply could become available. This is equivalent to about two years of U.S. total requirements for enrichment services. If this were spread out over 20 years, it would add a net 1.1 million SWU per year or less than 3% (=1.1/41.5) to the available world supply. Furthermore, it would require virtually USEC's entire 3.5 million SWU of planned new commercial centrifuge enrichment capability to create the blendstock that would be required to down blend this material (3.43 = 490 * 0.184 * 76/20).

Eurodif plans for a new centrifuge enrichment plant have been announced (Table 1.1-5, Ref. 10). It plans to replace its existing gaseous diffusion plant with a new 7.5 million SWU per year enrichment plant that utilizes Urenco centrifuge technology. It expects to bring the new plant into operation beginning in 2007 and achieve full capability operation of 7.5 million SWU per year by 2016. Achieving the announced schedule is dependent upon Urenco and Areva reaching a detailed agreement regarding the structure of a joint venture to manufacture centrifuges (NF, 2002d).

LES announced its plan to build a new 3 million SWU per year enrichment plant in New Mexico, using Urenco centrifuge technology (Table 1.1-5, Ref. 11). It expects to bring the new plant into operation beginning in 2007 and to achieve full capability of 3 million SWU per year in 2013 (URENCO, 2002b; HNS, 2003; LES, 2003a).

USEC has also announced plans to replace the Paducah GDP with a new 3.5 million SWU per year centrifuge enrichment plant (Table 1.1-5, Ref. 12). It now plans to begin enrichment operations at the new plant by 2009, with full capability by 2012 (TPS, 2002; Spurgeon, 2002; USEC, 2003a).

The potential new capability in Other, (Table 1.1-5, Ref. 13) is primarily due to the expected increase in PRC capability at its centrifuge plant, using Russian technology. The centrifuge enrichment capacity is expected to expand starting around 2010 in order to keep pace with the PRC's growing internal requirements, reaching 1.5 million SWU per year by 2015, for an increase of almost 0.6 million SWU/yr. A small centrifuge enrichment plant in Brazil is expected to grow to 0.2 million SWU by 2010, for an increase of just over 0.1 million SWU/yr and will be devoted to internal needs (NF, 1999b; RNS, 2002b; NTI, 2002).

It is useful to note the geographical distribution of these current and potential future sources of enrichment services, as identified in Table 1.1-7, Current and Potential Future Sources of Uranium Enrichment Services Arranged According to Geographical Locations and the concentration of sources of enrichment services among individual companies, as identified in Table 1.1-8, Current and Potential Future Sources of Uranium Enrichment Services Arranged According to Commercial Ownership or Control, to better appreciate the market considerations that will be discussed in subsequent sections of this report.

1.1.2.4 Market Analysis of Supply and Requirements

1.1.2.4.1 Scenario A – LES and USEC Centrifuge Plants Are Built in the U.S.

Scenario A represents the scenario that is being actively pursued by both LES and USEC, consistent with schedules that have been announced by each company. Figure 1.1-7, Illustration of Supply and Requirements for Scenario A, presents LES's forecast of uranium enrichment supply and requirements through 2020, consistent with this scenario. The shaded areas are keyed by reference number to Tables 1.1-5 through 1.1-8 and are described above.

During the period 2003 through 2005, the average annual economically competitive and physically usable production capacity that is not constrained by international trade agreements, together with the SWU derived from Russian HEU and other sources reflected in the tables previously provided, is forecast to be 41.8 million SWU, assuming that Urenco adds an additional one million SWU of new capacity by then. However, this is just 1.6 million SWU (4.0%) more than average annual forecast requirements during this same period of 40.2 million SWU.

Moving forward in time to the period 2006 through 2010, during which it is assumed by LES that: Urenco has reached 8 million SWU per year of capacity in Europe; LES has 1.5 million SWU per year of capability in operation; Eurodif has the first 1.75 million SWU per year of centrifuge capability in operation and is supplementing this with 5.75 million SWU per year of its older more expensive GDP production to achieve a total capability of 7.5 million SWU per year, and has pre-produced and stockpiled the balance of 2.25 (=8.0–5.75) million SWU for use in subsequent years to optimize the transition; USEC will have brought the about 2.0 million SWU per year of centrifuge enrichment capability into operation, and will prepare to shutdown the older and more expensive GDP production after having pre-produced and stockpiled the balance of 2.0 (=6.5-4.5) million SWU for use in subsequent years to optimize the transition during 2011; Russia continues to sell 12 million SWU per year into the world market (i.e., includes supply to Russian designed nuclear power plants in the CIS and Eastern Europe, and exports to Western nuclear power plants, but excludes blendstock and enrichment of tails for other enrichers); the Russian HEU-derived LEU continues to provide enrichment services into the market at a rate of 5.5 million SWU per year and USEC has exhausted its DOE HEU-derived SWU; and DOE HEU-derived SWU continues to enter the market at a rate of 0.25 million to 0.7 million SWU per year. Under this scenario, the average annual economically competitive and unconstrained production capacity during the 2006 through 2010 period of 43.2 million SWU is only 1.6 million SWU (3.8%) more than average annual forecast requirements during this same period of 41.6 million SWU.

Continuing with this scenario to 2011 through 2015 period, by the end of this period it is assumed that Urenco continues to maintain a capability of 8 million SWU per year of capacity in Europe; LES has reached 3 million SWU per year of capability in operation; Eurodif has completed 6.5 million SWU per year of centrifuge capability in operation, has shut down its older more expensive GDP production, and is using 1 million SWU of pre-produced SWU to achieve a total annual capability of 7.5 million SWU; USEC will have brought the entire 3.5 million SWU per year of new centrifuge enrichment capability into operation and like Eurodif, will have shut down its older more expensive GDP production; Russia sells 12 million SWU per year into the world market; the Russian HEI-derived LES continues to provide enrichment services into the market at a rate of 5.5 million SWU per year; USEC has exhausted its DOE HEU-derived SWU and DOE HEU-derived SWU continues to enter the market at a rate of 0.25 to 0.7 million SWU per year. During the period 2011 through 2015, the average annual economically competitive and unconstrained production capacity, together with the SWU derived from Russian HEU and other elements of the tables previously provided, is forecast to be 42.0 million SWU which is 0.6 million SWU (1.4%) more than the average annual forecast requirements during this same period of 41.4 million SWU.

During the 2016 to 2020 period, the final capital additions are assumed to have been implemented for new centrifuge enrichment capacity. Minor perturbations to supply continue to take place. Accordingly, during the period 2016 through 2020, the average annual economically competitive and unconstrained production capacity, together with the SWU derived from Russian HEU and other elements of the tables previously provided, is forecast to be 41.8 million SWU which is 0.2 million SWU (0.5%) more than the average annual forecast requirements during this same period of 41.6 million SWU.

Supply and requirements are in very close balance after 2010, emphasizing the need for all supply sources, including the proposed LES and USEC centrifuge enrichment plants in the U.S. Commercial considerations and other implications associated with Scenario A are presented in ER Section 1.1.2.5.1, Scenario A – LES and USEC Centrifuge Plants Are Built in the U.S.

The following sections present alternatives to Scenario A wherein it is postulated that LES does not proceed with the construction and operation of its proposed gas centrifuge enrichment facility in New Mexico. To provide perspective for these scenarios, Figure 1.1-8, Illustration of Supply and Requirements for Scenario A Without the Proposed NEF, illustrates the forecast uranium enrichment supply and requirements situation for Scenario A without the 3 million SWU per year LES centrifuge enrichment plant.

1.1.2.4.2 Scenario B – No LES; USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP

An alternative scenario is that the 3 million SWU per year LES centrifuge uranium enrichment plant is not built in the U.S. Since an initial motivating factor for building this plant was to increase the amount of indigenous uranium enrichment capacity in the U.S., the first alternative considered is one that also provides for additional enrichment capacity located in the U.S. Under this scenario, it is postulated that USEC continues with its current plans to build and operate a 3.5 million SWU per year commercial uranium enrichment plant. However, instead of shutting down the Paducah GDP upon completion of the new centrifuge enrichment plant, USEC continues to operate the Paducah GDP. This would result in the availability of excess supply that is equal to about 9% of annual requirements. Commercial considerations and other implications associated with Scenario B are presented in ER Section 1.1.2.5.2, Scenario B – No LES; USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP.

1.1.2.4.3 Scenario C – No LES; USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability

This alternative scenario also assumes that the 3 million SWU per year LES centrifuge uranium enrichment plant is not built in the U.S. It also provides for additional enrichment capacity located in the U.S. Under Scenario C, it is postulated that USEC continues with its current plans to build and operate a 3.5 million SWU per year commercial uranium enrichment plant and also continues to operate the Paducah GDP on a temporary basis to compensate for the absence of the LES plant, while its commercial centrifuge plant is being gradually brought into operation. However, instead of stopping at 3.5 million SWU, USEC continues to add centrifuge enrichment capability to its new commercial centrifuge enrichment plant in order to compensate for the 3 million SWU per year of enrichment services that would have been provided by LES under Scenario A. Under Scenario C, USEC would need to operate the Paducah GDP for an additional two or three years in order to meet the enrichment services requirements that would have been supplied by LES and also to pre-produce inventories that would be needed to supplement centrifuge production during the expansion of the new plant. Commercial considerations and other implications associated with Scenario C are presented in ER Section 1.1.2.5.3, Scenario C – No LES; USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability.

1.1.2.4.4 Scenario D – No LES; USEC Does Not Deploy Centrifuge Plant and Continues to Operate Paducah GDP

This alternative scenario assumes that the 3 million SWU per year LES centrifuge uranium enrichment plant is not built in the U.S. Under this scenario, it is postulated that USEC does not succeed with its current plans to build and operate a 3.5 million SWU per year commercial uranium enrichment plant. Instead, it assumed that USEC continues to operate the Paducah GDP on a long term basis at 6.5 million SWU per year to compensate for the absence of the 3 million SWU per year LES plant and the 3.5 million SWU per year USEC centrifuge plant. Commercial considerations and other implications associated with Scenario D are presented in ER Section 1.1.2.5.4, Scenario D – No LES; USEC Does Not Deploy Centrifuge Plant and Continues to Operate Paducah GDP.

1.1.2.4.5 Scenario E – No LES; Urenco Expands Centrifuge Capability in Europe

This alternative scenario also assumes that the 3 million SWU per year LES centrifuge uranium enrichment plant is not built in the U.S. However, it does not provide for additional enrichment capacity located in the U.S. Under this scenario, it is postulated that Urenco expands its existing European plants to compensate for the 3 million SWU per year of enrichment services that would have been provided by LES under Scenario A. Commercial considerations and other implications associated with Scenario E are presented in ER Section 1.1.2.5.5, Scenario E – No LES; Urenco Expands Centrifuge Capability in Europe.

1.1.2.4.6 Scenario F – No LES; Russia Increases Sales of the HEU-Derived SWU Under the U.S.-Russian Agreement

This alternative scenario assumes that the 3 million SWU per year LES centrifuge uranium enrichment plant is not built in the U.S. However, it does not provide for additional enrichment capacity located in the U.S. Under this scenario, it is postulated that Russia increases sales of the HEU-derived SWU to USEC under the U.S.-Russia Agreement to compensate for the 3 million SWU per year of enrichment services that would have been provided by LES under the Scenario A. Commercial considerations and other implications associated with Scenario F are presented in ER Section 1.1.2.5.6, Scenario F – No LES; Russia Increases Sales of the HEU-Derived SWU Under the U.S.-Russian Agreement.

1.1.2.4.7 Scenario G – No LES; Russia Is Allowed to Increase Sales Into Europe and the U.S.

This alternative scenario also assumes that the 3 million SWU per year LES centrifuge uranium enrichment plant is not built in the U.S. However, it does not provide for additional enrichment capacity located in the U.S. Under this scenario, it is postulated that Russia is allowed to increase its sales of commercial enrichment services into the U.S. and Europe to compensate for the 3 million SWU per year of enrichment services that would have been provided by LES under Scenario A. Commercial considerations and other implications associated with Scenario G are presented in ER Section 1.1.2.5.7, Scenario G – No LES; Russian is Allowed to Increase Sales Into the U.S. and Europe.

1.1.2.4.8 Scenario H – No LES; U.S. HEU-Derived LEU is Made Available to the Commercial Market

This alternative scenario assumes that the 3 million SWU per year LES centrifuge uranium enrichment plant is not built in the U.S. Under this scenario, it is postulated that the U.S. government makes available additional HEU-derived LEU to the U.S. commercial market. However, as previously discussed in ER Section 1.1.2.4, Market Analysis of Supply and Requirements, it is not apparent that there are sufficient net equivalent enrichment services to compensate on a long term basis for the 3 million SWU per year of enrichment services that would have been provided by LES under Scenario A. Commercial considerations and other implications associated with Scenario H are presented in Section 1.1.2.5.8, Scenario H – No LES; HEU-Derived LEU is Made Available to the Commercial Market.

The scenarios described above do not represent the only long term possibilities for U.S and world enrichment supply. These scenarios do represent the most likely alternatives apparent at the present time based upon known and planned sources of supply. When examining the alternatives available if LES does not build a uranium enrichment plant in the U.S., only one alternative source of supply is considered in each alternative scenario. It is of course possible that several alternative supply sources could combine to fill the supply gap that is anticipated if the LES facility is not built. However, the approach taken allows the implications of each potential alternative source of supply to be examined individually. Nonetheless, the implications that are presented in ER Section 1.1.2.5, Commercial Considerations and Other Implications of Each Scenario, for each individual alternative scenario would still be relevant even if the alternatives are postulated to be used in combination.

1.1.2.5 Commercial Considerations and Other Implications of Each Scenario

As background for the discussion that follows, it is important to recognize that the owners and operators of nuclear power plants have two primary objectives in purchasing nuclear fuel, including uranium enrichment services (Rives, 2002; Culp, 2002). The first objective is security of supply – that is the ability of the purchaser to rely on their suppliers to deliver nuclear fuel materials and services on schedule and within technical specifications, according to the terms of the contract, for the contract's entire term. The second objective is to ensure a competitive procurement process – that is the ability of the purchaser to select from among multiple suppliers through a process that is conducive to fostering reasonable prices for the nuclear fuel materials and services that are purchased.

While one can postulate alternative supply scenarios, a number of which are presented in ER Section 1.1.2.4, there are commercial considerations and other implications associated with each such scenario, many of which can have a significant impact on the purchasers' ability to achieve the two primary purchasing objectives just presented.

Nuclear power plants are a significant component of the U.S. electric power supply system, providing 20% of the electricity that is consumed in the U.S. each year. The current U.S. market for uranium enrichment services is characterized by annual requirements of approximately 11.5 million SWU. During the eight year period 2003 through 2010 these requirements are forecast to average 11.7 million SWU per year and during the ten year period 2011 through 2020 they are forecast to average 11.4 million SWU per year.

Indigenous supply from the single, aging, high cost, and electric power intensive Paducah GDP, which is operated by USEC, could potentially supply up to 6.5 million SWU of these requirements (approximately 55%), as was previously discussed in ER Section 1.1.2.4. However, USEC has obligated much of the ongoing production from the Paducah GDP to meet the contractual requirements of some of its Far East customers. As a result, a significant amount of USEC's obligations to U.S. customers are being met with the Russian HEU-derived SWU that USEC purchases from Techsnabexport (Tenex) under its contract as executive agent for the U.S. government. Recognizing the numerous problems associated with long term dependence on the Paducah GDP, USEC has established plans to build a 3.5 million SWU per year commercial uranium enrichment plant within ten years, using an upgraded version of DOE centrifuge technology, and shut down the Paducah GDP. The balance of U.S. requirements for uranium enrichment services are under contract to Urenco and Eurodif, whose facilities are located in Europe (DOE, 2003a).

Operators of many nuclear power plants in the U.S., who are also the end users of uranium enrichment services in the U.S., view the present supply situation with concern. They see a world supply and requirements situation for economical uranium enrichment services that is presently in balance, exhibiting a potential for significant shortfall if plans that have been announced by two of the primary enrichers are not executed (i.e., Scenario A - both USEC and LES proceed with their respective plans to build new commercial centrifuge uranium enrichment plants in the U.S. and USEC ceases to operate the Paducah GDP). These U.S. purchasers find that as a result of trade actions and substantial duties imposed on Eurodif (FR, 2002a; FR, 2002b) that one source of competitive enrichment services for U.S. consumption has been significantly restricted for the foreseeable future. They view themselves as being largely dependent on a single enricher, USEC, whose only operating enrichment plant is the Paducah GDP, which has very high operating costs that impact the financial situation of USEC itself. These purchasers are concerned that the primary source of enrichment services that USEC delivers for use in their nuclear power plants is obtained from Russia and could be vulnerable to either internal or international political unrest in the future ((O'Neill, 2002). Also, there is concern that neither the performance nor economics of the updated version of the DOE centrifuge technology that USEC is planning to use have been successfully demonstrated. This is not to say that the technology would not be successful, but there is still much to be done, while the schedule announced by USEC is very aggressive and the economics remain unproven.

With this background the commercial considerations and other implications associated with each of the scenarios identified in ER Section 1.1.2.4 will be briefly addressed.

1.1.2.5.1 Scenario A – LES and USEC Centrifuge Plants Are Built in the U.S.

This scenario effectively replaces the 6.5 million SWU per year of enrichment services from the Paducah GDP, with a combination of 3.5 million SWU per year of enrichment services from a new USEC commercial centrifuge enrichment plant and 3 million SWU per year of enrichment services from a new LES centrifuge enrichment plant, leaving the total capability of indigenous U.S. primary supply effectively unchanged, but secure for the long term. As shown in Figure 1.1-7, Illustration of Supply and Requirements for Scenario A, economic world supply capability is in approximate balance with long term world requirements for this scenario. Given the balance between the forecasts of world long term supply and requirements for uranium enrichment services, the poor economics and limited lifetime of the Paducah GDP, and the potential uncertainty surrounding the announced schedule and ultimate success of USEC's centrifuge program, there is a need for new U.S. enrichment capability that utilizes proven technology on an achievable schedule, as is provided for in Scenario A.

This scenario would result in the establishment of two long term sources of energy efficient, low cost, reliable uranium enrichment services in the U.S., which is positive with respect to the security of supply objective. In addition, the presence of two indigenous enrichment facilities in the U.S. should serve to foster competition and result in more predictable long term sources of uranium enrichment services, which would help meet the objective of ensuring a competitive procurement process for U.S. purchasers of these services. Two indigenous enrichment suppliers, each with the potential to expand capacity would also provide protection against the prospect of severe supply shortfalls if Russia decides against the extension of the current U.S.–Russia HEU Agreement beyond 2013.

1.1.2.5.2 Scenario B – No LES; USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP

Under this scenario, it is postulated that LES does not build a uranium enrichment plant in the U.S. Accordingly, there is a 2.8 million SWU per year supply deficit (i.e., 3 million SWU per year of LES capacity that is partially offset by 0.2 million SWU per year of excess during the 2016-2020 period even with LES) for which other sources of supply must compensate. This scenario further assumes that this supply capability is made up by USEC, which continues to operate the Paducah GDP. However, USEC would also be operating a 3.5 million SWU per year centrifuge enrichment plant and would be expected to continue with its obligations under the executive agent agreement to purchase 5.5 million SWU per year of Russian HEU-derived SWU. Given its existing customer base, it is expected that USEC would have to operate the Paducah GDP at less than 3 million SWU per year.

The negative financial impact of operating the Paducah GDP at low production levels (NF, 2002e) could threaten USEC's ability to fund its planned centrifuge plant, as well as create financial instability for the corporation.

While providing for indigenous U.S. supply, the resulting concerns associated with the age of the Paducah GDP, its significant requirements for electric power, the low level at which it would have to be operated, the resulting impact on USEC overall financial situation, and the lack of multiple competitive sources of indigenous U.S. supply, would not alleviate concerns among U.S. purchasers of enrichment services regarding either long term security of supply or ensuring a competitive procurement process for U.S. purchasers of these services. Scenario B is not viewed by LES as an attractive long term solution.

1.1.2.5.3 Scenario C – No LES; USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability

Under this scenario, it is postulated that LES does not build a uranium enrichment plant in the U.S. Accordingly, there is a 2.8 million SWU per year supply deficit (i.e., 3 million SWU per year of LES capacity that is partially offset by 0.2 million SWU per year of excess during the 2016-2020 period even with LES) for which other sources of supply must compensate. This scenario further assumes that this supply capability is made up by USEC, which would proceed to build and operate a 3.5 million SWU per year centrifuge enrichment plant, continue to operate the Paducah GDP on an interim basis longer than currently planned, and then rapidly increase its centrifuge enrichment plant capability to as much as 6.3 million SWU per year. USEC would also be expected to continue with its obligations under the executive agent agreement to purchase 5.5 million SWU per year of Russian HEU-derived SWU. The immediate expansion of the just completed centrifuge enrichment plant would be expected to be quite difficult for USEC from a financial perspective. However, with financial participation from external sources, it may be achievable. At the present time, USEC can provide no assurance that it will be able to fund its previously announced 3.5 million SWU per year commercial centrifuge enrichment plant. To assume funding sources for a near doubling of the plant capability would be highly speculative at this time, particularly without its having demonstrated yet that the centrifuge technology will perform as anticipated.

Scenario C, should it come to fruition, provides for indigenous U.S. supply, but only from a single USEC-owned enrichment plant. The remaining concerns are that neither the performance nor economics of the updated version of the DOE centrifuge technology that USEC is planning to use have been successfully demonstrated and the outcome will not be known for a number of years. There would remain an ongoing absence of multiple competitive sources of indigenous U.S. supply. Accordingly, this may not alleviate concerns among U.S. purchasers of enrichment services regarding either long term security of supply or ensuring a competitive procurement process for U.S. purchasers of these services. Given its dependence on a yet to be proven technology and a single indigenous U.S. enricher, Scenario C is not viewed by LES as the most advantageous long term solution.

1.1.2.5.4 Scenario D – No LES; USEC Does Not Deploy Centrifuge Plant and Continues to Operate Paducah GDP

Under this scenario, it is postulated that neither LES nor USEC build uranium enrichment plants in the U.S. Accordingly, there is a 6.3 million SWU per year supply deficit (i.e., 3 million SWU per year of LES capacity, and 3.5 million SWU per year of USEC centrifuge capacity that are partially offset by 0.2 million SWU per year of excess during the 2016-2020 period even with LES and USEC centrifuge) for which other sources of supply must compensate. This scenario further assumes that this missing supply capability is primarily made up by USEC, which continues to operate the Paducah GDP at 6.5 million SWU per year. Given the unfavorable economics of continued GDP operation, this would be viewed as having a high economic cost associated with it. Obviously, USEC views continued operation of the Paducah GDP as being unacceptable or undesirable, as evidenced by its announcement to build a commercial centrifuge enrichment plant and shut down the Paducah GDP (TPS, 2002; Spurgeon, 2002).

At some point in time, it is reasonable to assume that the Paducah GDP must ultimately be replaced. Accordingly, Scenario D does not represent a permanent solution, but only a postponement of the time when new uranium enrichment capacity must be constructed in the U.S. The cost of such a postponement is likely to be quite high and the risk of supply disruption in the U.S. would increase as the Paducah GDP continues to get older.

While providing for indigenous U.S. supply, the concerns associated with the age of the Paducah GDP, its significant electric power requirements, the resulting impact on USEC's overall financial situation, and the lack of multiple competitive sources of indigenous U.S. supply, would not alleviate concerns among U.S. purchasers of enrichment services regarding either long term security of supply or ensuring a competitive procurement process for U.S. purchasers of these services. Scenario D is not viewed by LES as a viable long term solution.

1.1.2.5.5 Scenario E – No LES; Urenco Expands Centrifuge Capability in Europe

Under this scenario, it is postulated that LES does not build a uranium enrichment plant in the U.S. Instead it is postulated that Urenco expands its centrifuge capability in Europe to offset the loss of 3 million SWU per year of enrichment capability in the U.S. While this may be physically possible, from a commercial perspective this may be unacceptable to Urenco for a number of reasons. For example, there are a variety of risks associated with such factors as uncertain level of sales that might be achieved for Urenco in the U.S. market, significant concentration of its enrichment business in a single market, unpredictable changes in currency exchange rates, transatlantic shipping, and unknown future trade actions that could be undertaken by a protective U.S. government on behalf of its indigenous enricher. Furthermore, its decision to enter the LES partnership indicates that Urenco perceives building new centrifuge capability in the U.S. as a more attractive option to expanding its centrifuge enrichment capability in Europe (Scenario E). Of course, if enrichment prices were high enough and contract terms long enough, the above mentioned commercial risks could potentially be overcome from the enricher's perspective. However, such a situation would not be reviewed as favorable by U.S. purchasers.

Scenario E would not alleviate the desire on the part of U.S. purchasers for either additional indigenous uranium enrichment capability in the U.S. or provide for a second source of supply competition located in the U.S. Consequently, neither the security of supply objective nor the objective of ensuring a competitive procurement process for U.S. purchasers of these services could be assured.

1.1.2.5.6 Scenario F – No LES; Russia Increases Sales of the HEU-Derived SWU Under the U.S.-Russian Agreement

Under this scenario, it is postulated that LES does not build a 3 million SWU per year uranium enrichment plant in the U.S. Instead it is postulated that Russia increases its sales of the HEU-derived SWU to USEC under the U.S.-Russian Agreement. Given that uranium enrichment services from the Paducah GDP are preferentially used by USEC to meet contract obligations to its non-U.S. customers, this scenario implies that USEC could potentially be meeting approximately 75% ([5.5+3]/11.4) of U.S. post 2010 annual requirements for uranium enrichment services with Russian HEU-derived SWU. This would appear to introduce security of supply risks on a national level (IMPF, 2002).

While Scenario F may be physically possible, it should be recognized that the net addition of 3 million SWU per year derived from blending down the Russian HEU would require an additional 2.3 million SWU per year in enrichment capacity to prepare blend stock. Incidentally, this is equivalent to the combination of the 1.6 million SWU per year that is being used to enrich tails for the European enrichers, as shown in Table 1.1-5, and the 0.7 million SWU per year of Russian capability that is shown as being constrained (Table 1.1-6, Ref. 14). Furthermore, accelerating the use of the Russian HEU by approximately 55% (=3.0/5.5) would result in it being exhausted much earlier than previously anticipated, quite likely before 2020, based upon present estimates of available Russian HEU (Albright, 1997). Thus the issue of replacement capacity for LES would not have been solved, only postponed. There is also no guarantee that Russia will make the additional HEU needed to implement this option available in the first place.

Scenario F would not alleviate the desire on the part of U.S. purchasers for either additional indigenous uranium enrichment capability in the U.S. or provide for a second source of supply competition located in the U.S. Consequently, neither the security of supply objective nor the objective of ensuring a competitive procurement process for U.S. purchasers of these services could be assured.

1.1.2.5.7 Scenario G – No LES; Russia Is Allowed to Increases Sales Into the U.S. and Europe

Under this scenario, it is postulated that LES does not build a uranium enrichment plant in the U.S. Instead it is postulated that Russia increases its sales of commercial SWU to Western countries, including the U.S. While 3 million SWU per year of additional supply would be required to compensate for the lack of the proposed LES facility, Russia presently has only 2.3 million SWU per year in available and physically acceptable enrichment capacity. This includes the combination of the 1.6 million SWU per year that is presently used to enrich tails for the European enrichers, as shown in Table 1.1-5, Ref. 15, and the 0.7 million SWU of Russian capability that is shown as being constrained in the future (Table 1.1-5, Ref. 14). Some reports have suggested that Russia might be able to expand its export capability by 25% to 30% (NMR, 2002a; Korotkevich, 2003), which would be equivalent to 2.5 to 3.0 million SWU per year in exportable enrichment services, by replacing its older less efficient centrifuges with its higher capacity generation of centrifuges. However, this is not certain. Russian commercial enrichment sales in the U.S. have been subject to trade restrictions for the past ten years. If the current suspension agreement ends in 2004, the original antidumping investigation could resume. USEC and its labor unions have given no indication that they would cease their opposition to new imports of Russian commercial enrichment services into the U.S. Additionally, the agreement between USEC and DOE that was executed in 2002 appears to allow USEC to cease operation of the Paducah GDP without penalty under this scenario (USEC, 2002c).

Scenario G would not alleviate the desire on the part of U.S. purchasers for either additional indigenous uranium enrichment capability in the U.S. or provide for a second source of supply competition located in the U.S. Consequently, neither the security of supply objective nor the objective of ensuring a competitive procurement process for U.S. purchasers of these services could be assured.

1.1.2.5.8 Scenario H – No LES; U.S. HEU-Derived LEU is Made Available to the Commercial Market

Under this scenario, it is postulated that LES does not build a uranium enrichment plant in the U.S. Instead it is postulated that U.S. HEU-derived LEU is made available to the commercial market. As discussed in ER Section 1.1.2.3, Current and Potential Future Services of Enrichment Services, the U.S. defense establishment is reported to hold approximately 490 MT (540 tons) HEU in various forms that have not been declared surplus to U.S. government needs. However, there has been no indication if some or all of this material may be made available for commercial use, and if so on what schedule. Any forecast that includes use of the enrichment services that may be associated with this material must be recognized as being highly speculative. Therefore, LES does not consider it to be prudent to include it in this market analysis. Furthermore, to the extent that some or all of the equivalent uranium enrichment services associated with this material were assumed to become available, it is important to remember that blendstock must be prepared.

Based on the discussion presented in ER Section 1.1.2.3, the net increase in enrichment services that could be obtained from any additional DOE HEU-derived LEU would be only 24% of the SWU contained in the LEU. Therefore even if it were assumed that all 490 MT (540 tons) HEU were made available, at the present conversion rate of 0.184 million SWU per MT HEU, multiplied by 24%, the net increase in supply would be only 22 (=490x0.184x0.24) million SWU. This is about two years of U.S. total requirements for enrichment services. If this were spread out over 20 years, it would add a net 1.1 million SWU per year, or less than 3% to the available world supply. This still leaves a deficit of 1 to 2 million SWU per year during the postulated 20 years over which this material would be used.

The issue of replacement capacity for LES would not have been solved under Scenario H. Consequently, neither the security of supply objective nor the objective of ensuring a competitive procurement process for U.S. purchasers of these services could be assured.

1.1.3 Conclusion

Including the scenario that is being actively pursued at the present time, Scenario A, a total of eight alternative supply scenarios have been identified and summarized in ER Section 1.1.2.4, Market Analysis of Supply and Requirements, with respect to their ability to meet future long term nuclear power plant operating requirements for uranium enrichment services. In addition, a number of commercial considerations and other implications for each scenario have been identified in ER Section 1.1.2.5, Commercial Considerations and Other Implications of Each Scenario. When the critical nuclear fuel procurement objectives, security of supply and ensuring a competitive procurement process for U.S. purchasers of these services are considered, it becomes apparent that for long term planning purposes those alternatives that rely upon either additional Russian or U.S. HEU-derived SWU (Scenarios F and H) or additional use of Russian commercial enrichment services (Scenario G) are inadequate. While further expansion of Urenco enrichment facilities in Europe to meet what would be potentially unfilled U.S. requirements (Scenario E) might on the surface be viewed as a satisfactory approach, it does not contribute substantially to meeting the objective of improved security of supply through the construction of additional indigenous U.S. supply capability. In addition, as a result of factors that are largely outside the control of either U.S. purchasers or Urenco, as identified in ER Section 1.1.2.5.5, Scenario E – No LES; Urenco Expands Centrifuge Capability in Europe, this approach may not contribute to meeting the objective of ensuring a competitive procurement process for U.S. purchasers of these services. In addition, the commercial risks, as also discussed in ER Section 1.1.2.5.5, may be unacceptable to Urenco.

This leaves Scenarios A through D, which provide for the use of either existing or new indigenous uranium enrichment capacity in the U.S. for further consideration. Among these alternatives, Scenarios A and C involve the long term use of centrifuge technology for uranium enrichment. In Scenario A, LES deploys and operates 3 million SWU per year of centrifuge enrichment capability while USEC deploys and operates 3.5 million SWU per year of centrifuge enrichment capability. In Scenario C, USEC ultimately deploys about 6.5 million SWU per year of centrifuge enrichment capability and LES does not proceed.

In contrast, Scenarios B and D rely either in part or entirely upon the long term use of the Paducah GDP. In Scenario B, USEC deploys and operates 3.5 million SWU per year of centrifuge enrichment capability, which it supplements by the continued operation of the Paducah GDP at a level of less than 3 million SWU per year, while LES does not proceed. In Scenario D, neither LES nor USEC deploy new centrifuge enrichment capability, and USEC continues to operate the Paducah GDP at 6.5 million SWU per year. LES believes that the approach that best serves the U.S. owners and operators of nuclear power plants and ultimately the consumers of electricity in the U.S. would be Scenario A. This approach, which is being actively pursued at the present time, provides for the construction and operation of two new uranium enrichment plants in the U.S., using centrifuge technology that would significantly improve security of supply, with ongoing competition from both USEC and LES, as well as Urenco and eventually Cogema (on behalf of Areva/Eurodif) ensure a competitive procurement process for U.S. purchasers of these services. The presence of multiple suppliers with the capability to increase capacity to meet potential supply shortfalls greatly enhances security of supply for both generators and end-users of nuclear electric generation in the U.S.

1.1.4 Section 1.1 Tables

Table 1.1-1 Summary of World Nuclear Power Installed Capacity Forecast (GWe)

Year	U.S.	Western Europe	CIS & E. Europe	East Asia	Other	World
2002	97.3	126.9	45.1	68.2	19.3	356.8
2005	99.1	125.0	48.5	75.6	23.4	371.6
2010	102.7	120.2	49.7	86.5	28.6	387.7
2015	100.0	112.6	49.8	96.6	30.0	389.0
2020	101.7	104.4	47.4	105.0	31.6	390.1

Table 1.1-2 Forecast of Annual Average Rate of Change in Installed Nuclear Power Capacity

World Region	Annual Rate of Change to 2010	Annual Rate of Change after 2010
United States	0.7%	-0.1%
Western Europe	-0.7%	-1.4%
East Asia	3.0%	2.0%
CIS/Eastern Europe	1.2%	-0.5%
Other	5.0%	1.0%
World	1.0%	0.1%

Table 1.1-3 World Average Annual Uranium Enrichment Requirements Forecast After Adjustment for Plutonium Recycle in MOX Fuel (Million SWU)

Year	U.S.	Western Europe	CIS & E. Europe	East Asia	Other	World
2002	11.5	11.2	8.2	7.4	0.5	38.9
2003-2005	11.6	11.3	8.5	8.2	0.6	40.2
2006-2010	11.8	11.2	8.6	9.1	0.9	41.6
2011-2015	11.4	10.8	8.2	9.9	1.0	41.4
2016-2020	11.4	10.4	7.9	10.8	1.1	41.6

Table 1.1-4LES Forecast of Adjustment for Plutonium Recycle in MOX Fuel to Uranium Enrichment Services (Million SWU)

Period	U.S.	World
2002	0.0	0.7
2003-2005	0.0	0.8
2006-2010	0.0	1.0
2011-2015	0.3	1.5
2016-2020	0.3	1.5

Table 1.1-5Current and Potential Future Sources of Uranium Enrichment Services

Ref.	Source	Technology	Current Annual Physical Capability Millions SWU	Annual Economically Competitive and Usable Capability Million SWU		Comments Regarding Potential Future Action
				2003	2016	
1	Inventories	Inventory	0.9	0.9	0.5	0.5 in 2005 onward. Includes existing LEU inventories, most of which will be used internally.
2	Urenco (existing and planned expansion)	Centrifuge	6.0	6.0	8.0	Expected to be 6.5 by end of 2003. For 2016 assumes replacement and expansion to 8.0 in Europe.
3	Eurodif (existing)	Diffusion	10.8	8.0	0.0	Scheduled to ramp down beginning in 2007 as replacement centrifuge plant begins operation.
4	USEC (existing)	Diffusion	8.0	6.5	0.0	Scheduled to ramp down beginning in 2010 as replacement centrifuge plant begins operation.
5	Russian/Tenex (commercial)	Centrifuge	11.1	11.1	11.6	Approx. 8.4 is used to meet CIS and Eastern European requirements, approx. 2.7 is exported to Western countries.
6	Other (existing)	Both	1.9	1.9	1.0	Primarily Japan & PRC for internal use; expected to decline to approx. 1.0 by 2010.
7a	Russian HEU-derived (includes 4.2 from blendstock)	Inventory down blending required	5.5	5.5	5.5	U.S.-Russian Agreement ends in 2013; may/may not be extended.
7b	Russian-HEU derived (blended with RepU)	Inventory down blending required	0.2	0.2	0.6	Russian HEU that is blended directly with European RepU under Framatome ANP contract.
8	USEC-DOE HEU-derived	Inventory, down blending required	0.6	0.6	0.0	Present supply is expected to be exhausted by 2006.
9	DOE HEU-derived (potential source)	Inventory, down blending required	0.0	0.0	0.3	0.3 expected beginning in 2005, ramping up to 0.7 between 2009 and 2012, then back to 0.3.
10	Eurodif (new)	Centrifuge	0.0	0.0	7.5	Scheduled to ramp up beginning in 2007, while ramping down existing diffusion capacity to achieve and maintain total capacity of 7.5 by 2016.
11	LES (new)	Centrifuge	0.0	0.0	3.0	Scheduled to ramp up beginning in late 2008, to achieve and maintain total capacity of 3.0 by 2013.
12	USEC (new)	Centrifuge	0.0	0.0	3.5	Expected to ramp up beginning in 2009 to achieve and maintain total capacity of 3.5 by 2012.
13	Other (new)	Centrifuge	0.0	0.0	0.7	Primarily Peoples Republic of China (PRC) capacity for internal use; expected to increase to match internal requirements.
14	Russian (constrained)	Centrifuge	1.5	0.0	0.0	Expected to ramp down to achieve and maintain total of 0.7 by 2007 as exports increase.
15	Russian (tails enrichment)	Centrifuge	1.6	0.0	0.0	Also constrained by Western trade policies.

Table 1.1-5 Current and Potential Future Sources of Uranium Enrichment Services

Ref.	Source	Technology	Current Annual Physical Capability Millions SWU	Annual Economically Competitive and Usable Capability Million SWU 2003	2016	Comments Regarding Potential Future Action
16	Russian (outside of specifications for use in nuclear power plants)	Centrifuge	1.6	0.0	0.0	Excess to internal needs and unsuitable for export; used to enrich tails to create uranium for internal use.
	Total		49.6	40.7	42.2	

Table 1.1-6Summary of Current Russian Sources and Uses of Enrichment Services

Source/Use	Current Annual Physical Capability Million SWU	Cross Reference to Table 1.1-5
Material Meeting Western Specifications		
• Exported to Western Countries	2.7	(5)
• Used for HEU Blendstock	4.2	(7a)
• Used to enrich tails for European enrichers	1.6	(15)
• Constrained material excess	1.5	(14)
Material Not Meeting Western Specifications		
• Used in CIS and Eastern European Nuclear Power Plants	8.4	(5)
• Used internally to process tails	1.6	(16)
TOTAL	20.0	
Russian HEU-derived SWU in excess of Blendstock (under U.S.-Russian Agreement)	1.3	(7a)
Russian HEU-derived SWU (blended with RepU for European utilities)	0.2	(7b)

Table 1.1-7 Current and Potential Future Sources of Uranium Enrichment Services Arranged According to Geographical Locations

Table 1.1-5 Ref.	Source	Geographical Location	Current Annual Physical Capability Million SWU	Annual Economically Competitive and Usable Capability Million SWU 2003	2016
4	USEC (existing)	U.S.	8.0	6.5	0.0
8	USEC – DOE HEU-derived	U.S.	0.6	0.6	0.0
9	DOE HEU-derived (potential source)	U.S.	0.0	0.0	0.3
11	LES (new)	U.S.	0.0	0.0	3.0
12	USEC (new)	U.S.	0.0	0.0	3.5
	Subtotal U.S.		**8.6**	**7.1**	**6.8**
2	Urenco (existing and planned expansion)	Europe	6.0	6.5	8.0
3	Eurodif (existing)	Europe	10.8	8.0	0.0
10	Eurodif (new)	Europe	0.0	0.0	7.5
	Subtotal Europe		**16.8**	**14.5**	**15.5**
5	Russian/Tenex (commercial)	Russia	11.1	11.1	11.6
7a	Russian HEU-derived (includes 4.2 from blendstock)	Russia	5.5	5.5	5.5
7b	Russian HEU-derived (blended with RepU)	Russia	0.2	0.2	0.6
14	Russian (constrained)	Russia	1.5	0.0	0.0
15	Russian (tails enrichment)	Russia	1.6	0.0	0.0
16	Russian (outside of specifications for use in nuclear power plants)	Russia	1.6	0.0	0.0
	Subtotal Russia		**21.3**	**16.8**	**17.7**
6	Other (existing)	East Asia (primarily)	1.9	1.9	1.0
13	Other (new)	East Asia (primarily)	0.0	0.0	0.7
	Subtotal East Asia		**1.9**	**1.9**	**1.7**
1	Inventories	Dispersed	0.9	0.9	0.5

Table 1.1-8 Current and Potential Future Sources of Uranium Enrichment Services Arranged According to Commercial Ownership or Control

Table 1.1-5 Ref.	Source	Commercial Ownership or Control	Current Annual Physical Capability Million SWU	Annual Economically Competitive and Usable Capability Million SWU	
				2003	2016
4	USEC (existing)	USEC	8.0	6.5	0.0
8	USEC – DOE HEU-derived	USEC	0.6	0.6	0.0
12	USEC (new)	USEC	0.0	0.0	3.5
7	Russian HEU-derived (includes 4.2 from blendstock)	USEC	5.5	5.5	5.5
	Subtotal USEC		**14.1**	**12.6**	**9.0**
9	DOE HEU-derived (potential source)	DOE	0.0	0.0	0.3
	Subtotal DOE		**0.0**	**0.0**	**0.3**
11	LES (new)	LES	0.0	0.0	3.0
	Subtotal LES		**0.0**	**0.0**	**3.0**
2	Urenco (existing/new)	Urenco	6.0	6.5	8.0
	Subtotal Urenco		**6.0**	**6.5**	**8.0**
3	Eurodif (existing)	Eurodif	10.8	8.0	0.0
10	Eurodif (new)	Eurodif	0.0	0.0	7.5
	Subtotal Eurodif		**10.8**	**8.0**	**7.5**
5	Russian/Tenex (commercial)	Russia	11.1	11.1	11.6
7b	Russian HEU-derived (blended with RepU)	Russia	0.2	0.2	0.6
14	Russian (constrained)	Russia	1.5	0.0	0.0
15	Russian (tails enrichment)	Russia	1.6	0.0	0.0
16	Russian (outside of specifications for use in Western nuclear power plants)	Russia	1.6	0.0	0.0
	Subtotal Russia		**16.0**	**11.3**	**12.2**
6	Other (existing)	PRC/Japan (primarily)	1.9	1.9	1.0
13	Other (new)	PRC/Japan (primarily)	0.0	0.0	0.7
	Subtotal Other PRC/Japan (primarily)		**1.9**	**1.9**	**1.7**
1	Inventories	Dispersed	0.9	0.9	0.5

1.1.5 Section 1.1 Figures

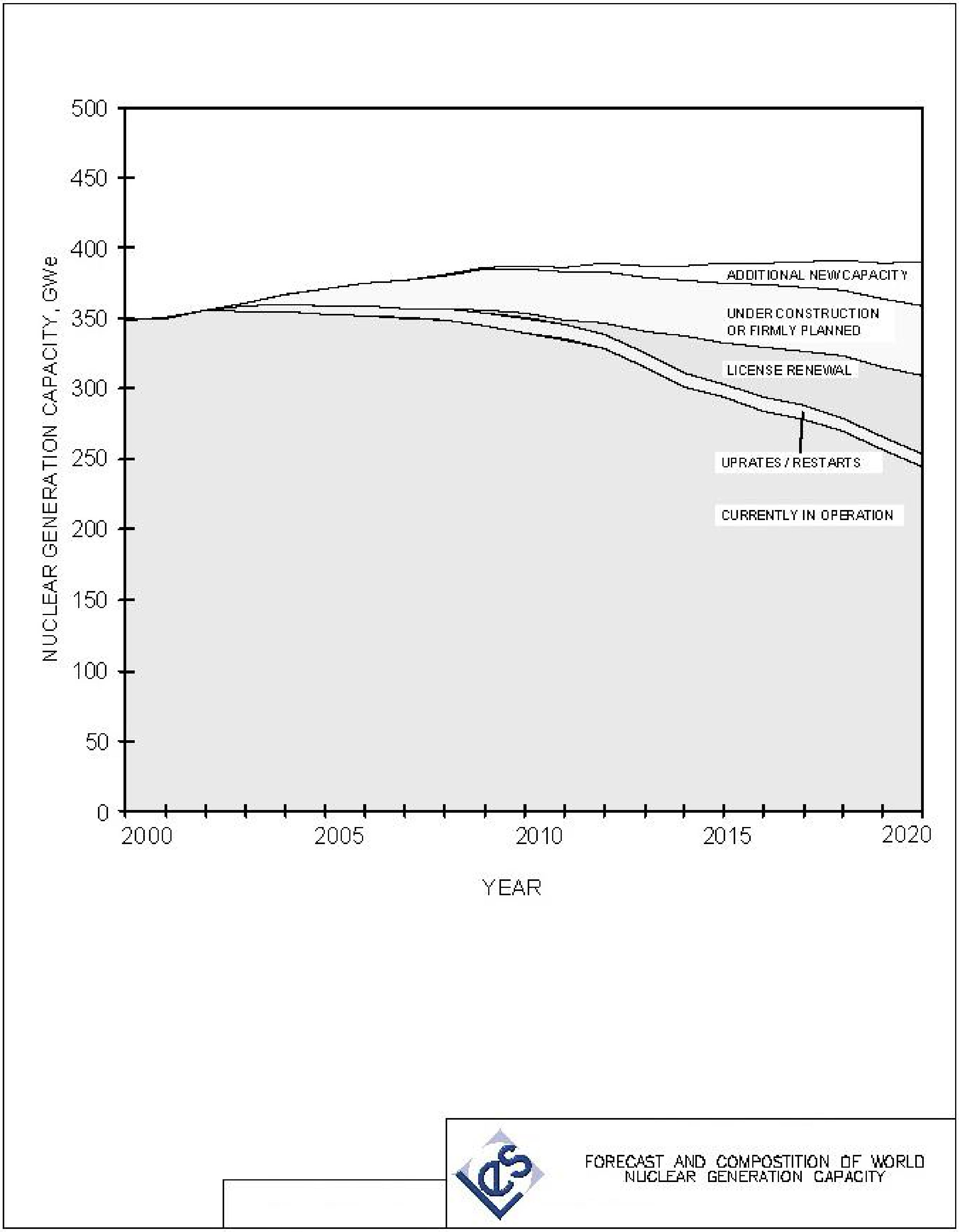
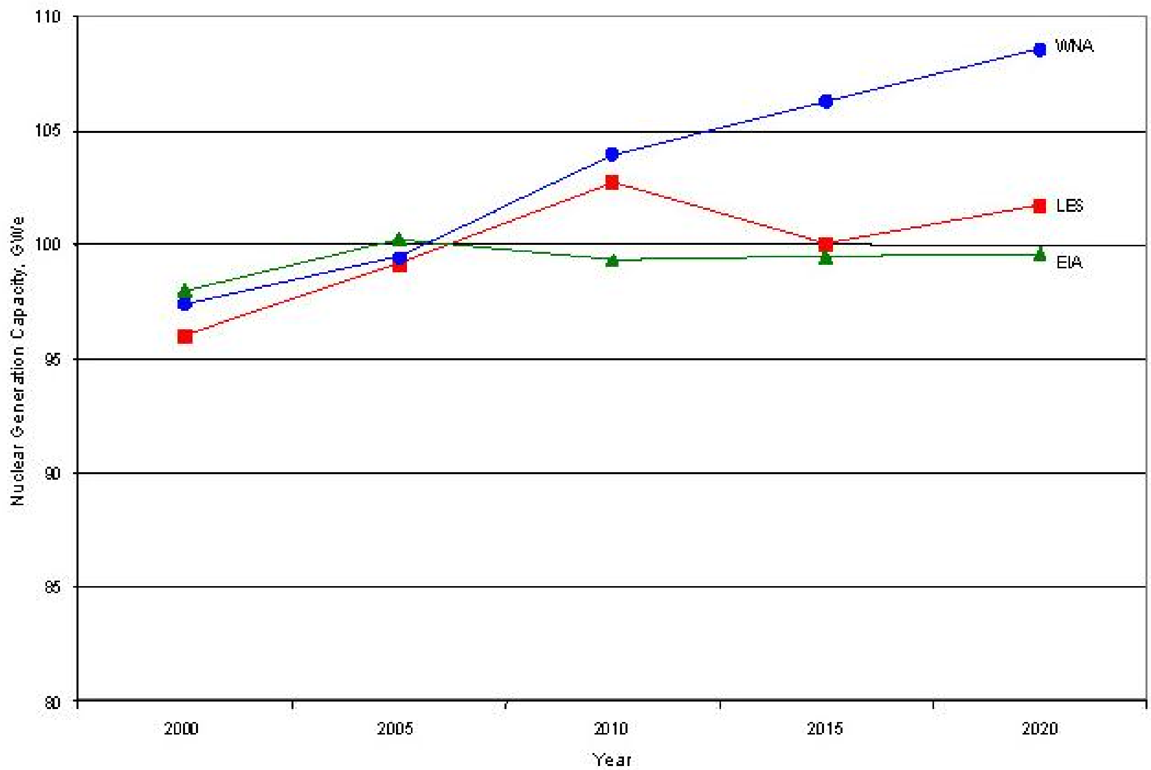


Figure 1.1-1 Forecast and Composition of World Nuclear Generation Capacity



COMPARISON OF FORECASTS OF
U.S. NUCLEAR GENERATION CAPACITY

Figure 1.1-2 Comparison of Forecasts of U.S. Nuclear Generation Capacity

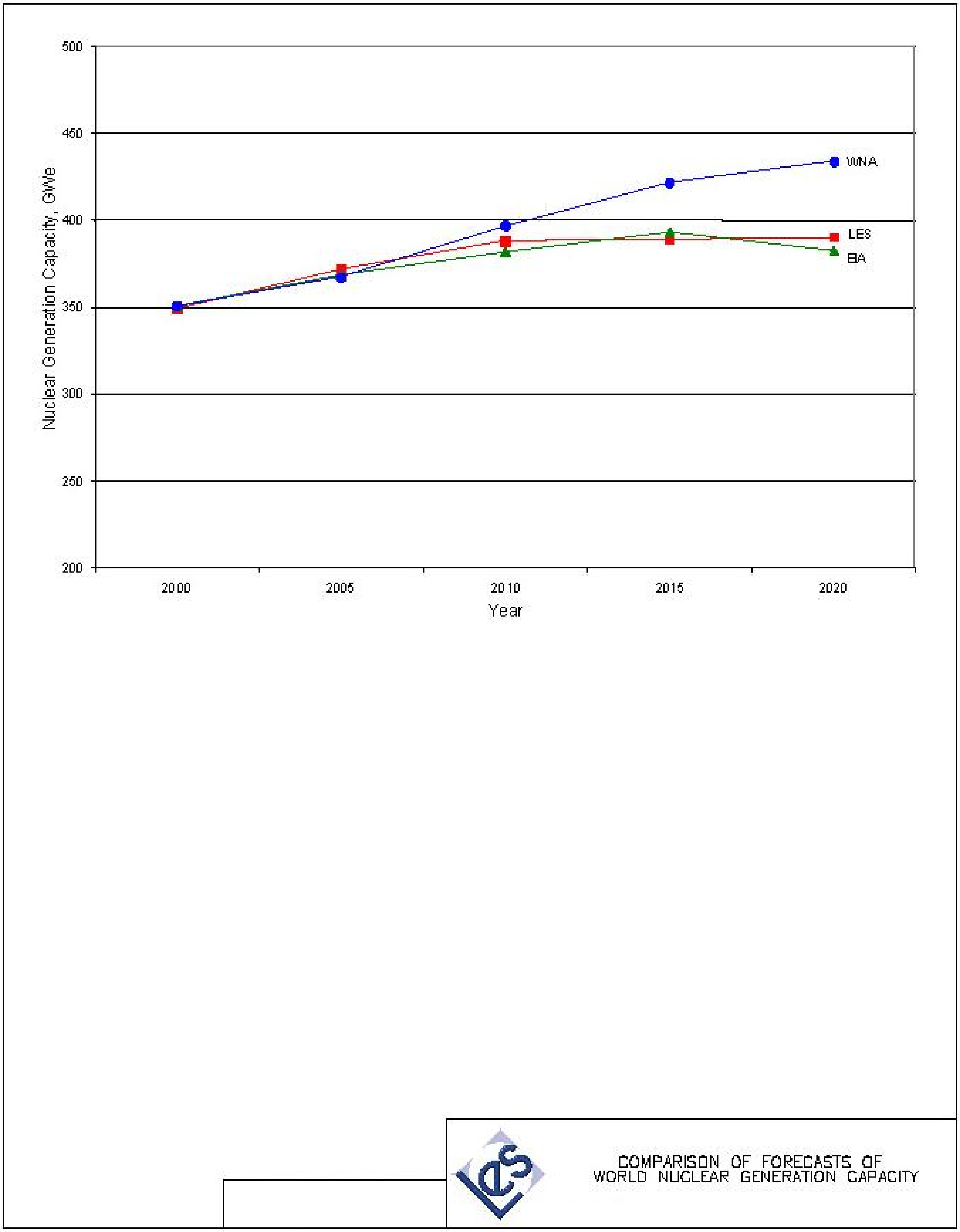
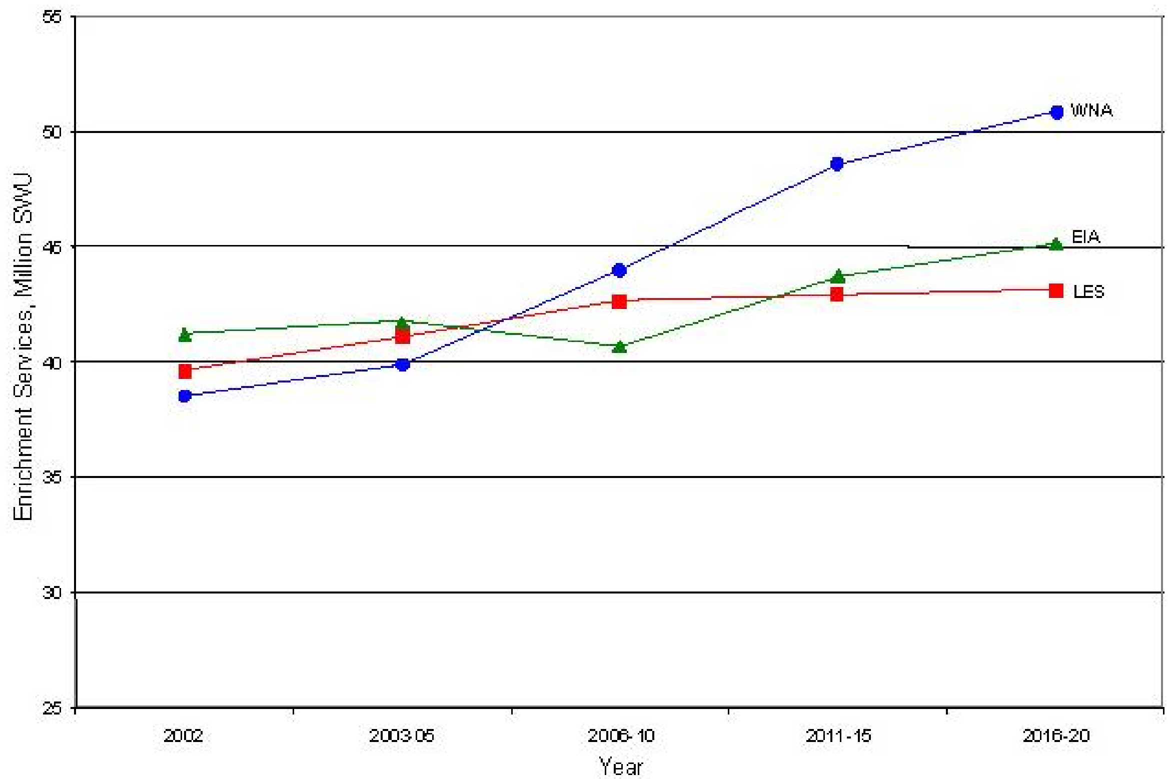
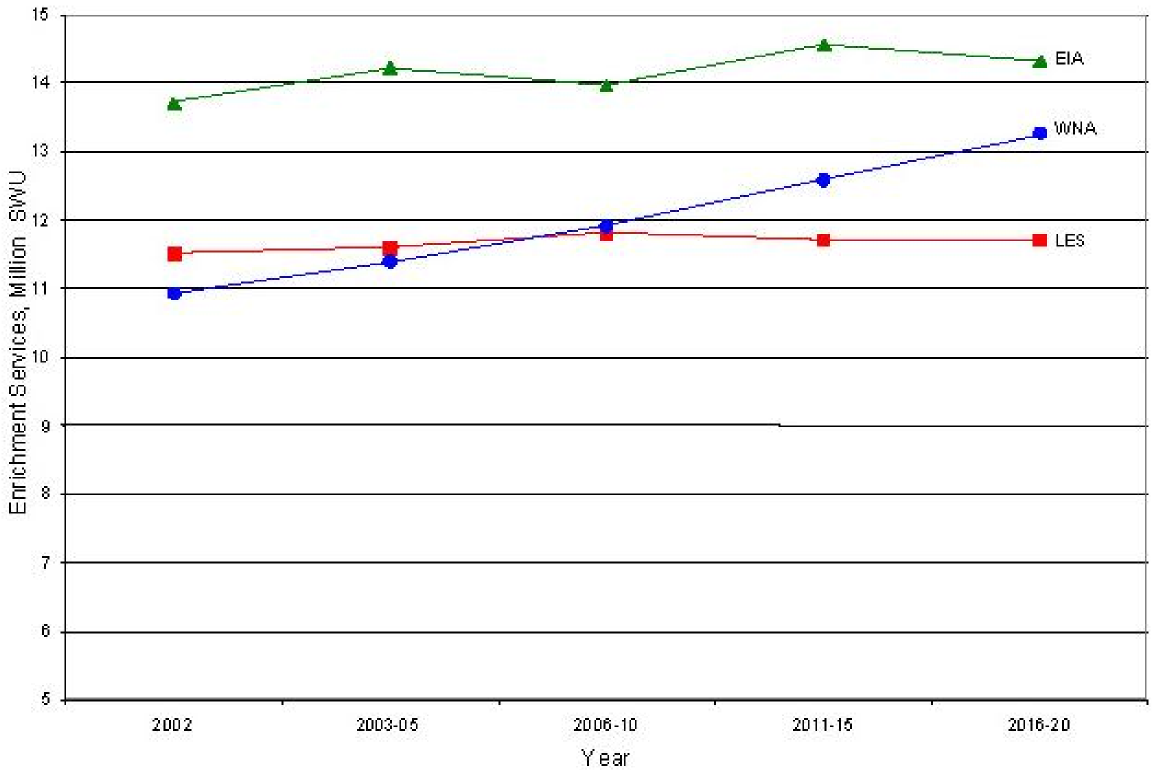


Figure 1.1-3 Comparison of Forecast of World Nuclear Generation Capacity



COMPARISON OF FORECAST OF WORLD AVERAGE ANNUAL URANIUM ENRICHMENT REQUIREMENTS FORECASTS, UNADJUSTED FOR PLUTONIUM RECYCLE IN MOX FUEL

Figure 1.1-4 Comparison of Forecast of World Average Annual Uranium Enrichment Requirements Forecasts, Unadjusted for Plutonium Recycle in MOX Fuel



COMPARISON OF FORECAST OF U.S. AVERAGE ANNUAL URANIUM ENRICHMENT REQUIREMENTS FORECAST, UNADJUSTED FOR PLUTONIUM RECYCLE IN MOX FUEL

Figure 1.1-5Comparison of Forecast of U.S. Average Annual Uranium Enrichment Requirements Forecast, Unadjusted for Plutonium Recycle in MOX Fuel

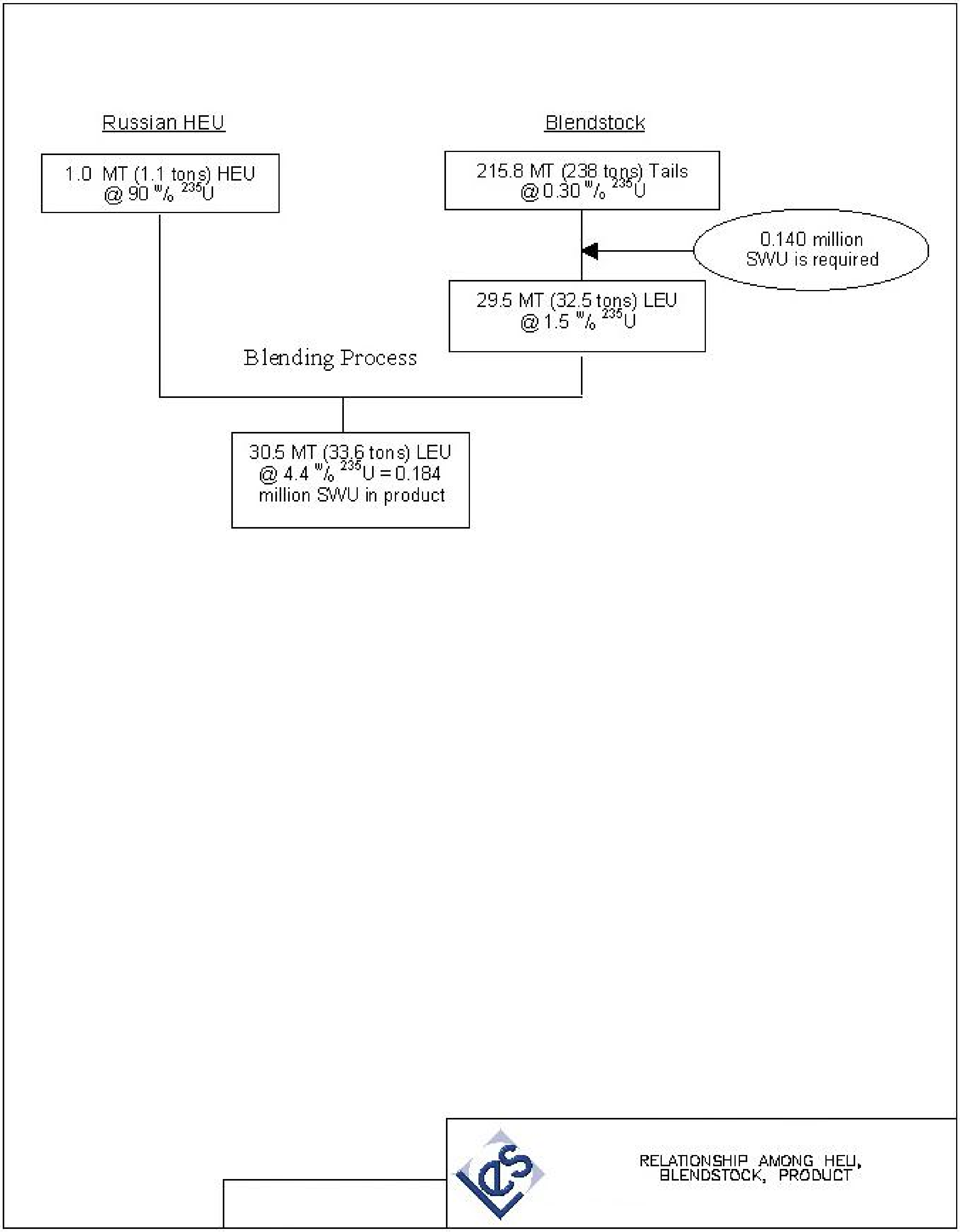


Figure 1.1-6Relationship Among HEU, Blendstock, Product

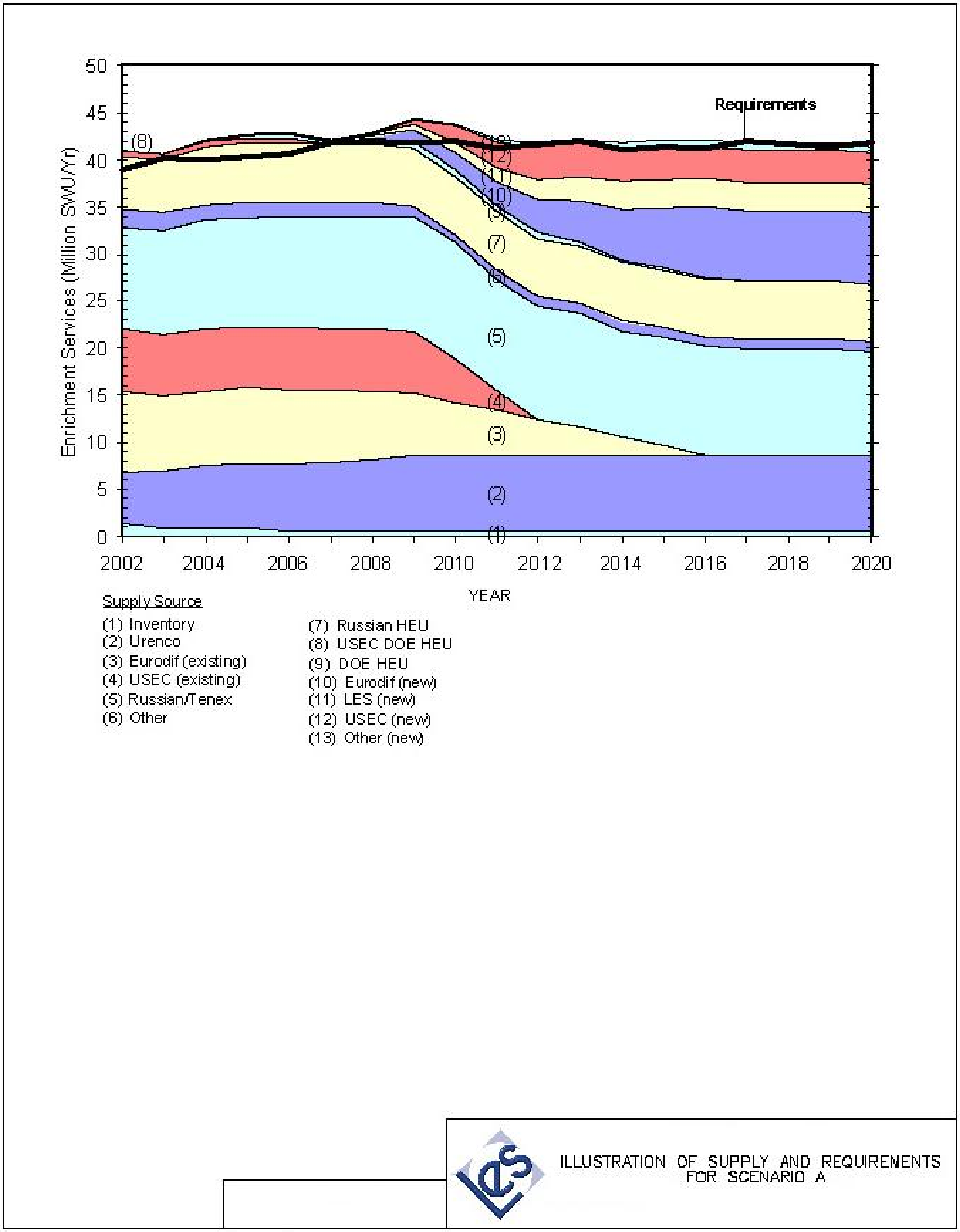


Figure 1.1-7Illustration of Supply and Requirements for Scenario A

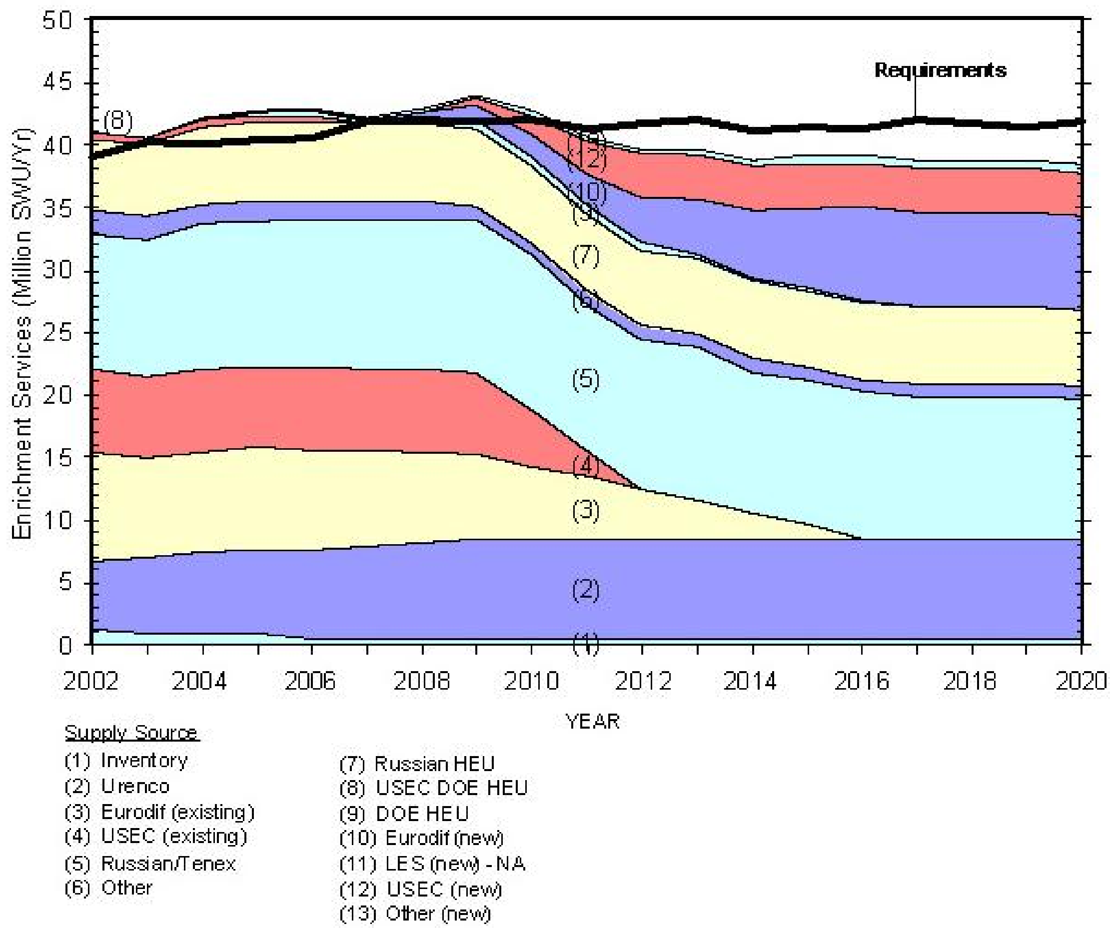


ILLUSTRATION OF SUPPLY AND REQUIREMENTS FOR SCENARIO A WITHOUT THE PROPOSED NEF

Figure 1.1-8Illustration of Supply and Requirements for Scenario A Without the Proposed NEF

1.2 PROPOSED ACTION

The proposed action is the issuance of an NRC license under 10 CFR 70 (CFR, 2003b) for the construction and operation of a uranium enrichment facility 8 km (5 mi) east of Eunice, New Mexico in Lea County. The NEF will use the gas centrifuge process to separate natural uranium hexafluoride feed material containing approximately 0.71 Uranium-235 (^{235}U) into a product stream enriched up to the LES license limit in isotope ^{235}U and a depleted UF_6 stream containing approximately 0.10 to 0.50 $^{w}/_{o}$ ^{235}U. Facility construction is expected to require eight (8) years. Construction will be conducted in six phases. Operation will commence after the completion of the first cascade in the first Cascade Hall. The facility is licensed for 30 years of operation. Decommissioning and Decontamination (D&D) is projected to take nine (9) years. LES estimates the cost of the plant to be approximately $1.2 billion (in 2002 dollars) excluding escalation, contingency, interest, tails disposition, decommissioning, and any replacement equipment required during the operational life of the facility.

1.2.1 The Proposed Site

The proposed NEF site is located in Southeast New Mexico, approximately 32 km (20 mi) south of Hobbs, New Mexico (population 28,657). The site is located in Lea County, approximately 0.8 km (0.5 mi) west of the Texas state border, 51 km (32 mi) west-north-west of Andrews, Texas (population 10,182) and 523 km (325 mi) southeast of Albuquerque, New Mexico (population 712,728). The nearest large population center (>100,000 population) and commercial airport is the Midland-Odessa, Texas area which is approximately 103 km (64 mi) to the southeast. The approximate center of the NEF is located at latitude 32 degrees, 26 min, 1.74 sec North and longitude 103 degrees, 4 min, 43.47 sec West. Refer to Figure 1.2-1, Location of Proposed Site and Figure 1.2-2, NEF Location Relative to Population Centers Within 80 Kilometers (50 Miles).

Lea County is situated at an average elevation of 1,220 m (4,000 ft) above mean sea level (msl) and is characterized most often by its flat topography. Lea County covers 11,381 km^2 (4,393 mi^2) or approximately 1,138,114 ha (2,822,522 acres) which is three times the size of Rhode Island and only slightly smaller than Connecticut. From north to south, Lea County spans 173 km (108 mi) and 70 km (44 mi) from east to west spans at its widest point.

The proposed NEF site location is Section 32, Township 21S, Range 38E. The site is located approximately 8 km (5 mi) east of the nearest city, which is Eunice, New Mexico (population 2,562). Eunice is located at the crossing junction of New Mexico Highway 207 and New Mexico Highway 234, 32 km (20 mi) south of Hobbs, New Mexico. New Mexico Highway 234 (east-west) and New Mexico Highway 18 (north-south) are the major transportation routes near the site. These two highways intersect about 6.4 km (4 mi) west of the proposed NEF site. An active railroad line operated by the Texas-New Mexico Railroad runs parallels to New Mexico Highway 18 and just east of Eunice within 5.8 km (3.6 mi) of the NEF site. There is also an active railroad spur line that runs from the Texas-New Mexico Railroad, along the North boundary of the NEF site and terminates at the Waste Control Specialists (WCS) facility, just across the New Mexico-Texas border.

The NEF site is currently owned by the State of New Mexico and is being acquired by LES through a State Land Swap arrangement. Until such time the land swap is completed, the State of New Mexico has granted a 35-year easement to LES for Section 32 for site access and control. The site is near the WCS. WCS is situated just across the Texas State border. 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 waste. WCS is also permitted to treat and dispose of hazardous waste. Land Section 33, currently owned by WCS, is under consideration for purchase by LES and serves as a natural buffer zone between WCS and the NEF. LES has no current plans to erect buildings or structures on Section 33 should this land purchase be consummated.

The site is bordered to the north by a sand/aggregate quarry owned by Wallach Concrete, Inc.. The quarry owner leases land space to a “produced water” reclamation company that maintains three small “produced water” lagoons. New Mexico Highway 234 borders the NEF site on the south. Lea County operates a landfill on the south side of New Mexico Highway 234, approximately 1 km (0.6 mi) from the center of the NEF site.

The NEF site is relatively flat with slight undulations in elevation, with an elevation profile ranging from 1,033 to 1,045 m (3,390 to 3,430 ft) above msl. Overall slope direction of the site is southwest. Predominant vegetation species identified were mesquite bush, yucca, sand sage and sand drop seed. The site is actively grazed by domestic livestock. (See Figure 1.2-3, NEF Location Relative to Transportation Routes for the site location relative to other important landmarks and transportation routes.)

1.2.2 Description of NEF Operations and Systems

The NEF is designed to separate a feed stream containing the naturally occurring proportions of uranium isotopes into a product stream enriched in ^{235}U and a stream depleted in the ^{235}U isotope. The feed material for the enrichment process is uranium hexafluoride (UF_6) with a natural composition of isotopes ^{234}U, ^{235}U, and ^{238}U. The enrichment process involves the mechanical separation of isotopes using a fast-rotating cylinder (centrifuge) which is based on a difference in centrifugal forces due to differences in molecular weight of the uranic isotopes. No chemical or nuclear reactions take place. The feed, product, and depleted UF_6 streams are all in the form of UF_6.

The UF_6 is delivered to the plant in standard Type 48Y international transit cylinders, which are connected to the plant in feed stations joined to a common manifold. Heat is then applied electrically to sublime UF_6 from solid to vapor. The gas is flow controlled through a pressure control system for distribution to individual cascades at sub-atmospheric pressure.

Individual centrifuges are not able to produce the desired product and depleted UF_6 concentration in a single step. They are therefore grouped together in series and parallel to form arrays known as cascades. A typical cascade hall comprises many hundreds of centrifuges. A cascade hall is made up of 12 cascades. UF_6 is drawn through cascades with vacuum pumps and moved to the transport cylinders located in product and tails take-off stations where it can desublime. Highly reliable UF_6 resistant pumps have been developed for transferring the process gas.

Depleted uranium material is desublimed at the Tails Low-Temperature Take-Off Station into chilled Uranium Byproduct Cylinders (UBCs), Type 48Y. The product is desublimed into 30B cylinders for shipping or for internal use.

The entire plant process gas system operates at sub-atmospheric pressure. This provides a high degree of safety but also means that the system is susceptible to in-leakage of air. Any in-leakage of air passes through the cascades and is preferentially directed into the product stream. A vent system is provided to remove hazardous contaminants (typically trace amounts of UF_6 and/or HF) from low levels of light gas (any gas lighter than UF_6) that arise on a regular basis from background in-leakage, routine venting of UF_6 cylinders, and purging of UF_6 lines.

Each Plant Module – consisting of two Cascade Halls - is provided with a cooling water system to remove excess heat at key positions on the centrifuges in order to maintain optimum temperatures within the centrifuges.

The centrifuges are driven by a medium frequency Alternating Current (AC) supply system. A converter produces the medium frequency supply from the AC main supply using high efficiency switching devices for both run-up and continuous operation.

The major structures and areas of the NEF are described below and shown in Figure 1.2-4, NEF Buildings.

The Security Building serves as the primary access control point for the facility. It also contains the Secondary Alarm Station (duplicate control console to the Central Alarm Station).

(See SAR 12.2 12.3 and 12.7) The Separations Building Modules (SBMs) have two Cascade Halls, a UF_6 Handling Area, and a Process Services Corridor. The Cascade Hall contains 12 cascades, each of which is made up of many centrifuges. Natural uranium in the form of UF_6 is fed into the cascades and UF_6 enriched in the ^{235}U isotope (product) and UF_6 depleted in the ^{235}U isotope (tails) are removed. The UF_6 Handling Area contains the Feed System, Product Take-off System, Tails Take-off System, and the Blending and Liquid Sampling Systems. The Process Services Corridor contains gas transport equipment, which connects the cascades to the UF_6 Feed System, Product Take-off System, Tails Take-off System and Contingency Dump System.

The Centrifuge Assembly Building (CAB) is used to assemble centrifuges before the centrifuges are moved to the SBM and installed in the Cascade Halls.

The Technical Services Building (TSB) contains the Mechanical Electrical and Instrumentation (ME&I) Workshop, a Medical Room, the Central Alarm Station (CAS), the Control Room, and the primary Emergency Operations Center (EOC) for the facility.

(See SAR § 12.2 and 12.3) The Central Utilities Building (CUB) provides a central location for the utility services for the process buildings. The CUB also contains the two standby diesel powered electric generators that provide power to protect selected equipment in the unlikely event of loss of offsite supplied power. The building also contains electrical rooms/areas, an air compressor area, battery rooms, and a Centrifuge Cooling Water System.

(See SAR § 12.4, 12.5, and 12.6) The Cylinder Receipt and Dispatch Building (CRDB) is used to receive, inspect, weigh and temporarily store cylinders of natural UF_6 sent to the plant and ship cylinders of enriched UF_6 to customers. Additionally, clean, empty product and UBC are received, inspected, weighed, and temporarily stored prior to their being filled in the SBMs.

The CRDB also contains various laboratories and maintenance facilities necessary to safely operate and maintain the facility. Most site infrastructure facilities (i.e., laboratories for sample analysis) are located in the CRDB.

(See SAR § 12.2 and 12.3) The Uranium Byproduct Cylinder (UBC) Storage Pad is a series of concrete pads designed to store up to 15,727 UBCs. A single-lined UBC Storage Pad Stormwater Retention Basin will be used specifically to retain runoff from the UBC Storage Pad during heavy rainfalls. This basin will also receive cooling tower blowdown. The unlined Site Stormwater Detention basin will receive rainfall runoff from the balance of the developed plant site. Liquid effluent from plant process systems will be discharged to the double-lined Treated Effluent Evaporative Basin provided with a leak detection system.

1.2.3 Schedule of Major Steps Associated with the Proposed Action

The NEF will be constructed in phases. Each phase will result in an additional SWU capacity, with the first unit beginning operation prior to the completion of the remaining phases. The NEF is designed for at least 30 years of operation. A review of the centrifuge replacement options will be conducted late in the second decade of 2000. Decommissioning is expected to take approximately nine (9) years.

The anticipated schedule for licensing, construction, operation, and decommissioning is as follows:

Milestone	Estimated Date
• Submit Facility License Application	December 2003
• Initiate Facility Construction	August 2006
• Start First Cascade	October 2008
• Achieve Full Nominal Production Output	October 2013
• Submit License Termination Plan to NRC	April 2025
• Complete Construction of D&D Facility	April 2027
• D&D Completed	April 2036

1.2.4 Section 1.2 Figures

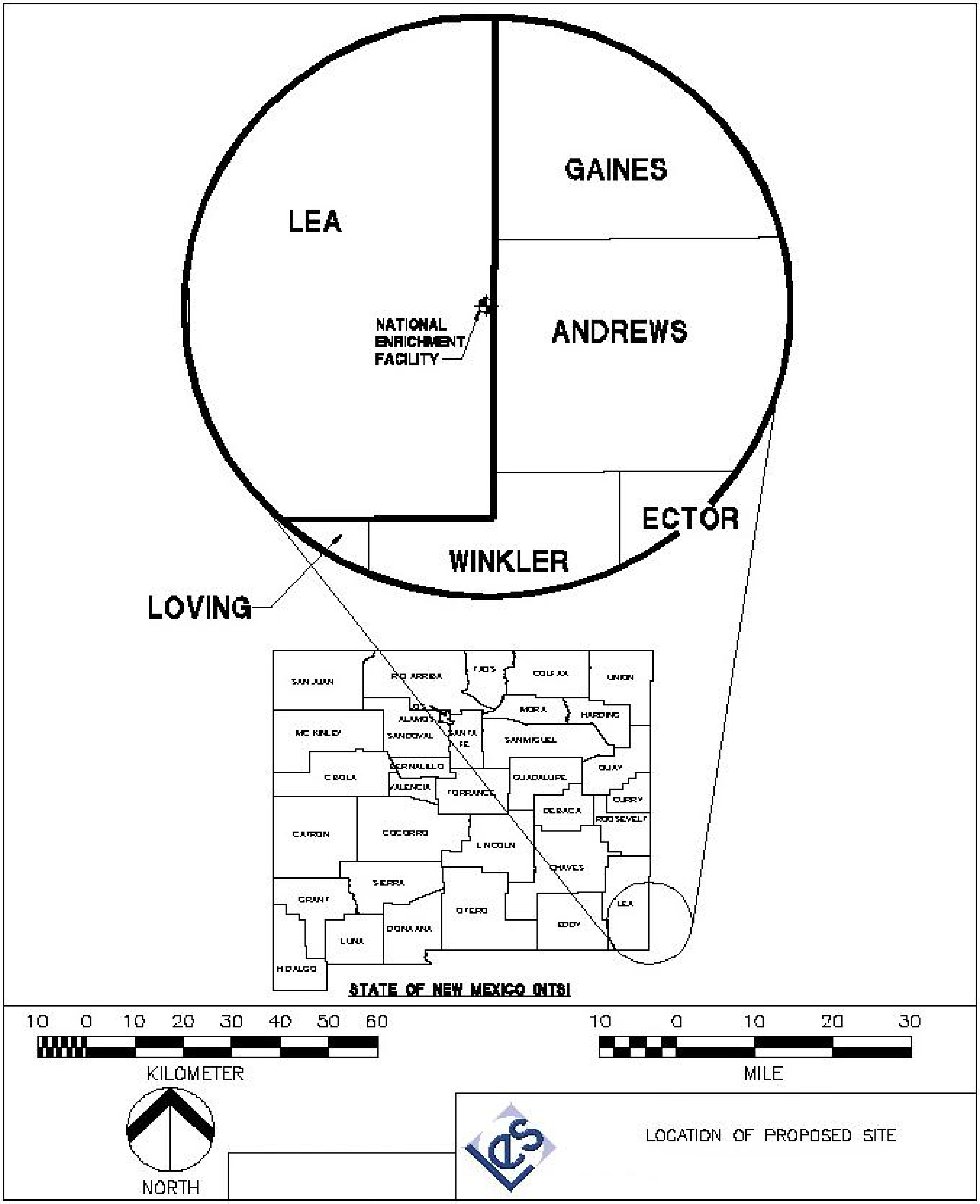


Figure 1.2-1 Location of Proposed Site

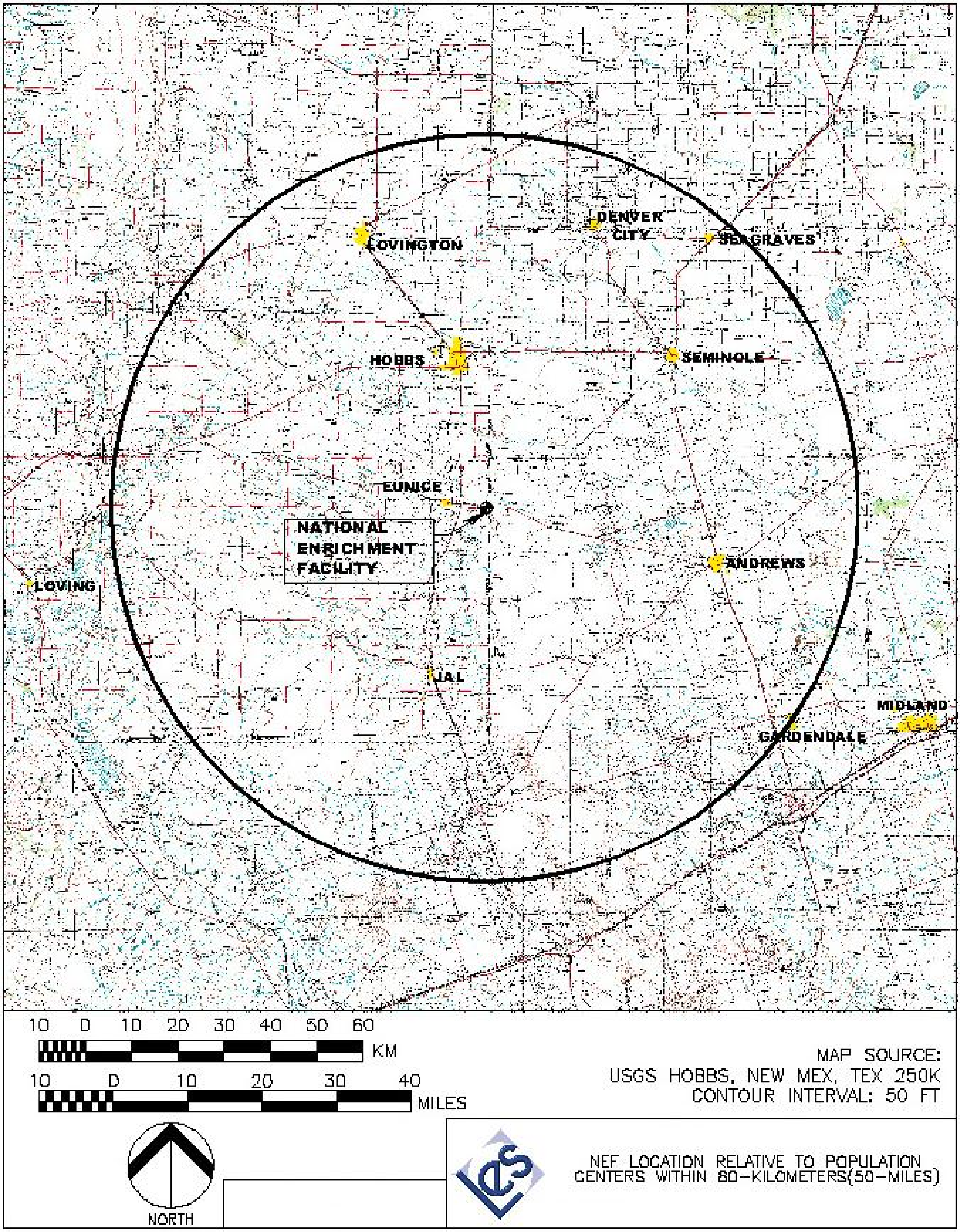


Figure 1.2-2 NEF Location Relative to Population Centers Within 80-Kilometers (50-Miles)

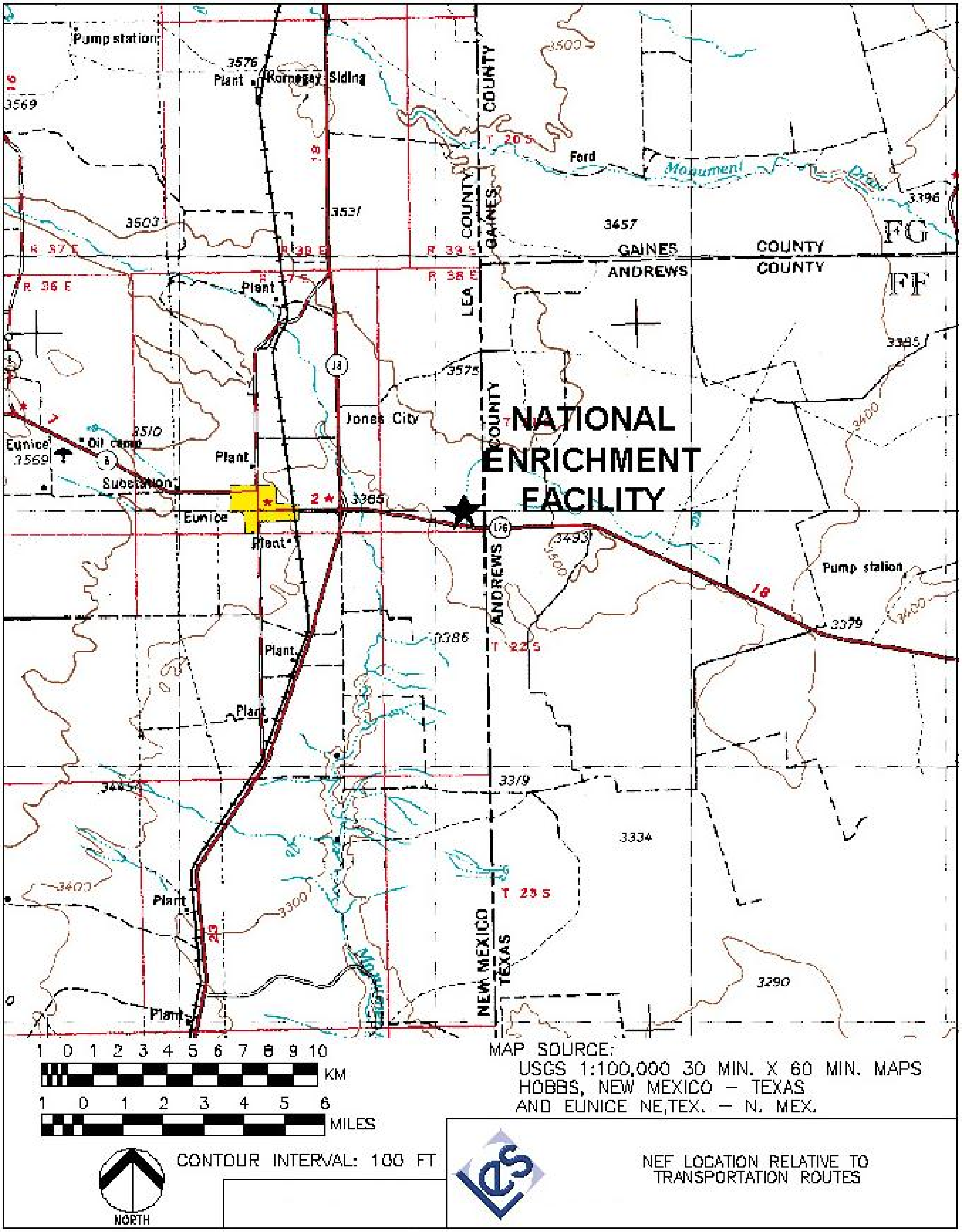


Figure 1.2-3 NEF Location Relative to Transportation Routes

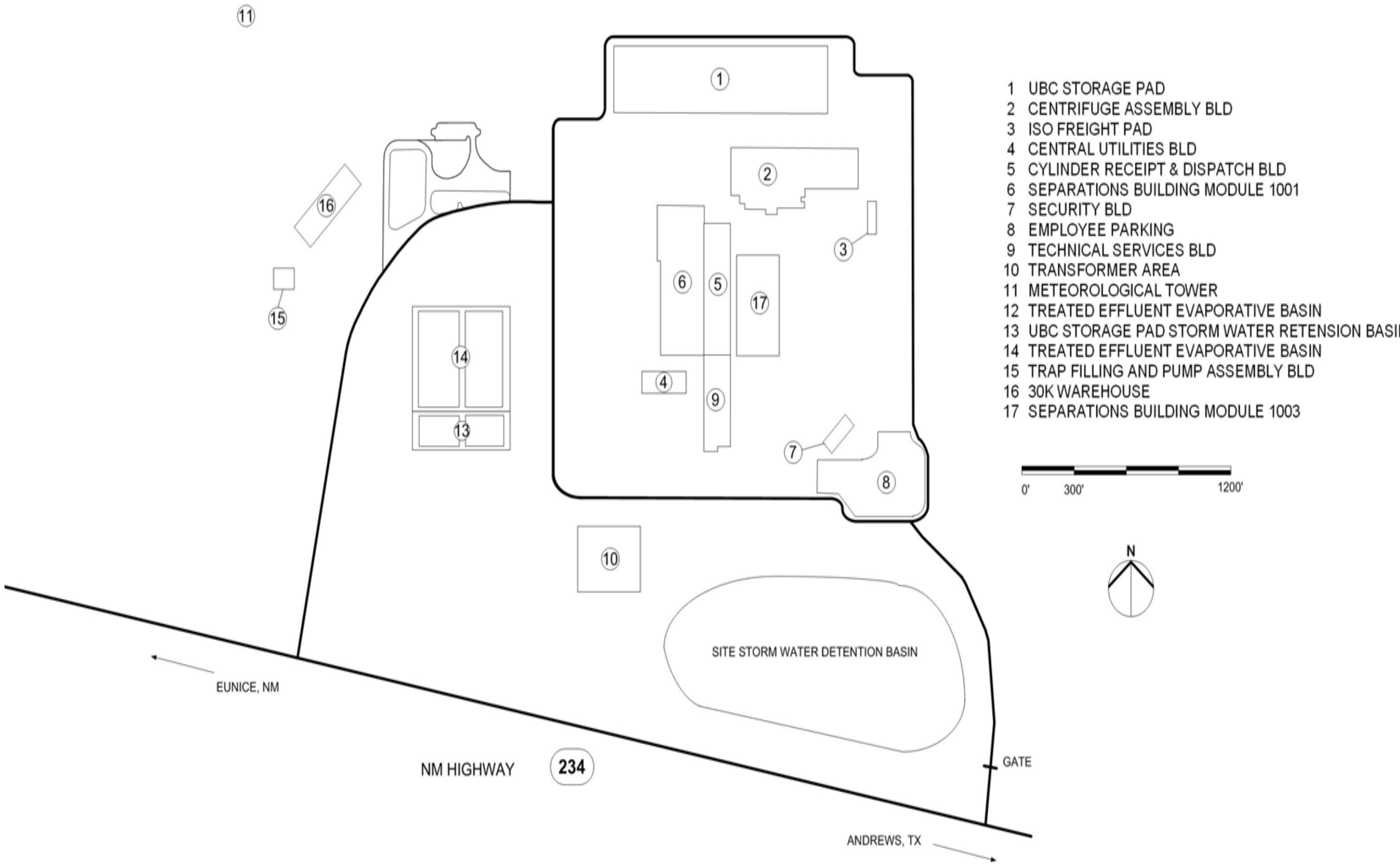


Figure 1.2-4 NEF Buildings

1.3 APPLICABLE REGULATORY REQUIREMENTS, PERMITS AND REQUIRED CONSULTATIONS

In addition to the NRC licensing and regulatory requirements, a variety of environmental regulations apply to the NEF during the site assessment, construction, and operation phases. Some of these regulations require permits from, consultations with, or approvals by, other governing or regulatory agencies. Some apply only during certain phases of NEF development, rather than over to the entire life of the facility. Federal, state and local statutes and regulations (non-nuclear) have been reviewed to determine their applicability to the site assessment, construction, and operation phases or the proposed site.

Following is a list of federal, state, and local agencies with which consultations have been conducted. Table 1.3-1, Regulatory Compliance Status, summarizes the status of the permits and approvals required to construct and operate NEF.

1.3.1 Federal Agencies

Nuclear Regulatory Commission (NRC)

The Atomic Energy Act of 1954, as amended, gives the NRC regulatory jurisdiction over the design, construction, operation, and decommissioning of the NEF facility specifically with regard to assurance of public health and safety in 10 CFR 70 and 40 (CFR, 2003b; CFR, 2003d), which are applicable to uranium enrichment facilities. The NRC performs periodic surveillance of construction, operation and maintenance of the facility. The NRC, in accordance with 10 CFR 51 (CFR, 2003a), also assesses the potential environmental impacts of the proposed plant.

NRC establishes standards for protection against radiation hazards arising out of licensed activities. The NRC licenses are issued pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Organization Act of 1974. The regulations apply to all persons who receive, possess, use or transfer licensed materials.

Domestic Licensing of Source Material (10 CFR 40) (CFR, 2003d) establishes the procedures and criteria for the issuance of licenses to receive, possess, use, transfer, or deliver source material.

Rule of General Applicability to Domestic Licensing of Byproduct Material (10 CFR 30) (CFR, 2003c) establishes the procedure and criteria for the issuance of licenses to receive, possess, use, transfer, or deliver byproduct material.

Packaging and Transportation of Radioactive Material (10 CFR 71) (CFR, 2003e) regulates shipping containers and the safe packaging and transportation of radioactive materials under authority of the NRC and DOT.

U.S. Environmental Protection Agency, (EPA)

The EPA has primary authority relating to compliance with the Clean Air Act (CAA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), and Resource Conservation and Recovery Act (RCRA). However, EPA Region 6 has delegated regulatory jurisdiction to the New Mexico Environment Department (NMED) for nearly all aspects of permitting, monitoring, and reporting activities relating to these statutes and associated programs. Applicable state requirements, permits, and approvals are described in Section 1.3.2, State Agencies.

Environmental Standards for the Uranium Fuel Cycle (40 CFR 190 Subpart B) (CFR, 2003f) establishes the maximum doses to the body organs resulting from operational normal releases and received by members of the public.

The Safe Drinking Water Act (SDWA) provides for protection of public water supply systems and underground sources of drinking water. 40 CFR 141.2 (CFR, 2003h) defines public water supply systems as systems that provide water for human consumption to at least 25 people or at least 15 connections. Underground sources of drinking water are also protected from contaminated releases and spills by this act. NEF is not using site groundwater or surface water supplies. NEF will obtain potable water from the nearby municipal water supply system of Eunice, New Mexico.

The Emergency Planning and Community Right-to-Know Act of 1986 (40 CFR 350 to 372) (CFR, 2003i) establishes the requirements for Federal, State and local governments, Indian Tribes, and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. The Community Right-to-Know provisions help increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment.

National Pollutant Discharge Elimination System (NPDES) General Permit for Industrial Stormwater: This permit is required for point source discharge of stormwater runoff from industrial or commercial facilities to the waters of the state. All new and existing point source industrial stormwater discharges associated with industrial activity require a NPDES Stormwater Permit from the EPA Region 6 and an oversight review by the New Mexico Water Quality Bureau. The NEF is eligible to claim the "No Exposure" exclusion for industrial activity of the NPDES stormwater Phase II regulations. As such, the LES would submit a No Exposure Certification immediately prior to initiating operational activities at the NEF site. LES also has the option of filing for coverage under the Multi-Section General Permit (MSGP) because the NEF is one of the 11 eligible industry categories. If this option is chosen, LES will file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the initiation of NEF operations. A decision regarding which option is appropriate for the NEF will be made in the future.

NPDES General Permit for Construction Stormwater: Construction of the NEF will involve the grubbing, clearing, grading or excavation of 0.4 or more ha (1 or more acres) of land coverage and must receive a NPDES Construction General Permit (CGP) from the EPA Region 6 and an 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 Stormwater 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.

U.S. Department of Transportation (DOT)

Transport of the NEF UF_6 cylinders requires compliance with the following DOT enabling regulations:

- 49 CFR 107, Hazardous Materials Program Procedures, Subpart G: Registration and Fee to DOT as a Person who Offers or Transports Hazardous Materials (CFR, 2003j).
- 49 CFR 171, General Information, Regulations and Definitions (CFR, 2003k).
- 49 CFR 173, Shippers – General Requirements for Shipments and Packages, Subpart I: Radioactive Materials (CFR, 2003l).
- 49 CFR 177, Carriage by Public Highway (CFR, 2003m).
- 49 CFR 178, Specification for Packagings (CFR, 2003m).

All provisions of these enabling regulations will be met prior to the transport of UF_6 cylinders. NEF may be transporting UF_6 cylinders back to its clients on interstate highways.

U.S. Department of Agriculture (USDA)

The U.S. Natural Resources Conservation Service (USNRCS) branch of the USDA is responsible for the preservation of prime or unique farmlands. However, the USNRCS does not identify NEF land as prime farmlands because the land is not available for agricultural production.

The Noise Control Act of 1972 (42 U.S.C. § 4901 et seq.) (USC, 2003b)

The Noise Control Act transfers the responsibility of noise control to State and local governments. Commercial facilities are required to comply with Federal, State, interstate, and local requirements regarding noise control. The NEF is located in a county (Lea) that does not have a noise control ordinance.

National Historic Preservation Act of 1966 (16 U.S.C. § 470 et seq.) (USC, 2003c)

The National Historic Preservation Act (NHPA) was enacted to protect the nation's cultural resources. The NHPA is supplemented by the Archaeological and Historic Preservation Act. This act directs Federal agencies in recovering and preserving historic and archaeological data that would be lost as the result of construction activities. Seven potential archaeological sites have been identified on the NEF site. These sites are eligible for listing on the National Register of Historic Places (NRHP) based on the presence of charcoal, intact subsurface features, and/or cultural deposits, or the potential for subsurface features. Three of these sites are within the proposed NEF plant footprint. A treatment/mitigation plan is being developed by LES to recover any significant information from all sites.

Hazardous Materials Transportation Act (49 U.S.C. § 1801 et seq. Title 49 CFR 106-179) (USC, 2003d)

The Hazardous Materials Transportation Act (HMTA) regulates transportation of hazardous material (including radioactive material) in and between States. According to HMTA, States may regulate the transport of hazardous material as long as they are consistent with HMTA or the Department of Transportation (DOT) regulations that are posed in Title 49 CFR 171-177. Other regulations regarding packaging for transportation of radionuclides are contained in Title 49 CFR 173 (CFR, 2003l), Subpart I. The NEF may be transporting UF_6 cylinders back to its clients on interstate highways.

U.S. Army Corps of Engineers (USACE)

The Clean Water Act established a permit program under Section 404 to be administered by the USACE to regulate the discharge of dredged or fill material into "the waters of the U.S." The USACE also evaluates wetlands, floodplains, dam inspection and dredging of waterways. The proposed NEF will not impact or involve any wetlands, surface waters, dams or other waterways. By letter dated March 17, 2004, the USACE notified LES of its determination that there are no USACE jurisdictional waters at the NEF site (USACE, 2004). Therefore, a Section 404 permit will not be required.

Occupational Safety and Health Administration (OSHA)

The Occupational Safety and Health Act of 1970 (OSHA) is designed to increase the safety of workers in the workplace. It provides that the Department of Labor is expected to recognize the dangers that may exist in workplaces and establish employee safety and health standards. The identification, classification, and regulations of potential occupational carcinogens are found at 29 CFR 1910.101 (CFR, 2003h), while the standards pertaining to hazardous materials are listed in 29 CFR 1910.120 (CFR, 2003o). OSHA regulates mitigation requirements and mandates proper training and equipment for workers. NEF employees and management are subject to the requirements of 29 CFR 1910.

U.S. Department of Interior (DOI)

The U.S. Fish and Wildlife Services (USFWS) Bureau of DOI is responsible for the protection of threatened and endangered species. There are no threatened or endangered species on the NEF site.

1.3.2 State Agencies

The New Mexico Environment Department (NMED) is charged with responsibility to manage and protect human health and the environment in the state of New Mexico. The NMED consists of several divisions that have responsibility for various permits and environmental programs. LES has consulted with NMED regarding NMED permit requirements. The general and specific NMED permits and permit requirements are discussed below by the NMED Bureau that has responsibility for reviewing and approving the permitting action:

New Mexico Air Quality Bureau (NMED/AQB):

The Air Quality Bureau (AQB) Permitting Section processes permit applications for industries that emit pollutants to the air. The Permitting Section consists of two groups: New Source Review and Title V. New Source Review (NSR) is responsible for issuing Construction Permits, Technical and Administrative Revisions or Modifications to existing permits, Notices of Intent (NOIs) for smaller industrial operations, and No Permit Required (NPR) determinations. The two types of Permits issued for larger industrial facilities are (NMAC, 20.2.78):

Construction Permits are required for any person constructing a stationary source which has a potential emission rate greater than 4.5 kg (10 lbs) per hour or 22.7 MT (25 tons) per year of any regulated air contaminant for which there is a National or New Mexico Ambient Air Quality Standard. If the specified threshold in this subsection is exceeded for any one regulated air contaminant, all regulated air contaminants with National or New Mexico Ambient Air Quality Standards emitted are subject to permit review. Within this subsection, the potential emission rate for nitrogen dioxide shall be based on total oxides of nitrogen; all sources with the potential emission rate greater than 4.5 kg (10 lbs) per hour, or 22.7 MT (25 tons) per year, of criteria pollutants (such as nitrogen oxides and carbon monoxide). Air quality permits must be obtained for new or modified sources.

Operating Permits (under Title V) are required for major sources that have a potential to emit more than 4.5 kg (10 lbs) per hour or 91 MT (100 tons) per year for criteria pollutants, or for landfills greater than 2.5 million m^3 (88 million ft3). In addition, major sources also include facilities that have the potential to emit greater than 9.1 MT (10 tons) per year of a single Hazardous Air Pollutant, or 22.7 MT (25 tons) per year of any combination of Hazardous Air Pollutants.

Generally, mobile sources are not required to obtain an operating permit from AQB; however, there are provisions for inspection and maintenance of mobile sources in certain non-attainment areas. Lea County, New Mexico is not located in a non-attainment area.

The NEF will emit levels of air pollution below the conditions of 20.2.72 NMAC, Operating Permits, which would require an air quality permit. The NEF, however, will have a potential emission rate for non-exempt equipment greater than 9.1 MT (10 tons) per year and thus be subject to 20.2.73 NMAC, Notice of Intent, for which LES submitted an application to the AQB by letter dated April 20, 2004.

By letter dated May 27, 2004, the AQB acknowledged receipt of the NOI application and notified LES that the application will serve as the Notice of Intent in accordance with 20.2.73 NMAC (AQB, 2004). The AQB also notified LES of its determination that an air quality permit under 20.2.72 NMAC is not required and that New Source Performance Standards (NSPS) and National Emissions Standards for Hazardous Air Pollutants (NESHAPS) do not apply to the NEF as well. Lastly, the AQB stated that operation of the standby diesel generators and surface coating activities are exempt from permitting requirements, provided all requirements specified in 20.2.72.202.B (3) and 20.2.72.202.B (6) NMAC, respectively, are met.

New Mexico Water Quality Bureau (NMED/WQB)

National Pollutant Discharge Elimination System (NPDES) General Permit for Industrial Stormwater: This permit is required for point source discharge of stormwater runoff from industrial or commercial facilities to the waters of the state. All new and existing point source industrial stormwater discharges associated with industrial activity require a NPDES Stormwater Permit from the EPA Region 6 and an oversight review by the New Mexico Water Quality Bureau. The NEF is eligible to claim the “No Exposure” exclusion for industrial activity of the NPDES stormwater Phase II regulations. As such, the LES would submit a No Exposure Certification immediately prior to initiating operational activities at the NEF site. LES also has the option of filing for coverage under the Multi-Section General Permit (MSGP) because the NEF is one of the 11 eligible industry categories. If this option is chosen, LES will file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the initiation of NEF operations. A decision regarding which option is appropriate for the NEF will be made in the future.

NPDES General Permit for Construction Stormwater: Construction of the NEF will involve the grubbing, clearing, grading or excavation of 0.4 or more ha (1 or more acres) of land coverage and must receive a NPDES Construction General Permit from the EPA Region 6 and an 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: The New Mexico Water Quality Bureau requires that facilities that discharge an aggregate waste water of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems apply for and submit a groundwater discharge permit and plan. This requirement is based on the assumption that these discharges have the potential of affecting groundwater. NEF will discharge treated process water, stormwater and cooling tower blow-down water to surface impoundments. Domestic sewage will be sent to the City of Eunice Wastewater Treatment Plant for processing. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system. The groundwater discharge permit/plan will be required under New Mexico Administrative Codes (NMAC) 20.6.2.3104 NMAC. Section 20.6.2.3104 NMAC of the New Mexico Water Quality Control Commission Regulations (20.6.2 NMAC) requires that any person proposing to discharge effluent or leachate so that it may move directly or indirectly into groundwater must have an approved discharge permit, unless a specific exemption is provided for in the Regulations. Pursuant to Regulation 20.6.2.3108 NMAC, NMED will, within 30 days of deeming the application administratively complete, publish a public notice and allow 30 days for public comment. By letter dated May 17, 2004 (NMED, 2004a), and subsequent letter dated July 9, 2004 (NMED, 2004c), the NMED notified LES that the Ground Water Discharge Permit Application received by NMED on April 28, 2004, was determined to be administratively complete. Discharge Permit DP-1481 was issued to NEF on Februaty 28, 2007.

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

New Mexico Hazardous Waste Bureau (NMED/HWB)

The New Mexico Hazardous Waste Bureaus (HWB) mission is to provide regulatory oversight and technical guidance to New Mexico hazardous waste generators and treatment, storage, and disposal facilities as required by the New Mexico Hazardous Waste Act [HWA; Chapter 74, Article 4 NMSA 1978] (NMAC 20.4.1) and regulations promulgated under the Act. The bureau issues hazardous waste permits for all phases, quantities and degrees of hazardous waste management including treating, storing and disposing of listed or hazardous materials.

Hazardous Waste Permits: These permits are required for the treating, storing or disposing of hazardous wastes. The level of permit and associated monitoring requirements depend on the volume and type of waste generated and whether or not the waste is treated or just stored for offsite disposal. Any person owning or operating a new or existing facility that treats, stores, or disposes of a hazardous waste must obtain a hazardous waste permit from the New Mexico Hazardous Waste Bureau. It is anticipated that small to medium volumes of hazardous waste will be stored at the facility for eventual offsite disposal. The NEF will generate small quantities of hazardous waste that are expected to be greater than 100 kg (220 lbs) per month and is not planning to store these wastes in excess of 90 days (see ER Section 3.12, Waste Management). Thus, the NEF will qualify as a small quantity hazardous waste generator in accordance with 20.4.1 NMAC. As a result, NEF will not require a hazardous waste permit, but instead must file a US EPA Form 8700-12, Notification of Regulated Waste Activity.

The NEF is committed to pollution prevention and waste minimization practices and will incorporate RCRA pollution prevention goals, as identified in 40 CFR 261 (CFR, 2003p). A Pollution Prevention Waste Minimization Plan will be developed to meet the waste minimization criteria of NRC, EPA and state regulations. The Pollution Prevention Waste Minimization Plan will describe how the NEF design procedures for operation will minimize (to the extent practicable) the generation of radioactive, mixed, hazardous, and nonhazardous solid waste.

<u>New Mexico State Land Office (NMSLO):</u>

Right–of-Entry Permit: Surface Resources section of the NMSLO administers renewable resources and sustainable activities on state trust land and works to enhance environmental quality of the lands. Also, it manages the biological, archeological, and paleontological resources. Surface Resources administers agriculture leases, rights of way, and special access permits. It is responsible for mapping, surveying, geographic information systems, and records management. LES applied for and received a Right-of-Entry Permit early in the license application preparation phase so that they could conduct environmental surveys on Section 32 prior to the land being transferred, or an easement granted, to LES.

<u>New Mexico Department of Game and Fish (NMDGF):</u>

Rare, Threatened and Endangered Species Survey: The NMDGF mission is to assist all New Mexico wildlife in need. The program funds four general categories: research, public education, habitat protection, and wildlife rehabilitation, including rare threatened and endangered species. LES conducted a rare, threatened and endangered (RTE) survey for both plants and animals. RTE species were not identified on the NEF site.

New Mexico Radiological Control Bureau (NMED/RCB):

(X-Ray) Radiation Machine Registration: Radiation machine is defined by the New Mexico Radiation Protection Regulations (NMRPR) as any device capable of producing radiation except those which produce radiation only from radioactive material. Examples include medical x-ray machines, particle accelerators, and x-ray radiography machines used for non-destructive testing of materials. The bureau regulates the machines and their usage in accordance with the requirements of the NMRPR (20.3 NMAC). Registrants are required to maintain hardcopies of pertinent parts of the regulations. Mandatory parts include 20.3.2, 20.3.4 (except appendices), and 20.3.10. Other parts apply as applicable for the type of use. LES plans to use non-destructive (x-ray) inspection systems for package security requirement. If the output at 0.3 m (1 ft) from the unit exceeds 1.29E-07 C/kg/hr (0.5 mR/hr), than the x-ray unit must be registered with the State Radiological Control Bureau under section 20.3.11 of NMAC. LES has notified the NMED/RCB (LES, 2004) that they will register NEF X-Ray equipment prior to use when the equipment specifications become available.

New Mexico State Historic Preservation Office (NMSHPO) (NMAC, 2001b):

Class III Cultural Survey: Cultural properties, including prehistoric and historic archaeological sites, historic buildings and other structures, and traditional cultural properties located on state land in New Mexico are protected by the Cultural Properties Act. It is unlawful for any person to excavate, injure, destroy, or remove any cultural property or artifact on state land without a permit. It is also unlawful for any person to intentionally excavate any unmarked human burial, and any material object or artifact interred with the remains, located on any non-federal or non-Indian land in New Mexico without a permit. LES retained a subcontractor that obtained a permit to conduct an archaeological survey. The survey was conducted during September and October of 2003.

A Class III Cultural Resource Inventory and Palentological Survey was conducted on the site. The survey for the cultural resources (archaeological, historical and palentological) consisted of the following: 1) File search and records check; 2) Class III field inventory; and 3) Class III inventory report for the project. The tasks described in this scope are those necessary to complete a Class III survey and National Register of Historic Places evaluations of all cultural resources within the project area and approval by the New Mexico State Historic Preservation Office. Results of the survey are provided in ER Section 3.8, Historic and Cultural Resources, and Section 4.8, Historic and Cultural Resource Impacts.

1.3.3 Local Agencies

Plans for construction and operation of the proposed NEF are being communicated to and coordinated with local organizations. Officials in Lea and Andrews Counties have been contacted regarding the locations of roads and water lines which traverse the site. The Eunice municipal water system operators have been contacted to obtain compliance information for the potable water supplies received from this city.

Emergency support services have been coordinated with the state and local agencies. When contacted, the Central Dispatch in the Eunice Police Department will dispatch fire, Emergency Medical Services (EMS) and local law enforcement personnel. Mutual Aid agreements exist between the Eunice Police Department, Lea County Sheriff's Department, and New Mexico State Police, which are activated if additional police support is needed. Mutual aid agreements also exist between Eunice, New Mexico, the City of Hobbs Fire Department, and Andrews County, Texas for additional Fire and medical services. If emergency fire and medical 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 facility.

Memoranda of Understanding (MOU) have been signed between LES and Eunice Fire and Rescue and the City of Hobbs Fire Department for fire and medical emergency services. MOUs have also been signed with the Eunice Police Department, the Lea County Sheriff's Office and the New Mexico Department of Public Safety, which includes both the New Mexico State Police and the New Mexico Department of Homeland Security and Emergency Management. Memoranda of Understanding have been executed with the agencies that have agreed to support the LES project for construction and operation of the NEF are included in NEF Emergency Plan. The Emergency Preparedness Manager ensures that MOU with offsite agencies are reviewed annually and renewed at least every four years or more frequently if necessary. The Emergency Preparedness Manager maintains files of the current MOU.

1.3.4 Permit and Approval Status

Several permits associated with construction activities have been drafted and will be formally submitted to the appropriate agency prior to the commencement of construction. Construction and operational permit applications will be prepared and submitted, and regulator approval and/or permits will be received prior to construction or facility operation.

Initial consultations have been made with the cognizant agencies. Some permits (including notices of intent) have been submitted to the State of New Mexico. More specific discussions will be held, as appropriate, as the project progresses. See Table 1.3-1, Regulatory Compliance Status, for a summary listing of the required Federal, State and local permits and their current status.

1.3.5 Section 1.3 Tables

Table 1.3-1 Regulatory Compliance Status

Requirement	Agency	Status	Comments
Federal			
10 CFR 70, 10 CFR 40, 10 CFR 30	NRC	Submitted December 2003	Facility License
NPDES Industrial Stormwater Permit	EPA Region 6	Completed	For Entire Site (New Mexico Review)
NPDES Construction General Permit	EPA Region 6	Completed	For Runoff Water during Construction Phases (New Mexico Review)
Section 404 Permit	USACE	Not Required	No jurisdictional waters
State			
Air Construction Permit	NMED/AQB	Not Required	Emissions below limits
Air Operating Permit	NMED/AQB	Not Required	Emissions below limits
NESHAPS Permit	NMED/AQB	Not Required	Emissions below limits
Groundwater Discharge Permit/Plan	NMED/WQB	Completed	For Industrial Discharges to Evaporative Retention/Detention Ponds. For Industrial Discharges to Evaporative Retention/Detention Ponds. Septic Discharges to the City of Eunice Wastewater Treatment Plant or site septic system as a backup.
NPDES Industrial Stormwater	NMED/WQB	Completed	Oversight Review by New Mexico (see above)
NPDES Construction General Permit	NMED/WQB	Completed	Oversight Review by New Mexico (see above)
Hazardous Waste Permit	NMED/HWB	Not Required	Waste Storage < 90 days
EPA Waste Activity EPA ID Number	NMED/HWB	Completed	NEF is Small Quantity Generator (SQG)
Machine-Produced Radiation-Registration (x-ray inspection)	NMED/RCB	Deferred Until Equipment Specifications Available	For Security Non-Destructive Inspection (X-Ray) Machines
Rare, Threatened & Endangered Specie Survey Permit	NMDGF	Completed	For conducting RTE species surveys on state-owned land
Right-Of-Entry Permit	NMSLO	Completed	For entry onto Section 32

Table 1.3-1 Regulatory Compliance Status

Requirement	Agency	Status	Comments
Class III Cultural Survey Permit	NMSHPO	Completed	To conduct surveys on Section 32
Section 401 Certification	NMED/WQB	Not Required	Co-operative agreement with USACE (see above)

2.0 ALTERNATIVES

This chapter describes the alternatives to the proposed action described in ER Section 1.2, Proposed Action. The range of alternatives considered in detail is consistent with the underlying need for and purposes of the proposed action, as set forth in ER Section 1.1, Purpose and Need for the Proposed Action. Accordingly, the range of alternatives considered is based on the underlying need for additional reliable and economical uranium enrichment capacity in the United States – as would be provided by the proposed National Enrichment Facility (NEF) – as well as related commercial considerations concerning the security of supply of enriched uranium. The alternatives considered in detail include (1) the "no-action" alternative under which the proposed NEF would not be built, (2) the proposed action to issue a Nuclear Regulatory Commission (NRC) license to Louisiana Energy Services (LES) for the construction and operation of the NEF, (3) alternative technologies available for an operational uranium enrichment facility, (4) design alternatives and (5) alternative sites for the proposed enrichment facility.

This chapter also addresses the alternatives that were considered, but ultimately eliminated, as well as the potential cumulative impacts of the proposed action. Finally, this chapter presents, in tabular form, a comparison of the potential environmental impacts associated with the proposed action and various scenarios possibly arising under the no-action alternative.

2.1 DETAILED DESCRIPTION OF THE ALTERNATIVES

This section identifies the no action alternative, the proposed action, and reasonable alternatives to the proposed action. Included are the technical design requirements for the proposed action and its reasonable alternatives.

2.1.1 No-Action Alternative

The no-action alternative for the NEF would be to not build the proposed NEF. Under the no-action alternative, the NRC would not approve the license application to construct and operate the proposed facility. Accordingly, the current owner of the property upon which the proposed facility would be sited, the State of New Mexico, would be free to pursue alternative uses of the property. In the absence of NRC approval of the NEF license, utility customers would be required to meet their uranium enrichment service needs through existing suppliers. In the US, this would mean that the one remaining enrichment facility, the gaseous diffusion facility operated by USEC at Paducah, Kentucky, would be the only domestic facility available to serve this purpose. Similarly, USEC would remain the sole domestic supplier of low-enriched uranium. This scenario would be inconsistent with the clear federal policy of fostering the development of additional, secure, reliable, and economical domestic enrichment capacity to promote both US energy security and national security. The Department of Energy (DOE) has noted that this could have “serious domestic energy security consequences, including the inability of the US enrichment supplier (USEC) to meet all of its enrichment customers’ contracted fuel requirements in the event of a fuel supply disruption from either the Paducah plant production or the highly enriched uranium (HEU) Agreement deliveries.”

As the DOE has further recognized, these energy security concerns are due largely to the current lack of available replacement capacity for the “inefficient and noncompetitive gaseous diffusion enrichment plants.” (Sterba, 1999) In its application for the Lead Cascade American Centrifuge Facility, USEC noted the Portsmouth facility “is over 50 years old and the power costs to product SWU are significant.” Although USEC is pursuing development and deployment of its own advanced centrifuge technology, this technology has yet to be proven commercially viable. Even if USEC were able to bring the proposed facility online successfully, its operation alone would neither provide for diverse suppliers of enrichment services in the US nor guarantee security of supply, particularly in view of forecasted installed nuclear generating capacity and uranium enrichment requirements discussed in ER Section 1.1.2, Market Analysis of Enriched Uranium Supply and Requirements.

As discussed in Chapter 1, Introduction to the Environment Report, the US- Russian HEU agreement (for which USEC is the US executive agent) is currently scheduled to expire in 2013, and like other arrangements for the importation of foreign-enriched uranium, it may be subject to disruptions caused by both political and commercial factors. These circumstances have raised concerns among US purchasers of enrichment services with respect to the security of their supplies. The recent contract dispute between Russia’s Techsnabexport (Tenex) and its former affiliate Globe Nuclear Services & Supply provides one example of the concerns raised by potential supply disruptions. As noted in a recent trade press article, even though this dispute is not expected to impact the US-Russian HEU Agreement or other sales by Tenex, “some utilities may now come to view those supplies as less certain and take steps to line up alternate sources of supply or to ask for price discounts to account for perceived increased delivery risk.” (NW, 2003)

Under the no-action alternative, a decision by the NRC not to approve the NEF license application would perpetuate the reliance on only one domestic source of enrichment services – a source that employs a high-cost, inefficient technology – as well as the existence of only domestic supplier of services. This alternative, therefore, would not serve the recognized need of the US government to promote energy and national security through the development of additional, secure, reliable, and economical domestic enrichment capacity; nor would it serve the need of utility customers to ensure secure supplies and diverse suppliers of enrichment services.

2.1.2 Proposed Action

The proposed action, as described in ER Section 1.2, Proposed Action, is the issuance of an NRC license under 10 CFR 70 (CFR, 2003f), 10 CFR 30 (CFR, 2003g) and 10 CFR 40 (CFR, 2003h) that would authorize LES to possess and use byproduct material, source material and special nuclear material (SNM) and to construct and operate a uranium enrichment plant at a site located in Lea County, New Mexico. ER Section 1.2 contains a detailed description of the proposed action, including relevant general background information, organization sharing ownership, and project schedule.

2.1.2.1 Description of the Proposed Site

The proposed NEF site is located in Southeastern New Mexico near the New Mexico/Texas state line, in Lea County. The site comprises about 220 ha (543 acres) and is within county Section 32, Township 21 South, Range 38 East. The approximate center of the NEF is at latitude 32 degrees, 26 minutes, 1.74 s North and longitude 103 degrees, 4 min, 43.47 s West. Refer to Figure 2.1-1, 80-Kilometer (50-Mile) Radius With Cities and Roads.

The site lies along the north side of New Mexico Highway 234. It is relatively flat with slight undulations in elevation ranging from 1,033 m to 1,045 m (3,390 m to 3,430 ft) above mean sea level (msl) from the overall slope direction is to the southwest. 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. Onsite vegetation includes mesquite bushes, shinnery oak shrubs and other native grasses. During the construction phase, a fence runs along the perimeter of the property. A 25.4-cm (10-in) diameter, underground carbon dioxide (CO_2) pipeline, running southeast-northwest, once traversed the site. The pipeline is owned by Trinity Pipeline, LLC. The CO_2 pipeline has been relocated to the western edge of the NEF property, at this location it is sufficiently far from the NEF so as not to pose a safety concern. A 40.6-cm (16-in) diameter, underground natural gas pipeline, owned by the Sid Richardson Energy Services Company, is located along the south property line, paralleling New Mexico Highway 234.

The area surrounding the site consists of vacant land and industrial properties. A railroad spur borders the site to the north. Beyond is a sand/aggregate quarry operated by Wallach Concrete Inc. The quarry owner leases land space to a “produced water” reclamation company (Sundance Services) which maintains three small “produced water” lagoons. There is also a man-made pond stocked with fish on the quarry property. A vacant parcel of land, Section 33 is immediately to the east. Section 33 borders the New Mexico/Texas state line which is 0.8 km (0.5 mi) east of the site. Several disconnected power poles are situated in front of Section 33, parallel to New Mexico Highway 234. Land further east, in Texas, is occupied by Waste Control Specialists (WCS) LLC, a licensed Resource Conservation Recovery Act (RCRA) disposal facility. A large mound of soil exists northwest of WCS. Reportedly, the mound consists of stockpiled soil excavated by WCS. High-voltage utility lines run in a north-south direction near the property line of WCS, parallel to the New Mexico/Texas state line. To the south, across New Mexico Highway 234, is the Lea County Landfill. DD Landfarm, a petroleum contaminated soil treatment facility is adjacent to the west. Land further north, south and west has mostly been developed by the oil and gas industry. Land east of WCS is occupied by the Letter B Ranch.

Baker Spring, which contains surface water seasonally, is situated a little over 1.6 km (1 mi) northeast of the site. A historical scenic oil country marker with a few picnic tables is situated about 3.2 km (2 mi) to the west along New Mexico Highway 234. New Mexico Highway 234 intersects New Mexico Highway 18 about 4 km (2.5 mi) to the west. The nearest residences are located along the west side of New Mexico Highway 18, just south of its intersection with New Mexico Highway 234. The city of Eunice, New Mexico is further west along New Mexico Highway 234 about 8 km (5 mi) from the site. Monument Draw, an area drainage way, is situated a short distance north and east of Eunice. Railroad tracks (Texas-New Mexico Railroad) are located on the east end of town and run north-south, parallel to New Mexico Highway 18. The Eunice Airport is situated about 16 km (10 mi) west of the city center. The city of Hobbs, New Mexico (population 28,657) is situated along New Mexico Highway 18 about 32 km (20 mi) to the north and the city of Jal, New Mexico is along New Mexico Highway 18 about 37 km (23 mi) to the south. To the east, New Mexico Highway 234 becomes Texas Highway 176 at the New Mexico/Texas state line. The nearest Texas town, Frankel City, is about 24 km (15 mi) to the east, just north of Texas Highway 176. Andrews, Texas (population 10,182), is further east along Texas Highway 176, about 51 km (32 mi) from the site. The nearest, largest population center is Midland-Odessa, Texas (population >100,000) which is approximately 103 km (64 mi) to the southeast.

Figure 2.1-2, Site Area and Facility Layout Map 1.6-Kilometer (1-Mile) Radius, Figure 2.1-3, Existing Conditions Site Aerial Photograph and Figure 2.1-4, NEF Buildings show the site property boundary and the general layout of the buildings on the NEF site.

2.1.2.2 Applicant for the Proposed Action

Louisiana Energy Services (LES), L.L.C.. is a Delaware limited liability company. It has been formed solely to provide uranium enrichment services for commercial nuclear power plants. The corporate identity is described in Section 1.2.1 of the SAR.

LES has presented to Lea County, New Mexico a proposal to develop the NEF. Lea County would issue its Industrial Revenue Bond (National Enrichment Facility Project) Series 2004 in the maximum aggregate principal amount of $1,800,000,000 to accomplish the acquisition, construction and installation of the project pursuant to the County Industrial Revenue Bond Act, Chapter 4, Article 59 NMSA 1978 Compilation, as amended. The Project is comprised of the land, buildings, and equipment.

Under the Act, Lea County is authorized to acquire industrial revenue projects to be located within Lea County but outside the boundaries of any incorporated municipality for the purpose of promoting industry and trade by inducing manufacturing, industrial and commercial enterprises to locate or expand in the State of New Mexico, and for promoting a sound and proper balance in the State of New Mexico between agriculture, commerce, and industry. After acquiring the project, constructing the facility, and installing the facility equipment, Lea County will lease the project to LES, which will operate the facility. Upon expiration of the Bond after 30 years, LES will purchase the project.

The County has no power under the Act to operate the project as a business or otherwise or to use or acquire the project property for any purpose, except as lessor thereof under the terms of the lease.

In the exercise of any remedies provided in the lease, the County shall not take any action at law or in equity that could result in the Issuer obtaining possession of the project property or operating the project as a business or otherwise.

LES is responsible for the design, quality assurance, construction, operation, and decommissioning of the enrichment facility. The President of LES reports to the LES Board of Managers. The Board of Managers are discussed in Section 1.2.1.2 of the SAR.

Foreign Ownership, Control and Influence (FOCI) of LES is addressed in the NEF Standard Practice Procedures for the Protection of Classified Matter, Appendix 1 – FOCI Package. The NRC in their letter dated, March 24, 2003, has stated "…that while the mere presence of foreign ownership would not preclude grant of the application, any foreign relationship must be examined to determine whether it is inimical to the common defense and security [of the United States]". (NRC, 2003b) The FOCI Package mentioned above provides sufficient information for this examination to be conducted.

2.1.2.3 Facility Description

The NEF is designed to separate a feed stream containing the naturally occurring proportions of uranium isotopes into a product stream enriched in ^{235}U and a uranium stream depleted in the ^{235}U isotope. Following is a summary description of the NEF process, buildings and related operation. The NEF Safety Analysis Report (SAR) contains a detailed description of facility characteristics, including plant design and operating parameters.

The feed material for the enrichment process is uranium hexafluoride (UF_6), with a natural composition of isotopes ^{234}U, ^{235}U, and ^{238}U. The enrichment process involves the mechanical separation of isotopes using a fast rotating cylinder (centrifuge) and is based on a difference in centrifugal forces due to differences in the molecular weight of the uranic isotopes. No chemical or nuclear reactions take place. The feed, product, and depleted uranium streams are all in the form of UF_6.

The UF_6 feed arrives from conversion facilities as a solid under partial vacuum in 122-cm (48-in) diameter transportation cylinders. Product material is collected in 76-cm (30-in) diameter containers and transported to a fuel fabricator. The depleted UF_6 material is collected in 122-cm (48-in) diameter containers and removed for storage onsite.

At full production in a given year, the plant will receive approximately 8,600 MT (9,480 tons) of UF_6 feed, produce 800 MT (880 tons) of low enriched UF_6, and yield 7,800 MT (8,600 tons) of depleted UF_6. The principal NEF operational structures are shown on Figure 2.1-4, NEF Buildings, and include the following:

- SBMs (includes UF_6 Handing Area, Cascade Halls, Process Services Corridor)
- Cylinder Receipt and Dispatch Building (CRDB)
- Technical Services Building (TSB)
- Centrifuge Assembly Building (CAB)
- Uranium Byproduct Cylinders (UBC) Storage Pad
- Administration Building
- Central Utilities Building (CUB)
- Security Building

Information on items used, consumed, or stored at the site during construction and operation is provided in ER Section 3.12.4, Resources and Materials Used, Consumed or Stored During Construction and Operation.

2.1.2.3.1 (See SAR § 12.2 12.3 and 12.7) Separations Building Modules (SBMs)

The Separations Building Modules (SBMs) have two Cascade Halls, a UF_6 Handling Area, a Process Services Corridor, and Link Corridor. The Cascade Hall contains 12 cascades, each which is made up of many centrifuges. Natural uranium in the form of UF_6 is fed into the cascades and UF_6 enriched in the ^{235}U isotope (product) and UF_6 depleted in the ^{235}U isotope (tails) are removed. The UF_6 Handling Area contains the Feed System, Product Take-off System, Tails Take-off System, and the Blending (SBM-1001 only) and Liquid Sampling Systems. The Process Services Corridor contains gas transport equipment, which connects the cascades to the UF_6 Feed System, Product Take-off System, Tails Take-off System and Contingency Dump System. The Link Corridor contains mechanical, electrical, and HVAC rooms.

2.1.2.3.2 (See SAR § 12.4, 12.5, and 12.6) Cylinder Receipt and Dispatch Building (CRDB)

The CRDB is located between SBMs: SBM-1001 and SBM-1003 and adjacent to the Technical Services Building. All UF_6 feed cylinders and empty product cylinders and UBCs enter the facility through the CRDB. It is designed to include space for the following:

Outside the CRDB Bunker:

- Loading and unloading of cylinders
- Cylinder preparation area for testing new or cleaned cylinders
- Inventory weighing
- Preparation and storage of protective cylinder overpacks
- Buffer storage of feed cylinders
- Semi-finished product storage
- Final product storage
- Prepared cylinder storage
- Staging (temporary storage) of tails and empty feed cylinders

Inside the CRDB Bunker:

- Equipment decontamination
- Rebuilding of vacuum pumps
- UF_6 cylinder valve repair
- UF_6 cylinder preparation
- Solid waste collection and packaging
- Collection and treatment of liquid effluents
- Contaminated material handling
- Mass spectrometry and chemical analysis
- Radiation monitoring
- Filtration and exhaust of gaseous effluent through Gaseous Effluent Vent Systems (GEVS)
- HVAC equipment (supporting radiological and non-radiological portions of the CRDB)

The majority of the floor area is used as lay-down space for the cylinders, for both storage and staging. The cylinders are placed on cradles to stabilize them while being stored in the CRDB.

(See SAR § 12.4) Cylinders are delivered to the facility in transport trucks. The trucks enter the CRDB through the main vehicle loading bay, which is equipped with vehicle access platforms that aid with cylinder loading and unloading. Three double girder bridge cranes on two sets of crane rails handle the cylinders within the CRDB. Each crane spans half the width of the CRDB. The two bridge cranes on the West side run the full length of the building. The third bridge crane on the east side services the area north of the CRDB Bunker.

After delivery, the cylinders are processed for receipt as either empty UBCs (48Y cylinders) or empty product cylinders (30B cylinders) or UF_6 feed cylinders (48Y cylinders). They are inspected and weighed and moved to their appropriate locations. UF_6 feed cylinders are delivered to a storage area in the CRDB.

When required for processing, the cylinders, which have been placed in storage areas, will be moved by the overhead cranes one of two rail transporters in the CRDB.

(See SAR § 12.4) The rail transporter in the UF_6 Handling Area travels on rails embedded in the floor along the entire length of the UF_6 Handling Area to the CRDB's cylinder transporting and stillage area. It moves the cylinders to and from the appropriate feed or receiver stations. It has the ability to handle both the feed cylinders and UBCs 122-cm (48-in) and product 76-cm (30-in) cylinders.

Floors in the CRDB Bunker are made of exposed concrete with a washable epoxy coating finish designed to resist process chemicals, decontamination agents, and radiation. The floors of the CRDB shell are coated with a concrete sealer.

During initial plant operations, until the CRDB construction is complete, all cylinders will enter the facility through the West end of the SBM-1001 UF_6 Handling Area. Cylinders will be unloaded from the transport trailer using a double gantry crane. The gantry crane spans a transport trailer unloading station located just outside SBM-1001. Cylinders on the gantry crane are then retrieved by the rail transporter for use. Cylinder dispatch from the facility is handled in the reverse order.

Cylinders received at the site are expected to be in good working condition. Cylinders with deficient conditions are returned to an approved supplier for corrective maintenance and testing in accordance with ANSI N14.1-2001, provided the cylinder fully complies with all DOT transport requirements.

Cylinders with deficient conditions that do not fully comply with all DOT transport requirements must be corrected at the site. Such corrective maintenance may include valve replacement, plug replacement and post maintenance testing on containers with UF_6. Such corrective maintenance and testing is performed in the CRDB Ventilated Room in accordance with ANSI N14.1-2001 and the LES QA Program.

Inside the CRDB steel Butler building, there is an inner, two story stand-alone concrete structure referred to as the "CRDB Bunker."

Inside the CRDB Bunker, the following functional areas are located on the ground floor:

- Ventilated Room (Room 143)
- Decontamination Workshop (Room 151)
- Vacuum Pump Rebuild Workshop (Room 154)
- Vacuum Pump Test Room (Room 155)
- Liquid Effluent Collection and Treatment Room (Room 156)
- Solid Waste Collection Room (161)
- Mass Spectrometry Laboratory (Room 136)

- Chemical Laboratory (Room 133)
- Sample Storage (Room 139)

Also inside the CRDB Bunker, the following functional areas are located on the second floor:

- Gaseous Effluent Vent System (GEVS) Room (Room 242)
- Contaminated Material Handling Room (Room 261)
- Radiation Monitoring Laboratory (Room 262)

(See SAR § 12.5 and 12.6) Decontamination Workshop

The Decontamination Workshop provides a maintenance facility for both UF_6 pumps and vacuum pumps. It is also used for the temporary storage and subsequent dismantling of failed pumps. The activities carried out within the Decontaminated Workshop include receipt and storage of contaminated pumps, out-gassing, perfluorinated polyether (PFPE) oil removal and storage, pump stripping, and the dismantling and maintenance of valves and other plant components.

The Decontamination Workshop also provides a facility for the removal of radioactive contamination from contaminated materials and equipment. The decontamination system consists of a series of steps including equipment disassembly, degreasing, decontamination, drying and inspection. Components commonly decontaminated include pumps, valves, piping, instruments, sample bottles, tools and scrap metal.

The Decontamination Workshop is under negative pressure. Therefore, any equipment or personnel entering this room must go through an air-lock.

Gaseous Effluent Vent System (GEVS) Room

GEVS removes uranium compounds particulates containing uranium [i.e., uranyl fluoride (UO_2F_2)], and hydrogen fluoride (HF) from potentially contaminated process gas streams. Pre-filters and high efficiency particulate air (HEPA) filters remove particulates, including uranium particles, and impregnated activated carbon filters remove HF.

Laboratory Areas

The Laboratory Areas provide space for three laboratories that receive, prepare, and store various samples as follows:

- (See SAR § 12.5) Mass Spectrometry Laboratory – designed for the purpose of measuring the isotopic abundance of various uranium isotopes in prepared samples, the bulk comprising hydrolyzed uranium hexafluoride
- (*See SAR § 12.5)* Chemical Laboratory – designed for the purposes of analyzing sold and liquid samples taken from all area of the facility.
- Radiation Monitoring Laboratory – designed for the purposes of analyzing samples taken from all areas of the facility in support of radiological control.

Contaminated Material Handling Room

The Contaminated Material Handling Room, located in the CRDB, provides an area for the Recycling Group to store protective clothing drums and other material/waste containers that have been assayed and released from the Safeguards item control program. This area will normally provide storage for containers awaiting Radiation Protection survey to be either unconditionally released or transferred to the solid waste collection system for additional processing. In addition, the contaminated Material Handling Room will contain cabinets and bins with supplies to support the waste program and a connection to the CRDB GEVS to support ventilation engineering controls when required.

Liquid Effluent Collection and Treatment Room

The Liquid Effluent Collection and Treatment Room is used to collect potentially contaminated liquid effluents produced onsite, which are monitored for contamination prior to processing. These liquid effluents are stored in tanks prior to processing. The effluents are segregated into significantly contaminated effluent, slightly contaminated effluent or non-contaminated effluent. Both the significantly and slightly contaminated liquids are processed for uranium recovery while the non-contaminated liquid is neutralized and routed to the double-lined Treated Effluent Evaporative Basin, with leak detection. Liquid effluents produced by the plant include hydrolyzed uranium hexafluoride, degreaser water, citric acid, floor wash water, hand wash/shower water and miscellaneous effluent. The LECTS Room will also be used for trap filling.

Radiation Protection Access and Control Room

The Radiation Protection Access and Control Room is the point of demarcation between the radiological controlled areas and non-radiological controlled areas of the plant. This area provides a point for release of material and personnel that have been within the posted Radiolgical Control Areas for exiting the CRDB and SBMs through a breezeway into the TSB or to the outside. It includes space for personnel contamination monitors, electronic access control system, and a radiation protection counting station.

(*See SAR § 12..6)* Solid Waste Collection Room

The Solid Waste Collection Room processes both wet and dry low-level solid waste. Wet waste is categorized as radioactive, hazardous or industrial waste and includes assorted materials, oil recovery sludge, oil filters and miscellaneous hazardous wastes. Dry waste is also categorized as radioactive, hazardous or industrial waste and includes assorted materials, activated carbon (impregnated with potassium carbonate/potassium hydroxide), aluminum oxide (also referred to as alumina), sodium fluoride, HEPA filters, scrap metal and miscellaneous hazardous materials.

(*See SAR § 12.4)* Truck Bay/Shipping and Receiving Area

The Truck Bay, located at the North end of the CRDB, is used for the shipping and receiving of UF6 cylinders as well as to load packaged low-level radioactive wastes and hazardous wastes onto trucks for transportation offsite to a licensed processing facility and/or licensed disposal facility. It is also used for miscellaneous shipping and receiving.

(*See SAR § 12.6)* Vacuum Pump Rebuild Workshop

The Vacuum Pump Rebuild Workshop provides space for the maintenance and re-building of plant equipment, mainly pumps that have been decontaminated in the decontamination facility, and other miscellaneous plant equipment.

(*See SAR § 12.6)* Ventilated Room

The Ventilated Room provides space for the maintenance of chemical traps and cylinders. The Ventilated Room is also used for the temporary storage of full and empty traps and the contaminated chemicals used in the traps. The activities carried out within the Ventilated Room include receipt and storage of saturated chemical traps, chemical removal and temporary storage, contaminated cylinder pressure testing, and cylinder pump out and valve maintenance. The Ventilated Room is under negative pressure. Therefore, any equipment or personnel entering this room must go through an air-lock.

2.1.2.3.3 Technical Services Building (TSB)

The TSB is adjacent to the south end of the Cylinder Receipt and Dispatch Building (CRDB). The TSB contains support areas for the facility and acts as the secure point of entry to the CRDB. The TSB contains the following functional areas, some of which are contained in a hardened area:

Control Room

The Control Room is the main monitoring and reporting point for the entire facility. The Control Room provides facilities to both directly and indirectly monitor and operate plant control systems. It is permanently manned area and contains the following equipment:

- Overview screen
- Control desk
- Fire alarm system
- Plant Control Systems
- Communication systems.

Training and Simulator Rooms

These rooms are used for Control Room training. The rooms are in the hardened area and contain the following:

- Plant Control System training system
- Centrifuge Monitoring System training system
- Central Control System switches and servers

Central Alarm Station (CAS) Area

The Central Alarm Station Area is used as the primary security monitoring station for the facility. The area includes the Central Alarm Station (CAS), offices, conference area and secure archives. All electronic security systems are controlled and monitored from this center. These systems include Closed Circuit Television (CCTV). Intrusion Detection and Assessment (IDA), Access Control and radio dispatch. The Secondary Alarm Station (SAS) will be located in the Security Building and will serve as a duplicate control console to the CAS.

Medical Room

The Medical Room is designed to provide space for a nurse’s station.

Emergency Operations Center Room

The Emergency Operations Center Room serves as an assembly area for emergency planning purposes.

Technical Support Center Assembly Room

The Technical Support Center Assembly Room serves as an assembly area for emergency planning purposes and has an area allocated for the storage of emergency equipment and supplies and emergency monitoring equipment.

Break Room

The Break Room has space for vending machines, tables and a small kitchenette.

I&C Electrical Shop Room

The I&C Electrical Shop Room serves as a work area for general electrical and I&C components and maintenance.

Mechanical Shop Room

The Mechanical Shop Room serves as a work area for general mechanical maintenance and work such as painting or welding.

Chemical Storage Room

The Chemical Storage Room serves as a storage area for typical industrial chemicals.

Waste Processing Room

The Waste Processing Room serves as a processing area of non-radioactive wastes.

2.1.2.3.4 Centrifuge Assembly Building (CAB)

The CAB is located North and East of the CRDB. It is used for the assembly, inspection, and mechanical testing of the centrifuges prior to installation in the Cascade Halls of the SBMs. Centrifuge assembly operations are undertaken in clean room conditions. The building is divided into the following distinct areas:

- Centrifuge Component Storage Area
- Centrifuge Assembly Area “A”
- Centrifuge Assembly Area “B”
- Centrifuge Assembly Area “C”
- Assembled Centrifuge Storage Area
- Building Office Area
- Centrifuge Test and Post Mortem Facilities (CTF/PMF).

Centrifuge Component Storage Area

The Centrifuge Component Storage Area serves as the initial receipt location for the centrifuge parts. It is designed to store up to four weeks of delivered centrifuge components. These components are delivered by truck in specifically designed containers, which are then packed into International Organization for Standardization (ISO) freight containers. These containers are off-loaded via fork lift truck and placed in the storage area through one of two roller shutter doors located at the end of the CAB.

Because the assembly operations are undertaken in clean room conditions, the centrifuge component containers will be cleaned in a washing facility located within the Centrifuge Component Storage Area, prior to admission to the Centrifuge Assembly Area. The component store also acts as an acclimatization area to allow components to equilibrate with the climatic conditions of the Centrifuge Assembly Area.

Transfer of components and personnel between the component store and the centrifuge assembly areas will be via an airlock to prevent ingress of airborne contaminants.

Centrifuge Assembly Area

Centrifuge components are assembled into complete centrifuges in these areas. The centrifuge operates in a vacuum; therefore, centrifuge assembly activities are undertaken in clean-room conditions to prevent ingress of volatile contaminants, which would have a detrimental effect on centrifuge performance. Prior to installation into the cascade, the centrifuge has to be conditioned, which is done in the Centrifuge Assembly Area prior to storage in the Assembled Centrifuge Storage Area.

Assembled Centrifuge Storage Area

Assembled and conditioned centrifuges are stored in the Assembled Centrifuge Storage Area prior to installation. During construction of the plant, a separate installation team will access this area and transfer the assembled and conditioned centrifuges to the Cascade Halls for installation.

Building Office Area

A general office area is located adjacent to the assembly area. It contains the main personnel entrance to the building as well as entrances to the assembly storage and assembly workshop. It is a two-story area, which includes:

- Offices
- Change Rooms
- Break Room
- Maintenance Area
- Chemical Storage Area
- Battery Charging Area.

Centrifuge Test and Post Mortem Facilities

The Centrifuge Test Facility provides an area to test the functional performance of production centrifuges and ensure compliance with design parameters. The Post-Mortem Facility provides an area to investigate production and operational problems. The demand for centrifuge post mortems is infrequent.

The principal functions of the Centrifuge Post Mortem Facility are to:

- Facilitate dismantling of non-contaminated centrifuges or contaminated centrifuges using equipment and processes, that minimize the potential to contaminate personnel or adjacent facilities.
- To prepare potentially contaminated components and materials for transfer to the CRDB prior to disposal.

Centrifuges are brought into the facility on a specially designed transport cart. The facility is also equipped with radiological monitoring devices, toilets and washing facilities, and hand, foot and clothing personnel monitors to detect surface contamination.

The Centrifuge Post Mortem Facility includes a centrifuge dismantling area and an inspection area. The centrifuge dismantling area includes a stand onto which the centrifuge to be dismantled is mounted providing access to the top and bottom of the centrifuge. A local jib crane is located over the stand to enable removal of the centrifuge from the transport cart and facilitate loading onto the stand.

The inspection area includes an inspection bench, portable lighting, a microscope, an endoscope and a digital video/camera.

2.1.2.3.5 (*See SAR § 12.2 and 12.3)* Uranium Byproduct Cylinders (UBC) Storage Pad

The NEF uses an area outside of the CRDB for storage of UBCs containing UF_6 that is depleted in ^{235}U. The depleted UF_6 is stored under vacuum in corrosion resistant Type 48Y cylinders, i.e., UBCs.

The UBC Storage Pad design provides storage cylinders of depleted uranium. The UBC Storage Pad will also be used to store full and empty feed cylinders and clean, empty product cylinders that are not immediately recommended to the plant. Approximately 625 UBCs per year will be stored on the UBC Storage Pad. The storage area required to support plant operations accommodates a maximum of 15,727 cylinders of depleted uranium. These cylinders are stacked two high on cradles that elevate the cylinders approximately 0.2 m (0.65 ft) above ground level. (See ER Section 4.13.3.1.1, Uranium Byproduct Cylinder (UBC) Storage.)

Powered vehicles move the cylinders from the CRDB to the UBC Storage Pad, where single girder mobile gantry cranes remove the cylinders from the vehicles and place them on the UBC Storage Pad.

The UBC Storage Pad will be developed in sections over the life of the facility.

2.1.2.3.6 Administration Building

The Administration Building is near the TSB. It contains general office areas for the facility. Personnel enter the Administration Building and general office areas via the main lobby.

Over 50 work locations are provided for the plant office staff. The office environment consists of private, semiprivate, and open office space. It also contains a kitchen, break room, conference rooms, building service facilities such as the janitor's closet and public telephone, and a mechanical equipment room.

2.1.2.3.7 (*See SAR § 12.2 and 12.3)* Central Utilities Building (CUB)

The Central Utilities Building is located near the TSB. It houses two diesel generators, which provide the site with standby power. The building also contains day tanks, switchgear, control panels, and building heating, ventilating, and air conditioning (HVAC) equipment. The rooms housing the diesels are constructed independent of each other with adequate provisions made for maintenance, as well as equipment removal and equipment replacement.

The diesel fuel unloading area provides tanker truck access to the two above ground tanks, which provide diesel fuel storage. Secondary containment (berms) will be provided to contain spills or leaks from the two above ground diesel fuel tanks.

The CUB also houses the Centrifuge Cooling Water System, pumps, and air compressors.

2.1.2.3.8 Security Building

The main Security Building is located at the entrance to the plant. It functions as a security checkpoint for all incoming and outgoing personnel. Employees and visitors that have access approval will be screened at the main Security Building. A smaller Gatehouse has been placed at the secondary site entrance. All vehicle traffic including common carriers, such as mail delivery trucks, will be screened at this location.

The Security Building also contains a Visitor Center. There are adequate physical barriers, locked doors, etc. to separate the visitor accessible areas from areas designed to support security functions.

The main Security Building contains Entry Exit Control Point (EECP) for the facility. All personnel access to the plant occurs at this location. Vehicular traffic passes through a security checkpoint before being allowed to park. Parking is located outside of the Controlled Access Area (CAA) security fence. Personnel enter the Security Building and general office areas via the main lobby.

Personnel requiring access to the facility areas or the CAA must pass through the EECP. The EEC is designed to facilitate and control the passage of authorized facility personnel and visitors. Entry to the plant area from the Security Building is only possible through the EECP.

2.1.2.4 Process Control Systems

The NEF uses various operations and Process Controls Systems to ensure safe and efficient plant operations. The principal process systems include:

- Decontamination System
- PFPE Oil Recovery System
- Liquid Effluent Collection and Treatment System
- Solid Waste Collection System
- Gaseous Effluent Vent System
- Centrifuge Test and Post Mortem Exhaust Filtration System

2.1.2.4.1 (See SAR § 12.5.1.3 and 12.7.2.1*)* Decontamination System

The Decontamination System is designed to remove radioactive contamination [in the form of uranium hexafluoride (UF_6), uranium tetrafluoride (UF_4) and uranyl fluoride (UO_2F_2), i.e., uranium compounds] from contaminated materials and equipment. The system consists of a series of steps, including equipment disassembly, degreasing, decontamination, drying, and inspection.

Items commonly decontaminated include pumps, valves, piping, instruments, sample bottles, and scrap metal. Decontamination is typically accomplished by immersing the contaminated component in a 5% citric acid bath with ultrasonic agitation, rinsing with water, drying using compressed air, and then inspecting before release. The process time is about one hour for most plant components. Liquid waste is sent to the Liquid Effluent Collection and Treatment System; solid waste/sludge to the Solid Waste Collection System, and enclosure exhaust air to the GEVS prior to venting.

2.1.2.4.2 (*See SAR § 12.8)* PFPE Oil Recovery System

Vacuum pumps use a Perfluorinated Polyether (PFPE) oil, which oil is a highly fluorinated, inert oil selected especially for use to avoid reaction with UF_6. The PFPE Oil Recovery System reclaims spent PFPE oil from pumps used in the UF_6 processing system. The recovery employs anhydrous sodium carbonate (Na_2CO_3) in a laboratory-scale precipitation process to remove the primary impurities of UO_2F_2, UF_4, and activated carbon to remove trace amounts of hydrocarbons. Refer to ER Section 4.13, Waste Management Impacts, for the annual estimated oil quantity recovered.

2.1.2.4.3 (See SAR 12.6) Liquid Effluent Collection and Treatment System

The Liquid Effluent Collection and Treatment System collects potentially contaminated liquid effluents that are generated in a variety of plant operations and processes. These liquid effluents are collected in holding tanks and then transferred to bulk storage tanks prior to processing. The bulk liquid storage is segregated by the level of contamination into three categories. Significant and slightly contaminated liquids are processed for uranium recovery, while the non-contaminated liquid is routed to the Treated Effluent Evaporative Basin. The effluent input streams include hydrolyzed UF_6 , degreaser water, citric acid, floor wash water, and hand wash/shower water and miscellaneous effluent. Refer to Safety Analysis Report (SAR) Section 3.3 for additional information.

2.1.2.4.4 (*See SAR § 12.6)* Solid Waste Collection System

Solid wastes are generated in two categories: wet and dry. The Solid Waste Collection System is simply a group of methods and procedures that apply, as appropriate, to the two categories of solid wastes. The wet waste portion of the system handles all plant radiological, hazardous, and industrial wastes. Input streams include oil recovery sludge, oil filters, and miscellaneous hazardous materials. Each is segregated and handled by separate procedures. The dry waste portion (i.e., liquid content is 1% or less of volume) input streams include activated carbon, aluminum oxide, sodium fluoride, filters, scrap metal, nonmetallic waste and miscellaneous hazardous materials. The wastes are likewise segregated and processed by separated procedures.

2.1.2.4.5 Gaseous Effluent Vent System

There are three GEVS that support UUSA: Pumped Extract GEVS (PXGEVS), Local Extract GEVS (LXGEVS), and CRDB GEVS. The GEVS are designed to route potentially contaminated gaseous through filter systems prior to exhausting via roof mounted vent stacks. The stacks contain continuous monitors to indicate radioactivity levels. All three GEVS are monitored from the Control Room.

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

The LXGEVS, located on the second floor of the CRDB Bunker, provides flexible exhaust hoses strategically located throughout the SBM and CRDB to collect and filter potential releases from local work areas for connection and disconnection of cylinders and maintenance activities.

The CRDB GEVS, located on the second floor of the CRDB Bunker, provides filtration of potentially contaminated gaseous streams in the CRDB from areas that include the Ventilated Room, Decontamination Workshop, Contaminated Material Handling Room, PFPE Oil Recovery System, Decontamination System, Chemical Laboratory, and Vacuum Pump Rebuild Work shop. The total air flow is handled by a central gaseous effluent distribution system that operates under negative pressure.

Each of the three GEVS have two separate 100% capacity filtration trains consisting of pre-filters, high efficiency particulate air (HEPA) filter, impregnated activated carbon filters, a second HEPA filter, and centrifugal fan, with automatically operated inlet-outlet isolation dampers, monitors, and differential pressure transducers.

2.1.2.4.6 Centrifuge Test and Post Mortem Facilities Exhaust Filtration System

The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System routes potentially contaminiated exhaust gases from centrifuge test and post mortem activities through a filter system prior to exhausting through a roof mounted vent stack to the atmosphere. It 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 stack, located on the Centrifuge Assembly Building (CAB) roof, contains continous monitors to indicate radioactivity levels. The Centrifuge Test and Post Mortem Exhaust Filtration System is monitored from the Control Room. Operations that require the Centrifuge Test and Post Mortem Exhaust Filtration System to be operational are manually shut down if the system shuts down. The Centrifuge Test and Post Mortem Exhaust Filtraion System is monitored from the Control Room.

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[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.This system incorporates a single 100% filter train consisting of pre-filters, impregnated activated carbon filters, and high efficiency particulate air (HEPA) Bag In/Bag Out fulters, and one fan, with automatically operated inlet-outlet isolation dampers, monitors, and differential pressure tranducers.

2.1.2.5 Site and Nearby Utilities

The city of Eunice, New Mexico will provide water to the site. Water consumption for the NEF is calculated to be 168.5 m^3/day (44,500 gal/d) to meet potable and process consumption needs. Peak water usage for fire protection is23.7 L/s (375 gal/m). Electrical service to the site will be provided by Xcel Energy. The projected demand is approximately 30 MW. Sanitary wastewater will be sent to the City of Eunice Wastewater Treatment Plant via a system of lift stations and 8 inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system.

Identified, onsite pipelines include a 25.4-cm (10-in) diameter, underground carbon dioxide pipeline that runs southeast-northwest. This pipeline is owned by Trinity Pipeline LLC. A 40.6 cm (16 in) diameter, underground natural gas pipeline, owned by the Sid Richardson Energy Services Company, is located along the south property line, paralleling New Mexico Highway 234. A parallel 35.6-cm (14-in) diameter gas pipeline is not in use. There are no known onsite underground storage tanks, wells, or sewer systems.

Detailed information concerning water resources and the use of potable water supplies is discussed in ER Section 3.4, Water Resources, and the impacts from these water resources are discussed in ER Section 4.4, Water Resources Impacts. A discussion of impacts related to utilities that will be provided is included in ER Section 4.1, Land Use Impacts.

2.1.2.6 Chemicals Used at NEF

The NEF uses various types and quantities of non-hazardous and hazardous chemical materials. A Chemical Safety Program tracks the general locations of hazardous chemicals onsite and the specific hazards associated with these chemicals.

2.1.2.7 Monitoring Stations

The NEF will monitor both non-radiological and radiological parameters. Descriptions of the monitoring stations and the parameters measured are described in other sections of this ER as follows:

- Meteorology (ER Chapter 3, Section 3.6)
- Water Resources (ER Chapter 3, Section 3.4)
- Radiological Effluents (ER Chapter 6, Section 6.1)
- Physiochemical (ER Chapter 6, Section 6.2)
- Ecological (ER Chapter 6, Section 6.3)

2.1.2.8 Summary of Potential Environmental Impacts

Following is a summary of impacts from undertaking the proposed action and measures used to mitigate impacts. Table 2.1-1, Summary of Environmental Impacts for the Proposed Action, summarizes the impact by environment resource and provides a pointer to the corresponding section in ER Chapter 4, Environmental Impacts, that includes a detailed description of the impact. Detailed discussions of proposed mitigation measures and environmental monitoring programs are provided in ER Chapter 5, Mitigation Measures and Chapter 6, Environmental Measurements And Monitoring Programs, respectively.

Operation of the NEF would result in the production of gaseous, liquid, and solid waste streams. Each stream could contain small amounts of hazardous and radioactive compounds either alone or in a mixed form.

Gaseous effluents for both non-radiological and radiological sources will be below regulatory limits as specified in permits issued by the New Mexico Air Quality Bureau (NMAQB) and release limits by NRC (CFR, 2003q; NMAC 20.2.78). This will result in minimal potential impacts to members of the public and workers.

Liquid effluents include stormwater runoff, sanitary waste water, cooling tower blowdown water, and treated liquid effluents. All proposed liquid effluents, except sanitary waste water, will be discharged onsite to evaporative detention or retention basins. General site stormwater runoff is collected and released untreated to a site stormwater detention basin. A single-lined retention basin will collect stormwater runoff from the Uranium Byproduct Cylinder (UBC) Storage Pad, and cooling tower blowdown water. All stormwater discharges will be regulated, as required, by a National Pollutant Discharge Elimination System (NPDES) Stormwater Permit. LES will also need to obtain a New Mexico Groundwater Quality Bureau (WQB) Groundwater Discharge Permit/Plan prior to operation for its onsite discharges of stormwater, treated effluent water, cooling tower blowdown water, and sanitary water. Approximately 174,100 m^3 (46 million gal) of stormwater from the site is expected to be released annually to the onsite retention/detention basins.

NEF liquid effluent discharge rates are relatively low (see Table 3.12-4). Domestic sewage will be sent to the City of Eunice Wastewater Treatment Plant for processing or to onsite septic tanks and leach fields.

The NEF water supply will be obtained from the city of Eunice, Mew Mexico. Current capacities for the Eunice, New Mexico municipal water supply system is 16,350 m^3/day (4.32 million gpd) and current usage is 5,600 m^3/day (1.48 million gpd). Average and peak potable water requirements for operation of the NEF are expected to be approximately 168.5 m^3/day (44,500 gpd) and 87.7 m^3/hr (386 gpm), respectively. These usage rates are well within the capacity of the water system.

Solid waste that will be generated at the NEF, which falls into the non-hazardous, radioactive, hazardous, and mixed waste categories, will be collected and transferred to authorized treatment or disposal facilities offsite as follows. All solid radioactive waste generated will be Class A low-level waste as defined in 10 CFR 61 (CFR, 2003r). Approximately 86,950 kg (191,800 lbs) of low-level waste will be generated annually. In addition, annual hazardous and mixed wastes generated are expected to be about 1,770 kg (3,930 lbs) and 50 kg (110 lbs), respectively. As a result, the NEF will be a small quantity generator (SQG) of hazardous waste and dispose of the waste by licensed contractors. LES does not plan to treat hazardous waste or store quantities longer than 90 days. Non-hazardous waste, expected to be approximately 172,500 kg (380,400 lbs) annually, will be collected and disposed of by a County licensed solid waste disposal contractor. The non-hazardous wastes will be disposed of in the new Lea Country landfill which has more than adequate capacity to accept NEF non-hazardous wastes for the life of the facility.

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

Noise generated by the operation of the NEF will be primarily limited to truck movements on the road. The noise at the nearest residence will probably increase; however, it may not be noticeable. While the incremental increases in noise level are small, some residents may experience some disturbance for a short period of time as they adjust to these slight increases.

The results of the economic analysis show that the greatest fiscal impact (i.e., 66% of total value impacts) will derive from the 8-year construction period associated with the proposed facility. The largest impact on local business revenues stems from local construction expenditures, while the most significant impact in household earnings and jobs is associated with construction payroll and employment projected during the 8-year construction period.

Annual facility operations will involve about 210 employees receiving pay of $10.5 million and $3.1 million in benefits. LES expects that most of these jobs will be filled by Lea County and other nearby county residents, providing numerous opportunities in construction of new housing, in provision of services, and in education. NEF operations could have minor impacts on local public services including education, health services, housing, and recreational facilities, but are anticipated to be minimal.

Radiological release rates to the atmosphere and retention basins during normal operations are estimated to be less than 8.9 MBq/yr (240 μCi/yr) and 14 Bq/yr (390 μCi/yr), respectively. Estimated annual effective dose equivalents and critical organ (lung) dose equivalents from discharged gaseous effluent to a maximally exposed adult individual located at the plant site boundary are 1.7×10^{-4} mSv (1.7×10^{-2} mrem) and 1.4×10^{-3} mSv (1.4×10^{-1} mrem), respectively. The annual effective dose equivalent and critical organ (teen-lung) dose equivalents from discharged gaseous effluent to the nearest resident located beyond 4.3 km (2.63 mi) in the west sector are expected to be less than 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.2×10^{-4} mSv (1.2×10^{-2} mrem), respectively. Estimated annual effective dose equivalent and critical organ lungdose equivalents from liquid effluent to a maximally exposed individual at the south site boundary are 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.5×10^{-4} mSv (1.5×10^{-2} mrem), respectively. The nearest resident (teenager) location had a maximum annual effective dose equivalent of 1.7×10^{-6} mSv (1.7×10^{-4} mrem). The maximum annual organ (lung) at the nearest resident (teenager) from liquid effluents was estimated to be 1.3×10^{-5} mSv (1.3×10^{-3} mrem).

These dose equivalents due to normal operations are small fractions of the normal background radiation range of 2.0 to 3.0 mSv (200 to 300 mrem) dose equivalent that an average individual receives in the US (NCRP, 1987a), and within regulatory limits (CFR, 2003q). Given the conservative assumptions used in estimating these values, these concentrations and resulting dose equivalents are insignificant and their potential impacts on the environment and health are inconsequential.

Operation of the NEF would also result in the annual nominal production of approximately 7,800 metric tons (8,600 tons) at full capacity of depleted UF_6 . The depleted UF_6 would be stored onsite in Uranium Byproduct Cylinders (UBCs) and would have minor impact while in storage. The maximum annual dose equivalent due to external radiation from the UBC Storage Pad (skyshine and direct) is estimated to be less than 2.0×10^{-1} mSv (20 mrem) to the maximally exposed person at the nearest point on the site boundary (2,000 hrs/yr) and 8×10^{-12} mSv/yr (8×10^{-10} mrem/yr) to the maximally exposed resident (8,760 hrs/yr) located approximately 4.3 km (2.63 mi) from the UBC Storage Pad.

Based on 2000 US Census Bureau data, construction and/or operation of the NEF will not pose a disproportionate impact to the Lea County, New Mexico or Andrews County, Texas minority or low-income population.

2.1.3 Reasonable Alternatives

This section includes a discussion of alternative enrichment technologies available for an operational enrichment facility, significant alternative designs selected for the NEF to improve environmental protection, and the site selection process LES used to select the proposed NEF site and to identify alternatives to that site.

2.1.3.1 Alternative Technologies

LES proposes to use the gaseous centrifuge enrichment process at the NEF. The LES gaseous centrifuge technology used by LES (that of Urenco) has been operated and improved several times over the past 30 years. LES considers the alternative technologies of gaseous diffusion or laser enrichment, to be unreasonable due to their high operating, economic, and environmental costs and/or lack of demonstrated commercial viability.

Gaseous diffusion technology involves the pumping of gaseous uranium hexafluoride (UF_6) through diffusion barriers, resulting in the gas exiting the barrier being slightly enriched ^{235}U isotope. The diffusion barriers and their associated compressed gases are staged, similar to the staging of centrifuges, to produce higher enrichments. The technology, which was developed in the US during the 1940s, would entail increased capital cost requirements and excessive electrical energy consumption, without obvious environmental advantages. The amount of energy to produce one separative work unit (SWU) is about 50 times greater than the energy required for centrifuge technology (NRC, 1994a). This technology is currently being used by the US Enrichment Corporation (USEC) at its Paducah facility.

There are two types of laser enrichment technologies, the AVLIS and SILEX technologies. The development of each technology has involved USEC. AVLIS is the Atomic Vapor Laser Isotopic Separation process based on selective photo-ionization (through a laser light) and subsequent separation of ^{235}U atoms from vaporized uranium metal. This technology was proposed as a commercial venture by USEC and its partners in the late 1990s, but soon suspended due to operating and economic factors.

SILEX (Separation of Isotopes by Laser Excitation) is an advanced laser-based process developed by the Australian company, Silex Systems, Ltd. USEC holds the exclusive rights to SILEX's commercial use. The process, however, is still in the early stages of development. In the meantime, through its Lead Cascade Project, USEC intends to build and demonstrate the efficacy of an enrichment facility that will use a gaseous centrifuge technology based on research and development conducted by the US Department of Energy during a two-decade period that ended in 1985.

2.1.3.2 Alternative Designs

The NEF design is, in effect, an enhancement to the design of the Claiborne Enrichment Center formerly proposed by LES. In this regard, LES considered the design aspects of the proposed Claiborne Enrichment Center, for which it submitted a license application to NRC in 1991. Although the NRC staff approved the Claiborne Enrichment Center design, the underlying Urenco centrifuge plant design has undergone certain enhancements in recent years due to operating experience in Europe. These enhancements have been included in the NEF design.

2.1.3.3 Alternative Sites

The purpose of the site selection process was to locate a suitable site for construction and operation of the uranium enrichment facility, based on various technical, safety, economic and environmental factors. The process, followed prior to site selection, is described below and used a two-phased screening approach to locate a suitable site. The first phase of the screening analysis involved the evaluation of 15 sites (Figure 2.1-5, Alternate Site Locations) using a Go/No Go criteria. The second phase of the screening analysis involved a more detailed analysis of the sites that remained after the first screening phase against an additional criteria as well as more detailed subcriteria for the first phase criteria.

2.1.3.3.1 Methodology

The selection process used the Multi-Attribute Utility Analysis (MUA) methodology. MUA assesses the relative benefits of a site with multiple, often competing, objectives or criteria. It is designed to ensure that site selection is consistent with organization objectives and that selections are based on well-defined measures of site performance. The methodology uses five steps:

- Develop Value Hierarchy
- Assign Weighting
- Specify Performance Measures (Scales)
- Score and Rank Site
- Conduct Sensitivity Analysis

The value hierarchy contains LES's objectives and the performance criteria used to evaluate achievement of these objectives, which are fundamental, comprehensive, non-redundant, and independent to ensure mathematical validity of priority calculations. Fundamental objectives define the mission of the siting process. Comprehensive objectives cover the major concerns and policy issues considered by LES to be most important. Non-redundancy requires that objectives do not address the same or overlapping performances aspects. Independence of objectives ensures that accomplishment relative to an objective, in effect, dictated by the accomplishment of another objective. Figure 2.1-6, Value of Hierarchy for Site Selection, shows the value hierarchy developed for the LES siting process.

The weighting of objectives and criteria is necessary to reflect the values and priorities properly. Although all objectives identified in the value hierarchy are fundamental, they are not all equally important, nor are the criteria used to define accomplishment of each objective. Therefore, the weights assigned to the objectives reflect quantifiable tradeoffs between objectives and the desirability of one objective relative to others.

Performance measures examine how each fundamental criterion contributes to achieving the primary value of the value hierarchy. The measures developed used constructed scales, which provide precise, unambiguous definitions of project performance. The scales also provide a way to quantify expert opinion about project performance.

The sites are then given a score for each criteria and subcriteria using the scales developed. Site scores, in turn, are converted to measures of benefit by multiplying the scores times the relative contribution of the criterion to the overall value, determined by the weighting.

The results are then tested through a variety of sensitivity analyses that help verify assigned weighting and examine the relative importance of each objective to project ranking. The sensitivity analyses also help demonstrate how sites compare based on their scores for each objective.

2.1.3.3.2 First Phase Screening

Initially, the screening analysis involved the collection of existing qualitative and quantitative data on eight sites. Each site was evaluated using the data available and six first screening criteria (see Table 2.1-2, Matrix of Results from First Phase Screening, and table notes which further define the six screening criteria):

- Seismology/Geology
- Site Characterization Surveys
- Size of Plot
- Land Not Contaminated
- Moderate Climate
- Redundant Electrical Power

These criteria were initially applied to the following eight sites:

- Ambrosia Lake, New Mexico (Rio Algom/Quivira Mining Site)
- Columbia, SC (Westinghouse Nuclear Fuel Site)
- Metropolis, IL (Honeywell International Site)

- Paducah, KY (Department of Energy Gaseous Diffusion Plant Site)
- Portsmouth, OH (Department of Energy Gaseous Diffusion Plant Site)
- Wilmington, NC (Global Nuclear Fuel Site)
- Barnwell, SC (former Barnwell Nuclear Fuel Plant Site)
- Richland, WA (Framatome ANP Nuclear Fuel Cycle Facility Site)

In its site selection process, LES considered sites within the 48 contiguous states. The Columbia, Metropolis, Paducah, Portsmouth, Wilmington, Barnwell and Richland sites were included in the evaluation because they are extant nuclear facilities involved in the nuclear fuel cycle. (The latter two sites are also notable as sites with no existing soil or groundwater contamination.) Ambrosia Lake, a uranium mining site, was included in the evaluation upon the request of an LES partner organization.

Five of the eight sites (Barnwell, Columbia, Metropolis, Paducah and Richland) failed to meet the seismic criterion. Further, the Wilmington site was not made available for consideration. Because only Portsmouth, and Ambrosia Lake remained as viable sites, LES added two additional sites to the evaluation, as follows:

- Erwin, TN (Nuclear Fuel Services Site)
- Lynchburg, VA (Framatome Fuels Site)

The addition of these sites assured consideration of all major active domestic nuclear fuel facility sites. Framatome, however, did not provide the Lynchburg site for consideration.

Of the three remaining sites, Erwin failed the “size of plot” criterion. It was subsequently determined, following analysis of additional information, that Ambrosia Lake failed the seismic criterion. Upon completion of the first screening evaluation, therefore, it was determined that, of the initial eight sites considered, only Portsmouth met the first screening criteria.

Accordingly, LES sought to identify additional “contingency” sites. These sites were to be in seismically acceptable locations that had submitted applications to the NRC for a power reactor operating license and/or construction permit, but had subsequently cancelled or indefinitely deferred the project. The sites also would not be located adjacent to an operational nuclear power plant (due to enhanced security measures that could affect construction and operation of a centrifuge enrichment facility).

From NRC data, thirty-one planned sites were identified nationwide. Nineteen sites were located adjacent to operational nuclear plants. One site had been converted to a coal unit, and one Washington state site was not considered due to its close proximity to Richland, which failed the seismic criterion. Accordingly, ten sites were identified for consideration, as follows: Sterling, NY; Midland, MI; Bailly, IN; Forked River, NJ; Bellefonte, AL; Hartsville, TN; Phipps Bend, TN; Yellow Creek, MS; Cherokee, SC; and Marble Hill, IN.

Four of the ten sites (Sterling, Midland, Bailly, and Forked River) were located in northern climates, and were not considered due to the potential for severe weather which could impact the facility construction schedule. Of the remaining sites, a search of economic development information did not indicate available property at the Cherokee, Marble Hill, or Phipps Bend sites. Yellow Creek was not selected for consideration due to its remote location (e.g., 75 km (47 mi) from the nearest town of 25,000). Accordingly, Hartsville and Bellefonte were recommended for further consideration.

Subsequently three (3) additional sites were added by LES for consideration:

- Eddy County, New Mexico (adjacent to the Waste Isolation Pilot Plant (WIPP) Site)
- Lea County, New Mexico (adjacent to the Waste Control Specialists (WCS) Site in Texas)
- Clinch River Industrial Site, Tennessee (part of the old Breeder Reactor Site in Oak Ridge)

In all, a total of fifteen sites were evaluated against the first screening criteria.

A matrix of the results from the screening for all 15 sites against the essential criteria is provided in Table 2.1-8, Matrix of Results from First Phase Screening. The following discussion summarizes the results of the screening for the 3 additional sites.

The Clinch River Industrial Site does not meet the Go/No Go criterion for Seismology/Geology (i.e., "peak horizontal ground acceleration no greater than the range of 0.04 g – 0.08 g). In addition, the usable area of the Clinch River Industrial Site 61 ha (151 acres) does not support the 600 by 800-m (1,969- by 2,625-ft) plant footprint and would require extensive site work to fill the existing pit.

Both the Eddy County and Lea County Sites meet all of the Go/No Go criteria and were evaluated against the second final screening criteria as described in ER Section 2.1.3.3.2, First Phase Screening. Of the 15 sites evaluated, 6 sites (Bellefonte, Carlsbad, Hartsville, Portsmouth, Eddy County, and Lea County) met the initial screening criteria.

During the evaluation of the three additional sites, two adjacent parcels of land were under consideration in Lea County, New Mexico. Section 33 consists of approximately 182 ha (452 acres) in Township 21S, Range 38E of the New Mexico Meridian, and is contiguous with the Texas State Line. Section 32 consists of approximately 220 ha (543 acres) in of Township 21S, Range 38E and is directly west of Section 33. For screening purposes, both sites have the same characteristics with the exception of area size. The site evaluation was actually performed using Section 33. Subsequent to the site evaluation, Section 32 was selected for the NEF. LES has compared the two adjacent sites and concluded that the site evaluation results are applicable to either or both parcels of land.

Portsmouth, Hartsville, Lea County, Eddy County and Bellefonte were evaluated against the second phase criteria, as discussed further below. Over the course of the second phase screening, LES added a sixth site, Carlsbad, New Mexico (former Beker Industrial Corporation Site). (These six sites were also evaluated using the first phase screening criteria described above.)

Table 2.1-8, Matrix of Results from First Phase Screening, lists the results of the first phase screening analysis for all 15 sites discussed in this section. As shown, six sites (Bellefonte, Carlsbad, Hartsville, Lea County, Eddy County and Portsmouth) passed the first phase screening criteria. These sites, in turn, were evaluated in the second phase screening analysis.

2.1.3.3.3 Second Phase Screening/Final Site Selection

The second phase screening/final site selection screening analysis was conducted for six sites: Bellefonte, Carlsbad, Hartsville, Lea County, Eddy County and Portsmouth. This section sets forth the screening criteria used, and then discusses the application of those criteria to the six sites. To facilitate the decision analysis involving 20 screening criteria, the criteria were grouped using a value hierarchy into four major objectives:

- Operational Requirements
- Environmental Acceptability
- Schedule for Commencing Operations
- Operational Efficiencies

Figure 2.1-7, Contributions by Grouped Criteria shows how the criteria were grouped into these objectives.

A swing-weighting method was used to develop the weights for each tier of the value hierarchy. First, the four objectives were ranked in order of relative importance. A weight of 100 was assigned to the most important objective, Operational Requirements. The second most important objective, Environmental Acceptability, was assigned a weight between 0 and 100 that reflected its relative importance compared to the most important objective. In this case, a weight of 80 was assigned, showing only a slightly less relative importance than operational requirements. Similarly, the third and fourth ranked objectives resulted in weights of 70 for Schedule for Commencing Operations and 60 for Operational Efficiencies.

Table 2.1-9, Screening Criteria (Subsequent to First Screening) lists the screening criteria and the weighting values. Figures 2.1-7 and 2.1-8 summarize scoring for the sites against the screening criteria, while individual scores for each criterion are listed in Table 2.1-10, Scoring Summary.

2.1.3.3.3.1 Operational Requirements

Four criteria make up this objective, as follows:

Acceptable Seismology/Geology

The Go/No Go subcriteria for this criterion included:

- 1 in 500 year event with a peak horizontal Peak Ground Acceleration (PGA) no greater than the range of 0.04-0.08 ga;
- Ground movement < 1 mm (0.04 in);
- No capable fault with a 8-km (5-mi) radius of the site.

This criterion also involved six desirable, but non-essential, sub-criteria:

- The presence of minimal liquefiable materials is considered desirable.
- Lower PGA is preferred.
- The availability of well-documented and up-to-date seismological surveys is desirable.
- There is low or no potential for underlying karstification.
- A minimal amount of rock excavation is required.
- There is sufficient allowable bearing to minimize required ground improvements.

Size of Plot

The Go/No Go subcriteria for this criterion include:

- Site size supports a rectangular footprint of approximately 800 m (2,625 ft) by 600 m (1,969 ft) for a 3 million SWU facility.

- Future expansion capability exists for a 6 million SWU plant. (At this time, there is no intention to license, construct or operate a 6 million SWU plant.)

Desirable subcriteria for this criterion include:

- The degree of capability to support future expansion beyond a 6 million SWU facility (approximately 1,600 m (5,250 ft) by 600 m (1,969 ft) is considered. (At this time, there is no intention to license, construct or operate a 6 million SWU or larger plant.)
- The extent of the buffer area between the site and populated areas is considered.
- It is desirable for the site to require minimal or no adjustment to ideal plant layout to fit site and terrain.
- It is desirable for borrow and fill requirements to be met onsite or close by. Furthermore, this subcriterion looks for optimal site preparation costs due to variances in topography. It is also desirable if site topography optimizes the overall usability of the site for the site footprint, transportation access, and drainage.

Redundant Electrical Power Supply

The Go/No Go subcriterion for this criterion is that there be a dual dedicated power supply on separate feeders capable of delivering 20 Mega Volt-Ampere (MVA) for a 3 million SWU facility.

The four non-essential subcriteria for this criterion include:

- It is desirable for the local utility and/or government to be willing to share capital costs associated with the power supply to the facility substation. Factors to evaluate include utility willingness to construct feed lines, construct a substation, and maintain the feeder and substation.
- It is desirable for the power provider to provide the applicant an optimal rate structure. Factors to evaluate include optimal rate agreements, preferred customer status, a significant break in off-peak rates, and guarantees for quality and reliability.
- It is desirable that transmission feeders can supply power requirements for a 6 million SWU facility. (At this time, there is no intention to license, construct or operate a 6 million SWU plant.)
- It is desirable that the power supply have a guaranteed availability rate of greater than 99.5% and a +/-5% voltage regulation, and that the supplier be willing to guarantee quality of services. Factors to consider include historical performance of the utility, including performance in power restoration after severe weather outages; historical voltage regulation of the system; the capability to provide all power without buying from other suppliers; and the historical delivery performance to production and manufacturing facilities in the area.

Water Supply

The desirable subcriterion here is that groundwater or water from another source is readily available to provide ample water supply to the facility for both potable and process uses.

2.1.3.3.3.2 Environmental Acceptability

Six criteria make up this objective, as follows:

Site Characterization Surveys and Availability

The Go/No Go subcriterion for this criteria is that the site is not within the 500-year flood plain.

This criterion includes thirteen desirable subcriteria, as follows:

- It is desirable that existing surveys of quality are available for hydrology, meteorology, topography, archeology, and endangered species.
- The site should not be a habitat for federally-listed threatened or endangered species.
- It is desirable that there be a low probability of occurrence of archeological and/or cultural resources.
- It is desirable that there be a low probability for environmental justice issues.
- It is desirable that adjacent properties have no areas designated as protected for wildlife or vegetation that would be adversely affected by the facility.
- Waste water discharge (NPDES) permits should be readily achievable for projected plant discharges.
- It is desirable that few or no areas of the site be designated as wetlands, and that no requests for wetlands mitigation would be required.
- It is desirable that there be a low probability of high or excessive winds. Factors to consider include proximity of hurricane-prone zones, annual frequency of wind gusts greater than 80 km/hr (50 mi/hr); design wind speed, and tornado frequency.
- The facility should add no additional radiological sources to the environment.
- It is desirable that there be minimal risk from grass or forest fire events. Factors to consider include the proximity of fuel sources to the site, drought conditions, and wind.
- It is desirable that the natural site contours minimize the potential for localized flooding or ponding. Factors to consider include stream beds, natural and potential runoffs, runoff from adjacent areas, storm drainage systems in place, and requirements for retention ponds.
- It is desirable that there be a low potential for rockslides, mudslides, or other debris flow. This includes an evaluation of slopes on or near the facility greater than 9 m (30 ft) tall, near a vertical face, with no protective ground cover; and the possibility of upstream failure of dams, lakes or ponds.

Land Not Contaminated Through Previous Use

This criterion includes three Go/No Go criteria, as follows:

- The site is not contaminated with radiological material in soil or groundwater to a level that would inhibit licensing or transfer of property with clear identification of liabilities.
- The site is not identified as a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Resource Conservation and Recovery Act (RCRA) site contaminated with hazardous wastes or materials.
- The site does not have contamination that would require remediation prior to construction.

This criterion includes three desirable, but non-essential, criteria, as follows:

- It is desirable that well-documented site surveys and monitoring exists for radiological, chemical, and hazardous material contamination.
- There are no facilities in the area with existing release plumes (air or water), hazardous material, or radiation release that includes the site.
- This subcriterion considers whether future migration of contamination from adjacent or nearby sites is negligible.

Discharge Routes

This criterion includes two non-essential criteria:

- It is desirable that plant discharge and runoff controls be economically implemented for minimal effect to the environment.
- For sites with extant nuclear facilities, facility discharges should be readily identifiable from extant facility discharges.

Proximity of Hazardous Operations/High-Risk Facilities

This criterion includes four non-essential subcriteria, as follows:

- LES will consider the distance of the site from any facility storing, handling or processing large quantities of hazardous chemicals.
- LES will consider the distance of the site from one or more large propane pipelines.
- The site should not be located within 16 km (10 mi) of a commercial airport.
- The site should be outside the general emergency area for any nearby hazardous operations facility (other than an extant nuclear-related facility).
- The site should not be located within 8 km (5 mi) of an operating/manufacturing facility that inhibits site air quality. In addition, the site should have high air quality. The site terrain should not limit air dispersal. Finally, the surrounding community's air quality should be within regulatory requirements.

Ease of Decommissioning

This criterion consists of one non-essential consideration: site characteristics should not negatively affect decommissioning and decontamination activities.

Adjacent Sites' Medium/Long-Term Plans

This criterion consists of one non-essential consideration: planned major construction activities on adjacent sites are minimal over the next ten years. More specifically, no heavy industrial activities are planned within 1.6 km (1 mi) of the site boundary.

2.1.3.3.3.3 Schedule for Commencing Operations

Five criteria make up this objective, as follows:

Political Support

This criterion includes one Go/No Go subcriterion: federal, state, and local government officials do not oppose the facility.

The criterion also includes four non-essential criteria:

- Federal, state and local officials are advocates for the facility.
- Federal, state and/or local governments offer tax breaks and/or other incentives for the construction and operation of the facility.
- It is desirable for Federal, state and/or local governments finance road upgrades.
- It is desirable to have cooperation and assistance of federal, state and local government in obtaining necessary easements, leases, construction permits, operating permits, and disposing of low-level waste.

Public Support

This criterion includes two desirable, but non-essential, criteria:

- It is desirable that the majority of community merchants and citizens support the construction and operation of the facility in their locale.
- It is desirable for the local labor force to support the facility.

On or Near an Existing Nuclear Facility

This criterion consists of one non-essential consideration: that the site be located on (or near another) site with an existing or previous NRC license.

Moderate Climate

This criterion consists of one non-essential consideration: It is desirable that site construction delays due to weather conditions are minimal and average 15 days or less per year, considering temperature, rainfall, the potential for ice and sleet, and snowfall.

Availability of Construction Labor Force

This criterion consists of five desirable, but non-essential, subcriteria, as follows:

- The local area should have sufficient skilled construction labor to construct the facility on the desired schedule. Craft requirements include all major construction crafts (e.g., steelworkers, electricians, pipefitters, etc.)
- It is desirable if no major construction projects in the area are competing for the labor pool resources, such that resources would be limited.
- If construction crafts at the site are provided by union personnel, it is desirable if the labor union business agents commit to support plant construction on a preferential basis.
- It is desirable if there are existing craft apprenticeship programs.
- If construction crafts at the site are provided by union personnel, it is desirable that there be union support for the use of travelers for short-term assignments in areas of critical skill shortages.

2.1.3.3.3.4 Operational Efficiencies

Five criteria are grouped into this objective, as follows:

Availability of Skilled and Flexible Work Force for Plant Operations

This criterion consists of three desirable, but non-essential, subcriteria, as follows:

- It is desirable that there be a sufficient supply of qualified labor that readily can be trained for plant operations, maintenance, technical support, and waste management.
- It is desirable if the community has a technical school, technical or community college, or local nuclear facility that is willing to provide training for plant operations.
- It is desirable if local labor rules do not prohibit or discourage employee multi-tasking.

Extant Nuclear Site

This criterion consists of four desirable, but non-essential, subcriteria, as follows:

- It is desirable if the supply chain can be integrated by co-locating the facility with a fuel fabrication facility or a UF_6 production site.
- It is desirable to have an existing nuclear infrastructure that can be used to support the project, including security facilities and systems, waste treatment/disposal facilities, emergency response resources and equipment, etc., that might be shared.
- It is also desirable to have an existing non-nuclear infrastructure (e.g., dedicated water supply, steam facilities, etc.) that can be used for the facility.
- Specialized technical resources that can be used on a limited basis are also desirable.

Availability of Good Transport Routes

This criterion consists of four desirable, but non-essential, subcriteria, as follows:

- It is desirable to have a railhead located at the site.
- Close proximity to controlled-access highways and/or interstate highways is desirable.

- There should be traffic capacity for construction and operation activities, with minimal improvements required.
- There should be optimal and efficient highway and/or rail access for UF_6 feed suppliers to fuel fabricators.

Disposal of Operational Low-Level Waste

This criterion consists of a single non-essential consideration: It is desirable if site-specific issues (e.g., availability/access to nearby facilities for disposal of low-level waste, transportation modes, etc.) do not impede disposal of low-level waste.

Amenities for Work Force

This criterion consists of two desirable, but non-essential, sub-criteria, as discussed below:

- It is desirable that housing, hotels, and lodging be available for the seconded work force, as well as recreational facilities.
- It is desirable that there be cultural activities available at or near the area.

A swing-weighting method was used to develop the weights for each tier of the value hierarchy. The four objectives were ranked in order of relative importance. A weight of 100 was assigned to the most important objective, Operational Requirements. The other objectives were assigned weights reflecting their relative importance compared to Operational Requirements. A weight of 80 was assigned to Environmental Acceptability, 70 for Schedule for Commencing Operations and 60 for Operational Efficiencies. Table 2.1-3, Screening Criteria (Subsequent to First Screening) lists the criteria described above as well as the weights accorded to each criterion and sub-criterion.

Other Considerations

The commitment of capital for site preparation and facility construction is not very sensitive to alternative sites since it is heavily influenced by the costs of specialized equipment. Therefore, it was not explicitly considered in the alternative site selection process. Prevailing wage rates is not considered by LES to be an important site selection criteria and therefore was not considered in the alternative site selection process. LES did not explicitly consider other recurring and nonrecurring costs in the site selection process since they are not considered sensitive to any particular site.

2.1.3.3.4 Discussion

A description of each of the six sites considered in the second phase screening is provided in this section.

2.1.3.3.4.1 Criterion 1, Seismology/Geology

The site selection screening analysis for this criterion involved review of the subcriteria identified previously for the Phase 1 screening (i.e., peak ground acceleration (PGA), faulting, and ground movement), as well as consideration of six additional desirable but non-exclusionary subcriteria. These additional subcriteria are:

- Liquefaction Potential

- Up-to-Date Seismological Information
- Potential for Karstification
- Amount of Rock Excavation
- Differential Settlement
- Allowable Bearing

PGA was also added to the scoring process to differentiate sites with lower PGA values within the acceptable range because the lower PGA values would be more desirable from an operational standpoint.

A site-by-site summary of these conditions is presented below.

Bellefonte, AL

The proposed Bellefonte Site has geological and seismological conditions that are generally suitable for development. Requirements for PGA, ground movement, and fault location will likely meet design limits, assuming that geologic conditions are similar to the site conditions at the Bellefonte Nuclear Plant Site, where rock is generally located within 6.1 m (20 ft) of the ground surface. If deeper deposits of soft soils are present, then the PGA value at the ground surface could exceed the 0.08 gravitational acceleration (g_a) criterion. This can only be verified through soil borings onsite and through site-specific ground response evaluations. For site screening purposes, a PGA value of 0.06 g_a is believed to be reasonable for the Bellefonte Site.

Liquefaction potential is expected to be very low at this site because of the prevalence of cohesive soil in the area. Although nonliquefiable cohesive soils are more prevalent, occasional deposits of liquefiable silty sands have been reported at the nearby Bellefonte Nuclear Plant Site. In the absence of field explorations at the proposed site, the occurrence of the liquefiable deposits cannot be completely discounted. Site-specific field explorations will need to be conducted to establish whether soils are predominantly cohesive or whether liquefiable soils exist. However, even if liquefiable deposits are encountered at the site, the potential for liquefaction should still be very low because of the low PGA.

The existing seismological information provides an adequate basis for this screening evaluation. There is the potential for karstification. Sinkholes apparently developed in a nearby area during the construction of the Bellefonte Nuclear Plant. Explorations would be required to confirm that such conditions do not occur within the footprint of the proposed site. If thicker deposits of soft soil occur at the site, as they do in some areas of the Bellefonte Nuclear Plant Site, it may be difficult to meet allowable settlement and bearing capacity criteria without additional work on foundation preparation. Additional site explorations will be required to investigate these conditions. Rock was encountered near the ground surface in some areas within the Bellefonte Nuclear Plant site, and it is assumed that a similar condition could occur at the proposed site. If there is a potential for rock near the surface, rock excavation could be required. The rock excavation is not considered to be a significant design or construction concern because of the likely type and quality of the rock. Additional explorations will be required to define the location of rock.

The soil conditions at Bellefonte are assumed to consist of clays. It would not be unreasonable for these soils to have an allowable bearing pressure of 12,200 kg/m^2 (2,500 lbs/ft^2); however, additional exploration will be required to verify conditions. Relative to soil bearing conditions at the other five sites, this site should have the lowest rating.

Carlsbad, NM

The proposed Carlsbad site has geological and seismological conditions that are generally suitable for development. Requirements for PGA, ground movement, and fault location will likely meet design limits, assuming either rock or soil occurs at the site. Even if deep, soft soil conditions occur, the PGA value at the ground surface is estimated to meet the 0.08 g_a criterion.

Conditions for the desirable subcriteria also appear to be met. Liquefaction will not be an issue because of the prevalence of the deep groundwater conditions and the very low ground accelerations. Although no recent seismological information was found for the site, information was available for the WIPP, located approximately 32 km (20 mi) to the east. Detailed seismological information exists for the WIPP site and much of this could be useful. However, additional studies will be required for the Carlsbad site.

The potential for karstification at the site appears to be low, based on the geology at the WIPP site. There is no evidence of karstification at the proposed location, and the topography does not appear to be consistent with the occurrence of karstification. For these reasons, there does not appear to be a compelling reason for considering karstification at the site. However, the Carlsbad caverns are located in the general area, suggesting that further study is warranted. The potential for rock at or near the ground surface was not determined from the available information. If rock were to occur, it is expected to be sedimentary in origin, making it relatively easy to excavate. Soil conditions in the high desert environment are expected to be relatively good in terms of settlement and bearing support. Additional site explorations will be required to investigate these conditions. If settlement and bearing capacity concerns exist, it may be possible to remove the soft soil if rock is near the ground surface, or to implement some type of ground improvement method, such as use of stone columns or preloading.

The soil conditions at Carlsbad include sands, silts, and clays. The groundwater table is expected to be deep. For these conditions the allowable bearing capacity should be greater than 12,200 kg/m^2 (2,500 lbs/ft^2), but won't be as good as rock. Also, the location of the deep water table is expected to increase the capacity relative to similar soils with a higher water table. Because of the expected lower water table, this site was rated slightly higher than the Portsmouth site.

Eddy County, NM

Geological and seismological conditions at the proposed Eddy County Site appear to be suitable for development. Requirements for PGA, ground movement, and fault location should meet design limits, assuming that either rock or soil occurs at the site. Estimated values of PGA are approximately 0.04 g_a.

Conditions for the desirable subcriteria are also met based on the initial screening effort. Liquefaction will not be an issue because of the very low predicted ground acceleration and the very deep groundwater conditions. The available seismological information is excellent. Recent seismic hazard studies have been conducted for the DOE WIPP Site as part of the safety basis for the WIPP facility (DOE, 2003d). These studies include an evaluation of the probability of ground shaking and the location of active faults, using the latest seismic hazard assessment methods.

There are no reports of karstification in the available literature. Specific studies were conducted for the WIPP Site to evaluate this potential. The risks of dissolution were dismissed from consideration at the WIPP Site and, therefore, can be considered similarly for the Eddy County, New Mexico site. There is a potential for caliche within the depth of foundations. This cemented soil can usually be excavated with normal excavation equipment. The geology of this environment should provide low potential for differential settlement and high bearing support due to the dry conditions. Additional site explorations would be required to confirm these conditions before site development.

Hartsville, TN

This site appears to have geological or seismological conditions that are suitable for project development. PGA is acceptable with a value of 0.04 g_a, and no active faults were identified near the site. Ground movements associated with a seismic event could exceed 1 mm (0.04 in) if the frequency characteristics of the predominant earthquake result in ground motions with a frequency of less than 5 hertz (Hz). Although this frequency content appears reasonable for this area, additional evaluations will be required to confirm that this criterion is met.

Geological and seismological conditions at Hartsville suggest that subcriteria requirements will not cause significant design, construction, or performance concerns. The potential for liquefaction does not exist because of the prevalence of rock near the ground surface. There is some seismological information that will serve as good reference material; however, most of the information dates from the 1980s or before. Because of the prevalence of near-surface rock, differential settlement is expected to be minimal and bearing support for facilities should be good.

The only negative features for this site are the potential for Karst topography and the likelihood of rock excavation. Solution cavities with void heights of up to 3.05 m (10 ft) were noted in some locations within the project site. These cavities are located relatively near the ground surface (e.g., 15.2 m (50 ft), and therefore can be filled with grout, once located. The presence of near-surface rock could result in additional construction costs if excavation into the rock is required. Detailed geotechnical explorations are recommended to evaluate both of these issues.

The Hartsville site has rock located close to the ground surface. If the facility is located on competent rock, bearing capacities should exceed 19,500 kg/m^2 (4,000 lb/ft^2). This high bearing capacity is consistent with requirements for the highest rating.

Lea County, NM

The proposed Lea County Site has geological and seismological conditions that appear to be suitable for development. Requirements for PGA, ground movement, and fault location will likely meet design limits, assuming that either rock or soil occurs at the site. Estimated values of PGA are approximately 0.04 g_a, even if soil is encountered.

Conditions for the desirable subcriteria are also met based on the initial screening effort. Liquefaction will not be an issue because of the very low predicted ground acceleration and the very deep groundwater conditions. The available seismological information is limited to the recent seismic hazard work completed in the mid-1990s by the USGS; however, in view of the very low PGA values, the limited information is not considered an issue.

There are no reports of karstification in the available literature. Mention is made of desolution of salt beds in the region, which would result in a condition similar to karstification. However, this potential is not considered an issue at the site. There is a potential for cemented soil (i.e., caliche) within the depth of foundations. This cemented soil can usually be excavated with normal excavation equipment. The geology of this environment normally provides low potential for differential settlement and high bearing support due to the dry conditions. Additional site explorations would be required to confirm these conditions before site development.

Portsmouth, OH

The Portsmouth Site also meets the requirements for PGA, since the g_a value is 0.05, ground movement, and faulting. The presence of 9.1 m (30 ft) or more of alluvium lowers its rating slightly relative to other sites. There is a potential for liquefaction, differential settlement, and lower allowable bearing values because of the presence of sands, silts, and clays. The liquefaction potential should not cause any significant design or construction constraints because of the low levels of design acceleration. While the differential settlement will be potentially greater and allowable bearing pressure lower than similar design values for other sites, these conditions could be easily dealt with during design and construction by reducing foundation pressures used for design or by using a ground improvement method that will reduce the potential for differential settlement and increase the allowable bearing pressure.

Neither rock excavation nor karstification appear to be issues that have to be considered for this site. As noted above, rock is located at depths of greater than 9.1 m (30 ft); therefore, excavations should not encounter rock. The types of rock in the area appear to have a low potential for karstification.

Only limited seismological information was found for the site. This information indicated that faults have been identified but the information did not provide an indication of the level and date of review. Detailed seismicity studies have been conducted for other DOE facilities and, therefore, future studies should determine if recent detailed information might be available. The US Geological Survey (USGS) national hazards map served as a basis for this screening effort. Although the USGS work includes recent information on seismic hazards for the region, it may not cover some of the site-specific issues that could be important for design.

The soil conditions at Portsmouth comprise interlayers of sands, silts, and clays. These conditions should result in allowable bearing pressures of at least 12,200 kg/m^2 (2,500 lb/ft^2) but less than 19,500 kg/m^2 (4,000 lb/ft^2). A rating of 7 was selected to reflect the better than average conditions.

2.1.3.3.4.2 Criterion 2, Size of Plot

The evaluation of this criterion analyzed the site characteristics for:

- Buffer zone from populated areas
- Plant layout on the site compared to the optimal layout
- Future expansion to a 6 million SWU plant (At this time, there is no intention to license, construct or operate a 6 million SWU plant.)
- Adequate space for construction laydown and shop areas during construction
- Borrow/fill capabilities during site preparation

Bellefonte, AL

The proposed Bellefonte Site consists of approximately 76 ha (188 acres) owned by the Jackson County Industrial Development Authority (JCIDA) and 50 ha (123 acres) owned by individuals who have approached the JCIDA to sell their property. A total of 126 ha (311 acres) is available for locating the plant. The property has adequate space for a rectangular 600 m (1,969 ft) by 800 m (2,625 ft) plant footprint, but will not support a rectangular 600 m (1,969 ft) by 1600 m (5,250 ft) footprint for the plant expansion due to the irregular shape of the property. However, adequate space is available for the plant expansion with some slight adjustments to the optimal plant layout. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.) An inactive railroad spur built for the Bellefonte Nuclear Plant separates approximately 44.5 ha (110 acres) from the rest of the property, but the spur is owned by Tennessee Valley Authority (TVA) and should not pose any problem. Although not heavily populated, some homes are located between the proposed site and the Bellefonte Nuclear Plant Site. The area surrounding the site is primarily farmland. The site is relatively flat and open with sufficient access and roads surrounding the property. Little or no borrow or fill will be required but, if needed, can be accommodated onsite. The site also has more than adequate space for required construction shops and laydown areas.

Carlsbad, NM

Approximately 162 ha (400 acres) of land is available between the former Beker Industrial Corporation site and adjacent properties. The available acreage is more than adequate for both the proposed and expansion plants. However, some adjustment of the plant footprint may be required for the plant expansion because of the Lone Tree Draw running through the site. (At this time, there is no intention to license, construct or operate a 6 million SWU plant.) The surrounding land is used primarily for ranching and is only sparsely populated (less than 25 persons per 2.56 km^2 (1.0 mi^2). The site is flat and open and no borrow or fill will be required. Sufficient access is provided to the site via the adjacent interstate. The site also has sufficient space for required construction shops and laydown areas.

Eddy County, NM

The proposed site in Eddy County consists of 130 ha (320 acres) and is the southern half of Section 8 of Township 22S, Range 31E of the New Mexico Meridian. The site is bordered on the south by the DOE WIPP Site. The main WIPP access road is on the southeastern edge of the proposed site. The site is well buffered from residential areas. The closest town is Loving, New Mexico (population 1,326), which is approximately 29 km (18 mi) from the site. Two ranches are located within 16 km (10 mi) of the site.

The property readily supports a rectangular 600 m (1,969 ft) by 800 m (2,625 ft) plant footprint and also supports the rectangular footprint for the expanded plant. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.) The site is basically flat and will require minimal borrow/fill. Significant space is available for construction laydown.

Hartsville, TN

The proposed Hartsville site is approximately 106 ha (262 acres) consisting of 101 ha (249 acres) owned by the Four Lake Regional Industrial Development Authority and 5.3 ha (13 acres) currently owned by TVA. The property has adequate space for a rectangular 600 m (1,969 ft) by 800 m (2,625 ft) plant footprint and can accommodate a rectangular expanded plant layout with only minimal adjustments along the edge of the footprint. (At this time, there is no intention to license, construct, or operate a greater than 3 million SWU plant.)

The plant layout is generally rectangular in shape; however, adjustments to facility layout are required due to the uneven terrain. Borrow/fill is available on the site. Significant space is available for construction laydown.

Lea County, NM

The proposed site in Lea County consists of approximately 220 ha (543 acres) in Section 32 of Township 21S, Range 38E of the New Mexico Meridian. The site is bordered on the south by New Mexico Highway 234. The property on the east border is WCS and the Wallach Sand and Gravel Company gravel pits are northwest of the proposed site. The Lea County Landfill is south of the proposed site, across New Mexico Highway 234.

The site is well buffered from residential areas. The nearest population center is Eunice, New Mexico, which is about 8 km (5 mi) from the site, and the closest residence is about 4.3 km (2.63 mi) from the site.

The property readily supports a rectangular 600 m (1,979 ft) by 800 m (2,625 ft) plant footprint and also supports the rectangular footprint for the expanded plant. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.) The site is basically flat and will require minimal borrow/fill. Significant space is available for construction laydown.

Portsmouth, OH

The proposed Portsmouth Site consists of 138 ha (340 acres) in the northeast quadrant of the DOE property. Population densities were not calculated, but the site is buffered from populated areas. No homes or commercial businesses are located on the proposed site or surrounding DOE property and the nearest population center (Piketon, population of 1,907 in 2000) is located approximately 8 km (5 mi) from the proposed site. There is adequate space for the desired 600 m by 800 m (1,969 ft by 2,625 ft) footprint on the site; however, the site's terrain has elevation levels with variations greater than 18.3 m (60 ft) in the area of the plant footprint that could result in modification to the desired layout. Additionally, the footprint of the plant encroaches upon designated ponds and wetlands, which requires some mitigation or changes to the plant layout. The site is acceptable for a plant expansion, but the plant layout would require extensive revision because the site is irregular in shape. Also, an existing firing range would require removal prior to plant expansion, and the existing ponds/wetlands would have to be addressed for expansion planning. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.) The site has adequate space for required construction shops and laydown areas. Areas for borrow/fill are available, but the probable plant area could require significant site preparation and balancing of cut/fill due to the significant variations in elevations in the site area.

2.1.3.3.4.3 Criterion 3, Redundant Electrical Power

The evaluation of this criterion analyzed the electrical power supply system capabilities for the sites. Specific issues evaluated included:

- Capability to provide total plant power requirements (20 megavolt amperes (MVA) for a 3 million SWU plant (essential criteria) and 40 MVA for a 6 million SWU plant) on separate feeders for redundancy, quality, and reliability of service. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)
- Willingness of the local utility to provide optimal rate structure,
- Willingness of local utility to share in capital cost necessary to provide power to the site.
- High availability rate and willingness of supplier to guarantee quality of service.

Bellefonte, AL

TVA transmission lines are located on the Bellefonte Site. Both the local utility, a cooperative that receives power from TVA, and TVA have pledged to provide the redundant feeder capacity for the base plant and the expanded plant. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.) TVA operates the Browns Ferry, Sequoyah, and Widows Creek Power Plants that supply power to the area. The highest quality of power and reliability will be available through the TVA system, especially with the multiple sources of power production. The guaranteed availability of power is greater than 99.5%. Preferred customer rates are expected based on discussions with the local utility. TVA has indicated a general willingness to support the proposed plant to the maximum extent. The 161 kV and 450 kV lines through the proposed site will have to be relocated at considerable expense. TVA indicated willingness to discuss the business arrangement for accomplishing the tower relocation. TVA and the local utility will supply the required substation. The scoring is lower at Bellefonte than at Hartsville based upon the fact that an existing transmission line on the site would have to be relocated at significant expense, and TVA stated their willingness to cost share, but wanted to negotiate the cost sharing arrangement in the future.

Carlsbad, NM

Xcel Energy would provide power to the Carlsbad site. Redundant power supply appears to be available, although feeders will have to be provided from the redundant source. It is unclear whether the local utility would pay for the construction of the feeder. At the time when the site was evaluated, no data on quality of power or rate structure was available. Electrical rates in the area are lower than the national average.

Eddy County, NM

Xcel Energy will provide power to the Eddy County Site. Redundant power supply is available, although feeders will have to be provided from the redundant source. Existing redundant power is provided currently to the WIPP. Xcel Energy Company has a 1.8 recovery factor for the Class A quality power it provides to the WIPP facility. The utility has indicated a willingness to provide an optimal rate structure, depending upon the commitment from the facility.

Hartsville, TN

TVA feeders are located on the Hartsville Site. The local utility, a cooperative that receives power from TVA, with the backing from TVA, has pledged to provide the redundant feeder capacity for the base plant and the expanded plant. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.) The highest quality of power and reliability will be available through the TVA system, which has several production plants supporting the power grid around the site. The guaranteed availability of power is greater than 99.5%. Preferred customer rates are expected based on discussions with the local utility and TVA has indicated its willingness to provide the required distribution infrastructure to the site (i.e., substation, etc.).

Lea County, NM

Xcel Energy will provide power to the Lea County Site and currently supplies power to the Waste Control Specialists (WCS) disposal facility, which is near the proposed site. Xcel has stated that they can provide redundant power to the site, which would likely come from a 137 kVA transmission line located some 8 to 11 km (5 to 7 mi) from the proposed site. Xcel indicated that historically their power availability rate has been greater than 99.5% and they can supply +5% voltage regulation. The utility has indicated a willingness to provide a favorable rate structure, depending upon the commitment from the facility.

Portsmouth, OH

The Portsmouth Site is currently supplied electricity by the Ohio Valley Electric Corporation (OVEC) under a long-term contract that runs through 2005. OVEC operates two coal-fired power plants (Kyger Creek and Clifty Creek on the Ohio River) that were built for and dedicated to serving the Portsmouth Site. OVEC has five feeder lines into the Portsmouth Site serving three substations onsite. However, OVEC has committed all its power capability and can only provide transmission services to the site. American Electric Power (AEP) is the regional power provider to the site and is performing an engineering assessment to affirm capability and reliability to the site. The guaranteed availability of power is greater than 99.5%. Initial indications are that AEP has adequate capability to provide power for the expanded facility and their records indicate sufficient quality of service. At the time when the site was evaluated, no data on rate structure was available. AEP operates and maintains the Don Marquis Substation, which is adjacent to the DOE property and is approximately 3.2 km (2 mi) from the site proposed for this project. It is expected that AEP will provide preferred customer rates to the site, but AEP has not yet completed their evaluation. There is a potential significant expense for substations/breakers since OVEC currently feeds the site at 345kV and AEP would need to construct new feeders and substation.

2.1.3.3.4.4 Criterion 4, Water Supply

This criterion evaluated the capability to provide sufficient water to the plant at a reasonable cost.

Bellefonte, AL

The Bellefonte Site has sufficient available water supply. The Scottsboro water utility, which has more than adequate supply from their existing water plant, will provide a nominal 30-cm (12-in) line to the site for potable water needs. A fire water tank will be provided in or near the area. A sufficient supply of process water is available from the adjacent Town Creek or can be provided from wells.

Carlsbad, NM

The Carlsbad Site has sufficient available water supply from nine deep wells; most of their capacity is currently unused.

Eddy County, NM

The Eddy County Site is adjacent to the WIPP. The Carlsbad City Water System provides water to the WIPP Site through a water main with a 4.540 L/min (1,200 gal/min) capacity, about 2.27 M m^3/yr (600 M gal/yr) potential. This capability far exceeds the required usage for the base enrichment plant design. There are no significant users of the system other than the WIPP, whose consumption is approximately 1,140 L/min (300 gal/min) for staff use and for emergency water tanks. The city water line follows the WIPP North Access Road that crosses the southeast corner of the proposed Eddy County Site. A lateral line from this water main could be extended easily to the proposed site to provide a more than adequate water supply.

Hartsville, TN

The Hartsville Site has sufficient available water supply. The proposed industrial park at the TVA site is currently served by an existing nominal 15-cm (6-in) water line and 378,500-L (100,000-gal) storage tank. However, the utility has funding in place and is planning to upgrade the existing line to a nominal 200 cm or 25 cm (8 in or 10 in). The utility will also provide a larger capacity fire-water tank.

Lea County, NM

Water can be supplied to the Lea County Site from the city of Eunice, New Mexico. Eunice receives its water supply from approximately 32 km (20 mi) away, at Hobbs, New Mexico. A new water main currently is being installed to supply water from Hobbs to Eunice. Local officials estimate that approximately 1,890 L/min (500 gal/min) of water could be supplied from this new line to commercial/industrial uses such as an enrichment plant. A lateral extension from this main water line would need to be extended approximately 5.6 km (3.5 mi) to the proposed Lea County Site.

Portsmouth, OH

The Portsmouth Site has sufficient water supply and distribution system, but would require a valve station to provide water to the proposed site. Distance from the tie-in point to the proposed site is just over 1.6 km (1 mi).

2.1.3.3.4.5 Criterion 5, Environmental Protection

This criterion evaluated a suite of characteristics related to environmental protection and permitting. Characteristics evaluated are discussed below, under the following headings:

- Existing Characterization Surveys
- Protected Species, Adjacent Protected Properties, Archeological/Cultural Resources
- Environmental Justice
- National Pollutant Discharge Elimination System (NPDES) Permits
- Air Permits
- Permits to Impact Wetlands and Other Waters of the US or the State
- New Radiological Hazard, Fire Hazard, High Wind Hazard, Ponding Potential, Potential For Rock/Mud Slides

2.1.3.3.4.5.1 Existing Characterization Surveys

Bellefonte, AL

There are no existing surveys for this site. Some information developed for the TVA Bellefonte Nuclear Plant, located across an inlet of the Guntersville Reservoir from the site, may be applicable to the project, but the usefulness of this information is unknown at present.

Carlsbad, NM

There are no existing surveys for the Carlsbad Site. Existing information from the WIPP, approximately 32 km (20 mi) away, may be applicable to the site given the homogeneity of the landscape in the area. Characterization of the site would be required to support the license application.

Eddy County, NM

There are no existing surveys for the Eddy County Site. Existing information from the WIPP facility (adjacent to the site) should be applicable to the site, given the extensive amount of data collected and homogeneity of the landscape in the area. Characterization of the site would be required to support the license application.

Hartsville, TN

The Hartsville Site is within the boundary of the previously proposed nuclear power plant site. TVA has conducted abundant surveys of the site and this information is available to support the project. Additionally, an Environmental Assessment was completed in 2002 by TVA for transfer of the property to the Four Lake Regional Industrial Development Authority.

Lea County, NM

There are no existing surveys for the site. However, archeological and rare species surveys for a proposed landfill site immediately south of the proposed project site should be partially applicable. Studies done for the WCS facility, near the site across the Texas State Line, also should be applicable, particularly with regard to meteorological data and flora/fauna characterizations. Site characterization would be required to support the license application. Subsequent to site selection, this site has been characterized.

Portsmouth, OH

Two existing reports that address the area of the existing DOE facility near where the proposed facility would be sited were reviewed. A DOE report (Evaluation of Site Conditions for 138 ha (340 acres) of Department of Energy Land, Northeast Portion of the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio) characterized potential contamination of the proposed site. A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) characterization (Quadrant IV RFI Final Report for Portsmouth Uranium Enrichment Plant, Piketon, Ohio) has been performed for the area near the proposed facility site. However, no characterization or surveys have been performed for the specific site under consideration. Additional surveys and characterization will probably be required.

2.1.3.3.4.5.2 Protected Species, Protected Properties, Archeological/Cultural Resources

Bellefonte, AL

The Bellefonte Site comprises abandoned agricultural fields, hayfields, active cropland, old home sites, and early re-growth woodland. None of the developed and agricultural areas provide suitable habitat for protected species. The early regrowth woodland occupies approximately 1.2 ha (3 acres) in the southeastern corner of the site. The woodland has not been cleared within the past 10 years and is densely overgrown with brush. It does not provide suitable habitat for any protected species known to occur in the project vicinity. The intermittent stream crossing the southern part of the site is too densely overgrown in the sub-canopy layer to serve as a foraging flight corridor for gray bats. State wildlife management areas (WMAs) are located along Guntersville Reservoir near the proposed project site.

Portions of the Bellefonte Site lie within historic boundaries of a Cherokee Indian Reservation. The possibility exists that prehistoric artifacts may be found within the proposed site. Additionally, two cemeteries are located within the site boundaries. These are small private cemeteries near the eastern edge of the property that can be avoided during site development.

Carlsbad, NM

There are no existing surveys for the Carlsbad Site. Existing information from the WIPP, approximately 32 km (20 mi) away, indicates that protected species can occur in the area.

Existing surveys for the WIPP indicate that there is a high likelihood for archeological sites in the general area. Studies at the WIPP site and other studies in the area indicate an average of one site every 18.2 ha (45 acres) may be encountered. No protected properties are near the Carlsbad Site.

Eddy County, NM

There are no existing protected species surveys for the Eddy County Site. Existing information from the WIPP (WEST, 2002; DOE, 1996) indicate that no protected species occur on the WIPP Site. Given the homogeneity of the landscape between the proposed site and the WIPP Site and the narrow habitat requirements for the protected species known to occur in Eddy County, it is unlikely that protected species occur on this site.

Existing surveys for the WIPP (adjacent to the site) indicate that there is a high likelihood for archeological isolated occurrences in the general area. Studies at the WIPP Site and other studies in the area indicate finding an average of one isolated occurrence every 18 ha (45 acres), but no significant or potentially significant sites were found. While it appears unlikely that significant cultural or archeological resources would exist on the site, site-specific data are lacking.

No protected properties other than the WIPP Site are near the Eddy County Site.

Hartsville, TN

The 106-ha (262-acre) site proposed for use has been surveyed previously and found to contain no protected species or potentially suitable habitat for protected species. Potentially suitable habitat for protected species was identified on other portions of the TVA property, but not within the proposed site.

The site is adjacent to a Tennessee State Mussel Sanctuary and a United States Army Corps of Engineers (USACE) Reservoir Reservation. Two additional Mussel Sanctuaries and one State WMA also occur in the vicinity of the Hartsville Site. The site of a proposed water and sewer system associated with this project is located within the Hartsville WMA and crosses the Goose Creek portion of the USACE Reservoir Reservation.

Previous surveys conducted at the site have not identified any archeological or cultural resource issues for the Hartsville Site.

Lea County, NM

No protected species surveys have been completed for the site. However, surveys completed for the Lea County Landfill adjacent to the site found no protected species in the area. Therefore, there should be no protected species issues at the site.

No archeological/cultural resources surveys have been completed for the site. An archeological survey for the Lea County Landfill Site immediately south of the proposed project site indicate that the probability of significant archeological sites is low.

No protected properties are near the Lea County Site.

Portsmouth, OH

Previous studies indicated no known occurrences of protected species and no high quality potentially suitable habitat for protected species at the proposed site. However, surveys are 6+ years old and new data on the distribution of protected species in Ohio have been developed in the intervening period. Additionally, the proposed site contains reasonably mature hardwood forest and a stream corridor, indicative of potentially suitable summer (foraging, roosting, and maternity) habitat for Indiana bats, a Federally protected species. The US Fish and Wildlife Service (USFWS) will require additional surveys for Indiana bat (must be completed between

May 15 and August 15, when bats may be rearing young on the site). USFWS also will restrict timing of tree clearing activities (no tree clearing between April 15 and September 15, when Indiana bats may reside on or migrate through the site). No additional protected species issues are known to exist on the site.

Big Beaver Creek lies north of the proposed site and has potential to receive water for discharges from the proposed facility. Big Beaver Creek is designated a warm water habitat stream by the State of Ohio, and any discharges to the stream must not result in a lowering of any of the water quality criteria below that acceptable for a warm water habitat stream. The Wayne National Forest is near the proposed site to the southeast.

Previous archeological/cultural resource studies conducted on the grounds of the DOE facility have identified three sites within the boundaries of the proposed site that are potentially eligible for listing on the National Register of Historic Places (NRHP). These sites include a cemetery and two historic farm sites. Coordination with the Ohio State Historic Preservation Office will be required for these sites. Results of Phase II may lead to listing or recovery/preservation activities. Additionally, the Ohio State Historic Preservation Office has expressed concern over whether the historic value of the Portsmouth enrichment facility would be diminished through transfer of portions of the site from Federal control and development of these areas.

2.1.3.3.4.5.3 Environmental Justice

Subsequent to site selection, an Environmental Justice review for the Lea County, New Mexico site was performed as described in ER Section 4.11, Environmental Justice. For the purpose of the alternative site evaluation, detailed Environmental Justice analyses were not performed for each site.

Bellefonte, AL

The site appears to pose no significant issues in regard to Environmental Justice. A portion of the site lies within the boundaries of a historic Cherokee Indian reservation and Jackson County has a higher percentage of Native Americans than the national average. A low-income manufactured housing residential park is located adjacent to the northeastern boundary of the site.

Bellefonte is located in Jackson County, Alabama. Jackson County has an 8.1% minority population, with Native Americans making up 1.8% of the population (twice the national average). Median household income is $30,791, which is $1 above the state average, and 14.7% of the population lives below the poverty level.

Based upon the results of a 1997 Environmental Impact Statement (EIS) for the Bellefonte Nuclear Plant and the 2000 Census, it does not appear that a disparate impact evaluation would be required.

Carlsbad, NM

The Carlsbad Site is located in a sparsely populated area in Eddy County, New Mexico. Data collected for the WIPP indicate that the Hispanic population in the local area is above the national average but lower than the state average. Concerns over impacts to this population segment may raise Environmental Justice issues at the site.

Eddy County, NM

Data collected for the WIPP Site (DOE, 2001a) included an 80-km (50-mi) radius of influence (ROI), which encompassed the adjacent Eddy County Site. Within the designated ROI, the percentage of Hispanics and the percentage of persons living below poverty level were above the national average and the state averages for New Mexico and Texas. The relative isolation of the proposed facility should avoid impacts to these population groups.

Hartsville, TN

Analysis conducted by TVA indicated there are no Environmental Justice or socioeconomic issues for the Hartsville site. There should be no necessity for a disparate impact evaluation. Hartsville is located in Trousdale and Smith Counties in Tennessee. Trousdale County has a 13.4% minority population and 15.7% of the population living below the poverty level. Median household income is $27,319 (85% of the state average). Smith County has a 4.6% minority population and 12.6% of the population living below the poverty level. Median household income is $32,077, slightly above the state average.

Lea County, NM

Data collected for the WIPP (DOE, 2001a) included an 80-km (50-mi) ROI that included the Lea County Site. Within the designated ROI, the percentage of Hispanics and the percentage of persons living below poverty level were above the national average and the state averages for New Mexico and Texas. The relative isolation of the proposed facility should avoid impacts to these population groups.

Portsmouth, OH

Previous studies (1990 Census data) at Portsmouth Gaseous Diffusion Plant (PORTS) indicate no Environmental Justice issues or a need for an evaluation of disparate impact. The Reindustrialization Environmental Assessment conducted for the DOE facility supports that there is not a disparate impact. Review of 2000 Census data indicates no substantial changes from the 1990 Census analysis. Minority populations in Pike County constitute only 3.3% of the total population. The percentage of the population classified as low income in Pike County is 18.2%, less than 10% above the state average. Average household income in Pike County is $27,989, which is 78% of the state average. Scioto County has a 5.1% minority population and 21.0% of the population living below the poverty level. Average household income is $25,801 (72% of state average). Jackson County has a 2.1% minority population and 16.4% of the population living below the poverty level. Average household income is $27,774 (77% of state average). Ross County has an 8.3% minority population and 14.6% of the population living below the poverty level. Average household income is $33,580 (93% of state average).

2.1.3.3.4.5.4 NPDES Permits

Bellefonte, AL

An NPDES permit is achievable for this site, but there are constraints. Permitting is handled through the Alabama Department of Environmental Management (ADEM). ADEM currently, at the time of alternative site evaluation, was not issuing permits to rivers identified as Class II in the State due to a dispute regarding appropriate anti-degradation review. Obtaining an NPDES permit for this site may be delayed if ADEM has not resolved the dispute regarding anti-degradation review at the time of filing. Public water supplies are located downstream along the Tennessee River that may result in more stringent discharge limits and necessitate some level of pretreatment prior to discharge.

If discharge water can be disposed through municipal sewers, no NPDES permit would be needed. This would depend on local sewer infrastructure and demand at the time of permitting.

Carlsbad, NM

NPDES permits for construction-related stormwater discharge, industrial stormwater discharge, and possibly a facility discharge will be required. These permits are obtained through EPA. There are no identified impediments and obtaining a NPDES permit for this site should be achievable. However, a potential constraint on permitting could exist related to discharging to a dry arroyo that does not have flow year round.

Eddy County, NM

NPDES permits for construction-related stormwater discharge, industrial stormwater discharge, and possibly a facility discharge will be required. There are no identified impediments, and obtaining an NPDES permit for this site should be readily achievable through USEPA; the State of New Mexico does not administer the NPDES program.

Hartsville, TN

An NPDES permit is achievable for this site, but there are constraints. Permitting is through the Tennessee Department of Environment and Conservation (TDEC). A Tennessee State Mussel Sanctuary is adjacent to the site. Two additional Mussel Sanctuaries and one State WMA also occur in the vicinity of the Hartsville Site. Sensitive aquatic species are likely to be present in these areas and may result in more stringent discharge limits and necessitate some level of pretreatment prior to discharge.

If discharge water can be disposed through municipal sewers, no NPDES permit would be needed. This would depend on local sewer infrastructure and demand at the time of permitting.

Lea County, NM

NPDES permits for construction stormwater discharge, industrial stormwater discharge, and possibly a facility discharge will be required. While there are neighboring facilities, the facilities should not constrain the NPDES permit. There are no identified impediments, and obtaining an NPDES permit for this site should be readily achievable through USEPA; the State of New Mexico does not administer the NPDES program.

Portsmouth, OH

An NPDES permit is achievable for this site, but there are constraints. Big Beaver Creek adjacent to the Portsmouth Site is the likely receiving water for discharges and has been designated a warm water habitat. Any discharges to Big Beaver Creek cannot result in a lowering of the water criteria supporting its designated use. This may constrain NPDES permitting and necessitate some level of pretreatment prior to discharge.

Air Permits

All six sites are located in areas that currently attain their designated air quality.

Bellefonte, AL

No air permitting constraints were identified for this site. Permitting is through ADEM. Two large air discharge sources are located within 16 to 32 km (10 to 20 mi), including Mead Paperboard (pulp and paper facility), and TVA's Widow's Creek Steam Plant. These are not expected to affect the permitting effort for the site. Air permits for either a 3 million SWU or 6 million SWU facility should be readily achievable. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)

Carlsbad, NM

No air permitting constraints were identified for this site. The proposed site is in an attainment zone. There are no air emitting facilities nearby. Air permits through the New Mexico Environment Department should be readily achievable for either a 3 million SWU or 6 million SWU facility. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)

Eddy County, NM

The proposed site is in an attainment zone. The only facility nearby is the WIPP, and it is not expected to affect the permitting effort for the site. Air permits for either a 3 million SWU or 6 million SWU facility should be readily achievable from the New Mexico Environment Department. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)

Hartsville, TN

No air permitting constraints were identified for this site. The Hartsville area currently meets its designated ambient air quality standards. Permits should be obtainable without undue delay. There are no nearby significant sources that would contribute to air emissions. Air permits for either a 3 million SWU or 6 million SWU facility should be readily achievable. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)

Lea County, NM

There are numerous emission sources (e.g., oil and gas extraction wells, Wallach Concrete, Inc., etc.) in the county. These existing sources may affect conditions on new air permits obtained from the New Mexico Environment Department permits for either a 3 million SWU or 6 million SWU facility. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)

Portsmouth, OH

No air permitting constraints were identified for this site. The area surrounding the proposed facility currently meets ambient air quality standards. Air permits through the Ohio Environmental Protection Agency (OEPA) District Office responsible for Pike County (OEPA Southeast District Office). Air permits for either a 3 million SWU or 6 million SWU facility should be readily achievable. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)

2.1.3.3.4.5.5 Permits to Impact Wetlands and Other Waters of the US or the State

Bellefonte, AL

There are no wetlands on the site. One intermittent stream crosses near the southern end of the site. There may be no impacts to this stream during site development. If some relocation of the stream is required, the surrounding land is currently in agricultural production and there should be no constraining environmental issues in the relocation process.

Carlsbad, NM

There are no wetlands on the site. Dry arroyos are classified as Waters of the US and the State in New Mexico. The Lone Tree Draw crosses the western part of the site from southwest to northeast. This feature would require USACE 404 permitting and State 401 certification. Lone Tree Draw may constrain site development.

Eddy County, NM

There are no wetlands or other waters of the United States on the site. Neither a Clean Water Act Section 404 permit nor a State Section 401 Water Quality Certification will be required to construct on the site.

Hartsville, TN

There are no jurisdictional waters within the proposed facility site. The presence of a Tennessee State Mussel Sanctuary adjacent to the site in the Cumberland River may result in required protective measures for these waters.

Lea County, NM

There are no wetlands or other waters of the United States on the site. A recent survey determined that an arroyo does not exist at the site. Neither a Clean Water Act Section 404 permit nor a State Section 401 Water Quality Certification will be required to construct on the site.

Portsmouth, OH

Four wetlands, three ponds, and two streams are located in the vicinity of the proposed project footprint according to the Reindustrialization Environmental Assessment. However, 1994 aerial photographs indicate heavy ground disturbance in the area proposed for siting that may have altered previously existing waters. All existing information is more than 5 years old and new characterizations and delineations of boundaries of waters are likely to be required to support permitting.

Based on available information, the proposed project may result in the fill of 0.4 to1.2 ha (2 to 3 acres) of waters and relocation of up to 914 linear m (3,000 linear ft) of stream. These impacts would require an Individual Section 404 permit from the USACE (3 to 6 mos as specified for Hartsville) and individual antidegradation review by the OEPA (typically 6 mos to 1 yr).

2.1.3.3.4.5.6 New Radiological Hazard, Fire Hazard, High Wind Hazard, Ponding Potential, Potential for Rock/Mud Slides

Bellefonte, AL

The site is in an area where the construction design is to withstand 112 km/hr (70 mi/hr) winds. The proposed facility will constitute a new radiological source for the area. There is no significant fire hazard on or adjacent to the site. There is insufficient fuel load to sustain a major fire. Due to local topography, there is no potential for ponding at the site. The Bellefonte Site has no potential for rock or mud slides.

Carlsbad, NM

The site will be a new radiological hazard. There is no significant fire hazard at the site; the area is predominately desert scrub, and trees are not present. Desert range land does not support a sufficient fuel load to sustain a major fire. The proposed site is in an area designated for buildings designed for 112 km/hr (70 mi/hr) winds. Data collected for the WIPP indicate that the area has potential for violent convection storms and associated short-term winds, straight-line or cyclonic, in excess of 112 km/hr (70 mi/hr). Due to local topography, there is no ponding potential at the site, and there is no potential for rock or mud slides.

Eddy County, NM

The site is adjacent to an existing radiological hazard but that facility (the WIPP) does not handle uranium hexafluoride (UF_6). The proposed project will provide a new radiological hazard to the area through the handling of a different source of radiation. The proposed site is in an area designated for buildings designed for 112 km/hr (70 mi/hr) winds. Data collected for the WIPP indicate the area has potential for violent convectional storms. The WIPP Safety Analysis Report (DOE, 2003d) indicates a recurrence interval for 132 km/hr (82 mi/hr) winds of every 100 years in southeastern New Mexico, although no winds of this speed or greater velocity have been recorded. Tornado frequency has been estimated as 1 in every 1,235 years (DOE, 2003d). There is no significant fire hazard. The area is predominately desert scrub, and trees are absent. Desert range land will burn but does not support a sufficient fuel load to sustain a major fire. The site topography and soil characteristics do not promote ponding. The topography is level, and there is no potential for rock/mud slides.

Hartsville, TN

The Hartsville Site is in an area where the construction design is to withstand 112 km/hr (70 mi/hr) winds. Maximum recorded sustained wind speed in the area is 117 km/hr (73 mi/hr). The proposed facility will constitute a new radiological source for the area. There is a slight fire hazard, as forested and dense brushy land occurs on and adjacent to the site. As the site will be maintained, the risk should not be great once the facility is in operation. Due to local topography, there is no potential for ponding at the site. Also, due to local topography, the Hartsville Site has no potential for rock or mud slides.

Lea County, NM

The site is near an existing radiological hazard, but that facility (WCS) does not handle UF_6. The proposed project will provide a new radiological hazard to the area through the handling of a different source of radiation. Additionally, the WCS Site temporarily stores low-level waste and does not currently provide long-term storage or disposal of radioactive waste. Therefore, the relative risk from the new facility would be slightly greater than at Eddy County.

The proposed site is in an area designated for buildings designed for 112 km/hr (70 mi/hr) winds. The area has potential for violent convectional storms. The WIPP Safety Analysis Report (DOE, 2003d) indicates a recurrence interval for 132 km/hr (82 mi/hr) winds of every 100 years in southeastern New Mexico, although no winds of this speed or greater velocity have been recorded. Tornado frequency in the area has been estimated as 1 in every 1,235 years (DOE, 2003d). There is no significant fire hazard. The area is predominately desert scrub, and trees are absent. Desert range land will burn but does not support a sufficient fuel load to sustain a major fire. The site topography and soil characteristics do not promote ponding. The topography is level, and there is no potential for rock/mud slides.

Portsmouth, OH

The Portsmouth Site has site-specific data indicating that maximum winds are 121 km/hr (75 mi/hr, below the threshold of 128 km/hr (80 mi/hr). The site is in an area where the construction design is to withstand 112 km/hr (70 mi/hr) winds. The proposed facility will not constitute a new radiological source for the area. There is a slight fire hazard, as forested land occurs on and adjacent to the site. As the site will be maintained, the risk should not be great once the facility is in operation. There is potential ponding at the four wetlands along the northern boundary of the site and also at the three isolated ponds within the site. Depending onsite layout, this could impact construction. Due to local topography, the Portsmouth Site has no potential for rock or mud slides.

2.1.3.3.4.6 Criterion 6, Land Not Contaminated

The evaluation of this criterion analyzed the potential sites for issues associated with land contamination. All sites met the Go/No Go portion of this criterion and were evaluated for three key issues:

- Level of documentation on contamination that exists on the site
- Existence of neighboring air or groundwater plumes
- Potential for future migration of contamination from neighboring sites

Bellefonte, AL

An EIS for the Bellefonte Conversion Project at the nearby Bellefonte Nuclear Plant Site was completed in October 1997. There are no known plumes affecting the proposed site. However, two facilities with fairly substantial reported Toxics Release Inventory emissions are located 3.2 to 4.0 km (2 to 2.5 mi) from the proposed site. Several facilities handling chemicals and/or wastes are located within 3.2 to 4.0 km (2 to 2.5 mi) of the proposed site, but have a very low potential to present future groundwater contamination and/or air emissions concerns.

Carlsbad, NM

No information is available regarding potential contamination at the site. The proposed site is the location of a former ammonia/nitrogeneous fertilizer plant and, therefore, has the potential to contain some existing contamination. However, an existing contamination plume or the potential for future migration are unlikely because there are no industrial neighbors to the site.

Eddy County, NM

The current and historical use of the site was/is range land for grazing. Environmental sampling was conducted as part of the WIPP monitoring and permitting process, and there is no indication of hazardous or radioactive contamination. Environmental monitoring, including soil sampling, is performed annually along the southern edge of the proposed site, adjoining the WIPP, and north, northeast, and northwest of the site. There are no known air or groundwater plumes within 3.2 km (2 mi) of the site, and no future migration is anticipated from the nearby WIPP site.

Hartsville, TN

Existing documentation covering the proposed site is available in an EIS and Environmental Report (ER) from the mid-1970s license application for the Hartsville Nuclear Plant and an Environmental Assessment completed in March 2002 for transfer of 223 ha (550 acres) at the TVA site for development as an industrial park. The proposed site is not contaminated and there are no neighboring plumes. There are no adjoining sites with a potential for future migration of contamination; however, if new industries locate adjacent to the proposed site in the industrial park, there is a slight potential for future contamination.

Lea County, NM

The previous use of the site was range land for grazing. Limited environmental data have been collected at the nearby WCS Site as part of its licensing/permitting process and at the Lea County Landfill site south of the site as part of its permitting process. There is no indication of hazardous or radioactive contamination at the proposed site, but environmental sampling data are not available for the site (at the time of site selection). There are no known air or groundwater plumes within 3.2 km (2 mi) of the site, and no future migration of contamination is anticipated from nearby facilities (e.g., WCS, Lea County Landfill and Wallach Quarry) within 3.2 km (2 mi).

Portsmouth, OH

An RFI has been performed near this site and limited additional characterization was performed at the site for transfer of the property. Minimal soil and groundwater contamination was detected during these investigations. Currently, the OEPA and DOE disagree whether the property is contaminated and this difference in opinion has affected the transfer of the proposed site to the Southern Ohio Development Initiative (SODI) and will prevent transfer of the proposed site to any party until the matter is resolved. This site also scores lower because of a firing range isolated in the middle of the site with the potential of lead-contaminated soil, as well as a low potential for neighboring plumes and future migration from the adjacent sanitary landfill and other USEC facilities at the DOE site.

2.1.3.3.4.7 Criterion 7, Discharge Routes

This criterion identified whether waste water and stormwater could be easily disposed and any necessary controls could be easily implemented. An additional aspect of this criterion was whether other nuclear waste streams were located in the area and if those waste streams could be easily differentiated from that of the proposed facility.

Bellefonte, AL

There are no existing NPDES-permitted discharges at the proposed site, although there are NPDES-permitted discharges at the neighboring TVA Bellefonte Plant Site. At the time of alternative site selection, the State was not issuing NPDES permits to rivers identified as Class II in the State, e.g., Tennessee River, due to a dispute regarding appropriate anti-degradation review, but this issue was expected to be resolved in the near future. Public water supplies are located downstream along the Tennessee River that may result in more stringent discharge limits. Stormwater runoff should be easy to control and discharge from the facility. There are no radiological waste streams in the area.

Carlsbad, NM

There are no existing NPDES-permitted discharges at the proposed site. Stormwater runoff should be easy to control and discharge from the facility. However, there is nowhere to discharge process wastewater other than a dry arroyo, which could be a permitting concern. There are no existing radiological waste streams that may need to be differentiated from the facility waste stream.

Eddy County, NM

There are no existing NPDES-permitted discharges at the proposed site. Stormwater runoff should be easy to control and discharge from the facility. There are no existing radiological waste streams that may need to be differentiated from the facility waste stream. The only discharge from the adjacent WIPP Site is to lined, evaporative sewage lagoons.

Hartsville, TN

There are no existing NPDES-permitted discharges at the proposed site. Stormwater runoff should be easy to control and discharge from the facility, but there may be potential restrictions on process discharges because of the mussel sanctuary in the Cumberland River. There are no radiological waste streams in the area.

Lea County, NM

There are no existing NPDES-permitted discharges at the proposed site. Stormwater runoff should be easy to control and discharge from the facility. There are no existing radiological waste streams that may need to be differentiated from the facility waste stream. The only discharge at the nearby WCS Site is to an onsite ditch that only extends approximately 460 m (500 yd) within their property on the Texas side.

Portsmouth, OH

There are NPDES-permitted waste water discharges in the area, but not on the proposed site. However, since all existing NPDES permits are issued to USEC, it is unlikely USEC would readily accommodate the proposed facility discharge requirements. Stormwater runoff should be easy to control and discharge from the facility. The nearby landfill may result in groundwater contamination that could be difficult to differentiate from the waste stream of the proposed facility. However, with the groundwater flow patterns beneath the proposed site, it is presumed that the facility would be able to locate discharge points such that discharges could be generally isolated from the nearby landfill.

2.1.3.3.4.8 Criterion 8, Proximity to Hazardous Operations/High Risk Facilities

The evaluation of this criterion established the risk to the proposed facility from any nearby facilities. For analysis purposes, extant nuclear-related facilities were not considered a detriment.

Bellefonte, AL

There are no large hazardous chemical storage or handling facilities within 8 km (5 mi) of the proposed site. There are no major propane distribution pipelines within 3.2 km (2 mi) of the site. The Bellefonte Site is within 8 km (5 mi) of the Scottsboro Airport, but this facility has no commercial flights. Madison County Airport (nearest commercial airport) is more than 48 km (30 mi) away. The site is not within the general emergency area of any hazardous operations facility. There are no existing facilities that are expected to impact the air quality of the proposed site.

Carlsbad, NM

No major propane pipeline or any hazardous chemical storage or handling facilities was identified within 3.2 km (2 mi) and 8 km (5 mi), respectively, of the Carlsbad Site; although a natural gas transmission facility is within 4.8 km (3 mi). The site is located within 16 km (10 mi) of the Carlsbad Airport, which has limited commercial flights. The site is not within the general emergency area of any nearby hazardous operations facility. A natural gas transmission facility, located within 4.8 km (3 mi) of the site, has major source air emissions (nine stacks) that could impact the air quality of the proposed site.

Eddy County, NM

There are no facilities storing or handling large quantities of hazardous chemicals within 8 km (5 mi). However, the adjacent WIPP Site handles large quantities of transuranic wastes. There are no major propane pipelines within 3.2 km (2 mi) of the site, although a high-pressure gas line runs through the WIPP Site, approximately 0.8 km (0.5 mi) south of the site. There are no commercial airports within 16 km (10 mi), and the site is not located in a general emergency area. Other than the WIPP facility, there are no facilities within 8 km (5 mi) that would provide a nearby emissions source that could potentially affect air quality.

Hartsville, TN

There are no hazardous chemical storage or handling facilities within 8 km (5 mi) of the proposed site, but there are two natural gas small pump stations within 3.2 km (2 mi). There are no major propane distribution pipelines within 3.2 km (2 mi) of the site. The nearest airport with commercial traffic is more than 48 km (30 mi) away. The site is not within the general emergency area of any hazardous operations facility. There are no facilities that would provide a nearby emissions source that may affect air quality.

Lea County, NM

There are no facilities storing or handling large quantities of hazardous chemicals within 8 km (5 mi). However, the nearby WCS Site treats and disposes hazardous wastes and treats and temporarily stores low-level radioactive and low-level mixed wastes. There are no major propane pipelines within 3.2 km (2 mi) of the site. There are no commercial airports within 16 km (10 mi), and the site is not located in a general emergency area. Neighboring industry, e.g., Wallach Concrete, Inc., oil and gas extraction wells, etc., have particulate and organic emissions that could potentially have a negative impact on air quality at the proposed facility. A 25.4-cm (10-in) diameter, underground carbon dioxide pipeline, running southeast-northwest, traverses the site. The pipeline is owned by Trinity Pipeline, LLC. The pipeline conveys CO_2 at a pressure of 13.8 N/mm^2 (2,000 lbs/in^2) and has an accident exclusion zone of 320 m (1,050 ft). The pipe will need to be rerouted because of the exclusion zone. The rerouted pipeline will be of a safety concern.

Portsmouth, OH

No large hazardous chemical storage or handling facilities were identified within 8 km (5 mi) of this site. No large propane pipelines are within 3.2 km (2 mi) of the site. The TETCO interstate propane distribution line is more than 3.2 km (2 mi) north of the site. Portsmouth is within 12.9 km (8 mi) of the Pike County Airport, but this airport does not have commercial flights. The site is not within the general emergency area of any hazardous operations facility. There are no nearby facilities that could potentially impact the air quality.

2.1.3.3.4.9 Criterion 9, Ease of Decommissioning

The evaluation of this criterion analyzed potential sites for characteristics that would make demolition and decommissioning more difficult. All sites score high for this criterion, although the existing DOE site could slightly complicate decommissioning at the Portsmouth Site. With proper controls, stormwater can be managed acceptably at all sites. No issues with property transfer and redevelopment or residual contamination are expected. The proximity to other sources of radioactivity (i.e., landfill, etc.) on the existing DOE site would need to be addressed and could complicate a demonstration that unrestricted use release criteria have been achieved during decommissioning.

2.1.3.3.4.10 Criterion 10, Adjacent Sites' Medium-/Long-Term Plans

The evaluation of this criterion analyzed the potential that construction activities adjacent to sites would cause nuisance issues, including noise, dust, and traffic.

Bellefonte, AL

TVA completed a Final Environmental Impact Statement (FEIS) in 1997 for conversion of the nearby Bellefonte Nuclear Plant to a fossil-fueled power plant; however, TVA is not planning to move forward with this conversion in the near future. However, if they do move forward, nuisance issues should be temporary. No additional development adjacent to the proposed site is anticipated at this time.

Carlsbad, NM

Little future development surrounding the site is anticipated during the next 10 years; therefore, no nuisance issues associated with construction activities adjacent to the site are anticipated.

Eddy County, NM

Little or no future development activity is anticipated in the area surrounding the site during the next 3 to 5 years; therefore, no nuisance issues associated with construction activities adjacent to the site are anticipated.

Hartsville, TN

TVA designated 223 ha (550 acres) of their Hartsville Nuclear Plant site for an industrial park. The proposed site is only approximately 106 ha (262 acres). The local development organization plans to develop the remaining acreage. Because the remaining acreage could house a number of different industries, the nuisance issues could be sporadic over an extended period of time; however, for the most part, the nuisance issues are not anticipated to be significant. If the remaining acreage is developed over a fairly short period of time, there could be negative impacts on the adjacent small roads due to increased traffic.

Lea County, NM

Construction activities are anticipated to continue at the neighboring facilities, e.g., Wallach Concrete, Inc., Lea County Landfill, and the WCS Landfill; and these activities could cause nuisance issues, such as dust. However, minimal noise and traffic issues are anticipated as a result of these ongoing activities.

Portsmouth, OH

At the Portsmouth Site, future development is expected and being encouraged through the DOE Reindustrialization Program and the SODI. Nuisance issues will likely be moderate, due to the large extent of the PORTS site. Possibility exists for a new gas centrifuge enrichment facility to be built by USEC on the DOE property.

2.1.3.3.4.11 Criterion 11, Political Support

This criterion evaluated advocacy of local community, State and Federal officials; willingness to provide incentives and tax breaks; commitment to provide assistance in obtaining permits; and sharing of costs for infrastructure and road improvements.

Bellefonte, AL

The local and State governments were very positive in 1997 for the possible tritium project at the TVA Bellefonte Site and have indicated strong support for the proposed facility. The State has also indicated their willingness to help in obtaining necessary permits. TVA has also indicated their support for any site in the TVA region and has stated they will work to support development around the Bellefonte Site. State incentives are available for new industry in the area. To date, the incentives are in accordance with normal State practices. There is good road access to the proposed site around the entire perimeter and road improvements are not needed.

Carlsbad, NM

The local and State governments have indicated strong support for the proposed facility and assistance from the State in obtaining necessary permits is anticipated. State incentives are available for new industry in the area in accordance with statutory authorization signed by the Governor of New Mexico in March 1999. These incentives could include tax reductions for a uranium enrichment facility. There is good road access to the proposed site, and road improvements are not needed. The State has also indicated its willingness to help in obtaining necessary permits.

Eddy County, NM

The local and State governments have indicated strong support for the proposed facility. Strong support also has been expressed by members of the New Mexico Congressional Delegation. State incentives are available for new industry in the area in accordance with statutory authorization signed by the Governor of New Mexico in March 1999. These incentives could include tax reductions for a uranium enrichment facility. There is good road access to the proposed site, and minimal road improvements are needed. The State has also indicated its willingness to help in obtaining necessary permits.

BLM must complete the NEPA process before the site could be made available. The outcome of this process is uncertain. The overall duration of the process is also unknown. If the process was to take a significant amount of time, it could impact the economic analysis for the uranium enrichment plant.

Hartsville, TN

During the siting study, prior to announcement of the proposed site, the local and State governments and TVA indicated strong support for the proposed facility. The State also indicated its willingness to help in obtaining necessary permits. However, subsequent to initial site selection, conditions at the Hartsville Site indicated that there was no longer any political advocates for the site, and local officials either opposed siting the facility in Hartsville or withhold their positions pending submittal of the license application. Initially, incentives were available for new industry in the area in accordance with normal State practices. There now appears to be only minimal state incentives for the facility, and no local incentives.

Revenue generated by LES for the enrichment of uranium will not be exempt from the gross receipts tax in Tennessee and would be taxed at a rate of 7% for the state and 2.25% for the local government. In some other states, these revenues are tax exempt or taxed at a lower rate than Tennessee. Also, Tennessee would impose a resources excise tax on special nuclear material at a rate of $1.30 cents per separative work unit. Other states either do not impose a resource excise tax or base the tax on the amount of natural resources the plant consumes. Tennessee, in addition, assesses franchise and business taxes, whereas some other states do not or assess a minimal flat fee. Likewise, the current condition is such that there is no cooperation in permitting. Impediments to zoning of the site to allow for construction of the new enrichment facility have been raised by local officials.

Good access to the site is available. Minimal improvements to the surrounding access roads are needed.

Lea County, NM

The local and State governments have indicated strong support for the proposed facility. Strong support also has been expressed by members of the New Mexico Congressional Delegation. State incentives are available for new industry in the area in accordance with statutory authorization signed by the Governor of New Mexico in March 1999. These incentives could include tax reductions for a uranium enrichment facility. There is generally good road access to the proposed site, with minimal road improvements needed. The State has also indicated its willingness to help in obtaining necessary permits.

Portsmouth, OH

The Portsmouth Site has outstanding support by local officials, State officials (including the Governor), and U. S. Senators. DOE signed an agreement with USEC on June 17, 2002, that gives USEC a right of first refusal for any use of DOE property at the Portsmouth reservation. LES assessed this agreement and significantly lowered the advocacy by DOE, the land owner. The DOE has funds available in the amount of $10,000 per employee for payment to firms who hire employees displaced from the DOE site. Additional funds are available to train these workers. The State has committed to tax breaks and incentives. State officials have also committed to prioritizing support for obtaining required construction and operating permits. LES will most likely be required to pay for improvements to the access road to the site, especially in regards to entrance portals that separate workers from entrance to the remainder of the DOE reservation and USEC facility.

2.1.3.3.4.12 Criterion 12, Public Support

This criterion evaluated support of the local communities and various labor groups for the project at the time of site selection.

Bellefonte, AL

Strong community support is anticipated for proposed facility as evidenced by strong support of the proposed tritium facility in 1997. The area is non-union and labor does not speak as one voice. However, indications are that labor groups will be strong advocates.

Carlsbad, NM

Strong community support is anticipated for the proposed facility as evidenced by the strong support for the WIPP. Similarly, labor groups would also be expected to support the facility location in Carlsbad.

Eddy County, NM

Strong community support is anticipated for the proposed facility, as evidenced by the strong support for the WIPP and the proposed new Plutonium Production Pit Facility. Based on past experience with other nuclear facilities proposed for sites in the county, community leaders expect that labor groups will support the facility location in Eddy County. However, due to the status of the siting study, contact with the community has been limited.

Hartsville, TN

During the siting study, prior to announcement of the proposed site, discussions with various community representatives were generally positive. However, a citizens opposition group has been formed. Acceptance by the local community and business community is currently questionable and there is indication that the business community has mixed support for the LES enrichment plant. Subsequent to site selection, the labor unions in the general area confirmed strong support for this project.

Lea County, NM

Strong community support is anticipated for the proposed facility. This strong community support was subsequently confirmed following site selection (NRC, 2003f). General discussions with various community representatives have been positive and have indicated that labor groups would also be expected to support the facility location in Lea County. However, due to the status of the siting study, contact with the community has been limited.

Portsmouth, OH

The communities around the Portsmouth Site all appear supportive of the plant and would probably become advocates. Initial discussions with labor groups (Paper, Allied-Industrial, Chemical and Energy Workers International Union [PACE] and the Tri-States Building Council) indicate that they will support the plant being located at the Portsmouth Site.

2.1.3.3.4.13 Criterion 13, On or Near an Existing Nuclear Facility

This criterion evaluated whether the proposed site was located on or near a nuclear facility with an existing or previous NRC license. The Portsmouth Site is located at a nuclear facility with an existing NRC certification. The Bellefonte Site is located adjacent to a nuclear facility with an existing NRC construction permit. The Carlsbad Site is not located on or near a nuclear facility with an NRC license. The Hartsville Site is located on property that previously held an NRC construction permit for a nuclear power station. The Eddy County Site adjoins the DOE WIPP Site. Although the WIPP facility is not licensed by the NRC, the facility went through a stringent NEPA, as well as regulatory permitting, process prior to initiating underground disposal of transuranic wastes. The Lea County Site is near the WCS Site, which has a radioactive materials license from a NRC Agreement state, Texas, as well as various regulatory permits.

2.1.3.3.4.14 Criterion 14, Moderate Climate

Evaluation of the criterion for moderate climate included consideration of the annual mean, average low, and average high temperatures; annual average rainfall; frequency of heavy precipitation; annual average snowfall; average number of days with 2.5 mm (1 in) or more of snow on the ground; ice and sleet potential; and the potential for tornadoes and/or hurricanes.

Bellefonte, AL

The annual mean temperature for the Bellefonte Site is 15°C (59°F), with monthly mean high and low temperatures of 26.1°C (79°F) and 3.89°C (39°F), respectively. The Bellefonte Site is in a region of moderate precipitation, receiving an annual average of 145 cm (57 in), with an annual average of 10 cm (4 in) of snow and very low potential for ice or sleet. The area has a very low tornado potential, and hurricanes do not occur in the area. Lost construction or outdoor operational days are anticipated to be moderate (less than 15 days per year).

Carlsbad, NM

The annual mean temperature for the Carlsbad area is 16.1°C (61°F), with monthly mean high and low temperatures of 25.6°C (78°F) and 8.33°C (47°F), respectively. The Carlsbad Site is in an arid region, with average annual rainfall of 41 cm (16 in) and very low potential for snow, ice or sleet. Although severe thunderstorms with heavy rainfall do occur in the area, the storms are usually of short duration. The area has a very low tornado potential, and hurricanes do not occur in the area. Lost construction or outdoor operational days are anticipated to be minimal.

Eddy County, NM

The annual mean temperature for southeast New Mexico, based on data for Carlsbad, is 16°C (61°F), with monthly mean high and low temperatures of 26°C (78°F) and 8°C (47°F), respectively. The Eddy County Site is in an arid region, with average annual rainfall of 41 cm (16 in) and very low potential for snow, ice, or sleet. Although severe thunderstorms with heavy rainfall do occur in the area, the storms are usually of short duration. The area has a very low tornado potential, and hurricanes do not occur in the area. Lost construction or outdoor operational days are anticipated to be minimal.

Hartsville, TN

The annual mean temperature for the Hartsville site is 15°C (59°F), with monthly mean high and low temperatures of 25°C (77°F) and 3.3°C (38°F), respectively. The Hartsville site is in a region of moderate precipitation, receiving an annual average of 140 cm (55 in), with an annual average of 25 cm (10 in) of snow. On average, 2.5 cm or more (one or more in) of snow are on the ground for 5 days per year. In addition, the site has the potential for occasional ice or sleet during the winter. The area has a very low tornado potential, and hurricanes do not occur in the area. Lost construction or outdoor operational days are anticipated to be moderate (less than 15 days per year).

Lea County, NM

The annual mean temperature for southeast New Mexico, based on data for Carlsbad, is 16°C (61°F), with monthly mean high and low temperatures of 26°C (78°F) and 8°C (47°F), respectively. The Lea County Site is in an semi-arid region, with average annual rainfall of approximately 40 cm (16 in) and very low potential for snow, ice, or sleet. Although severe thunderstorms with heavy rainfall do occur in the area, the storms are usually of short duration. The area has a very low tornado potential, and hurricanes do not occur in the area. Lost construction or outdoor operational days are anticipated to be minimal.

Portsmouth, OH

The annual mean temperature for the Portsmouth Site is 11.7°C (53°F), with monthly mean high and low temperatures of 23.9°C (75°F) and 12.22°C (28°F), respectively. The Portsmouth Site is in a region of moderate precipitation, receiving an annual average of 102 cm (40 in). The site is in an area with a frequency for rainfall of greater than 2.5 cm (1 in) per day 4 to 12 days per year. The average annual snowfall for the Portsmouth area is 51 cm (20 in) and there is a potential for occasional ice or sleet during five winter months. The site is in an area where 2.5 cm (1 in) of snow or more could be expected on the ground for 12 to 25 days per year. The area has a very low tornado potential, and hurricanes do not occur in the area. Lost construction or outdoor operational days are anticipated to be moderate (approximately 15 days per year).

2.1.3.3.4.15 Criterion 15, Availability of Construction Labor Force

This criterion evaluated availability of sufficient craft labor, the potential for competing with other large projects in the area for construction craft, support by the labor organizations in establishing this project for preferential commitment of resources, availability of craft apprenticeship programs, and the support of labor to use travelers as needed to staff peak construction periods.

Bellefonte. AL

The labor force in the area of the Bellefonte site is non-union and provided by building contractors. Labor statistics indicate sufficient labor availability. Indications are that labor groups will be strong advocates. There are currently no planned competing projects. Apprenticeship programs are not readily available because the labor force is non-union; however, contractors will train resources as necessary to accomplish the work. Contractors can hire travelers as appropriate from any surrounding area.

Carlsbad, NM

Since the Carlsbad area may not have sufficient local craft labor to support the construction, other construction workers would come from outside the area (from either 274 km (170 mi) away in El Paso or 443 km (275 mi) away in Albuquerque). There are currently no planned competing projects, but the labor pool is weaker than the other sites, even without a competing project. The support for the project by local workers is anticipated to be positive. Information to evaluate labor support and apprenticeship programs was not readily available. There is support for travelers, since most of the construction workers will come from outside the area.

Eddy County, NM

The Eddy County area does not have sufficient local craft labor to support the construction, and the majority of construction workers would come from outside the area (El Paso, Albuquerque, Andrews, etc.) – which is typical for the oil industry in this area. There are currently no planned competing projects. The support for the project by local workers has not been determined by contact with labor representatives, but is expected to be positive. Information to evaluate apprenticeship programs was not readily available. There is support for travelers, since most of the construction workers will come from outside the area. It is expected that construction craft would be well qualified due to the requirements of the oil industry in the area.

Hartsville, TN

The labor force in the area of the Hartsville Site is non-union and provided by building contractors, support is expected to be positive. Labor statistics indicate sufficient labor availability. There are currently no planned competing projects. Apprenticeship programs are not readily available because the labor force is non-union; however, contractors will train resources as necessary to accomplish the work. Contractors can hire travelers as appropriate from any surrounding area.

Lea County, NM

Since the Lea County area may not have sufficient local craft labor to support the construction, other construction workers would come from outside the area (El Paso, Albuquerque, Andrews, etc.) – which is typical for the oil industry in this area. There are currently no planned competing projects. The support for the project by local workers has not been determined by contact with labor representatives, but is expected to be positive. Information to evaluate apprenticeship programs was not readily available. There is support for travelers, since most of the construction workers will come from outside the area. It is expected that construction craft would be well qualified due to the requirements of the oil industry in the area.

Portsmouth, OH

There appears to be sufficient craft resources and skills to construct the plant at the Portsmouth site. There are no identified competing projects at this time, but USEC has indicated that they may build a centrifuge plant at the site. Apprenticeship programs exist and the Tri-States Building Council encourages support of the programs by contractors and plant owners. The Tri-State Building Council would consider support of travelers on an as needed basis.

2.1.3.3.4.16 Criterion 16, Availability of Skilled and Flexible Workforce for Plant Operations

This criterion evaluated the availability of sufficient skilled labor force to operate the plant, the availability and support of technical schools or trade schools to train qualified candidates, and the operating organizations' support for multi-tasking of employees. Employee multi-tasking refers to employee's ability to perform general job functions rather than a single job function.

Bellefonte, AL

There is a sufficient labor pool to support plant operations; however, it is expected that few in the labor force have worked in a nuclear facility. There is a technical school adjacent to the site, which has indicated their support, including use of facilities and/or faculty for training and qualification of workers. In addition, a community college is located nearby. Multi-tasking of employees appears to be acceptable.

Carlsbad, NM

The labor pool in the immediate vicinity of the Carlsbad Site may not have sufficient resources to support the requirements for operating the plant; however, the surrounding labor pool is sufficient. There are trained nuclear workers at the WIPP; however, the skill set required is different for the two facilities. A major university, other post-secondary schools, and a technology training center in Carlsbad are available to assist with training and qualification of workers. Support for multi-tasking of employees is unclear.

Eddy County, NM

The labor pool in the immediate vicinity of the Eddy County Site may not have sufficient resources to support the requirements for operating the plant; however, the surrounding labor pool is sufficient. There are trained nuclear workers at the WIPP; however, the skill set required is different for the two facilities. A major university, other post-secondary schools, and a technology training center in Carlsbad are available to assist with training and qualification of workers. Multi-tasking of employees appears to be acceptable.

Hartsville, TN

There is a sufficient labor pool at or near the Hartsville Site to support plant operations; however, it is expected that few in the labor force have worked in a nuclear facility. A technical school is located within a few miles of the proposed site and is available for use in training of workers. The local development organization indicates that the technical school will provide space and faculty as appropriate to assist in development of the industrial park. Multi-tasking of employees appears to be acceptable.

Lea County, NM

The labor pool in the immediate vicinity of the Lea County Site may not have sufficient resources to support the requirements for operating the plant; however, the surrounding labor pool is sufficient. There are a small number of trained nuclear workers at the nearby WCS disposal facility, and workers from the WIPP may be available to support the operations staff. However, the skill set required is different for this facility than for an enrichment plant. Major universities and other post-secondary schools are located in Midland-Odessa and Lubbock, while a local junior college in Hobbs is available to assist with training and qualification of workers. Multi-tasking of employees appears to be acceptable.

Portsmouth, OH

There is a sufficient qualified labor pool at or near the Portsmouth Site to support plant operations. A significant number of operations personnel were laid off by USEC as a result of cessation of enrichment activities at the site. These workers are well qualified and have been formally qualified to work on several nuclear watch stations that would be relevant to operating positions at the new plant. Training centers and technical schools are available in the area to assist in training and qualification programs. The DOE also has funding available to help defray the costs of training displaced workers from PORTS. This funding can be used at the technical schools. Multi-tasking of employees is not the norm, but would be considered on a case-by-case basis.

2.1.3.3.4.17 Criterion 17, Extant Nuclear Site

Evaluation of the criterion for Extant Nuclear Site included consideration of several subcriteria, including supply chain integration and optimization through co-location with a fuel fabricator and/or UF_6 production facility, availability of existing nuclear and non-nuclear infrastructure, and availability of specialized technical resources that can be utilized on a limited basis.

Bellefonte, AL

The proposed site is not co-located with a fuel fabricator or UF_6 production facility, nor is the proposed site co-located on or near an existing nuclear facility. The proposed site is located essentially adjacent to the TVA Bellefonte Nuclear Plant site; however, there is no nuclear infrastructure at the proposed site or adjacent Bellefonte Nuclear Plant that could be utilized and only limited available non-nuclear infrastructure (i.e., utilities). There are no specialized nuclear resources nearby; however, there is a technical school and community college nearby that could provide specialized technical resources. Specialized nuclear resources might be available to the facility from TVA nuclear plants in northern Alabama and east Tennessee and/or the DOE facilities in Oak Ridge, Tennessee.

Carlsbad, NM

The proposed site is not co-located with a fuel fabricator or UF_6 production facility, nor is the proposed site located on or near an existing nuclear facility. This site is located farthest from existing fuel cycle facilities of the four sites. The proposed site is situated approximately 32 km (20 mi) from the WIPP site; however, there is no nuclear infrastructure at the proposed site or the WIPP that could be utilized, and only limited available non-nuclear infrastructure (i.e., utilities). Specialized nuclear resources might be available from the WIPP or Los Alamos, but they may be limited and may not include the required skill sets. There is a major university, other post-secondary schools, and a technology training center in Carlsbad that could provide specialized technical resources.

Eddy County, NM

The proposed site is not co-located with a fuel fabricator or UF_6 production facility. The site is located over 1,600 km (1,000 mi) from any existing fuel cycle facilities. The proposed site is situated adjacent to the WIPP, which is a transuranic waste disposal facility, and some nuclear infrastructure could be shared between these facilities. Only limited non-nuclear infrastructure is available (i.e., utilities). Specialized nuclear resources might be available from the WIPP or Los Alamos. There is also a university, other post-secondary schools, and a technology training center in Carlsbad that could provide specialized technical resources.

Hartsville, TN

The proposed site is not co-located with a fuel fabricator or UF_6 production facility, nor is the proposed site co-located on or near an existing nuclear facility. It is located at a site that previously sought and received a construction permit from the NRC. The proposed site is located on the TVA Hartsville Nuclear Plant site; however, there is no nuclear infrastructure at the proposed site that could be utilized and only limited available non-nuclear infrastructure (i.e., utilities). There are no specialized nuclear resources nearby; however, there is a technical school nearby that could provide specialized technical resources. Specialized nuclear resources might be available to the facility from TVA nuclear plants in east Tennessee and/or the DOE facilities in Oak Ridge, Tennessee.

Lea County, NM

The proposed site is not co-located with a fuel fabricator or UF_6 production facility. This site is located over 1,600 km (1,000 mi) from any existing fuel cycle facilities. The proposed site is situated near the WCS disposal facility, which has a radioactive materials license from the State of Texas and a minimal nuclear infrastructure to support low-level waste storage. Only limited non-nuclear infrastructure is available (i.e., utilities). Specialized nuclear resources might be available from the WIPP or Los Alamos. There also are universities in Midland-Odessa and Lubbock and a Junior College in Hobbs, New Mexico that could provide specialized technical support to the site.

Portsmouth, OH

Although not co-located with a fuel fabricator or UF_6 production facility, the Portsmouth Site is co-located at a nuclear facility (i.e., uranium enrichment facility). A wide range of existing nuclear infrastructure is located at the DOE site, but most are currently under lease to the USEC through 2004. A wide range of existing non-nuclear infrastructure is located at the DOE site but, again, most is currently under lease to USEC through 2004. However, DOE retains responsibility for an existing sanitary landfill, construction spoils disposal area, and borrow areas, which might be available to LES to utilize during construction activities. Limited specialized technical resources are available through DOE and/or DOE's subcontractor under personal services agreements; these resources are primarily related to waste transportation and disposal. Laid-off USEC technical resources might also be available but would probably have to be hired or contracted individually.

2.1.3.3.4.18 Criterion 18, Availability of Good Transportation Routes

Evaluation of this criterion considered access to railroads (distance to a railhead, and whether a railhead was available), controlled-access highways or interstates, and navigable waterways; capacity of the existing roads to handle the construction and operations traffic; and optimum and efficient transportation routes to fuel fabrication and UF_6 production facilities.

Bellefonte, AL

A Norfolk Southern Railroad runs within 1.6 km (1 mi) of the proposed site and an existing rail spur runs through the site to the Bellefonte Nuclear Plant site. However, the spur would need to be upgraded or a new one constructed. The nearest controlled-access highway (US-72) runs adjacent to the site, along the northern side of the property. The nearest interstate access (I-24) is approximately 48 km (30 mi) to the northeast. In addition to the excellent access to controlled-access roads, the Tennessee River is navigable with barge access within approximately 3.2 km (2 mi) (at TVA's Bellefonte Nuclear Plant site). The existing roads around the site can handle additional construction and operations traffic/load. The proposed site is approximately 459 km (285 mi) from the nearest fuel fabricator and within 805 km (500 mi) of two additional fuel fabricators. The UF_6 production facility in Metropolis, IL, is approximately 451 km (280 mi) from the proposed site.

Carlsbad, NM

The Burlington Northern-Santa Fe Railroad runs through the northwest corner of the proposed site. A controlled-access highway (U. S. Highway 62) runs adjacent to the southeast corner of the site. The existing roads to the site can handle additional construction and operations traffic/load. The proposed site is approximately 2310 km (1,435 mi) from the nearest fuel fabricator and approximately 1,795 km (1,115 mi) from the UF_6 production facility in Metropolis, IL. The nearest navigable waterway to the Carlsbad Site is the Pecos River, approximately 8.9 km (5.5 mi) to the south. However, this waterway is not navigable throughout its entire length to its confluence with the Rio Grande River.

Eddy County, NM

A railroad spur serving the WIPP Site is located approximately 3.2 km (2 mi) south of the proposed site and connects to the Burlington Northern and Santa Fe Railroad, approximately 10 km (6 mi) to the west. The WIPP North Access Road crosses the southeastern corner of the site and connects to a 4-lane, controlled-access highway (US 62/180), approximately 21 km (13 mi) north of the site. The existing roads to the site can handle additional construction and operations traffic/load. The proposed site is approximately 2,270 km (1,410 mi) from the nearest fuel fabricator and approximately 1,750 km (1,090 mi) from the UF_6 production facility in Metropolis, IL. The site is over 965 km (600 mi) from the nearest navigable waterway and major port access.

Hartsville, TN

The nearest railroad to the proposed site is approximately 29 km (18 mi) away, near Lebanon, TN. A 2-lane rural state highway (SR 25) runs adjacent to the site and an access road (River Road) runs from the proposed site to the highway. The nearest controlled access highway is 10 km (6 mi) away and the nearest interstate access (I-40) is approximately 35 km (22 mi) away (south of Lebanon, TN). The Cumberland River, which is essentially adjacent to the proposed site, is navigable and TVA has barge access at the site. The site access road is expected to be adequate to handle the additional construction and operations traffic/load with the government-funded, typical improvements that are scheduled over the next few years. The proposed site is approximately 427 km (265 mi) from the nearest fuel fabricator and within 805 km (500 mi) of two additional fuel fabricators. The UF_6 production facility in Metropolis, IL is approximately 322 km (200 mi) from the proposed site.

Lea County, NM

A rail spur runs along the northern edge and through the northeast corner of the proposed site. New Mexico Highway 234 runs along the southern edge of the site and connects to a 4-lane, controlled-access highway (New Mexico Highway 18) approximately 4 km (2.5 mi) west of the site. The existing roads to the site can handle additional construction and operations traffic/load. The proposed site is approximately 2,264 km (1,406 mi) from the nearest fuel fabricator and approximately 1,674 km (1,040 mi) from the UF_6 production facility in Metropolis, IL. The site is over 960 km (600 mi) from the nearest navigable waterway and major port access.

Portsmouth, OH

An existing rail spur connected to the main lines of both the Norfolk Southern Railroad and the CSX Railroad runs along the northern edge of the proposed site. The nearest controlled access highway (US-32) is within 1.6 km (1 mi) of the proposed site with a four-lane access road (North Access Road) 0.4 to 0.8 km (0.25 to 0.5 mi) of the proposed site. The existing roads have the capacity to handle the construction and operational traffic; however, the existing gravel road within the proposed site, which runs to the fire training facility and borrow areas, would need to be improved or another access road constructed into the site approximately 0.8 km (0.5 mi). In addition to the excellent access to controlled-access roads, the Ohio River is a navigable waterway with a port facility located 1.6 km (1 mi) west of Portsmouth, OH, approximately 35 km (22 mi) south of the proposed site. The proposed site is within 483 km (300 mi) of the nearest fuel fabricator facility and within 644 km (400 mi) of the UF_6 production facility in Metropolis, IL.

2.1.3.3.4.19 Criterion 19, Disposal of Operational Low-Level Waste

Evaluation of the criterion for Disposal of Operation Low-Level Waste considered the distance to available low-level waste disposal facilities, transportation modes, and whether shipments are currently made from the site to the disposal facility(ies). There are only three active, licensed commercial low-level waste disposal facilities in the United States, and these facilities are located in Barnwell, SC; Hanford, WA; and Clive, UT (Envirocare). However, due to the compacts in place with the three states where the disposal facilities are located, not all generators can use each of the three facilities.

Bellefonte, AL

The proposed site is located approximately 580 km (360 mi) from the Barnwell facility, but the Barnwell site will only accept wastes from non-Atlantic Compact states until 2008. The proposed site is approximately 2,970 km (1,845 mi) from the Envirocare facility; the Hanford facility will not accept wastes from Alabama. Both rail and truck transportation modes would be available for shipping the low-level waste but low-level wastes are not routinely shipped from the proposed site or neighboring Bellefonte Nuclear Plant site.

Carlsbad, NM

The Carlsbad Site is located approximately 1,578 km (980 mi) from the Envirocare facility and approximately 2,463 km (1,530 mi) from the Hanford facility. Both rail and truck transportation modes are available for shipping the low-level waste. Low-Level Waste is not routinely shipped from the proposed site or the nearby WIPP facility. New Mexico is not allowed to ship waste to the Barnwell facility.

Eddy County, NM

The Eddy County Site is located approximately 1,654 km (1,028 mi) from the Envirocare facility and approximately 2,503 km (1,555 mi) from the Hanford facility. Both rail and truck transportation modes are available for shipping the low-level waste. Community organizations, such as the Carlsbad Environmental Monitoring and Research Center and the Environmental Evaluation Group, in the Carlsbad area cooperatively transport low-level waste to the waste disposal site in Washington. New Mexico is not allowed to ship waste to the Barnwell facility.

Hartsville, TN

The proposed site is located approximately 749 km (465 mi) from the Barnwell facility, but the Barnwell site will only accept wastes from non-Atlantic Compact states until 2008. The proposed site is approximately 2,842 km (1,765 mi) from the Envirocare facility; the Hanford facility will not accept wastes from Tennessee. Truck transportation is available for shipping the low-level waste, but rail transportation is not presently available without transferring the wastes at a nearby location from truck to rail. In addition, low-level wastes are not routinely shipped from the proposed site or Hartsville Nuclear Plant site.

Lea County, NM

The Lea County Site is located approximately 1,636 km (1,016 mi) from the Envirocare facility and approximately 2,574 km (1,599 mi) from the Hanford facility. Both rail and truck transportation modes are available for shipping the low-level waste. Low-level waste is routinely shipped from the adjoining WCS facility. New Mexico is not allowed to ship waste to the Barnwell facility.

Portsmouth, OH

The Portsmouth site is located approximately 829 km (515 mi) from the Barnwell facility, but the Barnwell site will only accept wastes from non-Atlantic Compact states until 2008. The Portsmouth site is approximately 2,970 km (1,845 mi) from the Envirocare facility; the Hanford facility will not accept wastes from Ohio. Both rail and truck transportation modes are available for shipping the low-level waste and low-level wastes are shipped routinely from the DOE Portsmouth site to Envirocare for disposal.

2.1.3.3.4.20 Criterion 20, Amenities for Workforce

The purpose of this criterion was to evaluate amenities that would enable a workforce to live comfortably near the site. Amenities evaluated include housing, lodging, hospitals, recreation, and cultural aspects such as universities, theaters, museums, etc.

Bellefonte, AL

The town of Scottsboro, with a population of 14,762, is located approximately 10 km (6 mi) to the southwest of the proposed site. Large population centers proximate to the site include Chattanooga, Tennessee, and Huntsville, Alabama, both within 89 km (55 mi) of the proposed site. Adequate housing is anticipated in Scottsboro, along with restaurants, several hotels/motels, limited entertainment, and shopping centers. The surrounding area offers abundant recreational opportunities, including the Guntersville Reservoir; and the Chattanooga and Huntsville areas offer additional recreational and cultural opportunities. Huntsville has two universities, three hospitals, a large technical base associated with the Army missile program, and the NASA Marshall Space Flight Center.

Carlsbad, NM

Carlsbad is located approximately 10 km (6 mi) southwest of the proposed site, with a population of 25,625. The nearest large population center is El Paso, Texas, approximately 274 km (170 mi) southwest of the site. A number of hotels/motels and restaurants are located within Carlsbad. Local recreational and cultural activities include boating and water activities on Lake Carlsbad and the Pecos River, hiking and backpacking in the nearby Guadalupe Mountains and Carlsbad Caverns National Park, a local museum, community theater, and community concert and art associations. Since the site is not located near a large population base, amenities are limited.

Eddy County, NM

Carlsbad (population 25,625) is located approximately 42 km (26 mi) west of the Eddy County Site. The nearest large population center is El Paso, Texas (population 563,662), approximately 306 km (190 mi) southwest of the site. A number of hotels/motels and restaurants are located within Carlsbad. Local recreational and cultural activities include boating and water activities on Lake Carlsbad and the Pecos River, hiking and backpacking in the nearby Guadalupe Mountains and Carlsbad Caverns National Park, a local museum, community theater, and community concert and art associations. Since the site is not located near a large population base, amenities are limited.

Hartsville, TN

Population centers proximate to the site include Lebanon (population 20,235 in 2000), located approximately 32 km (20 mi) southwest of the site, and Gallatin (population 23,230 in 2000), located approximately 32 km (20 mi) west of the site. Abundant housing is anticipated in the towns of Hartsville, Lebanon, and Gallatin and the surrounding area, along with numerous restaurants, hotels/motels, entertainment, and shopping centers/malls. In addition, Nashville is located approximately 73 km (45 mi) to the southwest of the proposed site and offers numerous arts, entertainment, cultural, and recreational opportunities. Several hospitals and universities are located in the Nashville area.

Lea County, NM

The Lea County Site is located approximately 8 km (5 mi) from Eunice, New Mexico (population 2,562), and 32 km (20 mi) from Hobbs, New Mexico (population 28,657). The nearest large population center is Odessa (population 90,043)-Midland (population 94,996), Texas, approximately 103 km (64 mi) southeast of the site. A number of hotels/motels and restaurants are located within Hobbs. Limited local recreational and cultural activities are available in Hobbs, e.g., Harry McAdams State Park, and in Odessa-Midland, e.g., golf, professional minor league baseball, rodeos, museums, art galleries, symphony, and theatres. Recreational and cultural activities are also available in the Carlsbad area 145 km (90 mi) to the west, including boating and water activities on Lake Carlsbad and the Pecos River, hiking and backpacking in the nearby Guadalupe Mountains and Carlsbad Caverns National Park, a local museum, community theater, and community concert and art associations. Since the site is not located near a large population base, amenities are limited.

Portsmouth, OH

Larger population centers proximate to the site include Portsmouth (population 25,000), 32 km (20 mi) south of the site, and Chillicothe (population 23,000), 40 km (25 mi) north. Adequate housing is anticipated to be available in both Portsmouth and Chillicothe. Many restaurants, pubs, and shopping malls are located in Chillicothe. Columbus, located just over 113 km (70 mi) from Piketon, is the nearest town with a large population base.

2.1.3.3.5 Conclusions

The Eddy County Site scored highest in the evaluation, closely followed by the Lea County Site. However, the Eddy County Site is currently owned by the US Bureau of Land Management (BLM). In order to accomplish transfer of the property, BLM must complete an environmental assessment through the NEPA process which will require, at a minimum, 9 to 12 months. There is no guarantee of the result of the process outcome and there is a potential that it cannot be transferred to LES. As such, the Eddy County Site is not reasonably available for siting the new enrichment facility on a schedule consistent with the business objectives of the project. Accordingly, the preferred site for the enrichment facility is the Lea County Site.On the question of whether the Lea County Site should be rejected in place of an alternative site, the NRC has stated that the test to be employed is “whether an alternative site is obviously superior to the site which the applicant had proposed.” The Atomic Safety and Licensing Appeal Board equated the term “obviously” with “clearly and substantially” thus re-emphasizing the high standard used by the NRC in comparing alternative site analyses with that done for the proposed site. In short, NEPA does not require that a facility be built on the single best site for environmental purposes.

In this case, it is plain that, of the sites considered, none is clearly and substantially superior to the Lea County Site. On balance, the Eddy County and Lea County Sites are qualitatively and quantitatively similar. With respect to environmental considerations in particular, the two sites were scored identically with respect to several sub-criteria, including “protected species,” “archeology/cultural,” “environmental justice,” “protected properties,” “NPDES permits,” “wind hazard,” “fire hazard,” “ponding hazard,” and “rock/mudslide hazard.” Overall, the Lea County Site scored higher than the Eddy Site with respect to several criteria, including “political support” and “access to highways.” Even with respect to those criteria for which the Eddy County Site was scored higher than the Lea County Site, it must be noted that the scoring differences were sufficiently narrow as to be insignificant, given the uncertainty that is inherent in an analysis that is based on largely qualitative, and somewhat subjective, factors.

The Bellefonte Site ranked third overall, followed by the Hartsville site. The Portsmouth and Carlsbad Sites scored fifth and sixth, respectively. The results are listed in Table 2.1-10, Scoring Summary, and shown on Figure 2.1-7, Contributions by Grouped Criteria, and Figure 2.1-8, Contributions by Criteria.

A summary of each of the six sites is provided below.

2.1.3.3.5.1 Bellefonte, AL

Overall, the Bellefonte Site is acceptable, and ranked third in this evaluation. The site is readily available and consists of 126 ha (311 acres). Seismic criteria for the site appear satisfactory, but additional site-specific characterization is necessary to identify soft soils. With respect to environmental considerations, few existing surveys exist for the site. With respect to most environmental matters considered, the site appears to pose no significant adverse issues. However, it appears that historic preservation issues may arise because portions of the site are within the historic boundaries of a Cherokee Indian Reservation. Finally, TVA would have to relocate several transmission lines that currently cross the site. Bellefonte, while an acceptable site, is not the preferred site for this project.

2.1.3.3.5.2 Carlsbad, NM

The Carlsbad Site ranked sixth in the site evaluation. While the site scores well in regard to seismic considerations and availability of transportation routes, little environmental characterization and survey data exists for the site. Even without this data, certain environmental concerns have been identified. For example, while the Carlsbad Site is located in a sparsely populated area, there are some concerns with respect to a possible disparate impact of a facility here on local minority populations. In addition, the presence of an arroyo on the site would necessitate additional environmental approvals and may constrain site development. On the economic front, the labor pool is weaker at Carlsbad than at other sites considered due to its remote location. For these and other reasons, the Carlsbad Site is not the preferred site for this project.

2.1.3.3.5.3 Eddy County, NM

From a numerical standpoint, the Eddy County Site scored highest in the alternative site evaluation. The site scores very high with respect to seismicity. There is detailed environmental information available for the adjacent WIPP Site that is relevant to this site used in this assessment. This information demonstrated that the site scored very well in nearly all of the environmental protection sub-criteria (with the exception of archeological/cultural resources). However, as discussed above, the Eddy County Site is not reasonably available for siting the new enrichment facility on a schedule consistent with the business objectives of the project due to issues associated with transfer of the property from BLM. For this reason, the Eddy County Site is not the preferred site for this project.

2.1.3.3.5.4 Hartsville, TN

The Hartsville Site ultimately ranked fourth in the site evaluation. Geological and seismic conditions at the site are generally favorable, although the site exhibits the potential for karsification and the likelihood of rock excavation. The site scored well with regard to environmental, labor and transportation issues. However, after conducting an evaluation of technical and environmental considerations at the site, several concerns were identified from a business standpoint which render Hartsville impractical from a business perspective. In particular, unlike in other states, revenue generated by LES for the enrichment of uranium will not be exempt from the gross receipts tax in Tennessee, and the state also will impose a resources excise tax on special nuclear material. Moreover, the site would need to be rezoned for the facility, and the likelihood of rezoning being approved by the local government was low. Accordingly, the Hartsville Site is not the preferred site for this project.

2.1.3.3.5.5 Lea County, NM

From a numerical standpoint, the Lea County Site ranked second overall, closely following the Eddy County Site. However, the Lea County Site is the preferred site for this project for several reasons. The site scores very well with respect to seismicity. As discussed above, with respect to environmental consideration in particular, the Eddy County and Lea County sites were scored identically with respect to several subcriteria, including “protected species,” “archeology/cultural,” “environmental justice,” “protected properties,” “NPDES permits,” “wind hazard,” “fire hazard, “ponding hazard,” and “rock/mudslide” hazard. Overall, the Lea County Site scored higher than the Eddy Site with respect to several criteria including “political support” and “access to highways.” From a business perspective, political and community support is strong for the facility. For all of these reasons, no other site is obviously superior to the Lea County Site.

2.1.3.3.5.6 Portsmouth, OH

The Portsmouth Site ranked fifth of six sites in the Second Phase Screening. The site scores reasonably well overall, but presents certain difficulties both from an environmental and an economic standpoint that are not present at other sites. On the environmental front, the site layout is adequate, but significant site preparation would be required. NPDES permitting could be constrained due to existing conditions placed on the body of water that would receive discharges. In addition, the proposed project could result in the fill of certain waters, and relocation of a stream. An existing firing range in the middle of the site may have to be removed, and contributes to soil contamination. Perhaps the more significant constraint on this site, however, is the fact that this site consists of acreage on DOE property. DOE recently entered into an agreement with the USEC that no land or facilities on the property will be sold or leased without USEC concurrence. USEC concurrence is not forthcoming, thus rendering the site not reasonably available for use in the project. For these reasons, the Portsmouth Site is not the preferred site for this project.

2.1.3.3.5.7 Sensitivity Analysis

Sensitivity analysis was performed on the results to ensure that the site selection was not sensitive to small changes in the relative weights of objectives or criteria. (The process for assigning weights for objectives, criteria, and subcriteria is described earlier.) For example, sensitivity analysis assesses the probable effect onsite selection if Environmental Acceptability was weighted higher than Operational Requirements. Sensitivity analysis is performed by keeping the scores for each site constant, while varying the weight of a single objective or criteria.

Figures 2.1-9 through 2.1-12 show the sensitivity to weights for each of the four major objectives. Figure 2.1-9, Sensitivity of Site Selection to Objective – Operational Requirements shows sensitivity of the weight assigned to Operational Requirements; Figure 2.1-10, Sensitivity of Site Selection to Objective – Environmental Acceptability shows the sensitivity to the weight assigned to Environmental Acceptability; Figure 2.1-11, Sensitivity of Site Selection to Objective – Schedule for Commencing Operations shows the sensitivity to the weight assigned to Schedule for Commencing Operations; and Figure 2.1.12, Sensitivity of Site Selection to Objective – Operational Efficiencies shows the sensitivity to the weight assigned to Operational Efficiencies.

As shown on Figures 2.1-9 through 2.1-12, the selection of Eddy County and Lea County as the preferred sites is robust, or insensitive to small changes in objective or criteria weights. The sensitivity graphs shown on Figures 2.1-9 through 2.1-12 illustrate how the preferred alternative may change with an increase in the weight of one objective. In each figure, the colors represent the sites' rank for that particular objective and may change if the sites' rank changes in a subsequent objective (i.e., the site ranked highest for each objective is shown in blue, the second ranked site is shown in green, etc.). The x-axis measures increasing or decreasing weight of an objective and the y-axis measures overall decision score. The red vertical line on each of these graphs shows the “status-quo” of weights for each objective.

Sensitivity of Site Selection to Objective – Operational Requirements

Figure 2.1-9 shows that the selection of the preferred sites is insensitive to a change in the weight of Operational Requirements. If the weight of Operational Requirements was increased to the maximum (far right on graph), they would still be the preferred sites. If the weight of Operational Requirements was decreased to the minimum (far left on graph), they would still be the preferred sites along with Bellefonte.

Sensitivity of Site Selection to Objective – Environmental Acceptability

Figure 2.1-10 shows that the selection of the preferred sites is relatively insensitive to a change in the weight of Environmental Acceptability. If the weight of Environmental Acceptability was increased to the maximum (far right on graph), Hartsville would be the preferred site. However, at the extreme minimum, the Eddy County and Lea County sites would be preferred.

Sensitivity of Site Selection to Objective – Schedule for Commencing Operations

Figure 2.1-11 shows the sensitivity to a change in the weight of Schedule for Commencing Operations. If the weight of Schedule for Commencing Operations was increased to the maximum (far right on graph), Bellefonte and Lea County sites would still be the preferred sites. At the extreme minimum, the Eddy County site would be the preferred site with Lea County and Hartsville coming in second.

Sensitivity of Site Selection to Objective – Operational Efficiencies

Figure 2.1-12 shows that the selection of the preferred sites is not sensitive to a change in the weight of Operational Efficiencies.

Sensitivity analysis was also performed on each criteria (those shown on Figure 2.1-8, Contributions by Criteria). No criteria was shown to be sensitive to small changes in weights, further indicating that the selection of the preferred sites is a robust decision.

2.1.4 Section 2.1 Tables

Table 2.1-1a Chemicals and Their Properties

Form	Chemical	Chemical Formula	Corrosive	Flammable	Combustible	Oxidizer	Reactive	Toxic	Radioactive	Health Hazard	Irritant	Remarks
Liquid	uranium hexafluoride	UF_6	✓				✓	✓	✓			
	uranium compounds	UO_2F_2						✓	✓			Residual
	silicone oil	C_2H_6O			✓							
	ethanol	C_2H_5		✓								
	methylene chloride	CH_2Cl_2								✓		
	oil				✓							
	cutting oil				✓							
	paint				✓							
	degreaser solvent, SS25				✓							
	penetrating oil				✓							
	PFPE (Tyreno) oil											
	organic chemicals			✓	✓				✓			Note 2
	nitric acid (65%)	HNO_3	✓									
	hydrogen peroxide (30%)	H_2O_2				✓						
	acetone	C_3H_6O		✓								
	toluene	C_7H_8		✓								
	petroleum ether			✓								
	sulfuric acid	H_2SO_4	✓									
	phosphoric acid	H_3PO_4	✓									
	sodium hydroxide (0.1N)	NaOH	✓									
	diesel fuel				✓							
	citric acid waste											Note 1
	precipitation sludge							✓	✓			
	evaporator/dryer sludge							✓	✓			
	hand wash / shower water											Note 1
	miscellaneous samples											Note 4
	R23 trifluoromethane	CHF_3										

Table 2.1-1a Chemicals and Their Properties

Form	Chemical	Chemical Formula	Corrosive	Flammable	Combustible	Oxidizer	Reactive	Toxic	Radioactive	Health Hazard	Irritant	Remarks
	R404A fluoroethane blend	C_2HF_5/ $C_2H_3F_3$/ $C_2H_2F_4$										
	R410A (refrigerant blend)	R32 (50%) + R125 (50%) CH_2F_2 / CHF_2CF_3										
	R407C (refrigerant blend)	R32 (20%) + R125 (40%) + R134a (40%) CH_2F_2 / CHF_2CF_3 / CH_3CF_3										
	R507 penta/tri fluoroethane	C_2HF_5 / $C_2H_3F_3$										
	PFPE () oil											
	floor wash water											Note 1
	citric acid, 5-10%											
	degreaser water											Note 1
	degreaser sludge							✓	✓			
	standard solutions	25 elements										Note 4
	PFPE oil sludge											Note 1
	nitrogen	N_2										
	potassium or sodium hydroxide	KOH/NaOH	✓									
	miscellaneous effluent											Note 1
	laboratory chemicals	Various										
	water	H_2O										
	urine											
	hydrocarbon sludge				✓							
	miscellaneous chemicals											Note 3
Gas	uranium hexafluoride	UF_6	✓				✓	✓	✓			

Table 2.1-1a Chemicals and Their Properties

Form	Chemical	Chemical Formula	Corrosive	Flammable	Combustible	Oxidizer	Reactive	Toxic	Radioactive	Health Hazard	Irritant	Remarks
	uranium compounds	UO_2F_2						✓	✓			Residual
	hydrogen fluoride	HF	✓					✓				Residual
	oxygen gas	O_2				✓						
	acetylene gas	C_2H_2		✓								
	propane gas	C_3H_8		✓								
	primus gas			✓								
	hydrogen	H_2		✓								
	R23 trifluoromethane	CHF_3										
	R404A fluoroethane blend	C_2HF_5 / $C_2H_3F_3$ / $C_2H_2F_4$										
	R-407C (refrigerant blend)	R32 (20%) + R125 (40%) + R134a (40%) CH_2F_2 / CHF_2CF_3 / CH_3CF_3										
	R-410A (refrigerant blend)	R32 (50%) + R125 (50%) CH_2F_2 / CHF_2CF_3										
	R507 penta/tri fluoroethane	C_2HF_5 / $C_2H_3F_3$										
	helium	He										
	argon	Ar										
	gaseous effluents											
	miscellaneous chemicals											Note 3
	nitrogen	N_2										
Solid	uranium hexafluoride	UF_6	✓				✓	✓	✓			
	sodium fluoride	NaF						✓				
	sodium carbonate	Na_2CO_3						✓			✓	

Table 2.1-1a Chemicals and Their Properties

Form	Chemical	Chemical Formula	Corrosive	Flammable	Combustible	Oxidizer	Reactive	Toxic	Radioactive	Health Hazard	Irritant	Remarks
	diatomaceous earth									✓	✓	
	papers, wipes, gloves, etc.				✓							
	contaminated disposable clothing				✓							
	uranium compounds	UO_2F_2						✓	✓			Residual
	combustible solid waste				✓							Note 1
	citric acid, crystalline										✓	
	activated carbon	C										Note 1
	impregnated activated carbon	C, K_2CO_3, KOH			✓					✓		Note 1, 5
	aluminum oxide	Al_2O_3										Note 1
	carbon fibers											
	sand blasting sand											
	shot blaster media											
	ion exchange resin											Note 1
	filters, radioactive								✓			Note 1
	filters, industrial											
	metals (aluminum)											
	soils and grass											
	laboratory chemicals	various										
	scrap metal											Note 1
	non-metallic waste											Note 1
	miscellaneous chemicals											Note 3
	Activated carbon/potassium carbonate/potassium hydroxide											

Table 2.1-1a Chemicals and Their Properties

Form	Chemical	Chemical Formula	Corrosive	Flammable	Combustible	Oxidizer	Reactive	Toxic	Radioactive	Health Hazard	Irritant	Remarks

NOTES:

1. Many waste streams including gaseous effluent, liquid waste and solid waste will contain some level of residual compounds not within toxic concentrations. The radiation hazard is listed separately from these chemicals as residual compounds.
2. Assumed to be flammable/combustible and radioactive liquid.
3. Non-hazardous liquid, gas and/or solid.
4. Each component in the miscellaneous samples, standard solutions and laboratory chemicals in the Chemical Laboratory, is assumed to be non-hazardous.
5. Previous revisions of the license basis documents identify potassium carbonate as the HF absorption media for the carbon filters. In design development of the filter units it was determined that potassium hydroxide provides a preferred means of impregnating the carbon media. The potassium hydroxide is converted to alkaline potassium salts (carbonate being primary due to the affinity of aqueous KOH to rapidly absorb CO_2 from air and from the pores of the activated carbon).

Table 2.1-1b Summary of Environmental Impacts For The Proposed Action

Environmental Impact	Proposed Action [1]	ER Reference Section
Land Use	Minimal considering more than half the site will remain undeveloped and current activities on nearby properties.	4.1
Transportation	~1,500 radiological and 2,800 non-radiological additional heavy truck shipments/yr; traffic patterns impact predicted to be inconsequential.	4.2
Geology and Soils	Minimal; potential, short-term erosion during construction, but enhanced afterwards due to soil stabilization.	4.3
Water Resources	None from operation to surface or groundwater; stormwater (174,100 m^3/yr; 46 Mgal/yr) from the two stormwater runoff basins, controlled by NPDES permit.	4.4
Ecological Resources	Minimal impact. Not RTE species present.	4.5
Air Quality	Minimal; vehicle and fugitive emissions less than NAAQS regulatory limits during construction or operation.	4.6
Noise	Not significant; typically should remain within HUD guidelines of 65 dBA L_{dn} and EPA limit of 55 dBA L_{dn}	4.7
Historic and Cultural	Minimal in that all NHPR sites can be avoided or mitigated, if required.	4.8
Visual/Scenic	None out of character with existing site features.	4.9
Socioeconomic	Positive impact to economy; minimal impact to local public services.	4.10
Environmental Justice	No disproportionate impact.	4.11
Public and Occupational Exposure	Minimal; dose equivalents below NRC and EPA regulatory limits.	4.12
Waste Management (Rad/NonRad)	Within offsite licensed facility capacities; reduced waste streams due to new and high efficient technology.	4.13
- Gaseous	Well below regulatory limits/permits.	3.12
- Liquid	2,130 m^3/yr (562,631 gal/yr)	3.12
- Solid	86,950 kg/yr (191,800 lb/yr) of low-level wastes[2]	3.12
- Mixed	50 kg/yr (110 lb/yr)	3.12
- Hazardous	1,770 kg/yr (3,930 lb/yr)	3.12
- Non-hazardous	172,500 kg/yr (380,400 lb/yr)	3.12

[1] Projected impacts are based on preliminary design and assumed to be bounding. Impacts are expected to occur for the life of the plant.

[2] Excludes depleted UF_6.

Table 2.1-2 Matrix Of Results From First Phase Screening

Site	Criterion 1 Seismology/Geology[1]	Criterion 2 Site Characterization Surveys[2]	Criterion 3 Size of Plot[3]	Criterion 4 Land Not Contaminated[4]	Criterion 5 Moderate Climate[5]	Criterion 6 Redundant Electrical Power[6]
Ambrosia Lake, NM	**No Go**	Go	Go	Go	Acceptable	Go
Barnwell, SC	**No Go**	Go	Go	Go	Acceptable	Go
Bellefonte, AL	Go	Go	Go	Go	Acceptable	Go
Carlsbad, NM	Go	Go	Go	Go	Acceptable	Go
Clinch River Industrial Site, TN	**No Go**	Go	**No Go**	Go	Acceptable	Go
Columbia, SC	**No Go**	**No Go**	Go	Go	Acceptable	Go
Eddy County, NM	Go	Go	Go	Go	Acceptable	Go
Erwin, TN	Go	Go	**No Go**	Go	Acceptable	Go
Hartsville, TN	Go	Go	Go	Go	Acceptable	Go
Lea County, NM	Go	Go	Go	Go	Acceptable	Go
Metropolis, IL	**No Go**	Go	**No Go**	Go	Acceptable	Go
Paducah, KY	**No Go**	Go	Go	Go	Acceptable	Go
Portsmouth, OH	Go	Go	Go	Go	Acceptable	Go
Richland, WA	**No Go**	Go	Go	Go	Acceptable	Go
Wilmington, NC	Go	Not Evaluated[7]	**No Go**	Not Evaluated[7]	Acceptable	Go

Notes:

[1]Go/No Go Criteria: Peak ground acceleration (PGA) 0.04 – 0.08 g_a, ground movements <1 mm, and no capable fault within 8-km (5-mi) radius of site
[2]Go/No Go Criterion: Not located within 500-year flood plain
[3]Go/No Go Criterion: Supports a rectangular footprint of approximately 800 m (2,625 ft) by 600 m (1,969 ft) and expandable for a 6,000 tSW plant
[4]Go/No Go Criteria: Site not contaminated at levels that would inhibit licensing or property transfer, or would require remediation
[5]No Essential Subcriterion
[6]Go/No Go Criterion: Redundant electrical capability
[7]A site was not provided for evaluation.

Gray shading indicates site did not pass the initial phase screening.

Table 2.1-3 Screening Criteria (Subsequent to First Screening)

Criteria	Weight	Subcriteria (Weight)
OPERATIONAL REQUIREMENTS	**100**	
Acceptable Seismology/Geology	100	
Essential (Go/No Go) Criteria:		
• 1 in 500 year event with a peak horizontal ground acceleration no greater than the range of 0.04 – 0.08g_a (dependent upon the frequency content of the typical response spectra).		NA – Go/No Go without scale
• Ground movements < 1mm (0.04 in).		NA – Go/No Go without scale
• No capable fault (per NRC definition) within 8 km (5-mi) radius of site.		NA – Go/No Go without scale
Desirable (Non-Exclusionary) Criteria:		
• **Liquefaction Potential** – Minimal liquefiable materials present.		50
• **Peak Ground Acceleration** – Lower PGA preferred.		100
• **Survey Available** – Well documented and up-to-date seismological surveys are available.		60
• **Karstification** – Low or no potential for underlying karstification.		80
• **Rock Excavation** – Minimal amount of rock excavation required.		30
• **Differential settlement –** Low differential settlement to minimize required ground improvements.		50
• **Allowable bearing –** Sufficient allowable bearing to minimize required ground improvements.		30
Size of Plot (on existing site or available within new boundary)	80	
Essential (Go/No Go) Criteria: • Site size supports a rectangular footprint of approximately 800 m (2,625 ft) x 600 m (1,969 ft) for a 3 million SWU facility.		NA – Go/No Go without scale
• Future expansion capability exists for a 6 million SWU plant. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)		NA – Go/No Go without scale
Desirable (Non-Exclusionary) Critiera): • **Future Expansion** – Degree of capability to support future expansion beyond a 6 million SWU facility (approximately 1,600 m (5,250 ft) x 600 m (1,969 ft). (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)		100
• **Buffer Area** – Extent of buffer area between site and populated areas.		80
• **Plant Layout -** Site requires minimal or no adjustment to ideal plant layout to fit site and terrain.		90
• **Construction Laydown –** Accommodates construction laydown areas and temporary facilities without limiting plant layout.		40
• **Borrow/Fill -** Borrow/fill requirements can be met onsite or close by. Site preparation costs due to variances in site topography are optimal (cut/fill balanced without significant earthmoving requirements or use of borrow pits). Site topography optimizes the overall usability of the site for the site footprint, transportation access, and drainage.		30
Redundant Electrical Power Supply Essential (Go/No Go) Criteria:	75	
• Dual dedicated power supply on separate feeders with capability of delivering 20 MVA for a 3 million SWU facility.		NA – Go/No Go without scale

Table 2.1-3 Screening Criteria (Subsequent to First Screening)

Criteria	Weight	Subcriteria (Weight)
Desirable (Non-Exclusionary) Criteria): • **Transmission feeders** – Transmission feeders can supply power requirements for a 6 million SWU facility. (At this time, there is no intention to license, construct or operate a greater than 3 milllion SWU plant.)		50
• **Government Cost Sharing** – Local utility and/or government willing to cost share in capital costs associated with power supply to the facility substation.		10
Factors to evaluate include: -Utility willingness to construct feed lines. -Utility willingness to construct substation. -Utility willingness to maintain feeder and substation.		
• **Optimal Rate Structure -** Power provider willingness to provide optimal rate structure as a favored client. Factors to evaluate include:		60
-Optimal rate agreements with load factors, transmission costs, equipment maintenance, and repair, etc. that are advantageous to the plant. -Preferred customer status. -Significant break in off-peak rates. Guarantees for quality and reliability.		
• **Quality –** Power supply has a guaranteed availability rate of greater than 99.5% and a +/-5% voltage regulation and willingness of the supplier to guarantee quality of service. Factors to consider:		100
-Historical performance of utility, including down times. -Performance in restoration after severe weather outages. -Historical voltage regulation of system. -Capability to provide all power without buying from other suppliers. - Historical delivery performance to production and manufacturing facilities in the area.		
Water Supply	10	NA
Desirable (Non-Exclusionary) Criteria: Groundwater or water from another source is readily available to provide ample water supply to the facility for both potable and process uses.		
ENVIRONMENTAL ACCEPTABILITY	**80**	
Site Characterization Surveys and Availability	**100**	
Essential (Go/No Go) Criteria): • Site is not within the 500-year flood plain.		NA – Go/No Go without scale
Desirable (Non-Exclusionary) Criteria): • **Existing surveys** – Existing quality surveys are available for:		100
- Hydrology - Meteorology (rain, wind, tornadoes, temperatures, etc.) - Topography - Archeology - Endangered species		80
• **Protected Species -** Site is not a habitat for federal listed threatened or endangered species.		80

Table 2.1-3 Screening Criteria (Subsequent to First Screening)

Criteria	Weight	Subcriteria (Weight)
• **Archeology/Cultural -** Low probability of archeological/cultural resources.		70
• **Environmental Justice -** Low probability of environmental justice issues.		90
• **Protected Properties -** Adjacent properties have no areas designated as protected for wildlife or vegetation that would be adversely affected by the facility.		20
• **NPDES Permits -** Waste water discharge permit (NPDES) readily achievable for projected discharge of the plant.		70
• **Air Permitting -** Air Permit/NESHAPS readily achievable for projected discharge of both a 3 million SWU and a 6 million SWU facility. (At this time, there is no intention to license, construct or operate a greater than 3 million SWU plant.)		70
• **Wetlands and Other Waters –** Few or no areas designated as wetlands. No requests for wetlands mitigation required.		70
• **Wind -** Low probability of high/excessive winds. Factors to consider include:		50
- Proximity of hurricane-prone zones - Annual frequency of wind gusts greater than 80 km/hr (50 mi/hr) exceeding 10 - Design wind speed (176-160 km/hr; 160-112 km/hr; <112 km/hr) (110-100 mi/hr, 100-70 mi/hr; <70 mi/hr) - Tornado frequency		
• **New Radiological Source -** New plant adds no additional radiological sources to the environment.		10
• **Fire -** Minimal risk from grass or forest fire events. Factors to consider include:		10
- Proximity of fuel sources - Drought conditions - Wind		
• **Ponding -** Natural site contours minimize potential of localized flooding or ponding Includes evaluation of:		80
- Stream beds - Natural and potential runoffs - Runoff from adjacent areas - Storm drainage systems in place - Requirements for retention ponds		
• **Slides -** No/low potential for rockslides, mudslides, or other debris flow.		50
Includes evaluation of: - Slopes on or near facility greater than 9.1 m (30 ft) in height or near vertical face (greater than 60%) with no protective ground cover. - Possibility of upstream failure of dams, lakes, or ponds.		
Land Not Contaminated Through Previous Use	**90**	
Essential (Go/No Go Criteria): • Site is not contaminated with radiological material in soil or groundwater to a level that would inhibit licensing or transfer of property with clear identification of liabilities.		NA – Go/No Go without scale
• Site is not identified as a CERCLA or RCRA site contaminated with hazardous wastes or materials.		NA – Go/No Go without scale
• Site does not have contamination that would require remediation prior to construction.		NA – Go/No Go without scale

Table 2.1-3 Screening Criteria (Subsequent to First Screening)

Criteria	Weight	Subcriteria (Weight)
Desirable (Non-Exclusionary) Criteria: • **Documentation -** Well documented site surveys and monitoring for radiological, chemical, and hazardous material contamination.		50
• **Neighboring Plume -** No facility in the area with existing release plume (air or water) of hazardous material or radiation release that includes site.		100
• **Future Migration** – Future migration of contamination from adjoining or nearby sites negligible.		80
Discharge Routes	**40**	
Desirable (Non-Exclusionary) Criteria: • **Facility Discharges -** Plant discharge and runoff controls are economically implemented for minimal affect to the existing environment.		100
• **Differentiation -** For sites with extant nuclear facilities, facility discharges are readily identifiable from extant facility discharges.		50
Proximity of Hazardous Operations/High Risk Facilities	**30**	
Desirable (Non-Exclusionary) Criteria: • **Hazardous Chemical Facility –** Distance from any facility storing, handling or processing large quantities of hazardous chemicals.		100
• **Propane Pipeline –** Distance from large propane pipeline.		100
• **Airport -** Site is not located within 16 km (10 mi) of commercial airport.		60
• **General Emergency Area -** Site should be outside the general emergency area for any nearby hazardous operations facility (other than extant nuclear related facility)		60
• **Air Quality -** Site should not be located near paper mill or other operating/manufacturing facility that inhibits site air quality. Site has high level of ambient air quality. No facility within 8 km (5 mi) of site has significant air discharge of material affecting quality. Terrain does not limit air dispersal. Community air quality is significantly within regulations at the present time.		30
Ease of Decommissioning	**20**	NA
Desirable (Non-Exclusionary) Criteria: • **Ease of Decommissioning -** Site characteristics (e.g., hydrology) do not negatively affect D&D activities.		
Adjacent Site's Medium/Long-Term Plans (e.g., construction, demolition, site restoration)	**10**	NA
Desirable (Non-Exclusionary) Criteria: • **Adjacent Site's Long-Term Plans -** Planned major construction activities in adjacent sites are minimal over the next 10 years. No heavy industrial activities planned within 1.6 km (1 mi) of the site boundary.		
SCHEDULE FOR COMMENCING OPERATIONS	**70**	
Political Support	**100**	
Essential (Go/No Go) Criteria: • Federal, State, and local government officials do not oppose the facility.		NA – Go/No Go without scale
Desirable (Non-Exclusionary) Criteria: • **Advocates -** Federal, State, and local officials are advocates for the facility.		100

Table 2.1-3 Screening Criteria (Subsequent to First Screening)

Criteria	Weight	Subcriteria (Weight)
• **Incentives -** Federal, State, and/or local governments offer tax breaks and/or other incentives for the construction and operation of the facility.		50
• **Road Improvements -** Road upgrades are financed by the Federal, State, and/or local governments.		10
• **Cooperation in Permitting –** Cooperation and assistance by Federal, State, and local government in obtaining necessary easements, leases, construction permits, operating permits, and disposition of low-level waste.		50
Public Support	**100**	
Desirable (Non-Exclusionary) Criteria: • **Community Support -** Majority of community merchants and citizens support the construction and operation of the facility in their locale.		90
• **Labor Support -** Local labor force supports the facility.		60
On or Near an Existing Nuclear Facility Desirable (Non-Exclusionary) Criteria: • **On or Near an Existing Nuclear Facility –** Located on or near a site with an existing or previous NRC license.	**80**	NA
Moderate Climate Desirable (Non-Exclusionary) Criteria: • Site construction delays due to weather conditions are minimal and average 15 days or less per year, considering: - Temperature (range and average) - Rainfall (total and frequency) - Ice/Sleet potential - Snowfall (total and accumulation)	**80**	NA
Availability of Construction Labor Force	**75**	
Desirable (Non-Essential) Criteria: • Sufficient Labor Force – Local area has sufficient skilled construction labor pool to construct the facility on desired schedule. Craft requirements include all major construction crafts (e.g., steelworkers, electricians, pipefitters, operators, finishers, etc.).		100
• Competing Projects - No major construction projects in the area competing for the labor pool resources that would significantly limit resource availability.		80
• Labor Support - If construction crafts at the site are provided by union personnel, commitment by labor union business agents to support the plant construction on a preferential basis. Willingness of unions to sign a Project Labor Agreement that is owner/client protective. • Craft Apprenticeship - Existing craft apprenticeship programs.		60 10
• Support for Travelers - If construction crafts at the site are provided by union personnel, union support for use of travelers for short-term assignments in areas of critical skill shortages.		30
OPERATIONAL EFFICIENCIES	**60**	
Availability of Skilled and Flexible Workforce for Plant Operations	**100**	
Desirable (Non-Exclusionary) Criteria: • **Sufficient Labor Pool -** Sufficient supply of qualified labor that can readily be trained for plant operations, maintenance, technical support, and waste management.		100

Table 2.1-3 Screening Criteria (Subsequent to First Screening)

Criteria	Weight	Subcriteria (Weight)
• **Technical School -** Community has technical school, technical/community college, or local nuclear facility that is willing to provide candidates and training classes for the plant operations.		50
• **Multi-task Employees -** Local labor rules do not prohibit or discourage multi-tasking of employees.		50
Extant Nuclear Site	**80**	
Desirable (Non-Exclusionary) Criteria: • **Supply Chain -** Supply chain integration and optimization by co-location with a fuel fabrication facility or a UF_6 production site.		90
• **Nuclear Infrastructure -** Existing nuclear infrastructure that can be used to support the project, including security facilities and systems, waste treatment/disposal facilities, contaminated material handling, emergency response resources and equipment, medical dispensary, etc., that might be shared.		100
• **Non-nuclear Infrastructure -** Existing non-nuclear infrastructure (e.g., dedicated water supply, water treatment facilities, steam facilities, etc.) that can be used for the new facility.		70
• **Technical resources -** Specialized technical resources that can be used on a limited basis.		40
Availability of Good Transport Routes (for centrifuge deliveries from Europe and UF_6 cylinder transportation)	**60**	
Desirable (Non-Exclusionary) Criteria: • **Rail -** Railhead located at the site.		10
• **Access to Highways -** Close proximity access to controlled access highways (parkways) and/or interstate highways.		100
• **Construction Traffic -** Traffic capacity for construction and operation activities with minimal improvements.		10
• **Transport Routes -** Optimal and efficient highway and/or rail for UF_6 feed suppliers (environmental impact, safety, costs, and security) to fuel fabricators (environmental impact, safety, costs, and security).		10
Disposal of Operational Low-Level Waste	**60**	NA
Desirable (Non-Exclusionary) Criteria: • **Disposal of Low-Level Waste –** Site-specific issues (e.g., availability/access to nearby facilities for disposal of low-level waste, transportation modes, etc.) do not impede disposal of low-level waste.		
Amenities for Workforce	**20**	
Desirable (Non-Exclusionary) Criteria: • **Housing and Recreation -** Housing, apartments, hotels, and lodging available for seconded workforce. Recreational facilities (entertainment, shopping, and restaurants) available in or near the area.		100
• **Culture** – Cultural activities available at or near the area.		50

Table 2.1-4 Scoring Summary

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
100	**Operational Requirements**										
		100	Acceptable Seismology/Geology								
				50	Liquefaction Potential	8	10	10	10	10	8
				100	Peak Ground Acceleration	7	10	10	10	10	10
				60	Surveys Available	7	5	10	7	5	7
				80	Karstification	0	10	10	0	10	8
				30	Rock Excavation	8	6	6	5	6	10
				50	Differential Settlement	5	8	8	10	8	5
				30	Allowable Bearing	5	8	8	10	8	7
		80	Size of Plot								
				100	Future Expansion	8	9	10	10	10	8
				80	Buffer Area	8	10	10	10	10	9
				90	Plant Layout	8	9	10	8	10	8
				40	Construction Laydown	10	10	10	10	10	10
				30	Borrow/Fill	10	10	10	10	10	7
		75	Redundant Electrical Power Supply								
				50	Transmission Feeders	10	7	10	10	10	7
				10	Govt. Cost Sharing	9	7	10	10	10	5
				60	Optimal Rate Structure	7	5	7	7	7	5
				100	Quality	10	5	10	10	10	10

Table 2.1-4 Scoring Summary

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
		10	Water Supply		Water Supply	10	9	8	10	7	9
80	**Environmental Acceptability**										
		100	Environmental Protection								
				100	Existing Surveys	3	0	7	9	4	7
				80	Protected Species	10	5	10	10	10	8
				70	Archeology/ Cultural	7	3	5	10	5	5
				90	Environmental Justice	9	7	7	10	7	10
				20	Protected Properties	7	10	10	5	10	9
				70	NPDES Permits	7	7	10	7	10	7
				70	Air Permitting	10	10	10	10	8	10
				70	Wetlands and Other Waters	10	5	10	9	8	2
				50	Wind	10	7	7	10	7	10
				10	New Radiological Hazard	0	0	7	0	6	10
				10	Fire	10	10	10	8	10	8
				80	Ponding	10	10	10	10	10	9
				50	Slides	10	10	10	10	10	10
		90	Land not Contaminated								
				50	Documentation	9	0	8	10	5	5
				100	Neighboring Plume	8	10	10	10	10	8
				80	Future Migration	9.5	10	10	10	10	9
		40	Discharge Routes								

Table 2.1-4 Scoring Summary

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
				100	Facility Discharges	9	8	10	9	10	5
				50	Differentiation	10	10	10	10	10	7
		30	Proximity of Hazardous Operations								
				100	Hazardous Chemical Facility	10	5	7	10	5	10
				100	Propane Pipeline	10	10	10	10	10	10
				60	Airport	10	10	10	10	10	10
				60	General Emergency Area	10	10	10	10	10	10
				30	Air Quality	10	5	7	10	5	10
		20	Ease of Decommissioning		Ease of Decommissioning	10	10	10	10	10	9
		10	Adjacent Sites' Long-Term Plans		Adjacent Sites' Long-Term Plans	9	10	10	8	8	5
70	**Schedule for Commencing Operations**										
		100	Political Support								
				100	Advocates	9	10	10	0	10	6
				50	Incentives	8	9	10	2	10	8
				10	Road Improvements	10	10	10	10	10	8
				50	Cooperation in Permitting	9	8	8	0	10	6
		100	Public Support								
				90	Community Support	9	9	9	2	9	8
				60	Labor Supports	9	9	9	9	9	9

Table 2.1-4 Scoring Summary

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
		80	On or Near Existing Nuclear Facility		On or Near Existing Nuclear Facility	7	0	0	10	5	10
		80	Moderate Climate		Moderate Climate	7	9	9	6	9	5
		75	Construction Labor Force								
				100	Sufficient Labor Force	9	7	7	9	7	9
				80	Competing Projects	10	10	10	10	10	8
				60	Labor Support	9	5	5[a]	9	5[a]	9
				10	Craft Apprenticeship	5	5	5[a]	5	5[a]	8
				30	Support for Travelers	10	10	10	10	10	8
60	**Operational Efficiencies**										
		100	Workforce for Plant Operations								
				100	Sufficient Labor Pool	9	8	8	9	8	10
				50	Technical School	9	10	10	9	8	10
				50	Multi-task Employees	9	5	5	9	5	5
		80	Extant Nuclear Site								
				90	Supply Chain	0	0	0	0	0	0
				100	Nuclear Infrastructure	0	0	8	0	5	3
				70	Non-nuclear Infrastructure	5	5	5	5	5	5

Table 2.1-4 Scoring Summary

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
				40	Technical Resources	5	5	5	5	5	5
		60	Good Transport Routes								
				10	Rail	9	10	4	0	10	10
				100	Access to Highways	10	10	9	9	10	9
				10	Construction Traffic	10	10	10	7	10	8
				10	Transport Routes	9.5	2	2	10	2	8
		60	Disposal of Low-Level Waste		Disposal of Low-Level Waste	4	6	6	4	6	5

[a] The established rule for the decision-making analysis was to score a site a “5” if data were not available for evaluation.

2.1.5 Section 2.2 Figures

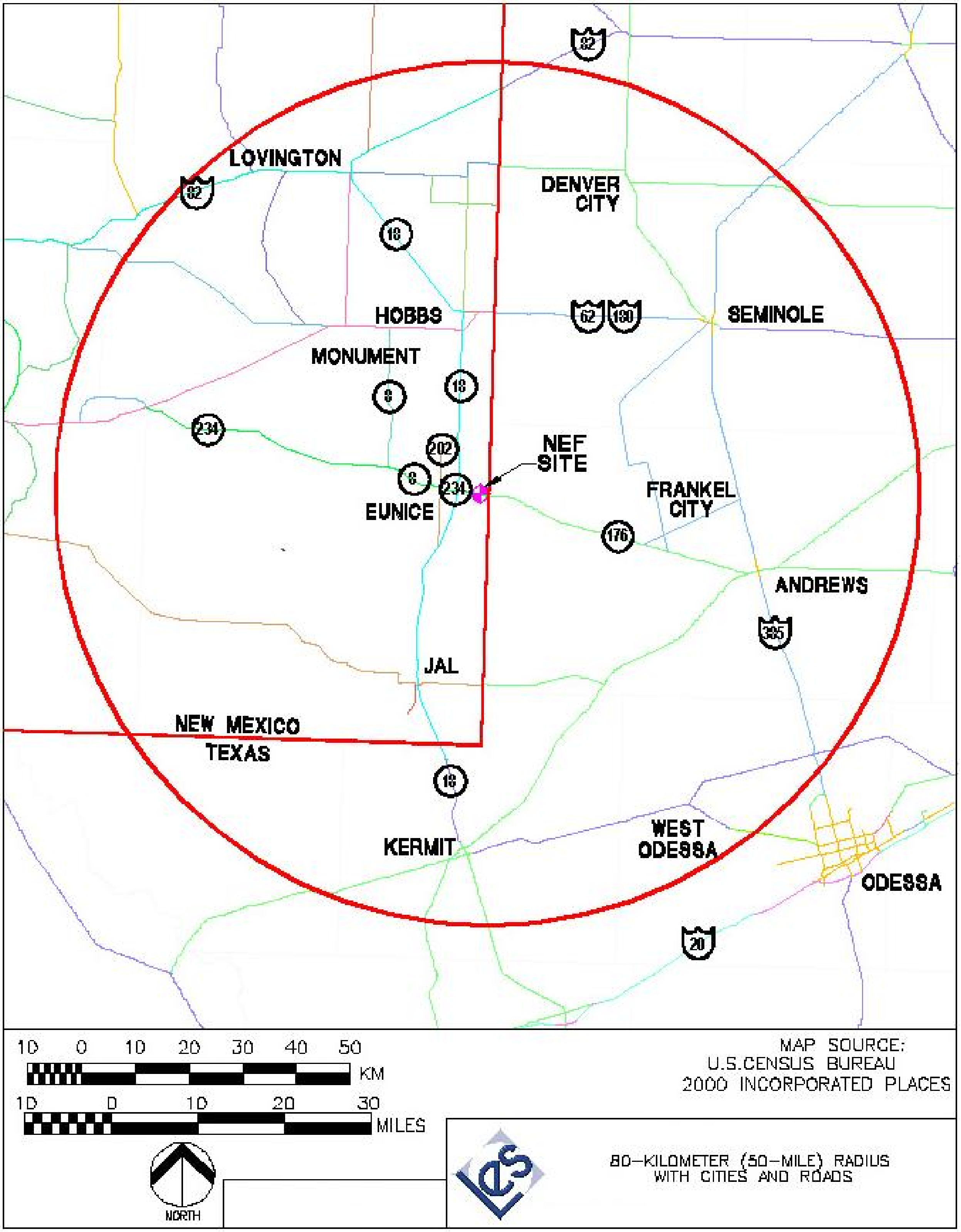


Figure 2.1-1 80-Kilometer (50-Mile) Radius With Cities and Roads

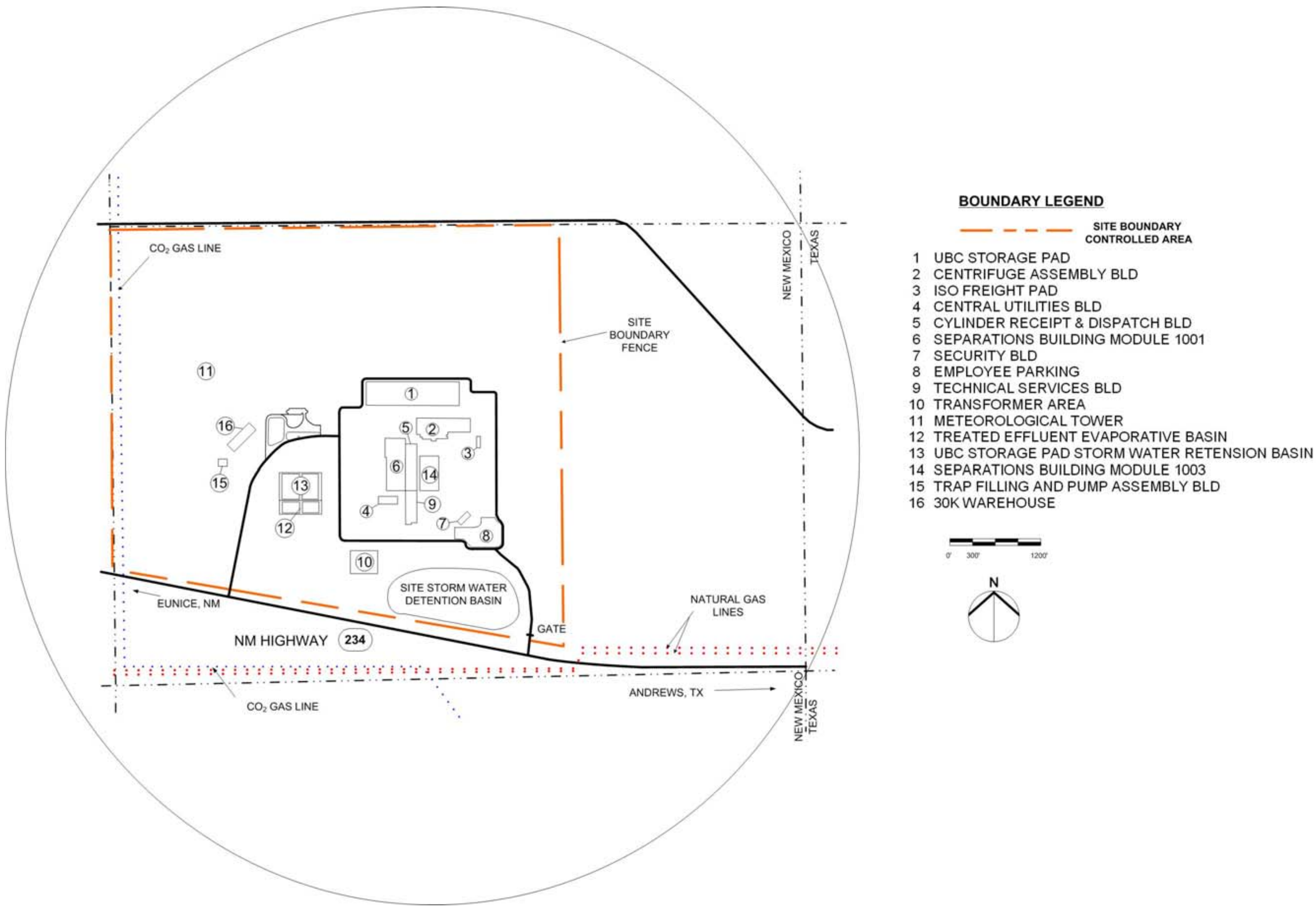


Figure 2.1-2 Site Area and Facility Layout Map 1.6-Kilometer (1-Mile Radius)

Figure 2.1-3 Existing Conditions Site Aerial Photograph

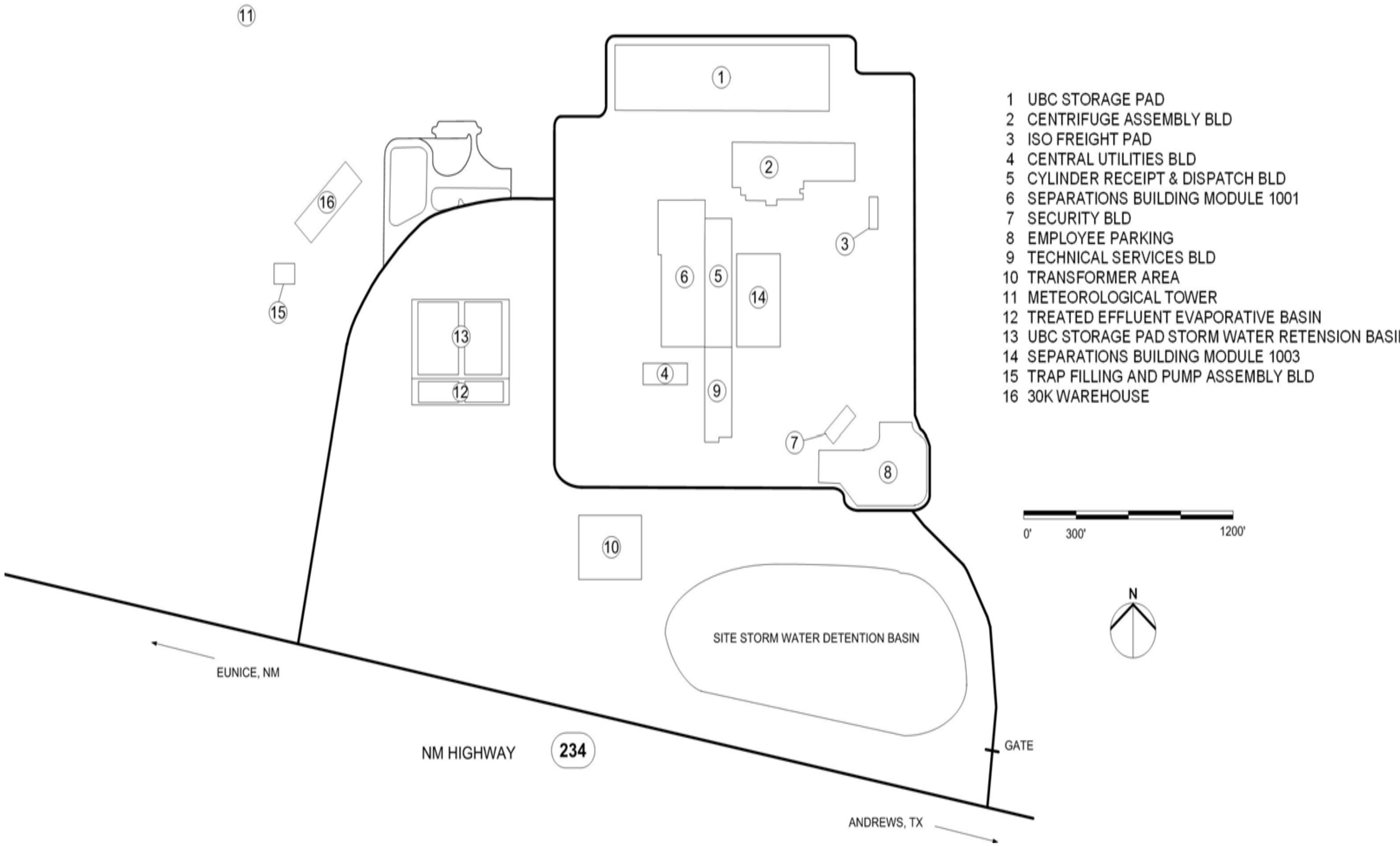


Figure 2.1-4 NEF Buildings

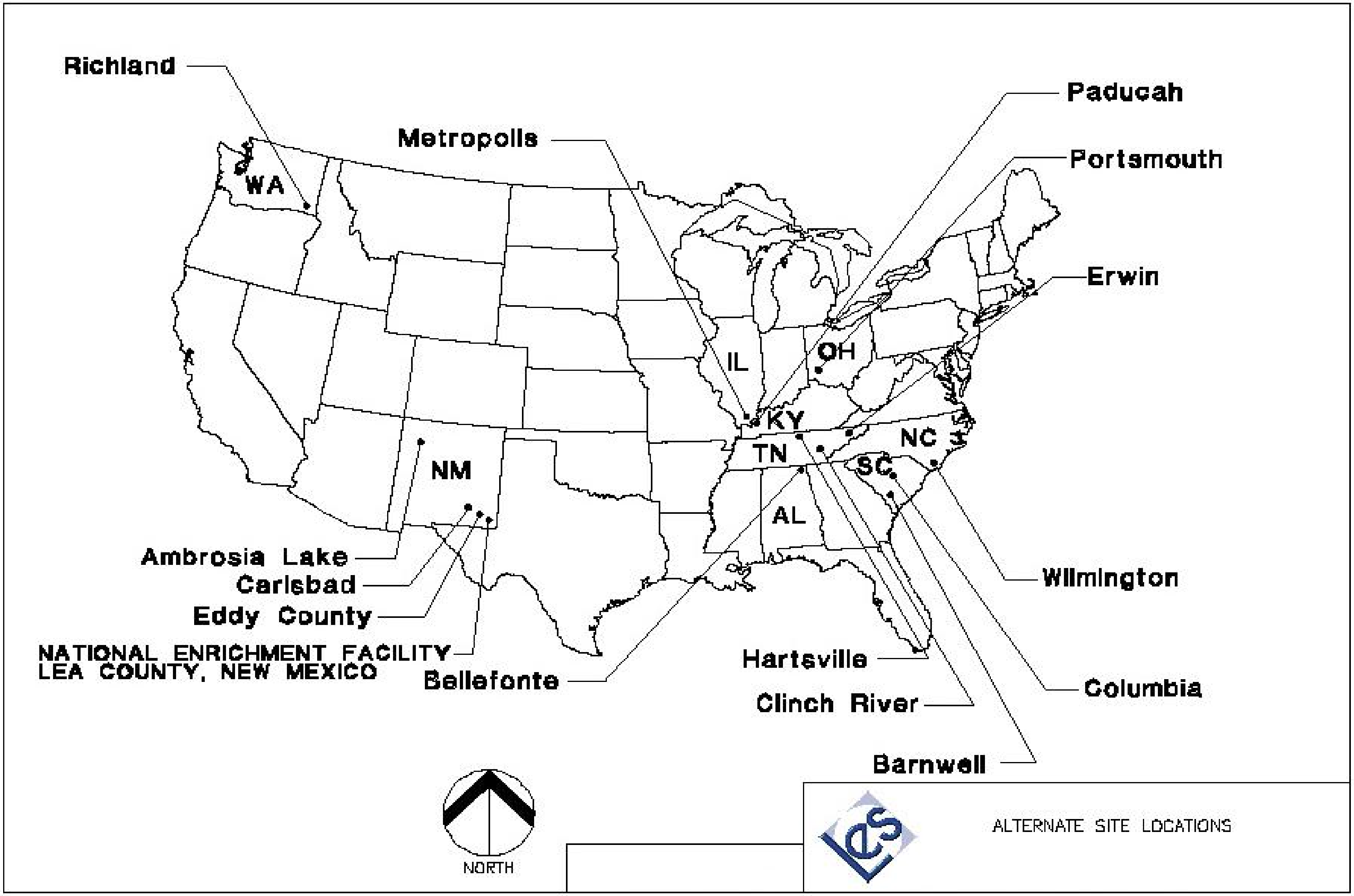
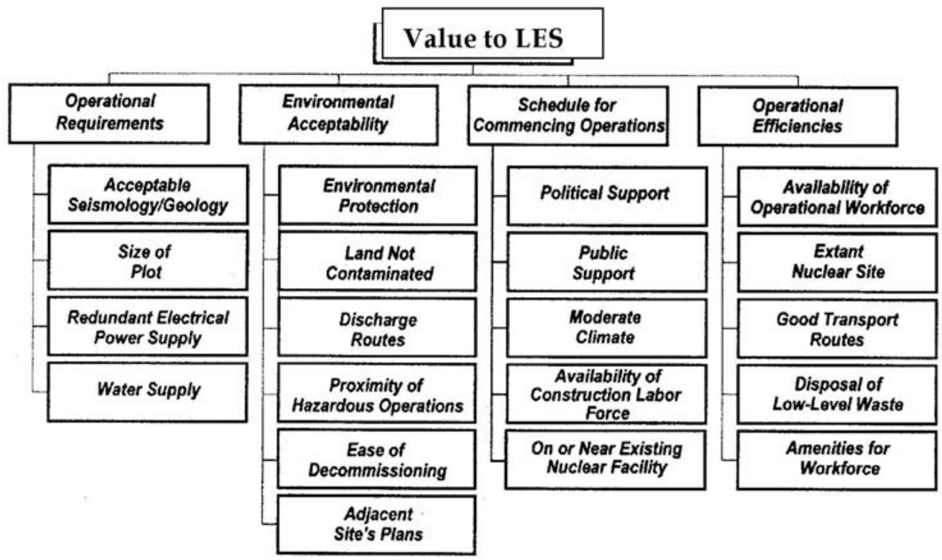


Figure 2.1-5 Alternate Site Locations



The value hierarchy represents objectives that create value for URENCO. They are defined and organized according to the principles of Multi-Attribute Utility Analysis, with performance metrics for each alternative.

VALUE OF HIERARCHY FOR SITE SELECTION

Figure 2.1-6 Value of Hierarchy For Site Selection

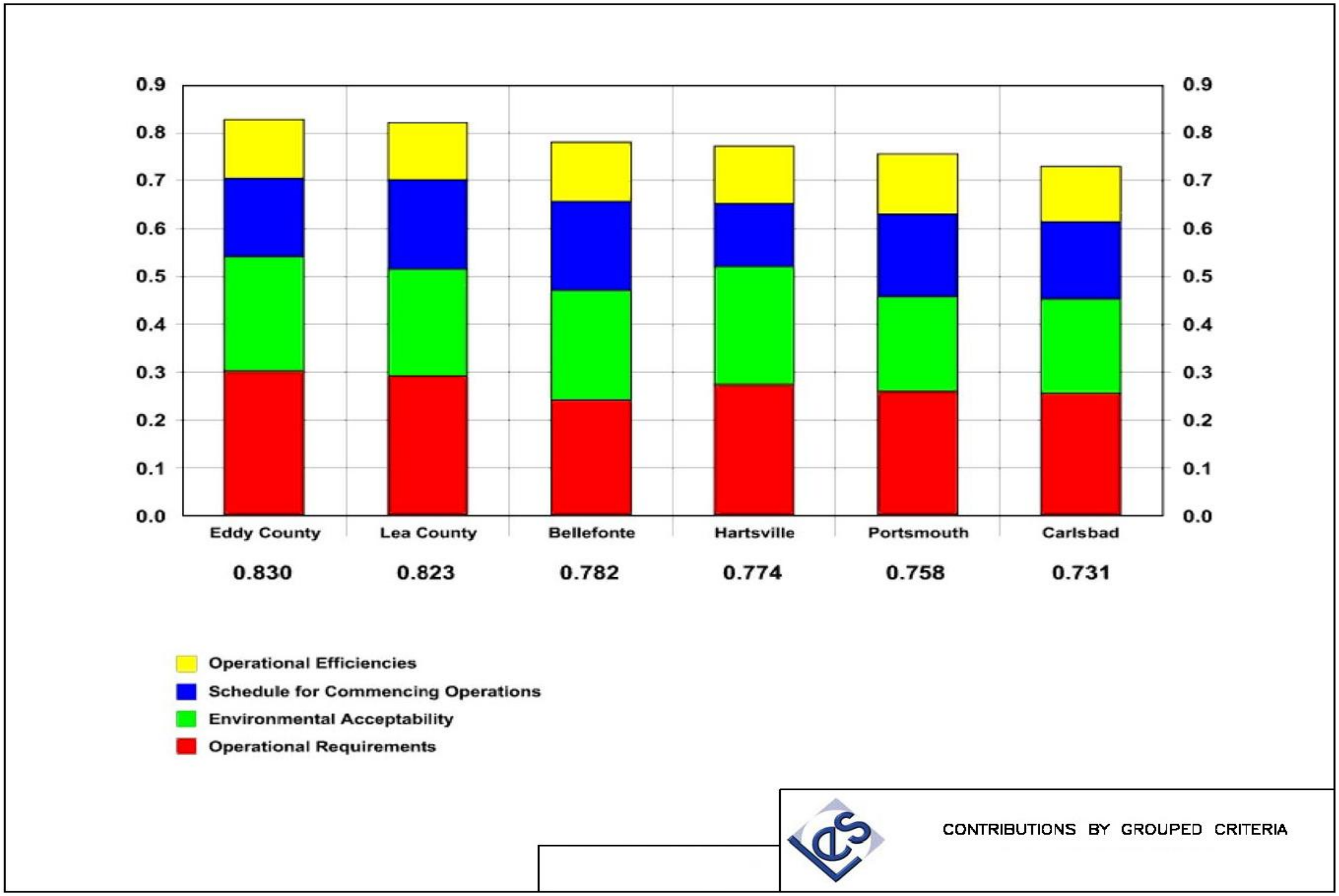


Figure 2.1-7 Contributions by Grouped Criteria

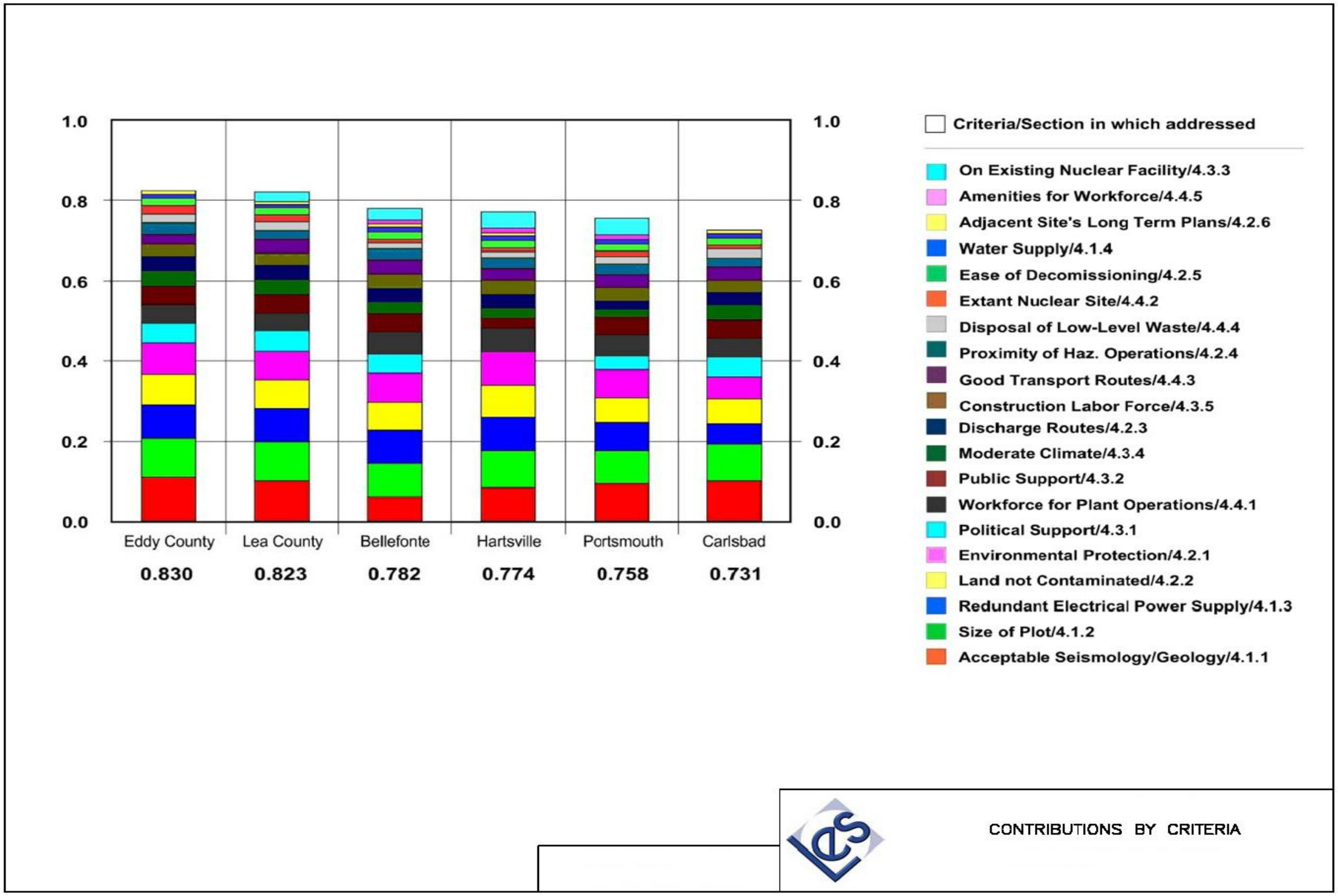


Figure 2.1-8 Contributions By Criteria

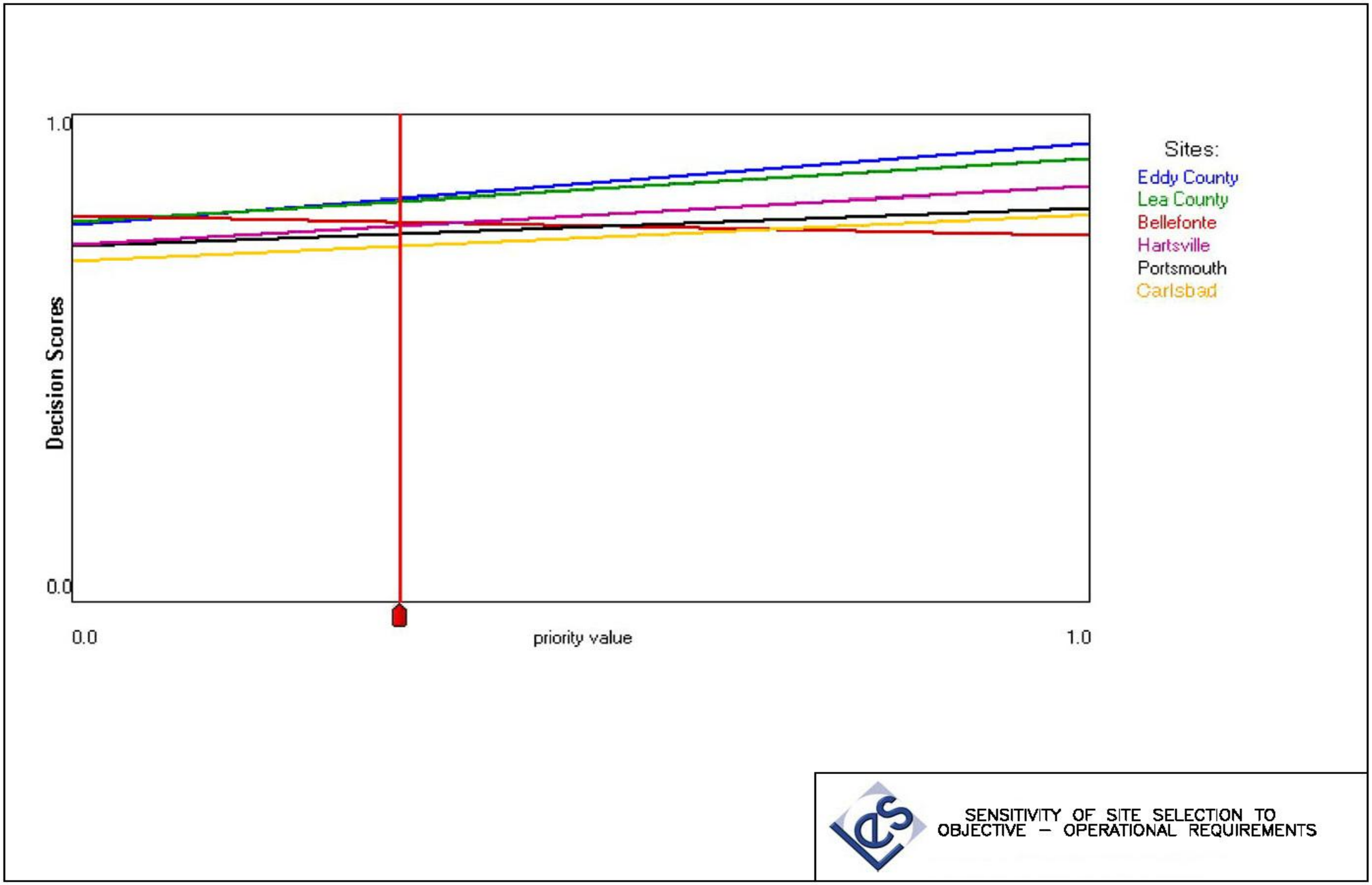


Figure 2.1-9 Sensitivity of Site Selection to Objective – Operational Requirements

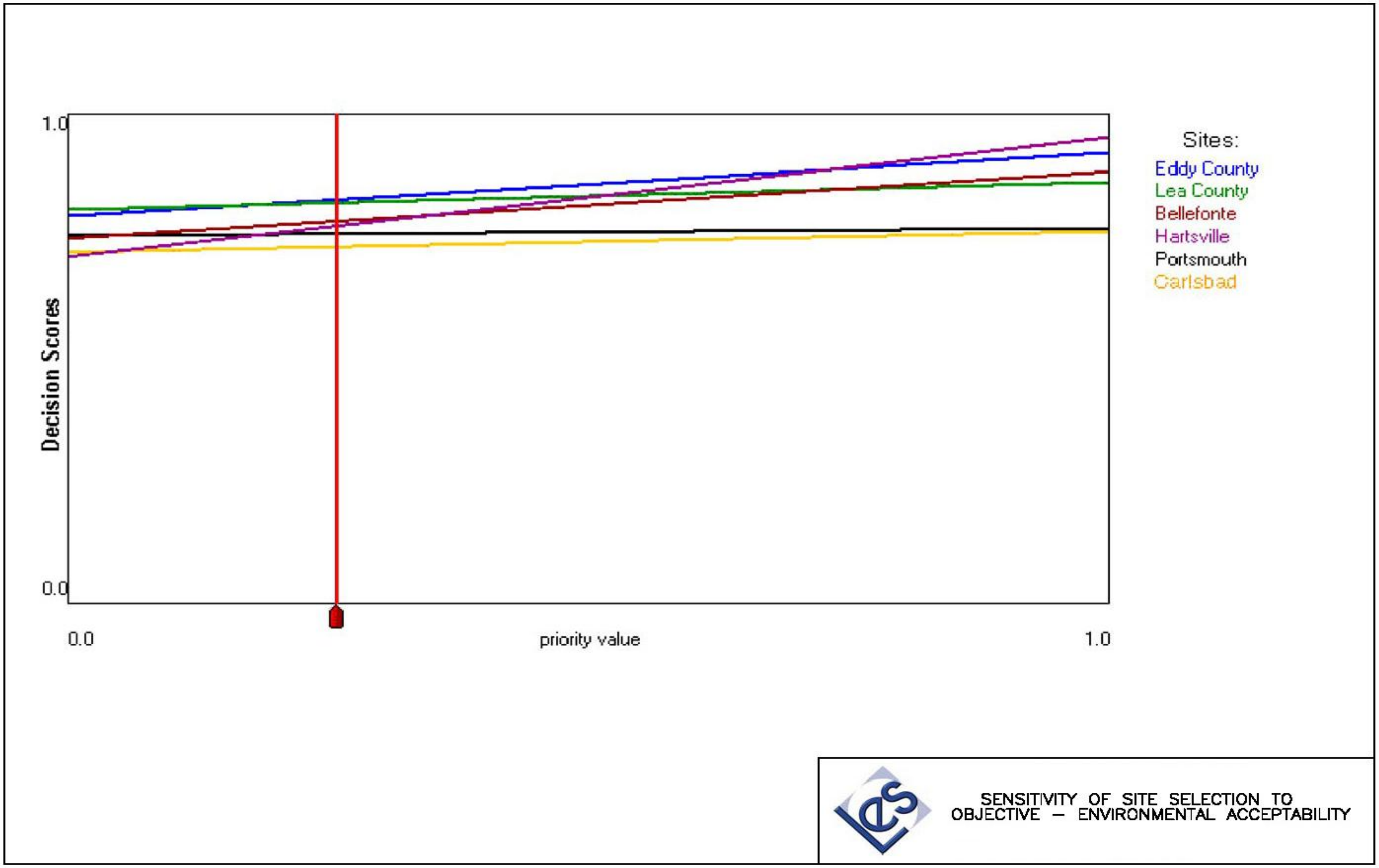


Figure 2.1-10 Sensitivity of Site Selection to Objective – Environmental Acceptability

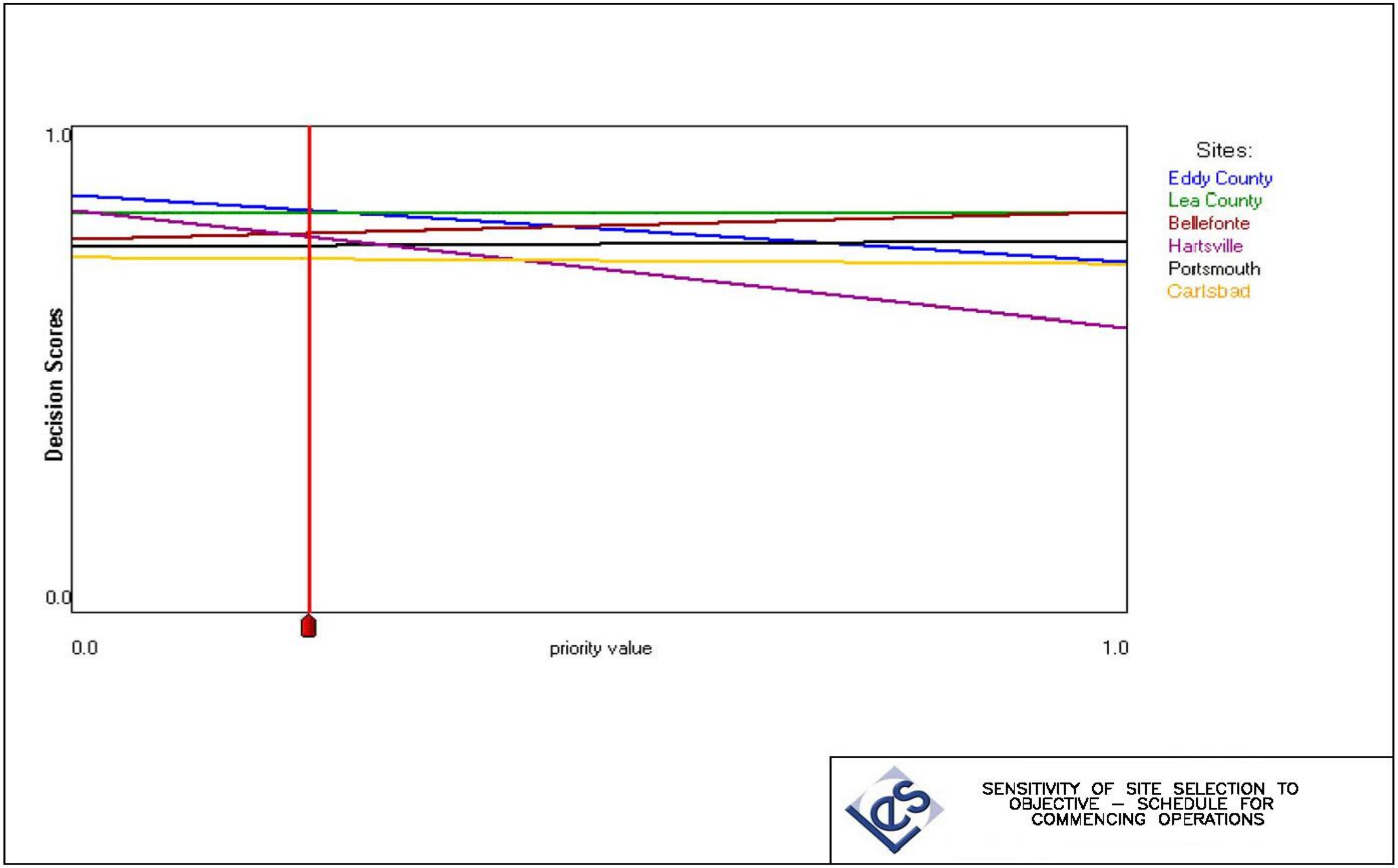


Figure 2.1-11 Sensitivity of Site Selection to Objective – Schedule for Commencing Operations

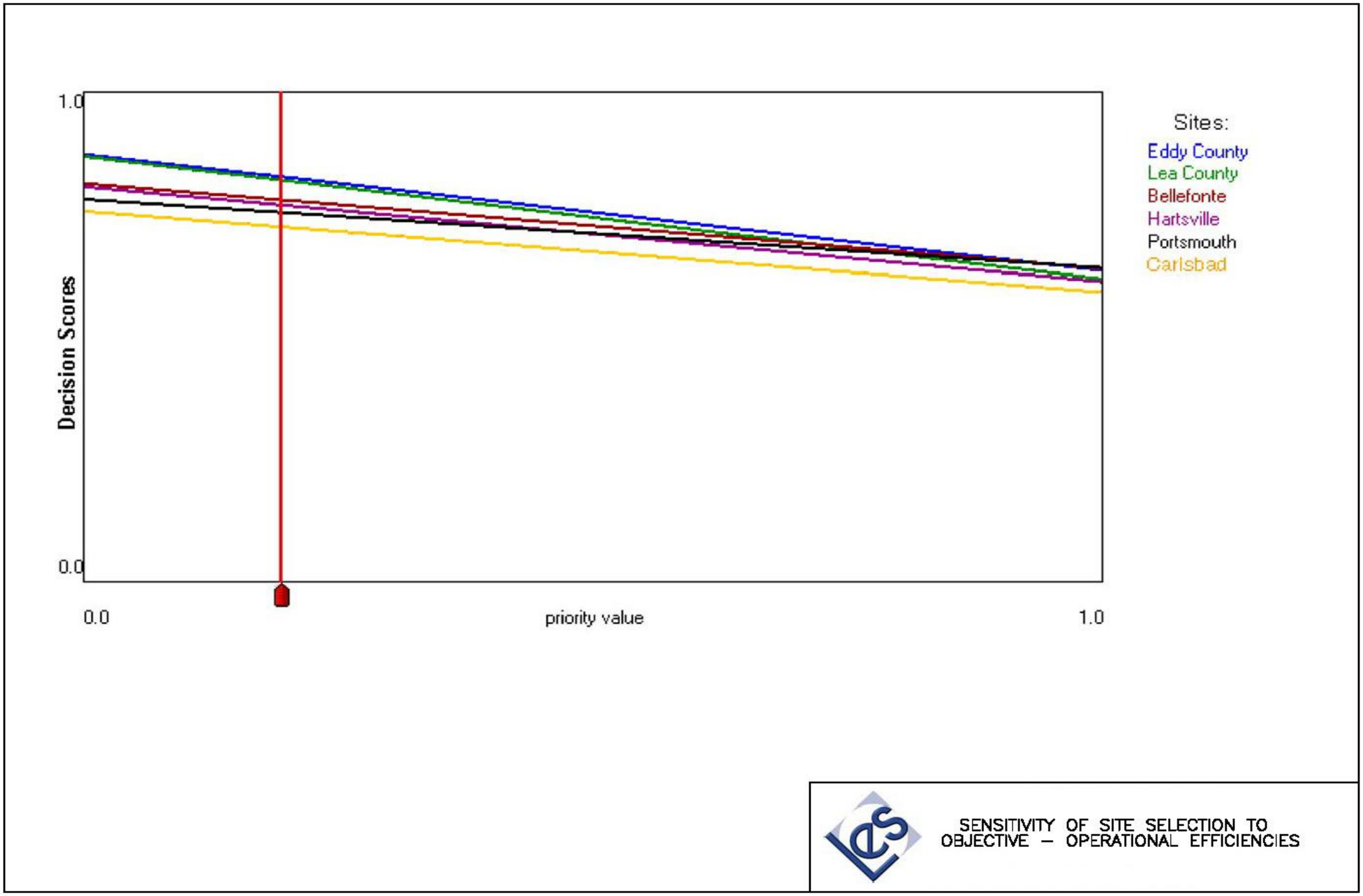


Figure 2.1-12 Sensitivity of Site Selection to Objective – Operational Efficiencies

2.2 ALTERNATIVES CONSIDERED BUT ELIMINATED

As set forth in ER Section 1.1, Purpose and Need for the Proposed Action, LES considered primary alternatives to the proposed action, i.e., alternatives to the construction and operation of the NEF. These alternatives include alternative sources of low-enriched uranium (LEU) currently available and potentially available to US nuclear utilities in the future, such as the future deployment of a gaseous centrifuge plant by USEC; expansion by Urenco of its centrifuge capability in Europe; increased sales of HEU-derived LEU under the US-Russia HEU Agreement; and increased availability of LEU derived from US-owned HEU. The alternatives considered do not meet the underlying need for the proposed NEF, which is to provide additional reliable and economical uranium enrichment capacity in the United States, in accordance with US energy and security policy objectives. The alternatives considered similarly fail to meet the important related commercial objectives of enhancing security of supply and eliminating dependence on a single domestic enricher. Additionally, various combinations of technical, economic, and political uncertainties associated with the alternatives identified in ER Section 1.1.2 warrant their elimination from further consideration in this ER. However, for completeness, the environmental impacts of several of the alternatives are compared to those of the proposed action in ER Section 2.4, Comparison of the Affected Environment.

LES also considered various secondary alternatives to the proposed action. These include alternative enrichment technologies, design alternatives, and alternative sites.

With respect to alternative technologies, LES considered the gaseous diffusion technology as an alternative method for enriching uranium, in so far as it is the only presently commercially viable process that allows for enrichment of uranium on the scale sought by LES for the proposed NEF. LES concluded that the gas centrifuge process is superior because the production of the same amount of separative work units (SWU) by the gaseous diffusion process requires approximately 50 times more electricity. Indeed, as evidenced by its Lead Cascade Project, USEC intends to replace its use of the gas diffusion technology with the use of a gas centrifuge technology.

With respect to alternative designs, LES considered six system design changes from the Claiborne Enrichment Center to the NEF that would reduce the impact to the environment. The systems changed to improve plant efficiency and reduce environmental impact include the Cascade System, Feed System, Product Take-Off System, Product Liquid Sampling System, Product Liquid Sampling System, Product Blending System, and Tails Take-Off System. Beyond minor changes, there are no other significant design alternatives that could lower the impact of the NEF on the environment.

With respect to alternative sites, six sites passed the first phase Go/No Go criteria (see ER Section 2.1.3.3). Eddy County and Lea County scored the highest (first and second, respectively) followed by Bellefonte third and Hartsville fourth, with Portsmouth and Carlsbad scoring fifth and sixth, respectively. Although the Eddy County Site scored highest, it is to be noted that the Eddy County Site is currently owned by the U. S. Bureau of Land Management (BLM), not by Eddy County or the City of Carlsbad. The Carlsbad Field Office of the BLM has stated that they will work hard to complete the National Environmental Policy Act (NEPA) process for transferring (or swapping) the land within 9 to 12 months, but they cannot guarantee the outcome of the NEPA process. There is a potential that the subject site may not be available for siting the new enrichment plant.

2.3 CUMULATIVE EFFECTS

Cumulative impacts are those impacts that result from the incremental impact of an action added to other past, present, and reasonably foreseeable actions in the future. In conducting this analysis, LES considered past, current and potential facilities and activities that could have some potential for cumulative impacts.

The anticipated cumulative impacts of the proposed operation of NEF are expected to be inconsequential, thus any incremental accumulative impacts caused by NEF should also be inconsequential. Development as an enrichment facility would also avoid impacts to other more environmentally sensitive sites.

There are several local County and private activities in geographic proximity that could potentially combine with the NEF operations to produce a larger impact than the NEF alone. These facilities are: 1) the Waste Control Specialist, LLC facility that is 1.6 km (1.0 mi) due east from NEF; 2) the Wallach Concrete, Inc. quarry that is located just north of NEF; 3) the Lea County landfill which is across New Mexico Highway 234, approximately 1.6 km (1 mi) south; the Sundance Industries “produced water” treatment facility collocated with the Wallach quarry; and 5) the oil and gas industries that are pervasive throughout southeastern New Mexico. A summary assessment of the potential for cumulative impacts is shown in Table 2.3-1, Potential Cumulative Effects for the NEF.

The potential local cumulative effects with the greatest likelihood of occurring are: decrements in air quality (increases in Total Suspended Particulate (TSP)) from combined WCS, Lea County landfill and TSP releases that can occur during NEF construction; increased environmental noise levels from the Lea County landfill and Wallach Concrete, Inc. quarry operations combined with NEF construction; and small increases in the environmental radiation public dose and radiological waste inventories should WCS seek and obtain a low-level radiation waste burial site (10 CFR 61) license (CFR, 2003r). The former two cumulative impacts are transient and will potentially exist only during the 8-year NEF construction period. The latter cumulative effect is speculative since it is unknown at this time if WCS will apply for or be granted a 10 CFR 61 license. Even if these cumulative impacts come to fruition, the cumulative impacts will be limited by regulatory limits and/or the lack of general public receptors residing near these facilities.

A fourth potential cumulative effect is that from the DOE Waste Isolation Pilot Plant (WIPP), located approximately 80 km (50 mi) west of the NEF. The WIPP facility is storing transuranic wastes. Since these wastes are drastically different in composition and activity levels, approximately 80 km (50 mi) away, as well as the WIPP wastes being stored in deep underground salt mine shafts, it is not plausible that a cumulative effect would occur between WIPP and the NEF.

The only other non-local cumulative impact is the cumulative dose to the general public from transportation of UF_6 as feed, product or depleted material and solid waste. Also, there is a dose to the onlooker, worker and driver. LES calculations (see Section 4.2.7, Radioactive Material Transportation) have showed the “worst-case” cumulative dose from all transport material categories combined to have minimal impact. Dose equivalent to the general public from the “worst case”, for instance, equalled 2.33×10^{-6} person-Sv/year (2.33×10^{-4} person-rem/year). Similarly, the dose equivalent to the onlooker, drivers and workers totaled 1.05×10^{-3}, 9.49×10^{-2}, 6.98×10^{-4} person-Sv/year (1.05×10^{-1}, 9.49 and 6.98×10^{-2} person-rem/year), respectively.

The sum total of all local and non-local cumulative impacts and effects are expected to be insignificant or very minor when compared to the established federal, state and local regulatory limits. Negative cumulative effects will be balanced by positive cumulative effects, such as the expansion of job opportunities that will diversify the employment opportunities and expand the local tax base and revenues.

2.3.1 Section 2.3 Tables

Table 2.3-1Potential Cumulative Effects for the NEF

ER Section Reference	Effect on:	NEF Effect	Cumulative Effects
4.1	Land Use	Insignificant	None, based on current and expected future activities. NEF is compatible with current land usage
4.2	Transportation	Minor, 1,500 radiological and 2,800 non-radiological additional heavy truck shipments per year	Cumulative effect will not be noticeable on the highway to the site because of existing traffic volume and mix
4.3	Geology & Soils	Minimal	None
4.4	Water Resources	Minor and not likely to affect water resources. Site groundwater will not be used	Not expected due to depth of groundwater and lack of surface waters.
4.5	Ecological	Minimal	None, no local habitats for RTE species
4.6	Air Quality	Minimal. Increased TSP emissions during construction	Potentially minor cumulative TSP effects when combined with WCS and Lea County landfill operations
4.7	Noise	Not significant. Increased noise levels during construction, but few nearby receptors	Potentially minor cumulative environmental noise effects when combined with WCS and Lea County landfill operations
4.8	Historic and Cultural	Minor negative effects that can be avoided or mitigated	No measurable change since effects are confined to onsite
4.9	Visual/Scenic Resources	Generally positive because of natural landscaping. None out of character with existing features.	Not significant since positive effects are confined to onsite
4.10	Socioeconomic	Positive	Cumulative effects will be positive when combined with other local industries and increase job opportunities, income and tax revenues.
4.11	Environmental Justice	No disproportionate impact or effect.	None
4.12	Public & Occupational Health	Increased environmental radiation exposure that are below limits.	Potentially minor cumulative environmental radiation levels should WCS obtain a 10 CFR 61 license
4.13	Waste Management	Minimal. Minor increased quantities of hazardous and radiological wastes	Potentially minor cumulative waste effects (total local inventory) should WCS obtain a 10 CFR 61 license. Unlikely that any cumulative effect would result from the WIPP facility.

2.4 COMPARISON OF THE PREDICTED ENVIRONMENTAL IMPACTS

As noted in ER Section 1.1.2, there are various scenarios if the NEF is not built, i.e., the no-action alternative scenarios. However, only three of the eight scenarios discussed are relevant when comparing domestic environmental impacts (B, C and D). The other scenarios (A, E, F, G, and H) are irrelevant when comparing domestic environmental impacts because they either include the proposed action (A) or require an analysis of environmental impacts in Europe (E, F and G), which is outside of the scope required to be considered in the National Environmental Policy Act, or is a scenario that must be recognized as being highly speculative (H). The anticipated affect to the environment for these no-action alternative scenarios, Scenarios B, C, and D, are described below.

Table 2.4-1, Comparison of Potential Impacts for the Proposed Action and the No-Action Alternative Scenarios, summarizes the potential impacts of each scenario and compares them against the proposed action in terms of domestic capacity and supply. It also lists the summary of individual environmental categories used in Chapter 4, Environmental Impacts.

Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios, compares each scenario against the proposed action for Chapter 4 environmental categories in relative terms, i.e., impacts are the same, greater than, or less than those anticipated for the proposed action. Chapter 4 contains the detailed description of potential impacts of the proposed action on individual resources of the affected environment.

Proposed Action

Under the proposed action, LES deploys a 3 million SWU/yr centrifuge enrichment plant (NEF), and USEC deploys a 3.5 million SWU/yr centrifuge enrichment plant. USEC is assumed to cease enrichment production at the Paducah Gaseous Diffusion Plant (GDP) when the centrifuge plant comes on line.

Scenario B – No NEF; USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP

Under this scenario, there is a 3 million SWU per year supply deficit, but is made up by USEC, operating a 3.5 million SWU per year centrifuge enrichment plant and continuing to operate the Paducah GDP at 3 million SWU per year or less. This would, however, have a significant negative impact on operational efficiencies at the Paducah GDP. It would also continue to have negative environmental impacts due to the high energy costs of operating the Paducah GDP and the related air quality impacts from operating the coal-fired electric power stations that supply the required electrical needs of the plant.

While providing for indigenous US supply, the resulting concerns associated with the age of the Paducah GDP, its significant requirements for electric power, the low level at which it would have to be operated, and the lack of multiple competitive sources of indigenous US supply, would not alleviate concerns among US purchasers of enrichment services regarding either long-term security of supply or reasonable economics. Scenario B is not viewed by LES as an attractive long-term solution.

Scenario C – No NEF; USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability

Under this scenario, there is a 3 million SWU per year supply deficit for which other sources of supply must compensate. This supply capability is made up by USEC, who would proceed to build and operate a 3.5 million SWU per year centrifuge enrichment plant, continue to operate the Paducah GDP on an interim basis longer than currently planned, and then rapidly increase its centrifuge enrichment plant capability to 6.5 million SWU per year. Negative environmental impacts would continue for a limited time with the operation of the Paducah GDP, as in Scenario B.

Scenario C provides for indigenous US supply. However, there are concerns that neither the performance nor economics of the updated version of the DOE centrifuge technology that USEC is planning to use have been successfully demonstrated at a commercial level nor will the outcome be known for a number of years. There also would remain an ongoing absence of multiple competitive sources of indigenous US supply. Accordingly, this may not alleviate concerns among US purchasers of enrichment services regarding either long-term security of supply or reasonable economics. Given the dependence on a single yet to be proven technology and the ongoing presence of a single indigenous US enricher, Scenario C is not viewed by LES as the most advantageous long-term solution.

Scenario D – No NEF; USEC Does Not Deploy Centrifuge Plant and Operates Paducah GDP at Increased Capacity

Under this scenario, there is a 6.5 million SWU per year supply deficit for which other sources of supply must compensate. USEC would then continue to operate the Paducah GDP at 6.5 million SWU per year. Given the unfavorable economics of continued GDP operation, this would be viewed as having a high economic cost associated with it and continued negative environmental impacts.

At some point in time, it is reasonable to assume that the Paducah GDP must ultimately be replaced. Accordingly, Scenario D does not represent a permanent solution, but only a postponement of the time when new uranium enrichment capacity must be constructed in the US. The cost of such a postponement is likely to be high and the risk of supply disruption in the US would increase as the Paducah GDP continues to age. While providing for indigenous US supply, the resulting concerns associated with the age of the Paducah GDP, its significant electric power requirements, and the lack of multiple competitive sources of indigenous US supply, would not alleviate concerns among US purchasers of enrichment services regarding either long term security of supply or reasonable economics. Scenario D is not viewed by LES as a viable long-term solution.

Summary

Not building the NEF could have the following consequences:

- A uranium enrichment supply deficit for which other sources of supply must compensate.
- Continued operation of an aging technology at a high-cost, electric power intensive facility, the Paducah GDP, or new technologies that have a larger production capacity, but concentrated in one location.
- Foster the continuation of a single, indigenous supplier, thereby eliminating competition.
- Diminish the objective of long-term security of supply.

Accordingly, LES considers that the NEF would be a complementary and competitive supplier for uranium enrichment service and would provide a means to offset both foreign enrichment supplies and the more energy-intensive production from the only US gaseous diffusion plant, with lesser environmental impacts.

While the no-action alternative scenarios would avoid any impacts to Lea County, New Mexico and Andrews County, Texas areas due to construction and operation of the NEF, it would lead to impacts at other locations. If the proposed NEF is not built, there will be a continued and increasing need for uranium enrichment services. The no-action alternative scenarios, as discussed above, would allow for at least three domestic options in regard to continued uranium enrichment supply, Scenarios B, C and D.

As summarized in Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios, the affects to the environment of all no-action alternative scenarios are anticipated to be greater than the proposed action in both the short and long term. There are potentially lesser impacts, in some environmental categories, but this is based on an unproven commercially demonstrated technology. In addition, the important objective of security of supply is delayed. Hence, it is reasonable to reject the no-action alternative scenarios because the affect to the environment from the proposed action is minimal, as demonstrated in ER Chapter 4, Environmental Impacts, and the benefits desirable, as demonstrated in ER Chapter 7, Cost-Benefit Analysis.

2.4.1 Section 2.4 Tables

Table 2.4-1 Comparison Of Potential Impacts For The Proposed Action And The No-Action Alternative Scenarios

		Alternative Scenarios		
Potential Impact	**Proposed Action[1]**	**B No NEF, USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP**	**C No NEF, USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability**	**D No NEF, USEC Does Not Deploy Centrifuge Plant and Operates Paducah GDP at Increased Capacity**
Domestic Capacity	Provides 3 million SWU/yr supply (NEF only)	3 million SWU/yr deficit; make up from continued operation of Paducah GDP at 3 million SWU/yr	3 million SWU/yr deficit; make up by USEC building gaseous centrifuge plant (GCP), operating Paducah on interim basis longer than planned, and then rapidly increasing GCP capability to 6.5 million SWU/yr	6.5 million SWU/yr deficit; make up from continued operation of Paducah GDP at 6.5 million SWU/yr
Domestic Supply	Fosters competition; two suppliers; secures long-term supply; reduces security of supply concerns by providing replacement supply for inefficient and noncompetitive gaseous diffusion enrichment plants	One supplier only; does not alleviate security of supply; unproven commercially demonstrated technology; reliance on aging high-cost, inefficient GDP technology	One supplier only; does not alleviate security of supply; unproven commercially demonstrated technology	One supplier only; not permanent, only maintains status quo; does not alleviate security of supply concerns because of reliance on aging, high-cost, inefficient GDP technology
Summary of Environmental Impacts (see Table 2.4-2 for list of categories)	Total Scoring[2]: 0	Total Scoring[2]: -4	Total Scoring[2]: -5 to -2	Total Scoring[2]: -7

[1]Proposed action assumes both LES and USEC deploy centrifuge plants and GDP is shutdown when USEC centrifuge plant comes on line. The proposed action receives a neutral score of zero (i.e., baseline impact on the environment).

[2]Scoring Methodology (all Alternative Scenarios compared against Proposed Action). Positive score means less impacts on the environment than proposed action. Negative score means greater impacts on the environment than proposed action.

Table 2.4-2Comparison of Environmental Impacts For The Proposed Action And The No-Action Alternative Scenarios

		Alternative Scenarios[1,3]		
Environmental Category	**Proposed Action[2]**	**BNo NEF, USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP**	**CNo NEF, USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability**	**DNo NEF, USEC Does Not Deploy Centrifuge Plant and Operates Paducah GDP at Increased Capacity**
Land Use	Minimal for NEF (see ER Section 4.1)	Less impact since only one of two gas centrifuge plants (GCPs) are built Scoring: +1	Same impact if undisturbed land, less impact if already disturbed land Scoring: 0 or +1 (use +0.5)	Less impact Scoring: +1
Transportation	Minimal for NEF (see ER Section 4.2)	Greater impact if at Paducah because concentrating shipments at one location or same impact if at other location Scoring: -1 or 0 (use -0.5)	Greater impact because concentrating shipments at one location Scoring: -1	Greater impact because concentrating shipments at one location Scoring: -1
Geology and Soils	Minimal for NEF (see ER Section 4.3)	Less impact since only one of two GCPs are built Scoring: +1	Same impact if undisturbed land, less impact if already disturbed land Scoring: 0 or +1 (use +0.5)	Less impact Scoring: +1
Water Resources	Minimal for NEF; low water use (see ER Section 4.4)	Greater impact because of greater water use by GDP and high water use to meet GDP electricity needs Scoring: -1	Greater impact for short term because of greater water use by GDP and high water use to meet GDP electricity needs; same or greater impact for the long term Scoring: -1 or -0.5	Significantly greater impact than Alternative Scenario B because of increased GDP capacity Scoring: -1.5

Table 2.4-2Comparison of Environmental Impacts For The Proposed Action And The No-Action Alternative Scenarios

		Alternative Scenarios[1,3]		
Environmental Category	**Proposed Action[2]**	**BNo NEF, USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP**	**CNo NEF, USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability**	**DNo NEF, USEC Does Not Deploy Centrifuge Plant and Operates Paducah GDP at Increased Capacity**
Ecological Resources	Minimal for NEF (see ER Section 4.5)	Greater impact since continued GDP operation and associated electric generation demand increases impact on ecological resources Scoring: -1	Same or greater impact if concentrating at one location Scoring: -0.5	Significantly greater impact than Alternative Scenario B because of increased electric energy demand to support increased GDP capacity Scoring: -1.5
Air Quality	Minimal for NEF; less than regulatory limits (see ER Section 4.6)	Greater impact since continued GDP operation and associated electric generation demand increases impact on air quality Scoring: -1	Greater impact in short term because of continued GDP operation and associated electric generation demand; same or greater impact in long term due more production at one location Scoring: -1 or -0.5	Significantly greater impact than Alternative Scenario B because of increased electric energy needs to support increased GDP capacity Scoring: -1.5
Noise	Minimal for NEF; typically within HUD and EPA limits (see ER Section 4.7)	Greater impact due to operation of electric generation to support GDP Scoring: -1	Greater impact in short term due to operation of electric generation to support GDP and concentration in one location; same or greater impact in long term due to concentration in one location Scoring: -1 or -.5	Significantly greater than Alternative Scenario B because of increased electric energy demand to support increased GDP capacity Scoring: -1.5
Historic and Cultural	Minimal for NEF; impacts can be avoided or mitigated (see ER Section 4.8)	Same or less impact Scoring: +0.5	Same or less impact Scoring: +0.5	Less impact since no new facility is constructed Scoring: +1

Table 2.4-2Comparison of Environmental Impacts For The Proposed Action And The No-Action Alternative Scenarios

		Alternative Scenarios[1,3]		
Environmental Category	**Proposed Action[2]**	**BNo NEF, USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP**	**CNo NEF, USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability**	**DNo NEF, USEC Does Not Deploy Centrifuge Plant and Operates Paducah GDP at Increased Capacity**
Visual/Scenic	Minimal for NEF; no visual impacts out of character with existing site (see ER Section 4.9)	Less impact since only one of two GCPs are built Scoring: +1	Same or less impact Scoring: +0.5	Less impact since no new facility is constructed Scoring: +1
Socioeconomic	Positive impact to economy due to NEF (see ER Section 4.10)	Less impact positive impact since only building one versus two plants Scoring: -1	Same or less positive impact Scoring: -0.5	Less positive impact since not building two new plants Scoring: -1
Environmental Justice	No disproportionate impact for NEF (see ER Section 4.11)	Same impact Scoring: 0	Same impact Scoring: 0	Same impact Scoring: 0
Public and Occupational Exposure	Minimal for NEF; doses below NRC and EPA regulatory limits (see ER Section 4.12)	Greater impact due to more effluents and operational exposure at GDP Scoring: -1	Greater impact in short term due to more effluents and operational exposure at GDP; same or greater impact in long term Scoring: -1 or -.5	Even greater impact than Alternative Scenario B because of increased GDP capacity Scoring: -1.5
Waste Management	Minimal for NEF; reduced waste streams due to new and highly efficient technology (see ER Section 4.13)	Greater impact because GDP waste stream larger Scoring: -1	Greater impact in short term because GDP waste stream larger; same in long term Scoring: -1 or 0	Even greater impact than Alternative Scenario B because of increased GDP capacity Scoring: -1.5

Table 2.4-2Comparison of Environmental Impacts For The Proposed Action And The No-Action Alternative Scenarios

		Alternative Scenarios[1,3]		
Environmental Category	**Proposed Action[2]**	**BNo NEF, USEC Deploys Centrifuge Plant and Continues to Operate Paducah GDP**	**CNo NEF, USEC Deploys Centrifuge Plant and Increases Centrifuge Plant Capability**	**DNo NEF, USEC Does Not Deploy Centrifuge Plant and Operates Paducah GDP at Increased Capacity**

[1]If impact was unknown, the impact was conservatively assumed to be the same or less than proposed option.

[2]Proposed action assumes both LES and USEC deploy centrifuge plants and GDP is shutdown when USEC centrifuge plant comes on line. The proposed action receives a neutral score of zero (i.e., baseline impact on the environment).

[3]Scoring Methodology (all Alternative Scenarios compared against Proposed Action). Positive score means less impacts on the environment than proposed action. Negative score means greater impacts on the environment than proposed action.

Less +1
Same or less +0.5
Same 0
Same or less positive -0.5
Same or greater -0.5
Less positive -1
Greater -1
Significantly greater -1.5

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 3.1-2 Agriculture 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

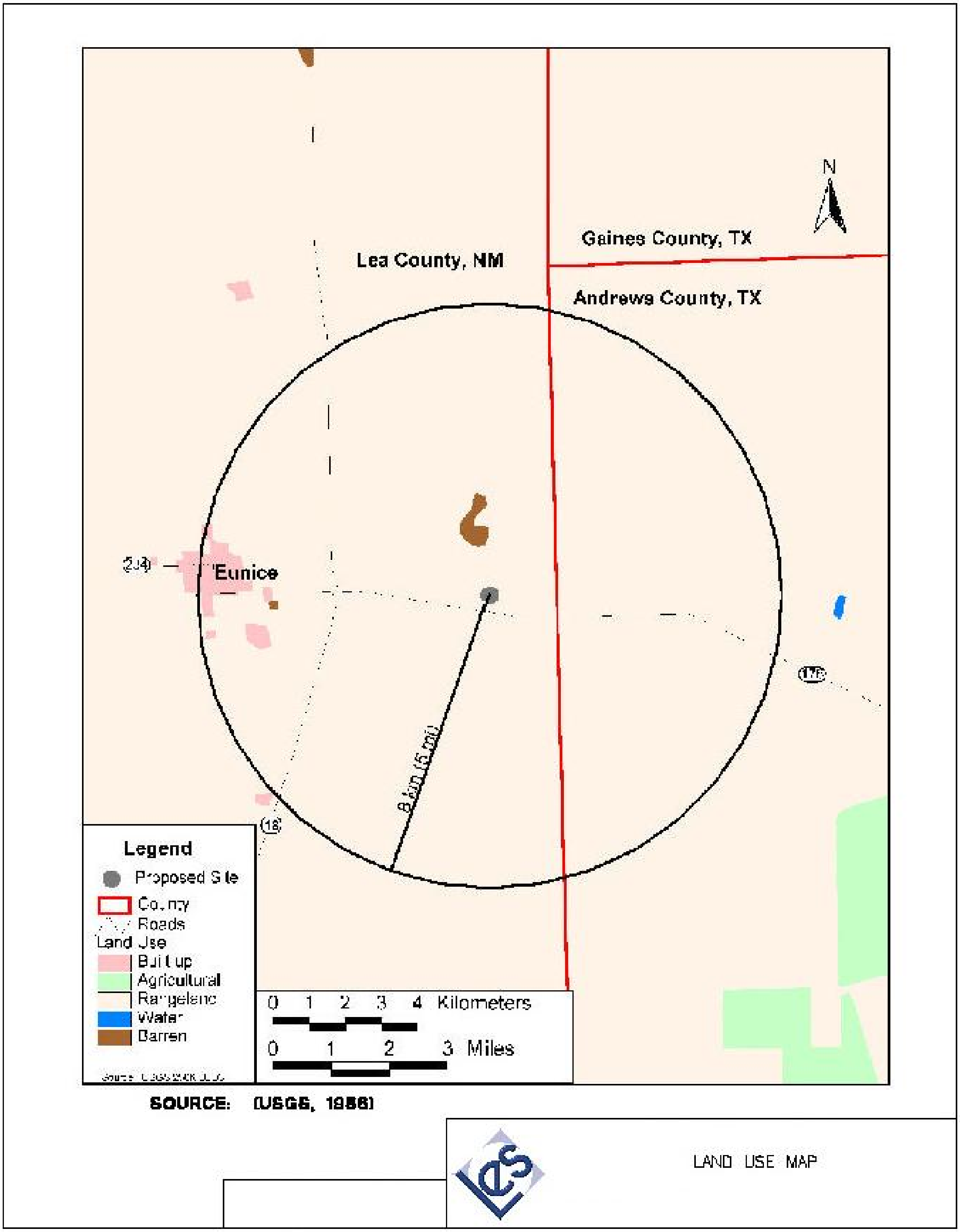


Figure 3.1-1 Land Use Map

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 3.2-1 Possible 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 3.3-2 Measured Permeabilities Near the NEF Site

Permeability Direction	Sediment Type	Permeability, cm/s (ft/s)
Vertical	Clays	1.00×10^{-9} to 1.76×10^{-8} (3.28×10^{-11} to 5.77×10^{-10})
Horizontal	Clays	1.63×10^{-9} to 1.10×10^{-8} (5.35×10^{-11} to 3.61×10^{-10})
Vertical	Siltstones and sandstones within 18 to 27 m (56 to 90 ft) depth	2.58×10^{-8} to 1.93×10^{-6} (8.46×10^{-10} to 6.33×10^{-8})
Horizontal	Siltstones and sandstones within 18 to 27 m (56 to 90 ft) depth	Average: 6.53×10^{-7} (2.14×10^{-8})
Vertical	Siltstone at 63 m (208 ft) depth	2.06×10^{-8} (6.76×10^{-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	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
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 3.3-3 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	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
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 3.3-3 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	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 3.3-3 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	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 3.3-3 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	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 3.3-3 Earthquakes 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)	
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 3.3-3 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	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 3.3-3 Earthquakes 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]
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 3.3-3 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	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
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 3.3-3 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	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 3.3-3 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 (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	(mi)	Data Sources[4]
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 3.3-3 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	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
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			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)	
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 3.3-3 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	Latitude	Focal	Depth[1]	MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
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 3.3-3 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)	(mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	(mi)	Data Sources[4]
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 3.3-4 Earthquakes 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)	
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 3.3-4 Earthquakes 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 3.3-6Modified 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 3.3-7 Comparison 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 3.3-8 NEF 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 3.3-9 Non-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

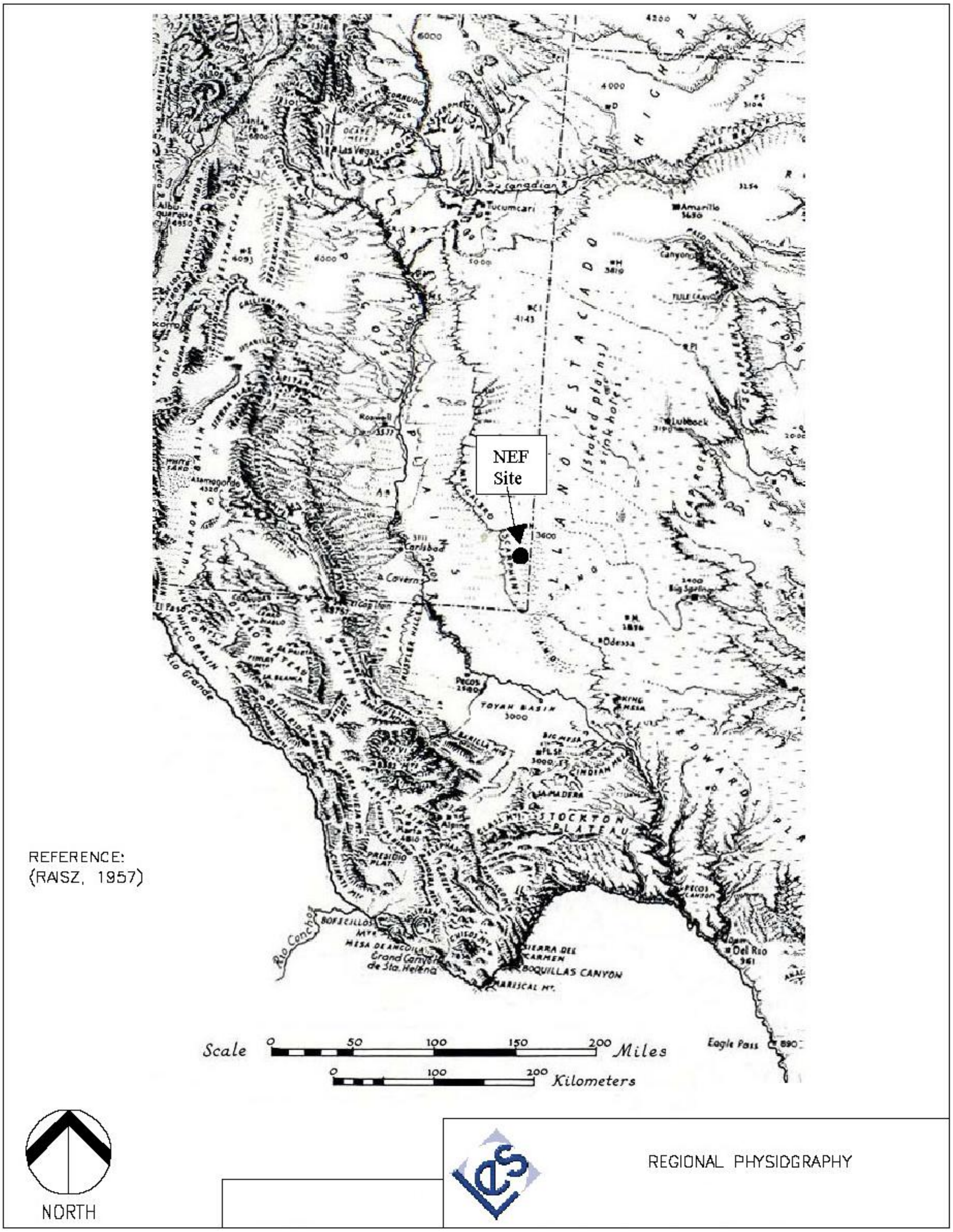


Figure 3.3-1 Regional Physiography

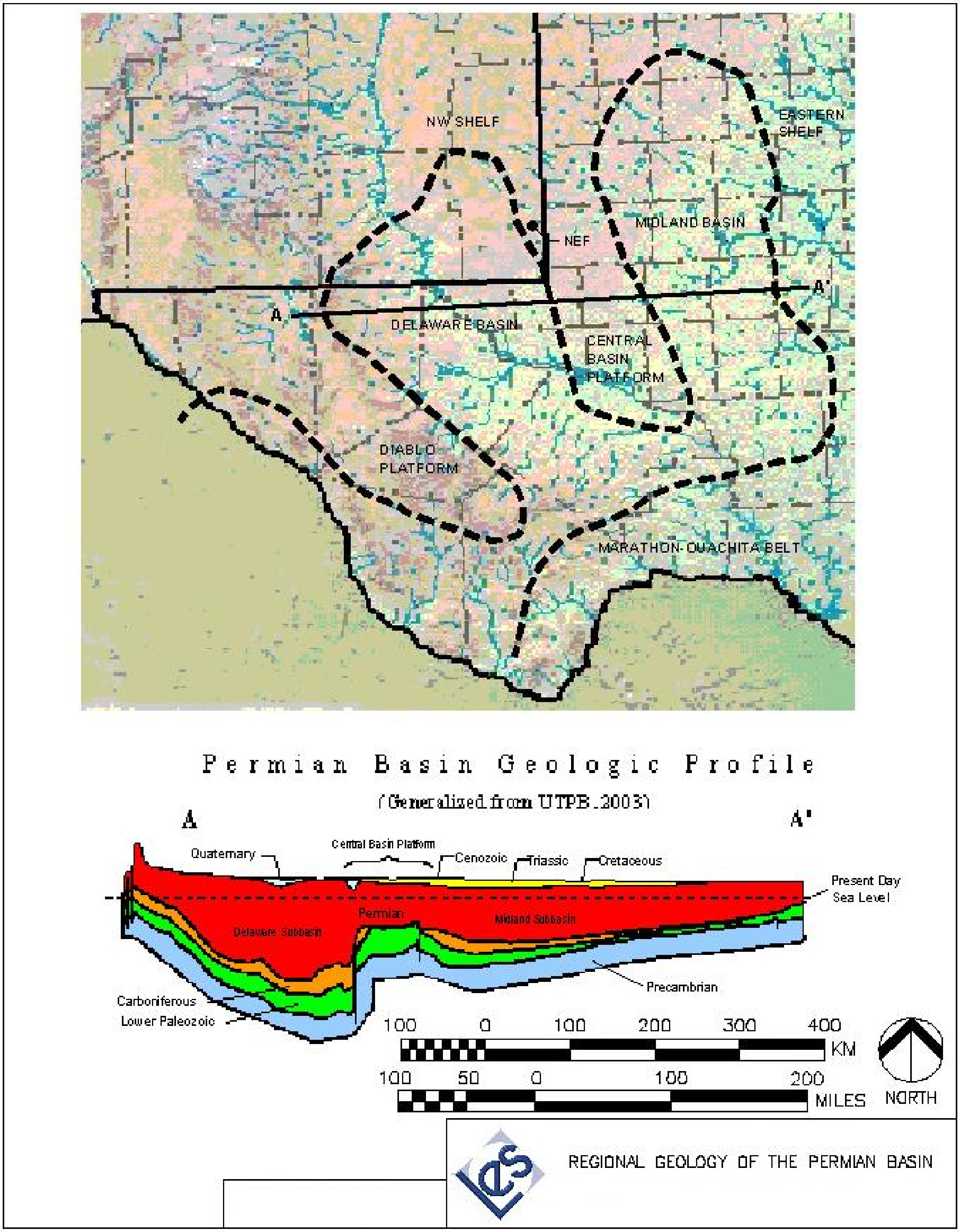


Figure 3.3-2Regional Geology of the Permian Basin

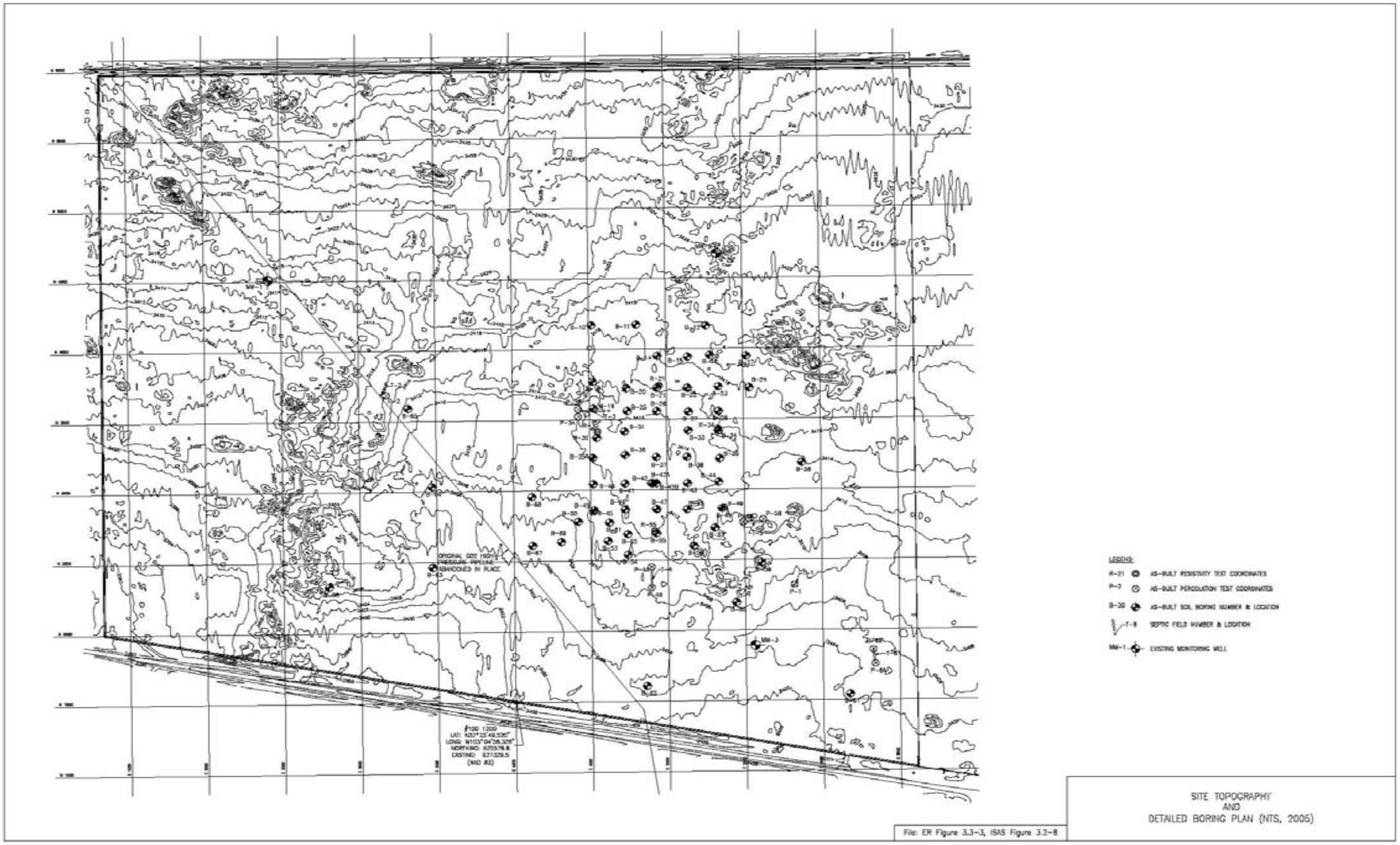


Figure 3.3-3Site Topography

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*

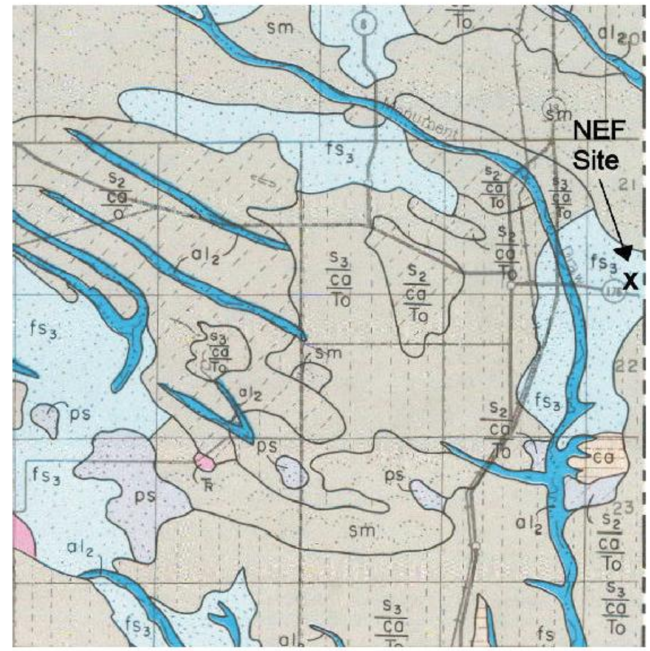
s_2/ca/To — MODERATELY THICK SAND ON CALICHE ON OGALLALA FORMATION — *Sand 1 to 3 ft thick. Surface layers noncalcareous over reddish loam. Local sand mounds. Ground favored for farming. Boundaries approximate*

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*

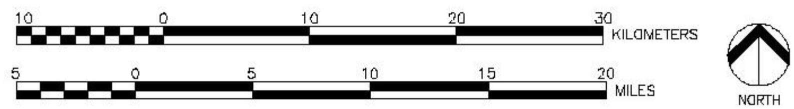
sm — LOOSE SAND IN MOUNDS — *Coppice dunes, commonly 3 to 7 ft high and 25 to 50 ft in diameter; generally elongated north of east but a local exception lies east of Columbus where elongation is south of east. Age is Holocene. Boundaries fairly accurate*

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

R̶ — 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, R̶s, Triassic Santa Rosa Sandstone). Many small areas omitted; indicated boundaries are approximate.* R̶ – *Triassic, undifferentiated*



REFERENCE: (NMIMT, 1977)



SURFICIAL GEOLOGIC MAP OF THE NEF SITE AREA

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

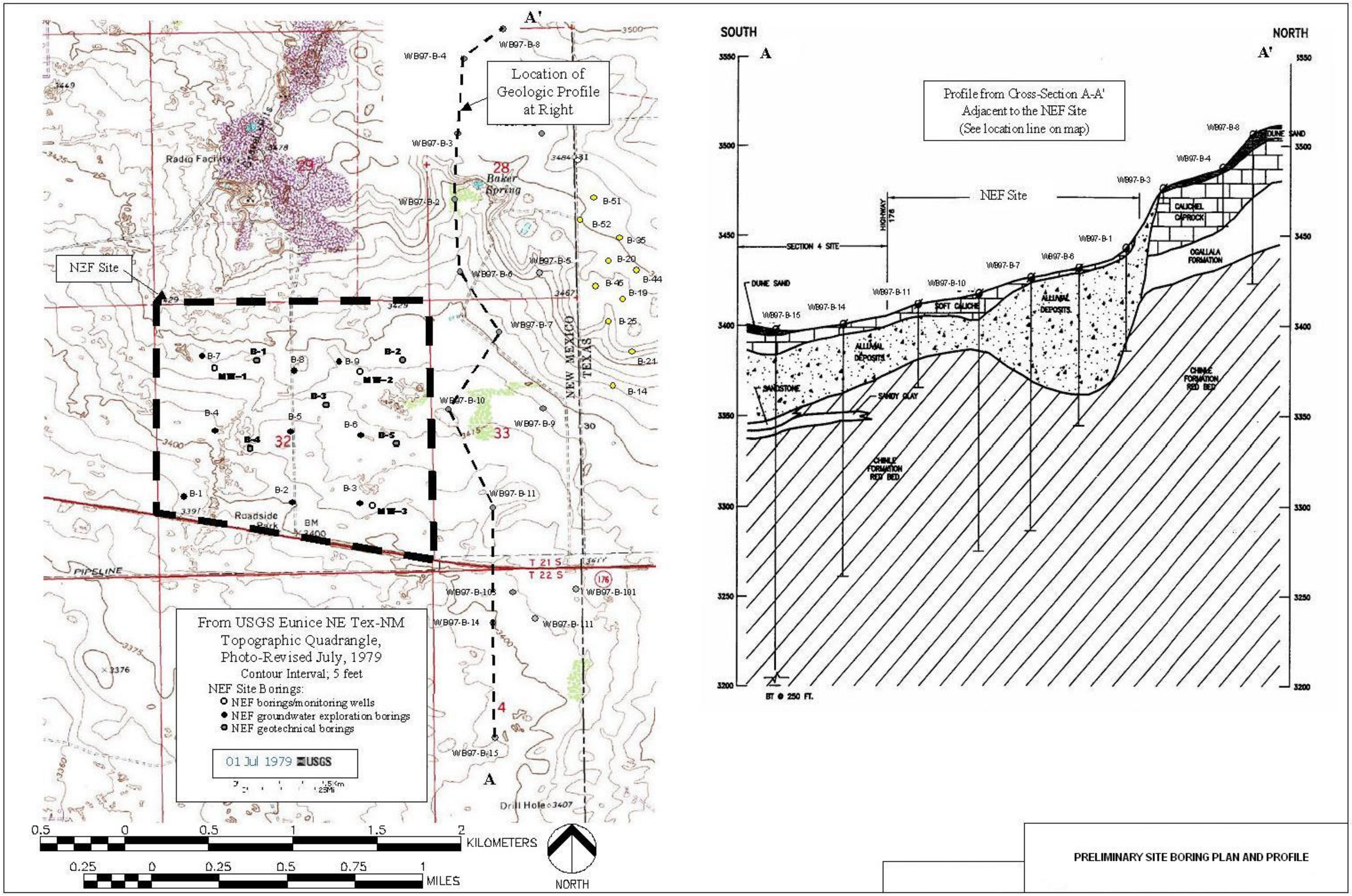
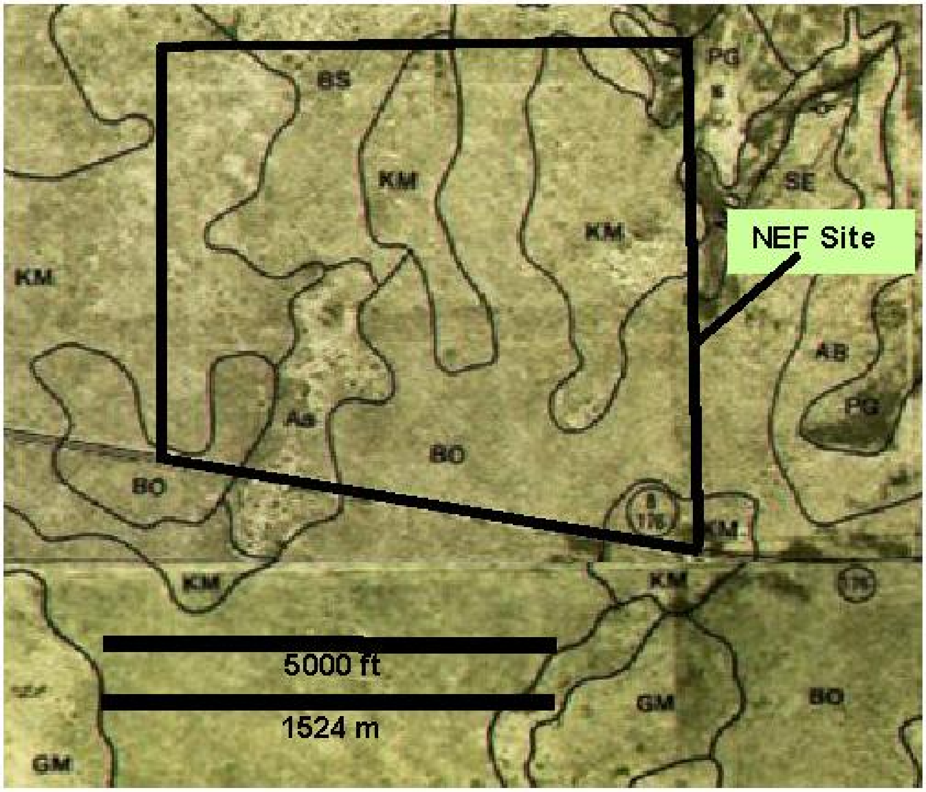


Figure 3.3-5Preliminary Site Boring Plan and Profile



USDA SOIL DESIGNATION	SOIL NAME/DESCRIPTION	UNIFIED SOIL CLASSIFICATION DESIGNATION(S)
As	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 SIMILAR 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

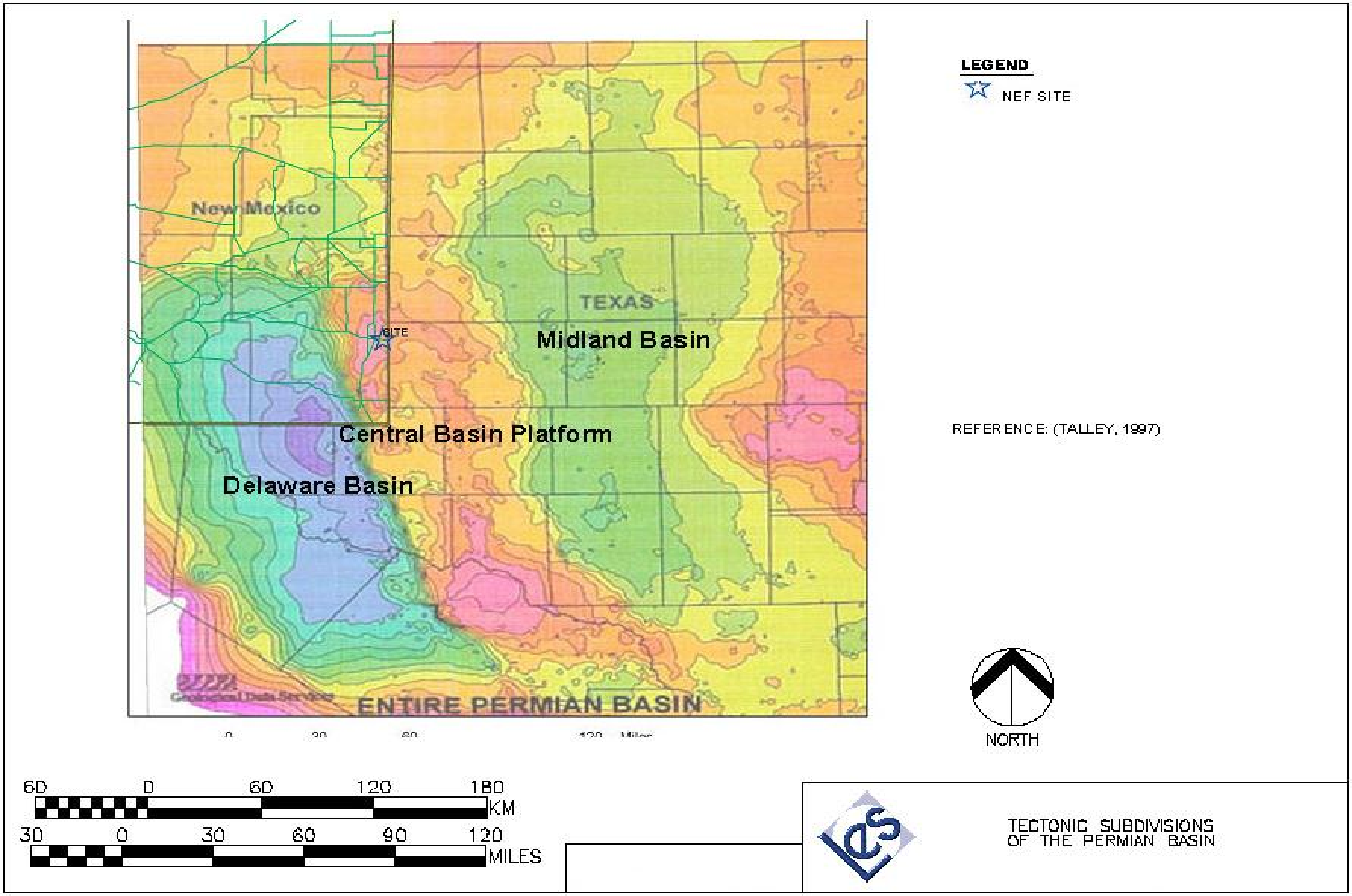


Figure 3.3-7 Tectonic Subdivisions of the Permian Basin

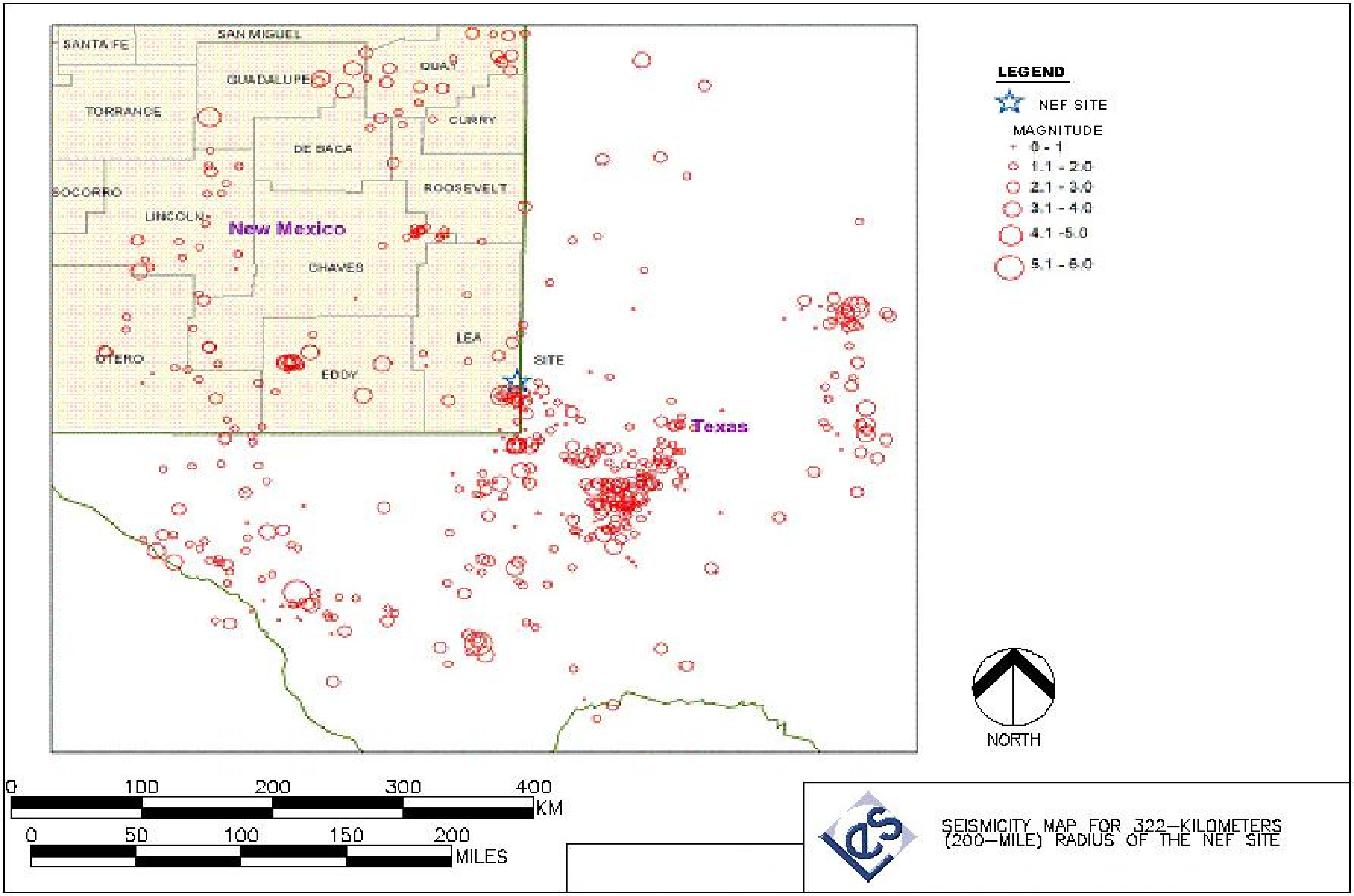


Figure 3.3-8Seismicity Map for 322-Kilometer (200-Mile) Radius of the NEF Site

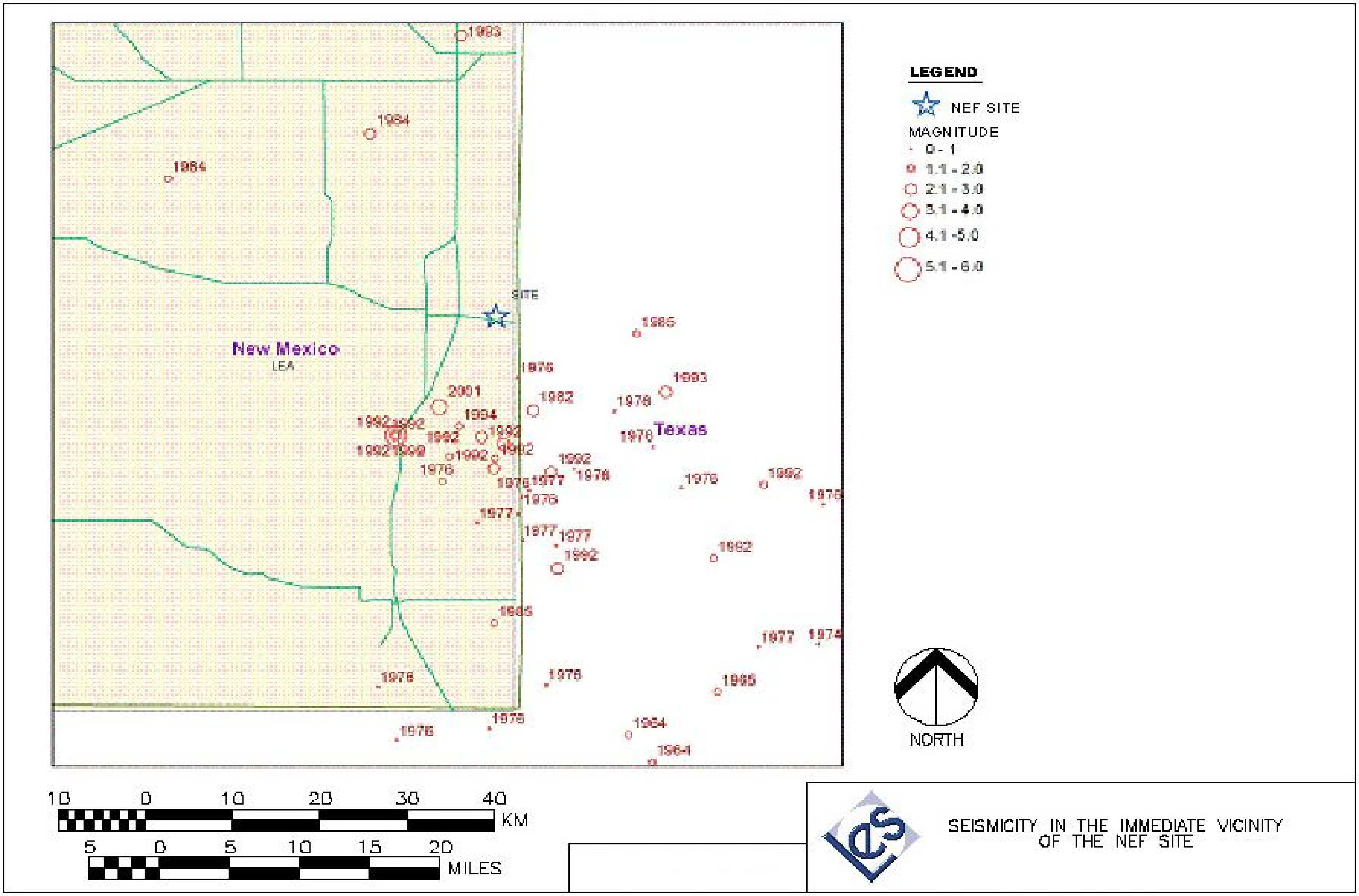


Figure 3.3-9Seismicity in the Immediate Vicinity of the NEF Site

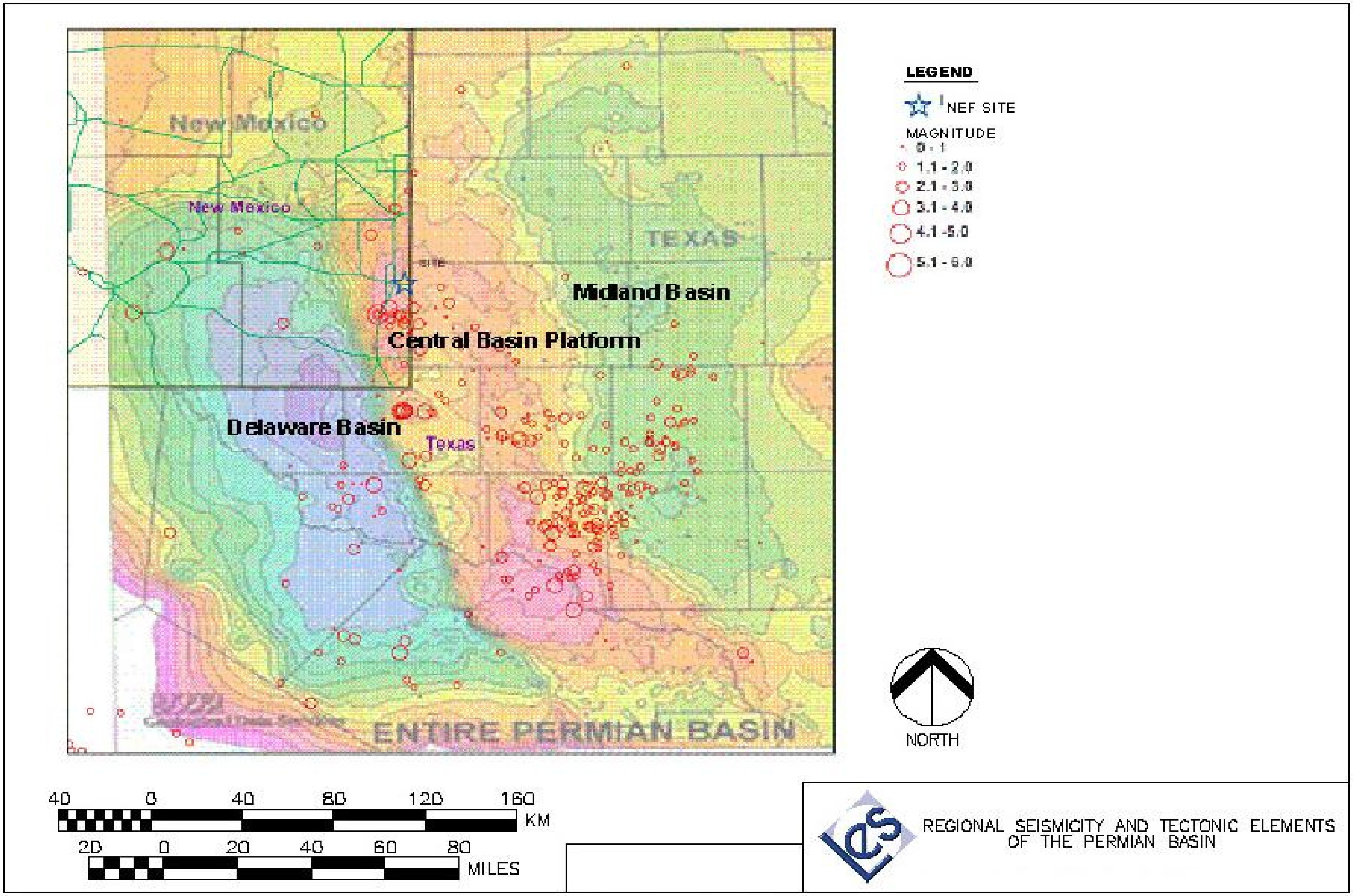


Figure 3.3-10Regional Seismicity and Tectonic Elements of the Permian Basin

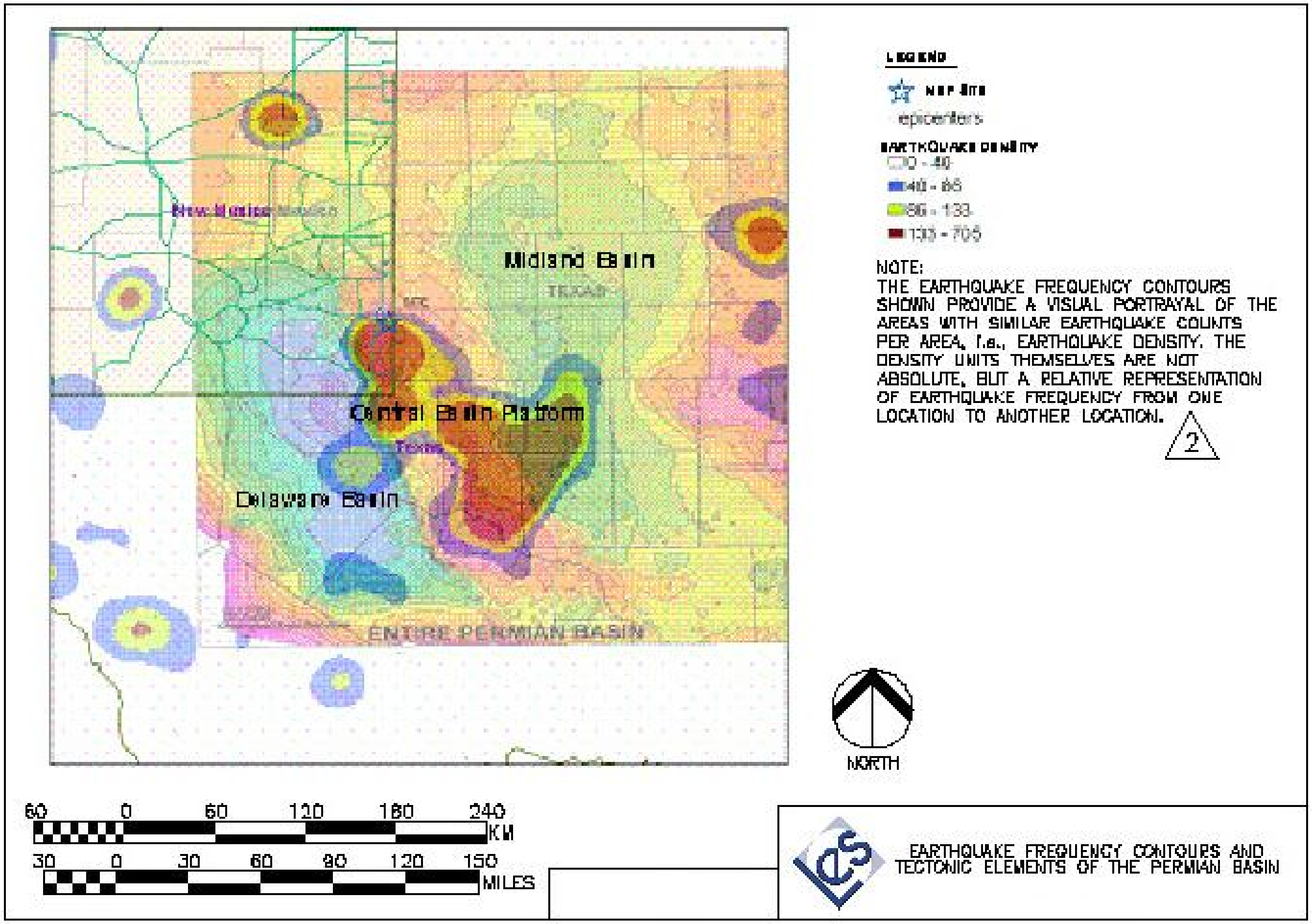


Figure 3.3-11Earthquake Frequency Contours and Tectonic Elements of the Permian Basin

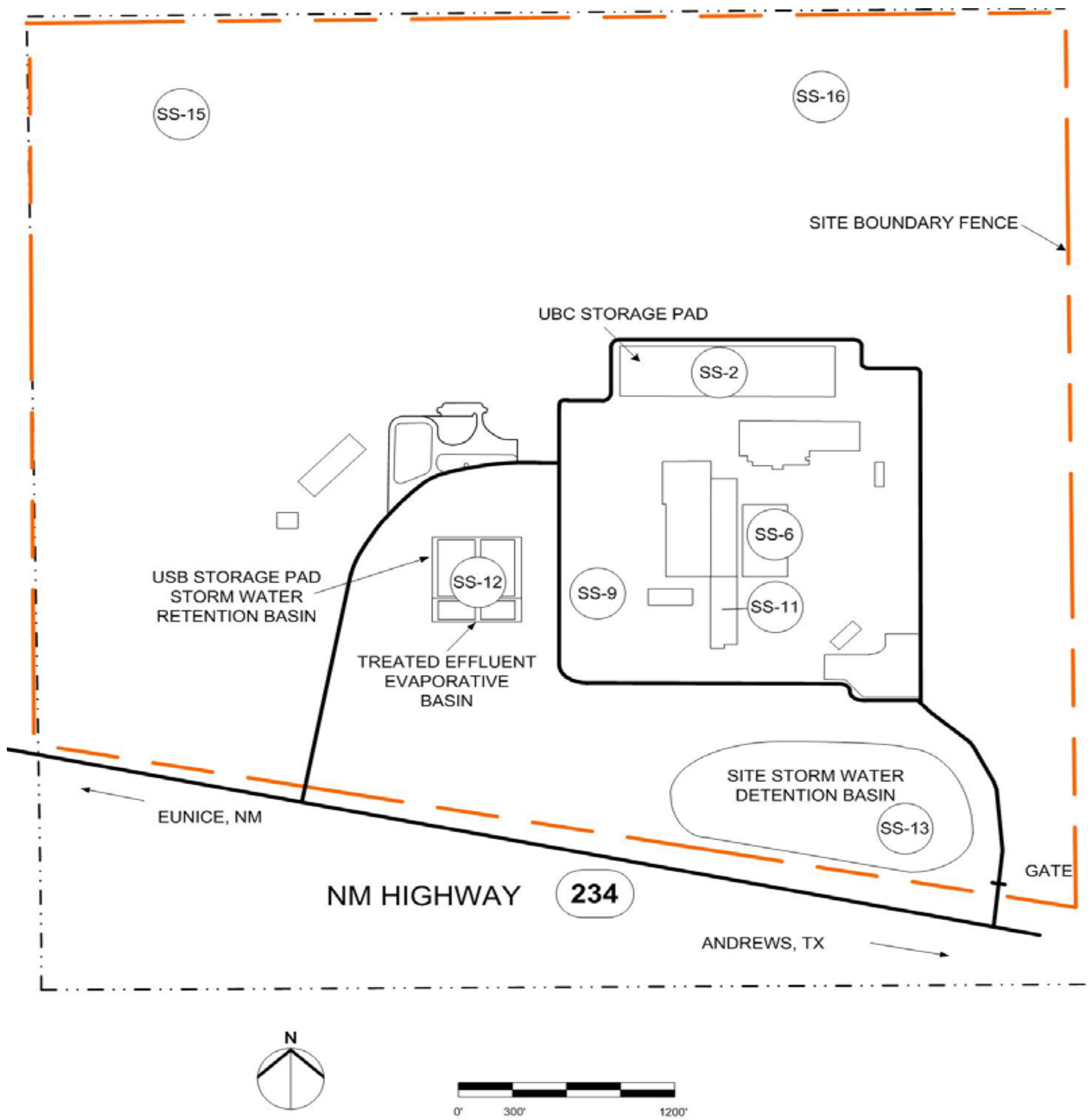


Figure 3.3-12 Soil Sample Locations

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 2,130 m^3 per year (562,631 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 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.

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, 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 Eunice, NM 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 $1x10^{-8}$ cm/s ($3.9x10^{-9}$ 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 3.7×10^{-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 x 10^{-6} to 3.9 x 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 x 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 3.4-1Summary 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)
Total Liquid Effluents	2,129,570 (562,631)

[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

		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)**
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 3.4-3 Chemical 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
Fire Protection	375.0

3.4.17 Section 3.4 Figures

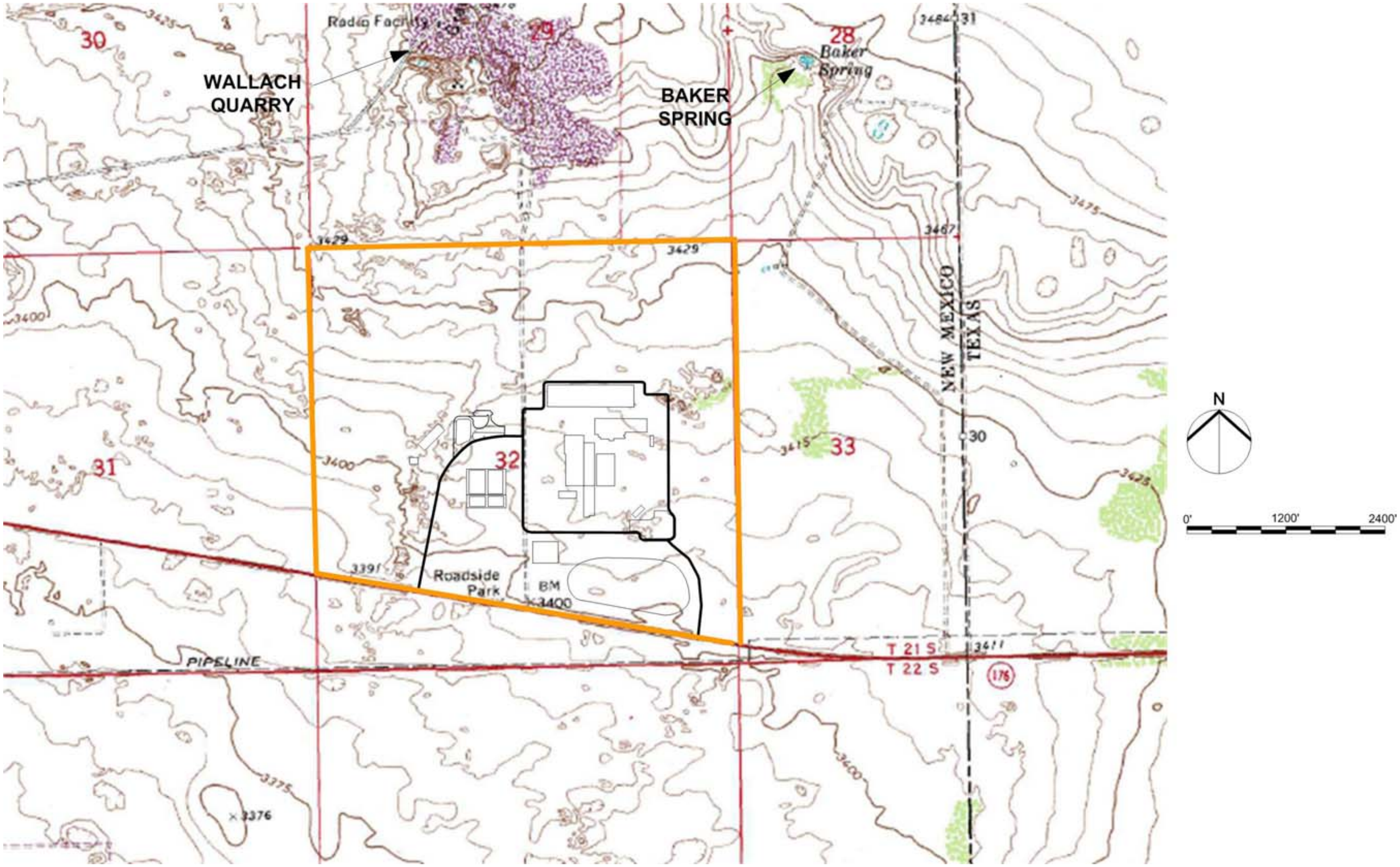


Figure 3.4-1 Local Hydrologic Features

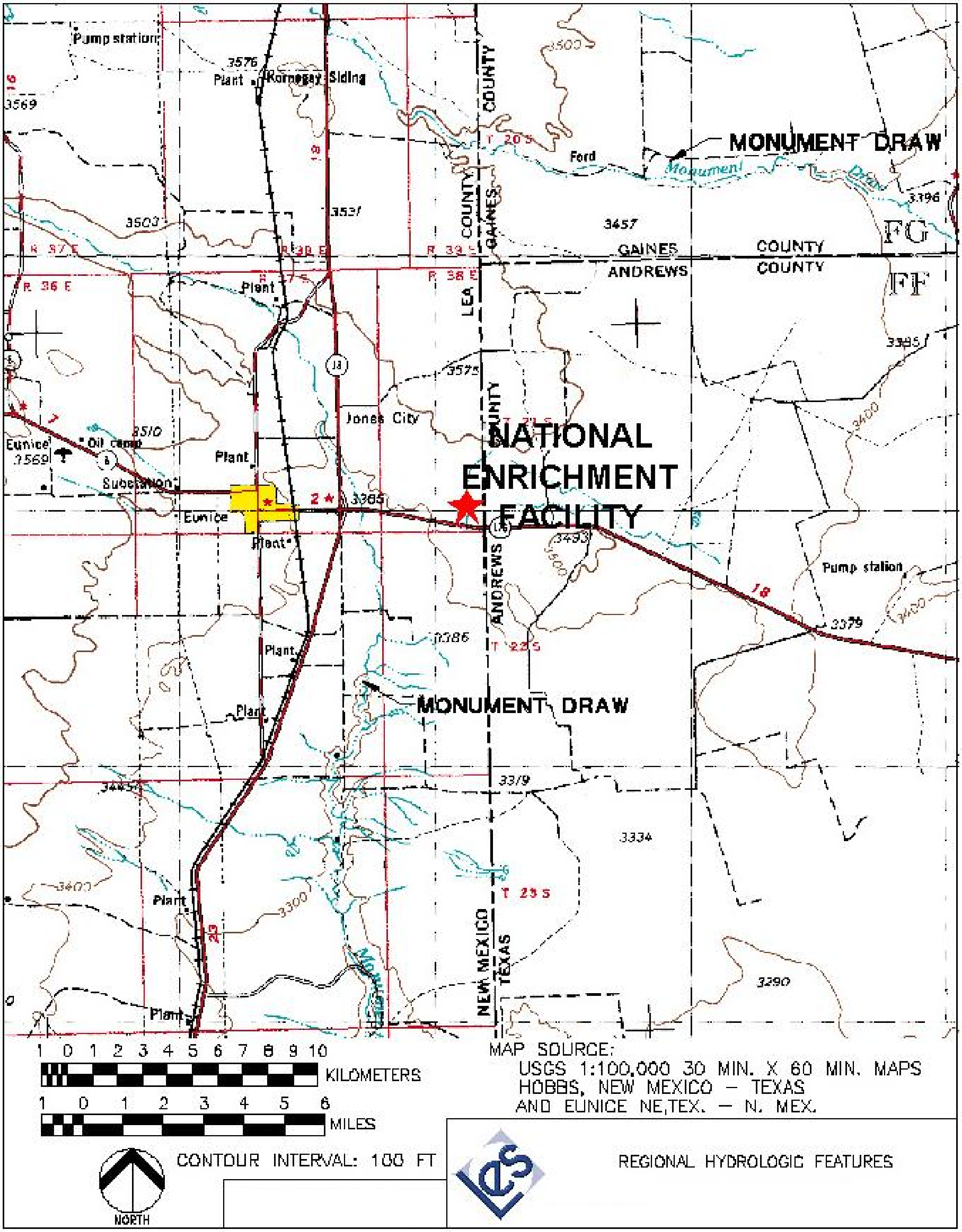
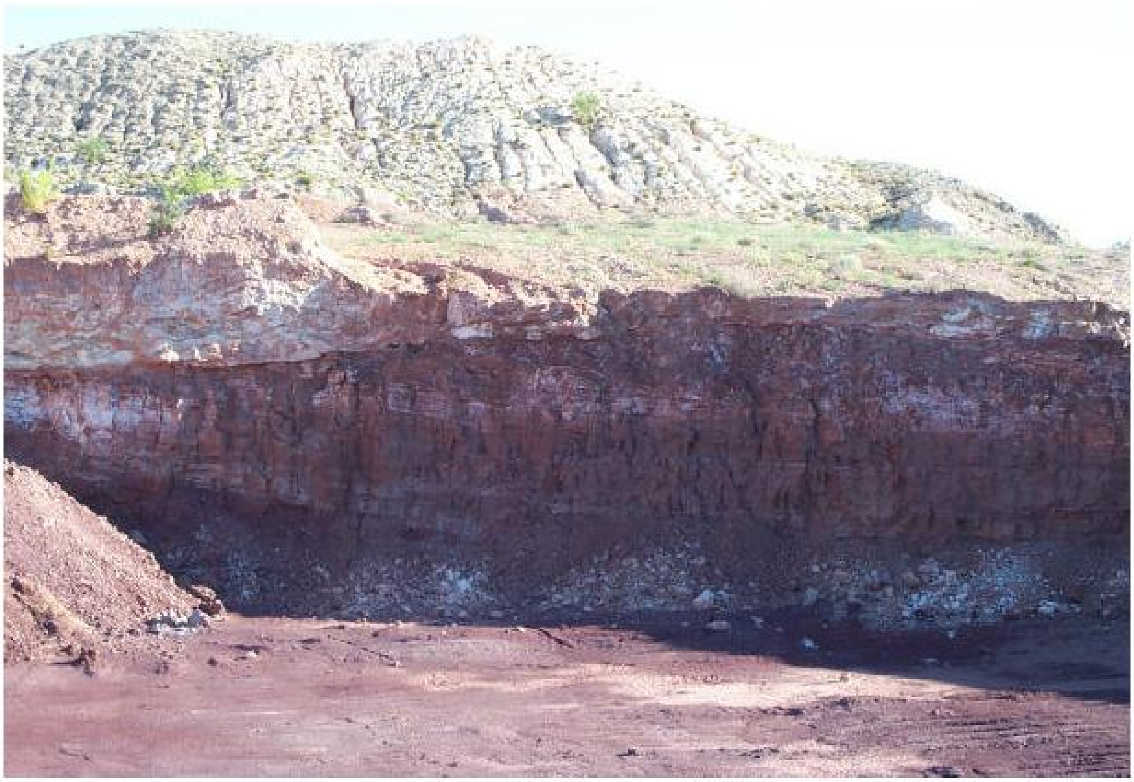


Figure 3.4-2Regional Hydrologic Features



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 3.4-4Groundwater 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

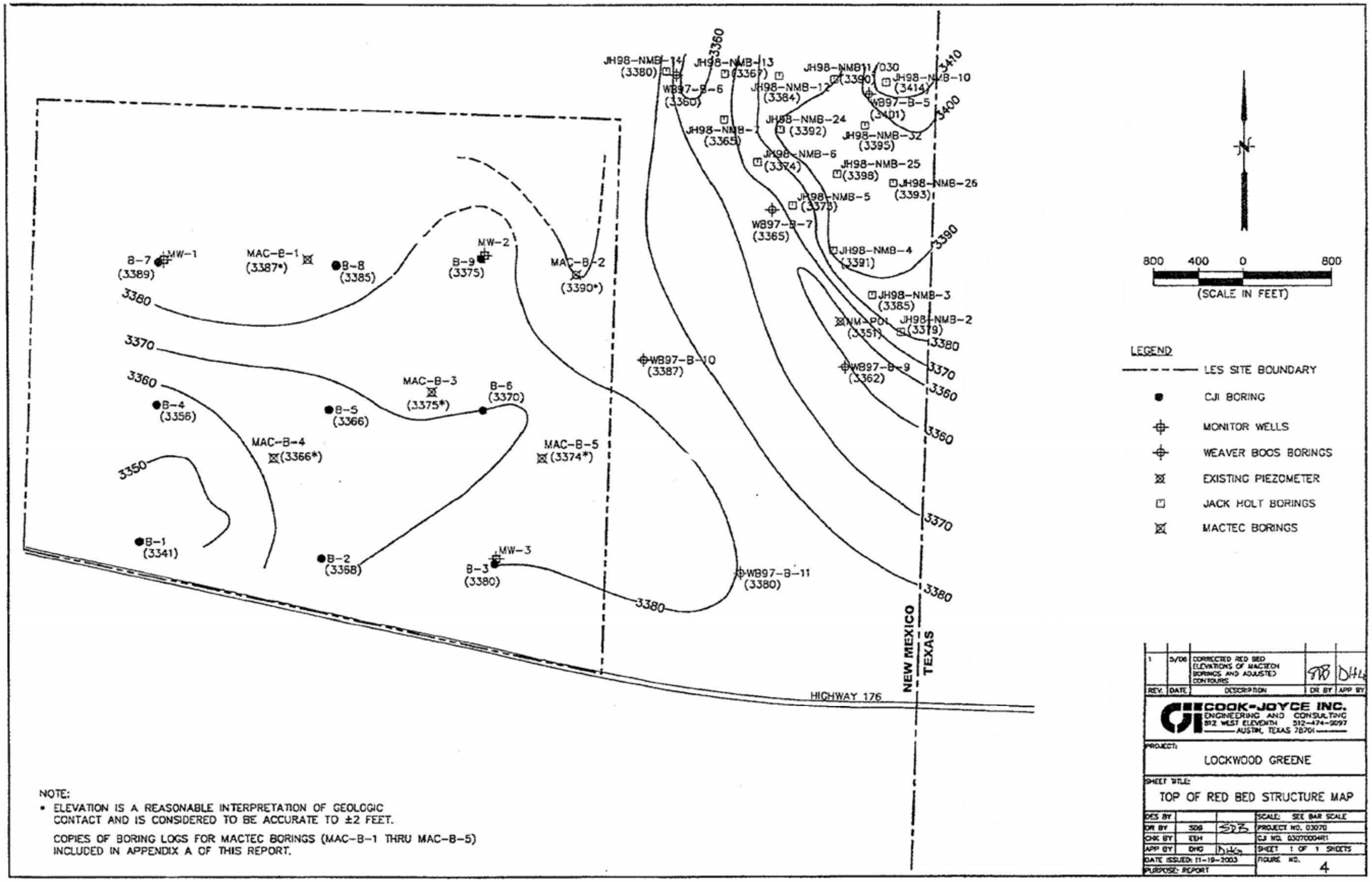


Figure 3.4-6Dockum Group (Chinle Formation) Surface Contour

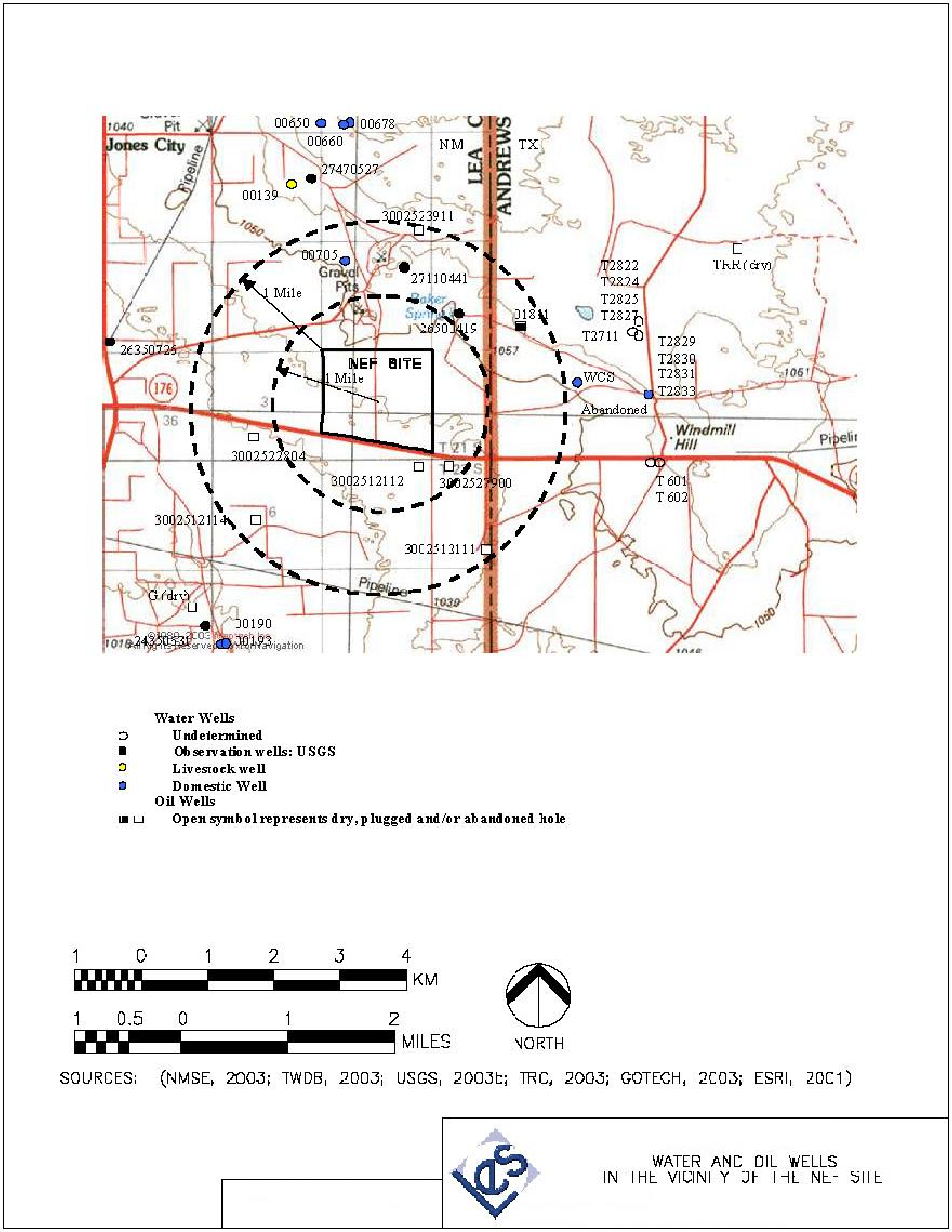


Figure 3.4-7Water and Oil Wells in the Vicinity of the NEF Site

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. 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 however as there is no suitable habitat, the food source is not sufficient to sustain 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 3.5-1Mammals 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
Desert Cottontail	*Sylvilagus audubonii*	Deserts, brush, chaparral and lowlands	Likely occurs at site

Table 3.5-1Mammals Potentially Using the NEF Site

Common Name	Scientific Name	Preferred Habitat	Probable Occurrence at NEF 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
Northern Cardinal	*Cardinalis cardinalis*	R			U
Long-Eared Owl	*Asio otus*		C	C	

Table 3.5-2Birds Potentially Using the NEF Site

Common Name	*Scientific Name*	Summer Breeder	*Wintering*	*Resident*	*Migrant*
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
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

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

Common Name	**Scientific Name**	Preferred Habitat	**Probable Occurrence at NEF 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	Relative	Mean	Relative
	% Cover	Cover	% Freq	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

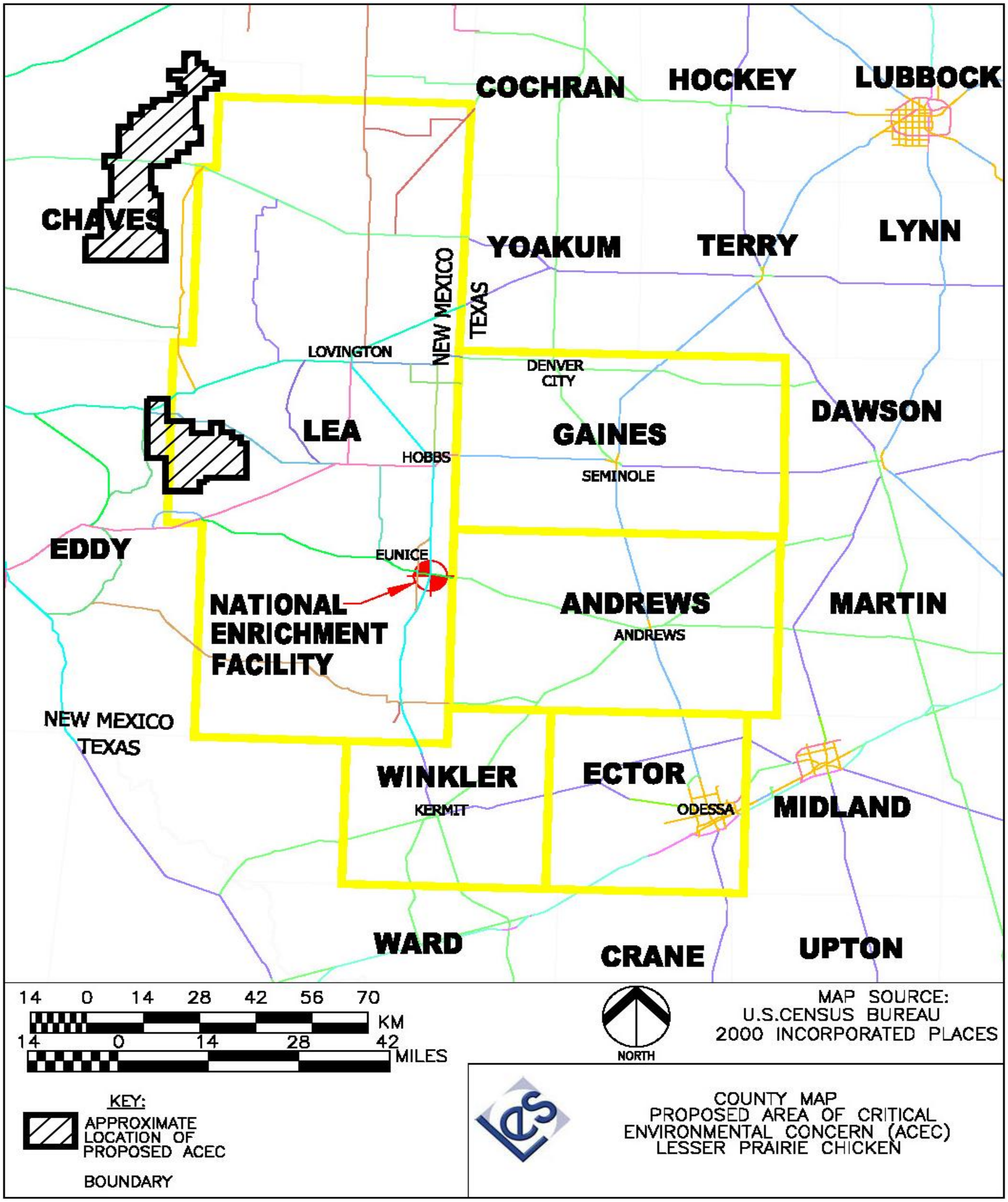


Figure 3.5-1 County Map Proposed Area of Critical Environmental Concern (ACEC) Lesser Prairie Chicken

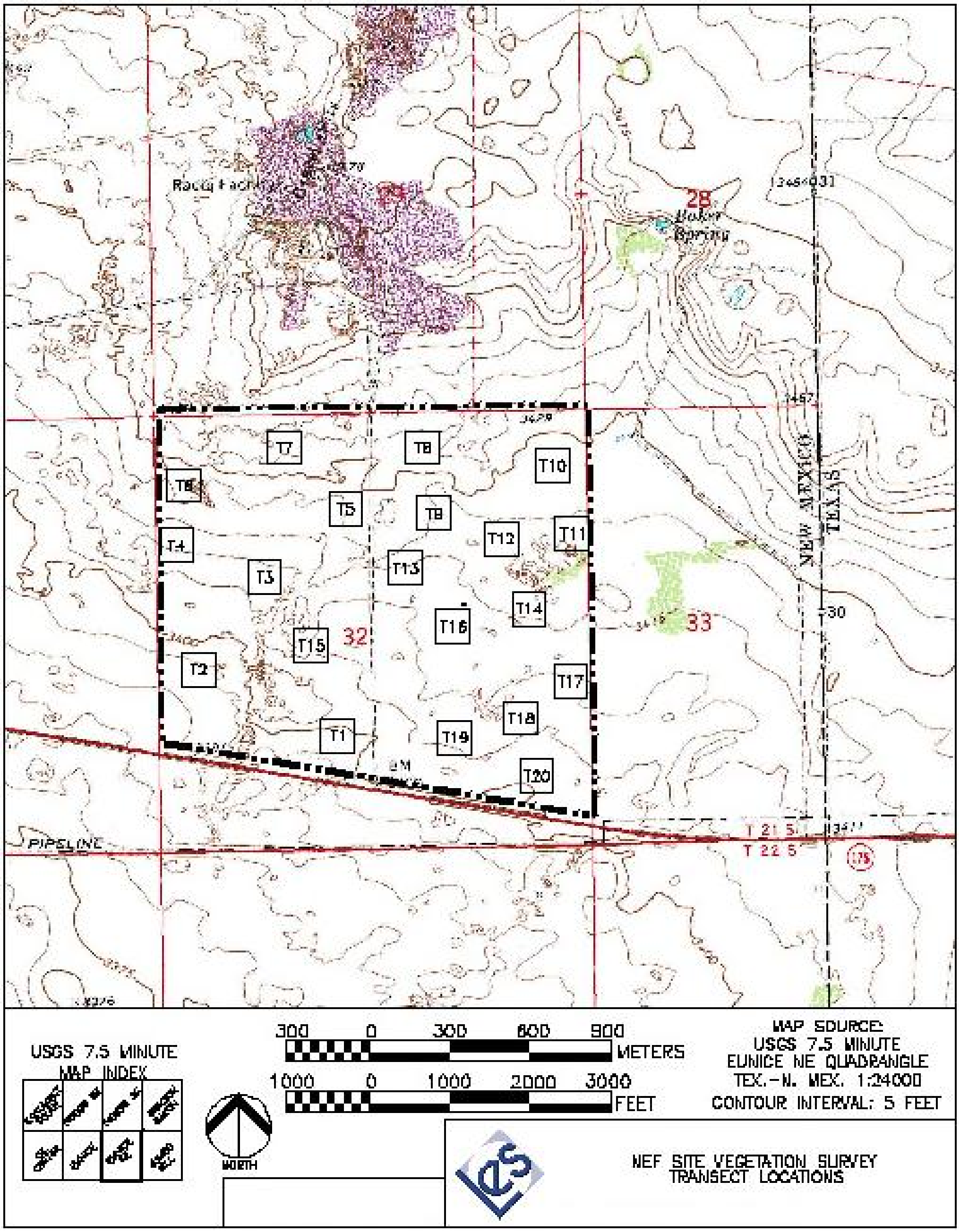


Figure 3.5-2NEF Site Vegetation Survey Transect Locations

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 3.6-7 Roswell, 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)

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)
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)
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)

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)
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)
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

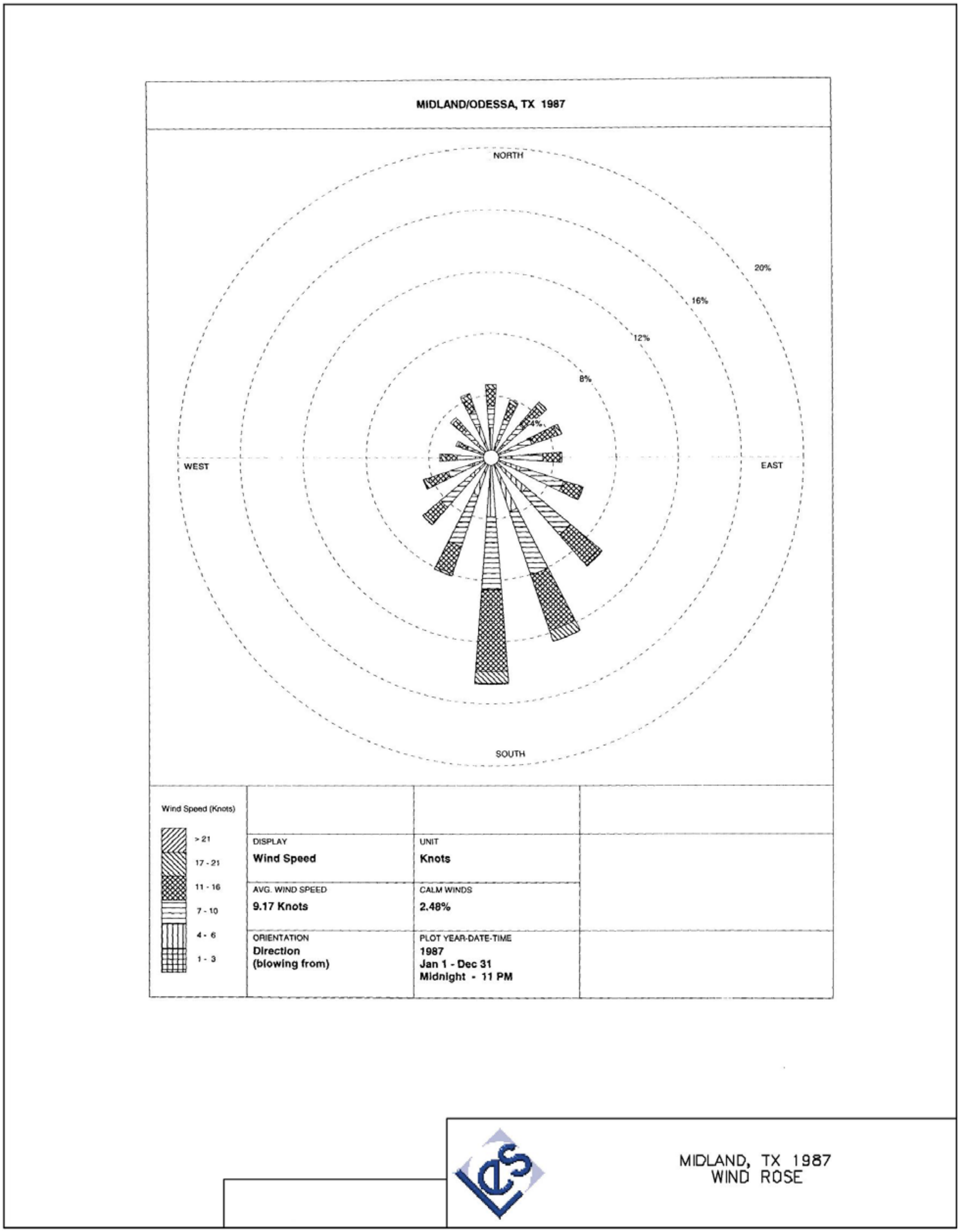


Figure 3.6-1 Midland, TX 1987 Wind Rose

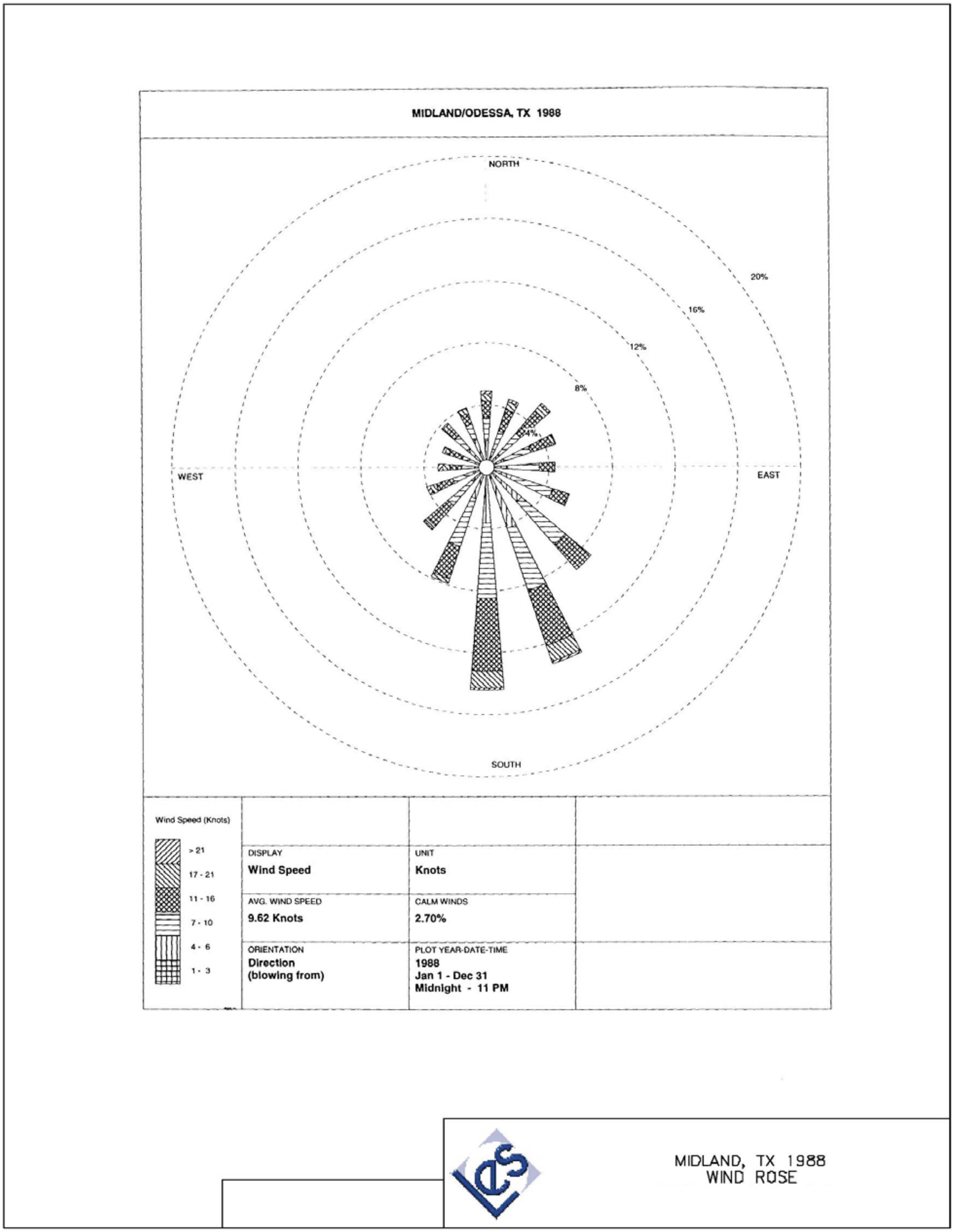


Figure 3.6-2 Midland, TX 1988 Wind Rose

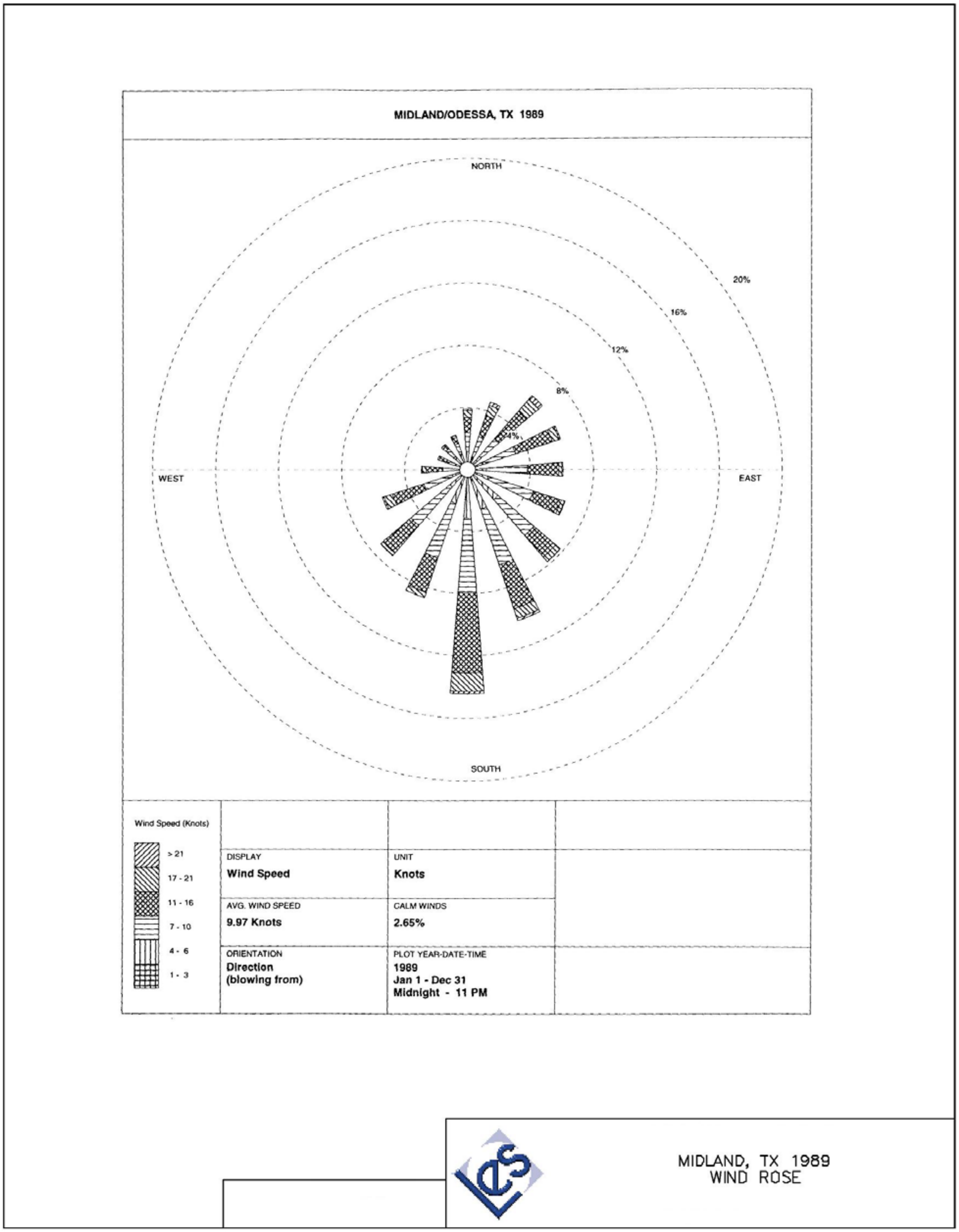


Figure 3.6-3Midland, TX 1989 Wind Rose

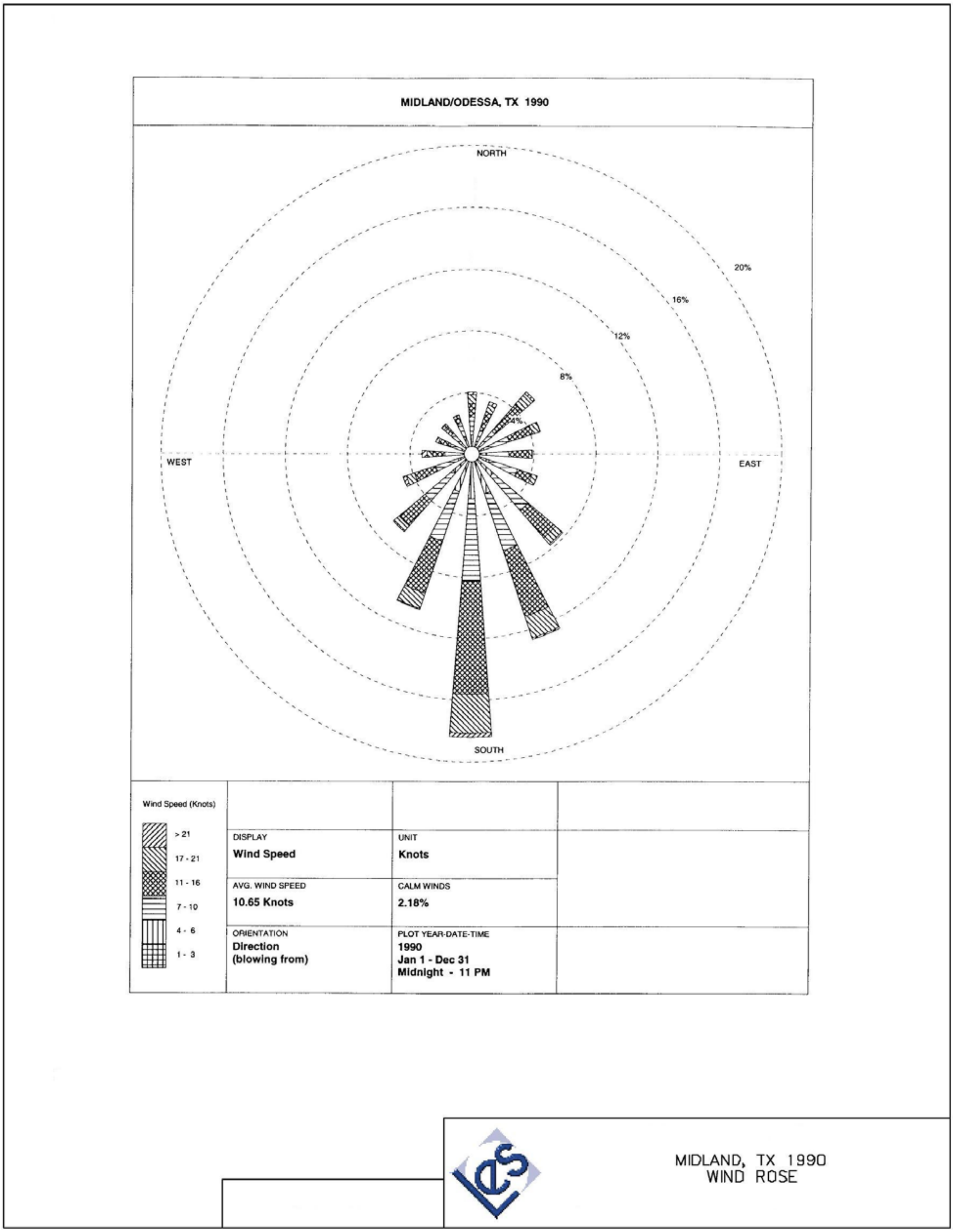


Figure 3.6-4Midland, TX 1990 Wind Rose

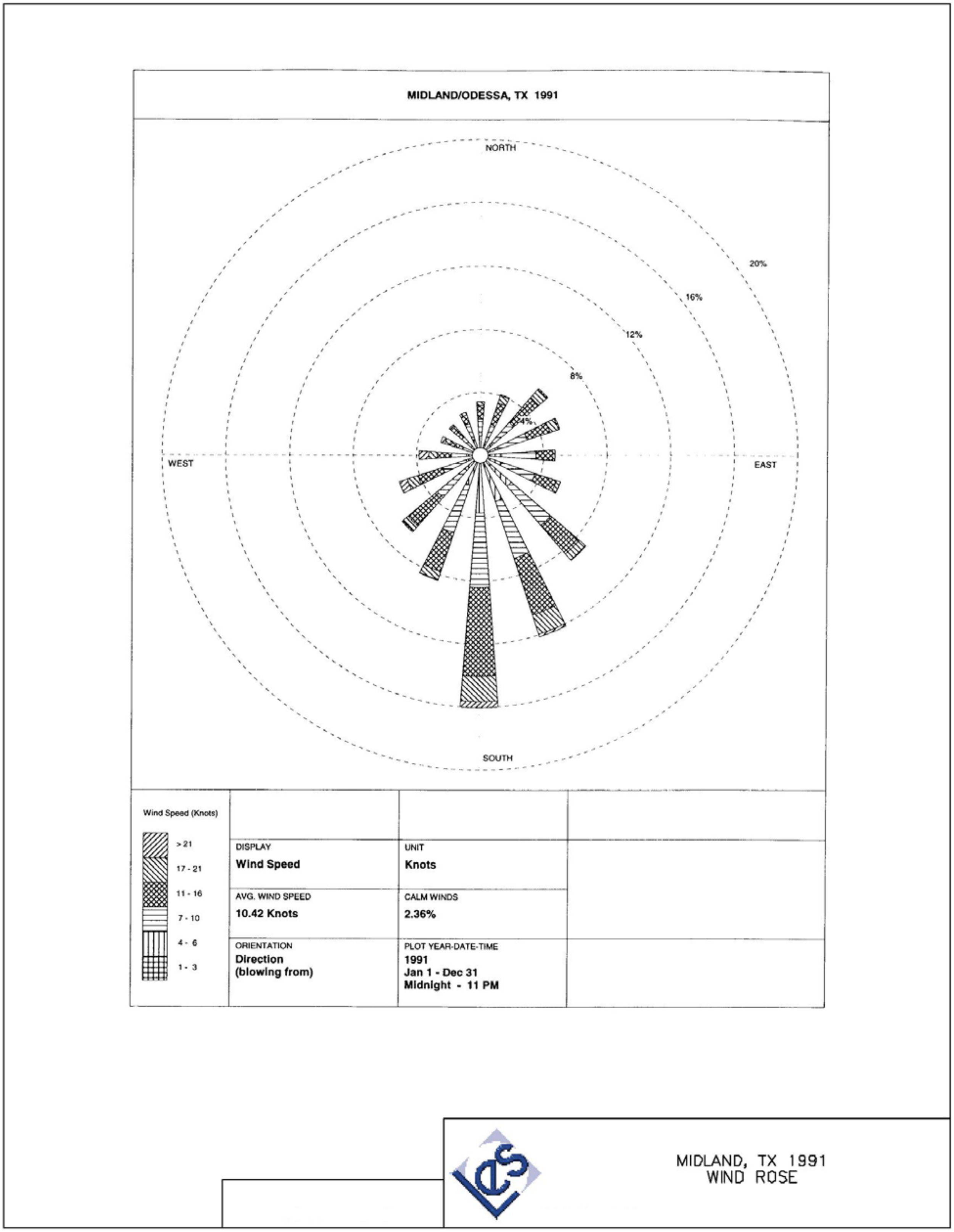


Figure 3.6-5Midland, TX 1991 Wind Rose

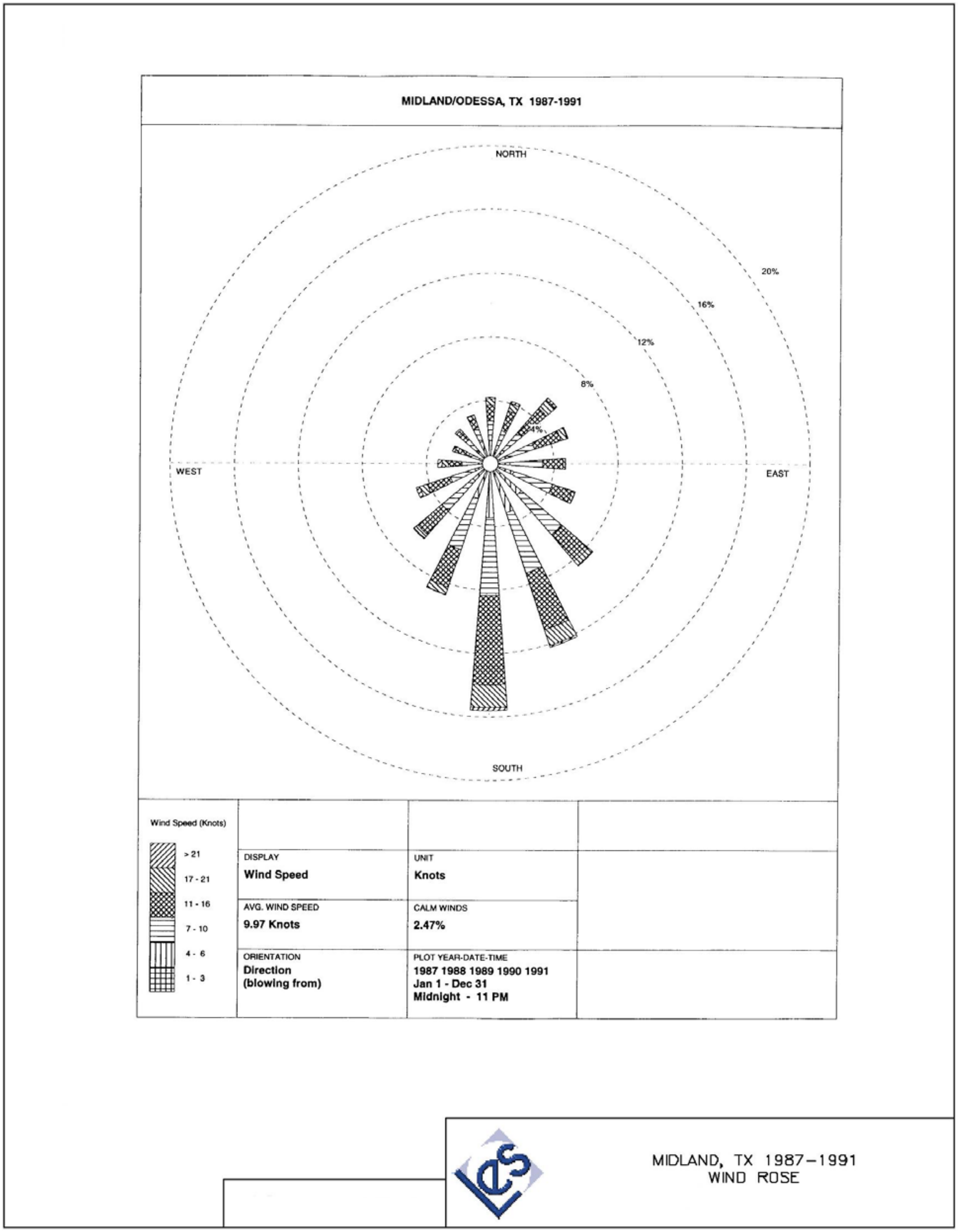
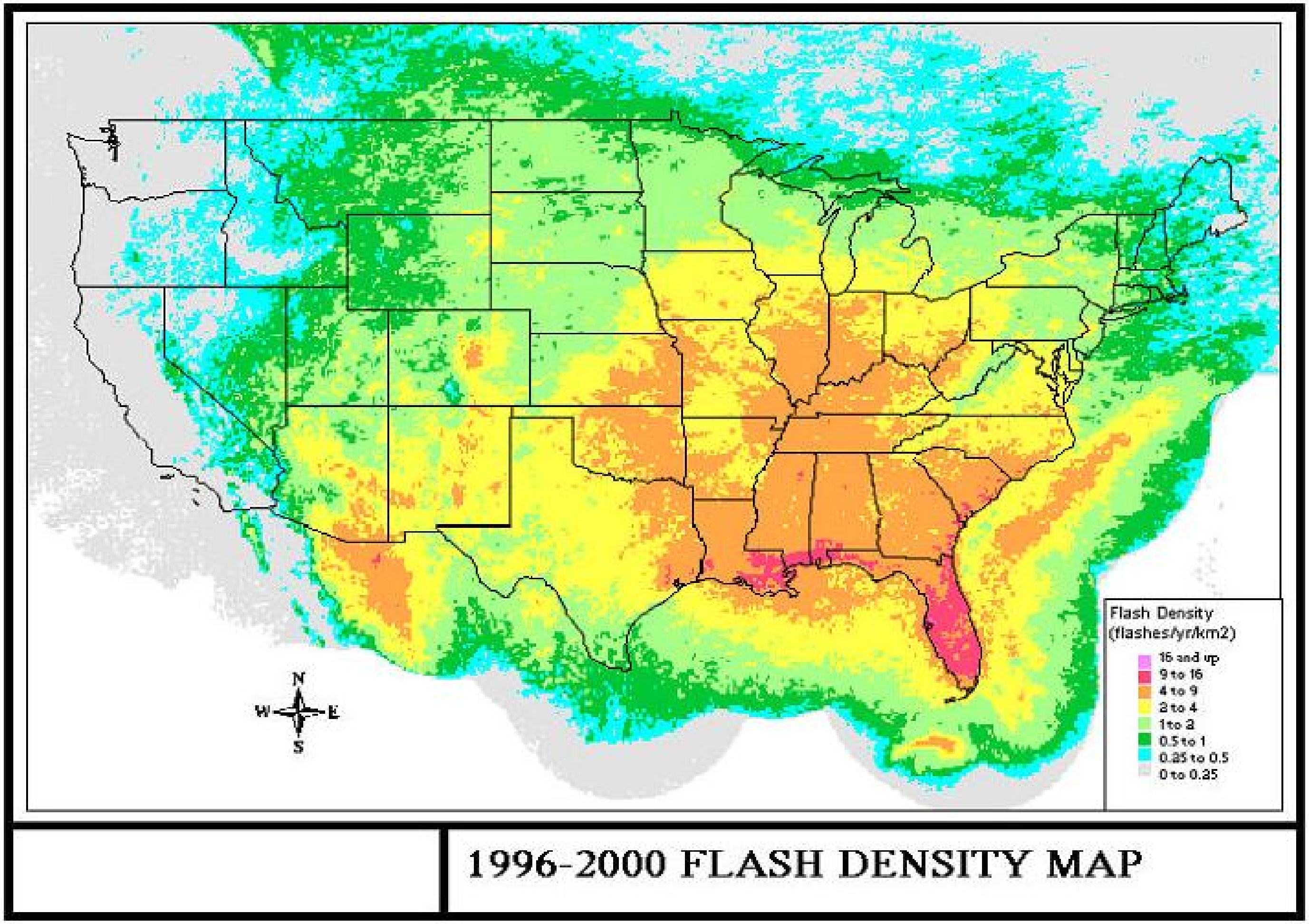


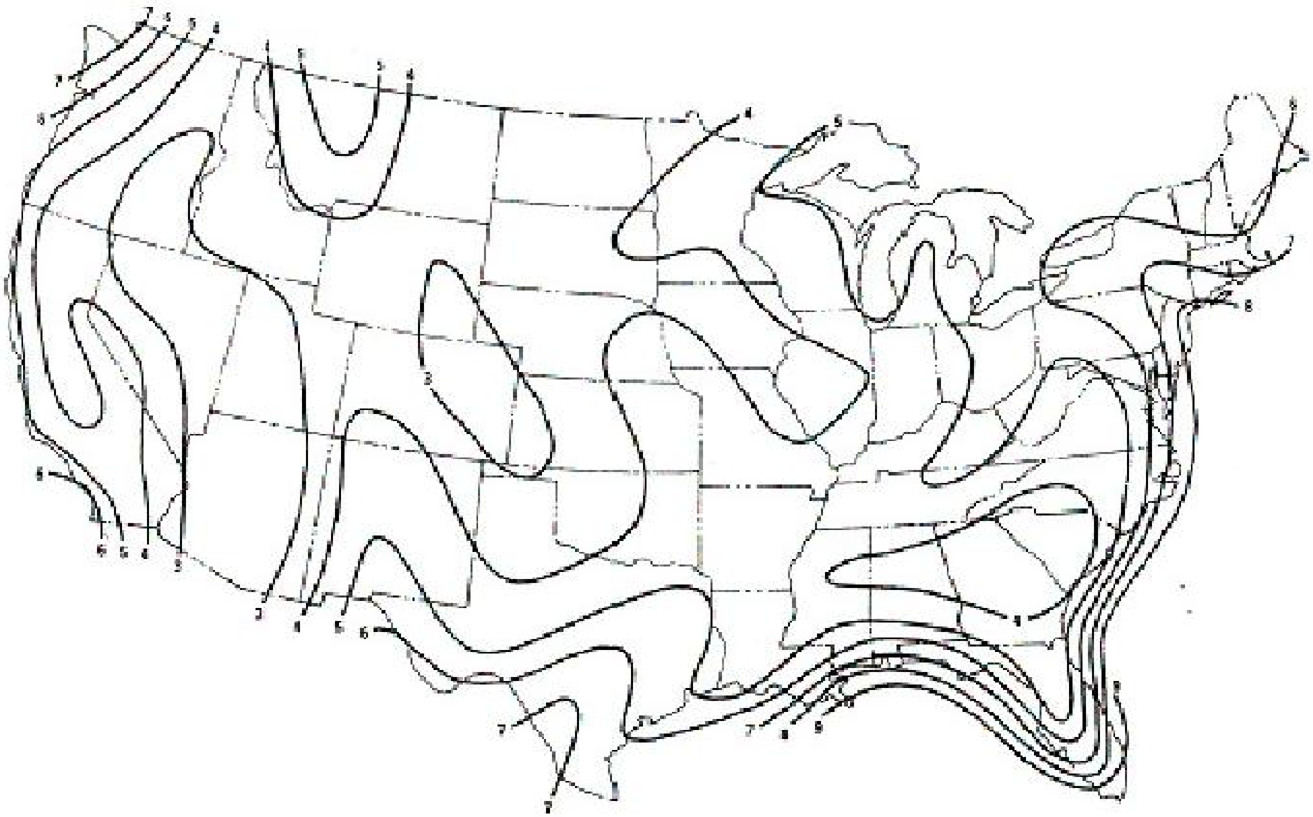
Figure 3.6-6Midland, TX 1987-1991 Wind Rose



(NWS, 2003)

AVERAGE LIGHTNING FLASH DENSITY

Figure 3.6-7 Average Lightning Flash Density



Isopleths (m x 10^2) of mean annual morning mixing heights

SOURCE: (EPA, 1972)

ANNUAL AVERAGE MORNING MIXING HEIGHTS

Figure 3.6-8Annual Average Morning Mixing Heights

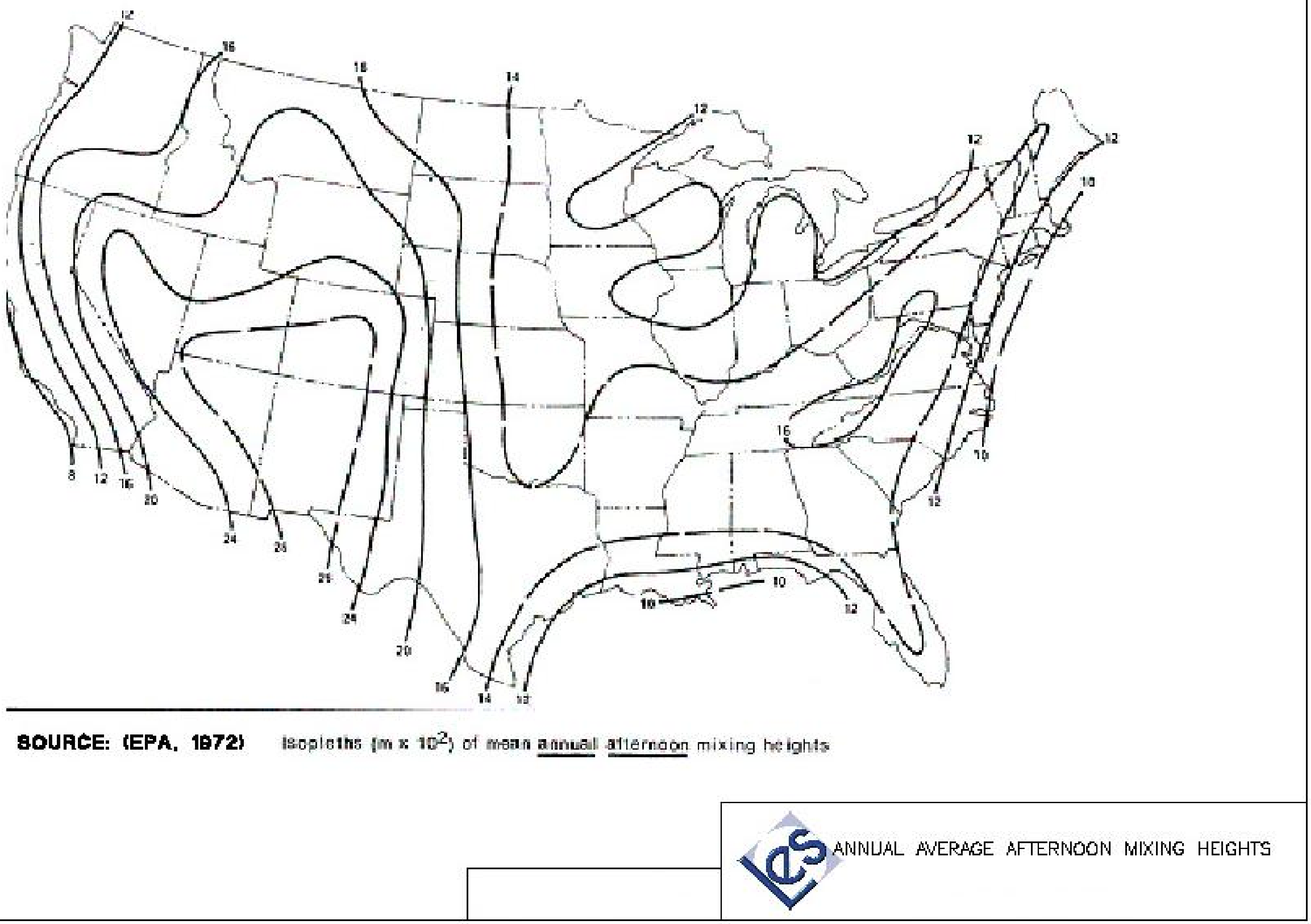
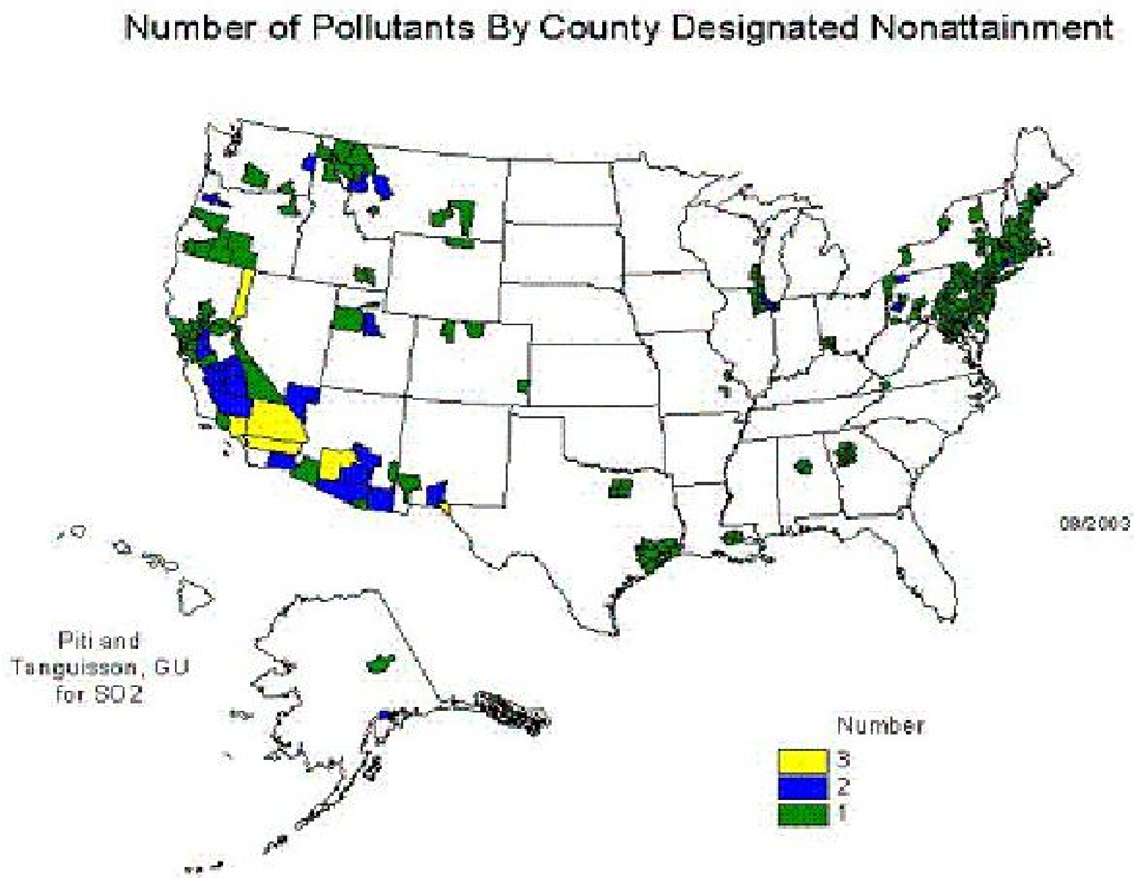


Figure 3.6-9Annual Average Afternoon Mixing Heights



(EPA 2003a)

EPA CRITERIA POLLUTANT
NONATTAINMENT MAP

Figure 3.6-10EPA Criteria Pollutant Nonattainment Map

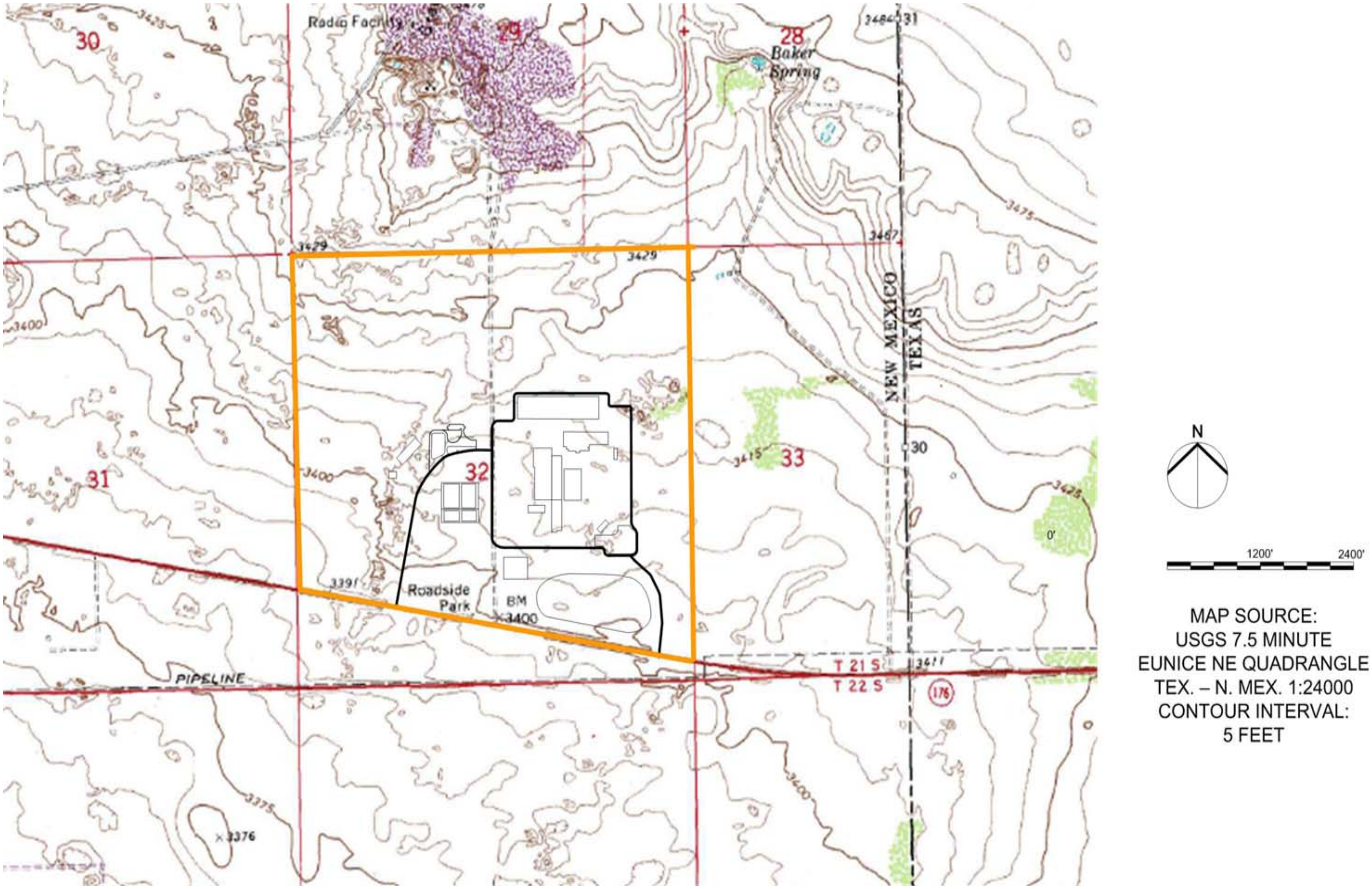
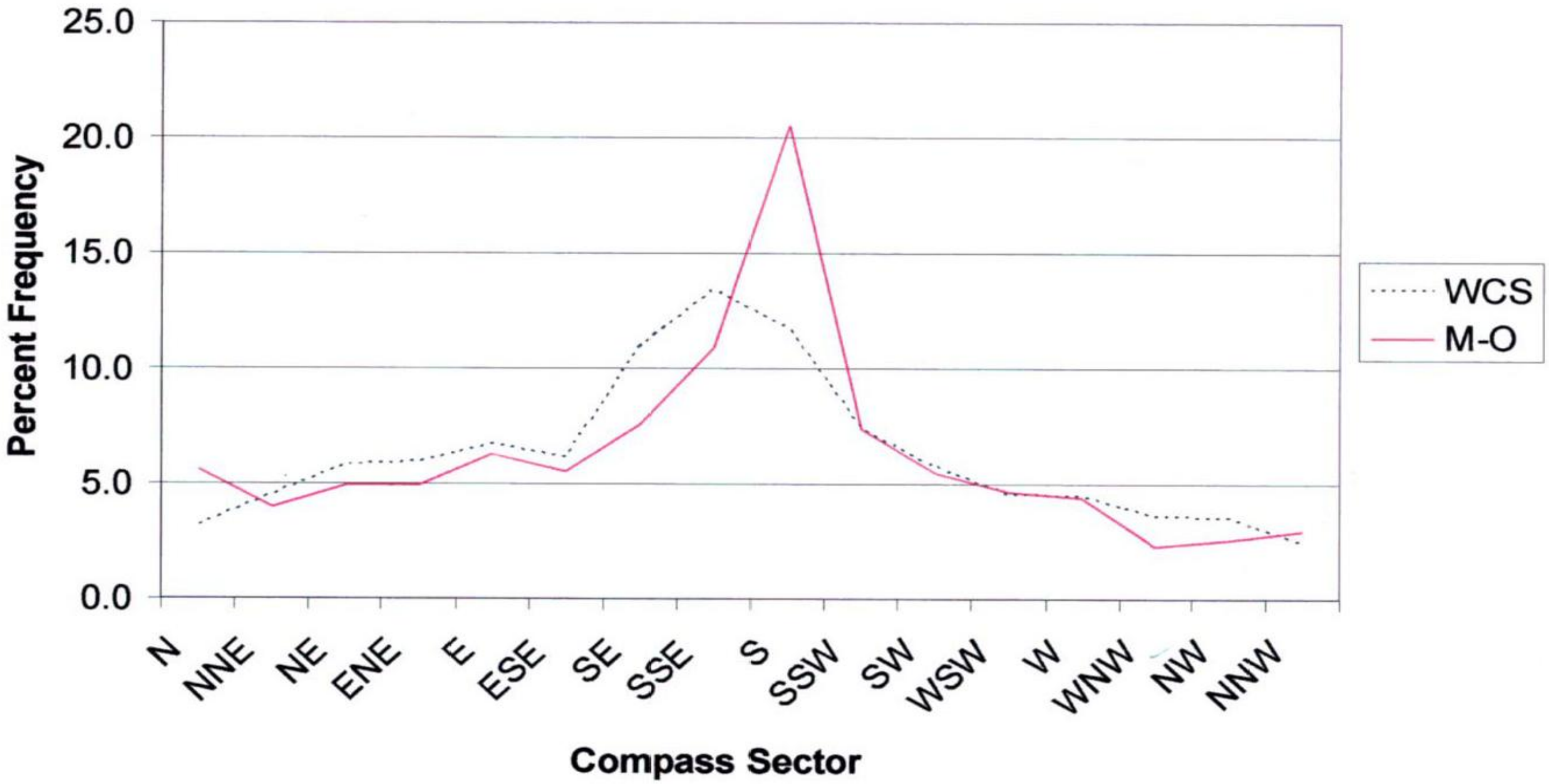


Figure 3.6-11Topographic Map of Site



COMPARISON OF WCS AND MIDLAND–ODESSA WIND DIRECTION DATA

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

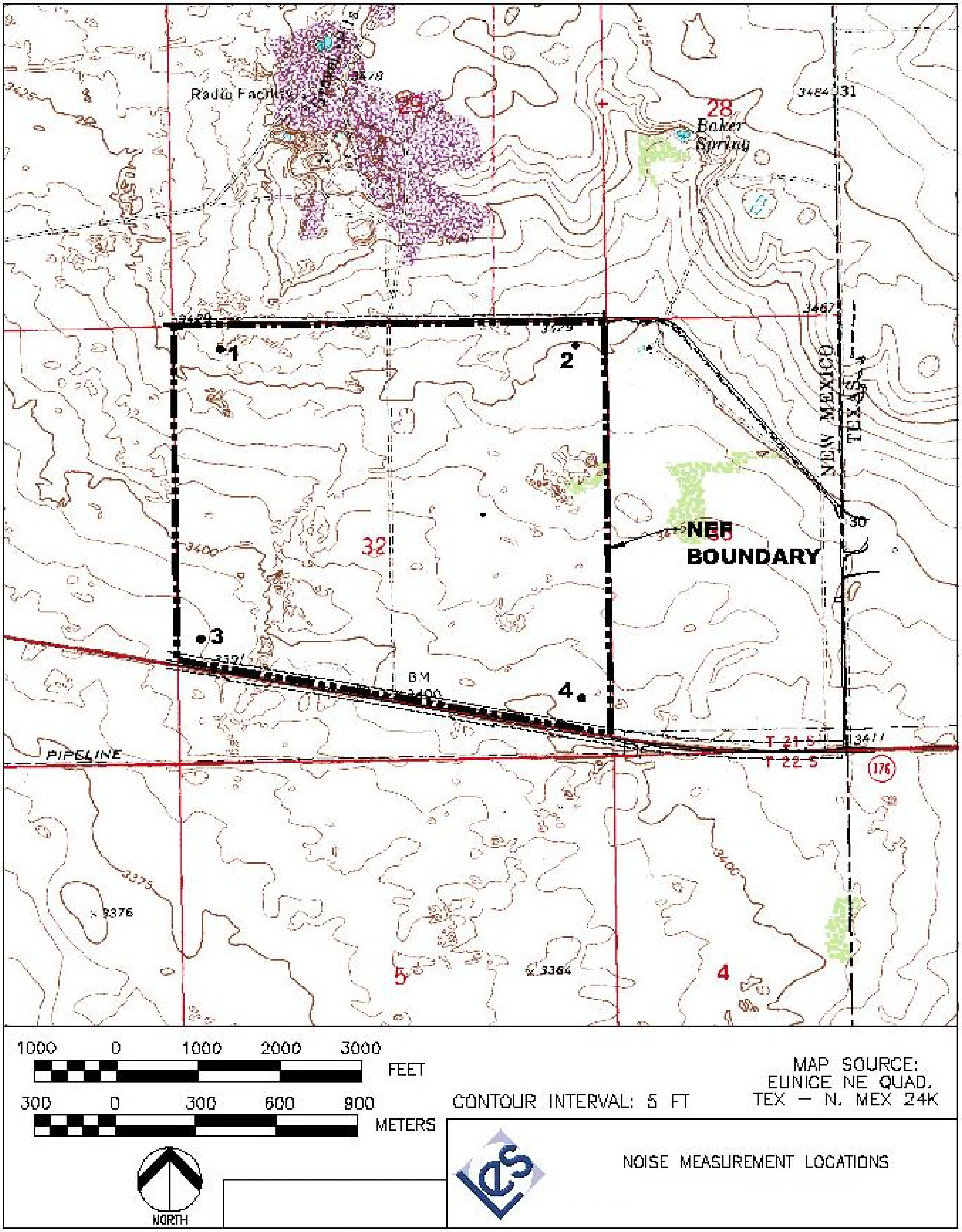


Figure 3.7-1 Noise Measurement Locations

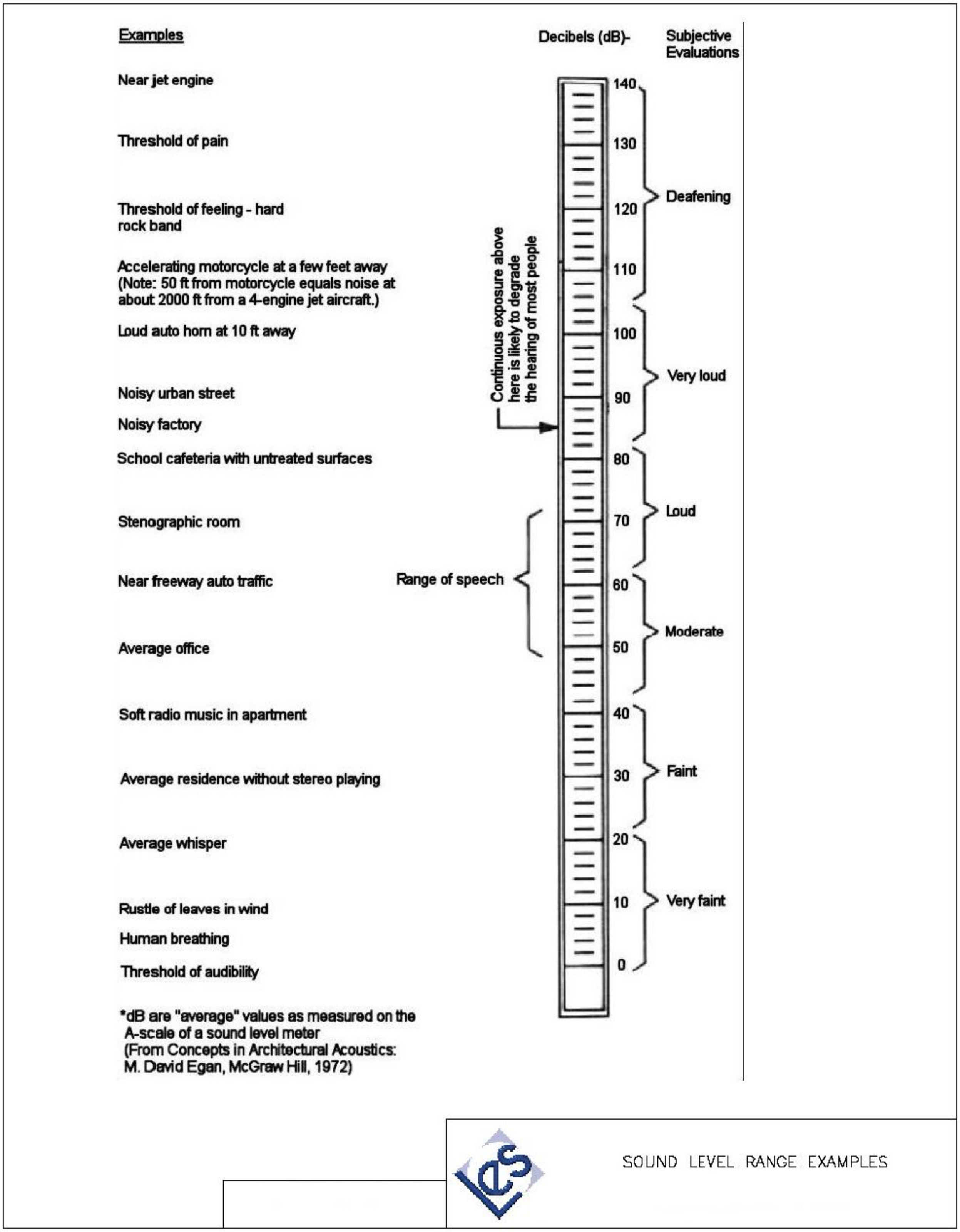


Figure 3.7-2Sound Level Range Examples

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 3.9-1Scenic 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

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

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

VIEW OF WEST HALF OF PROPOSED NEF SITE (SAND DUNE BUFFER) 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

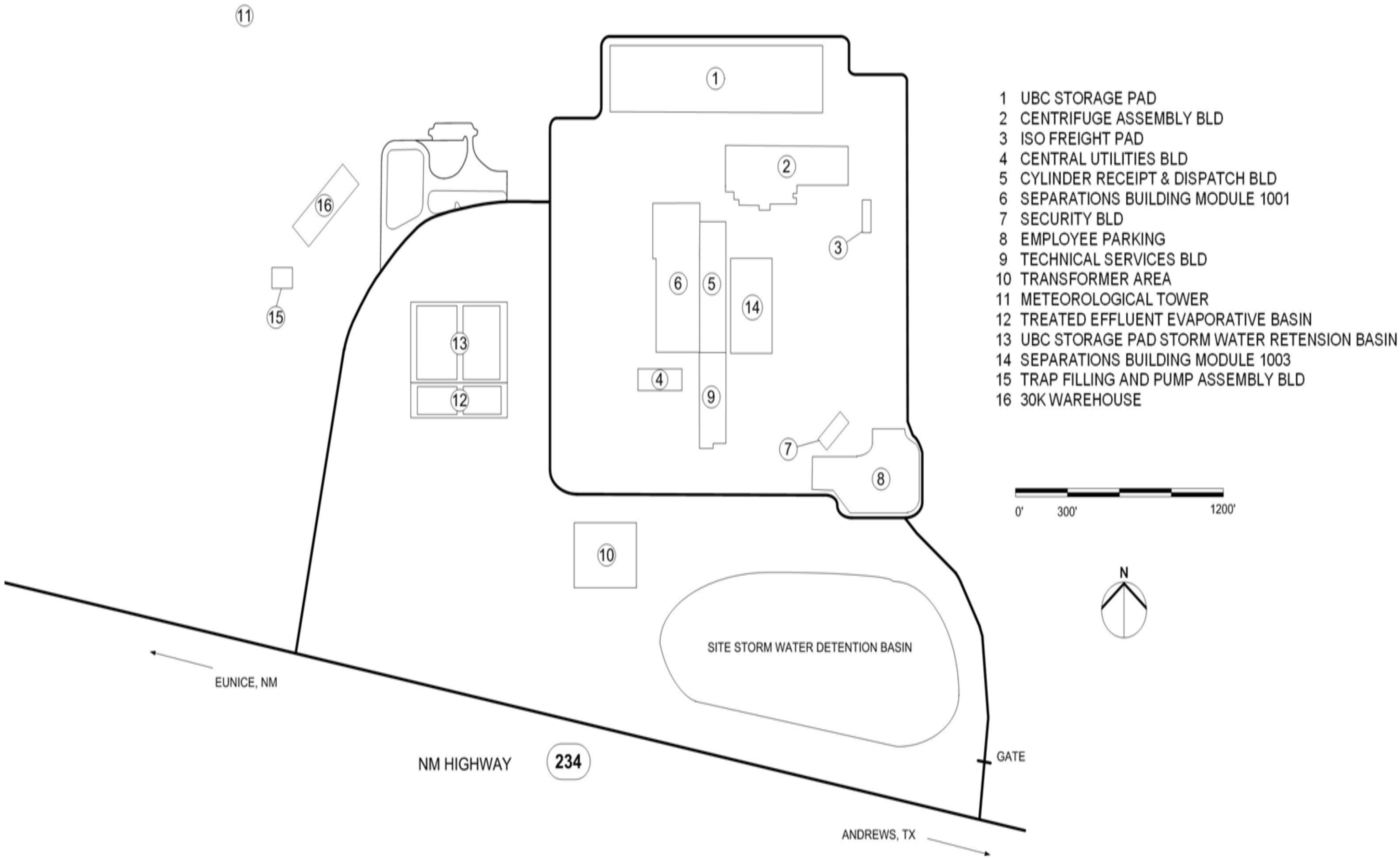


Figure 3.9-2 Constructed Features (Site Plan)

3.10 SOCIOECONOMIC

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

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

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

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

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

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

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

3.10.1 Population Characteristics

3.10.1.1 Population and Projected Growth

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

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

3.10.1.2 Minority Population

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

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

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

Health Care

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.

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

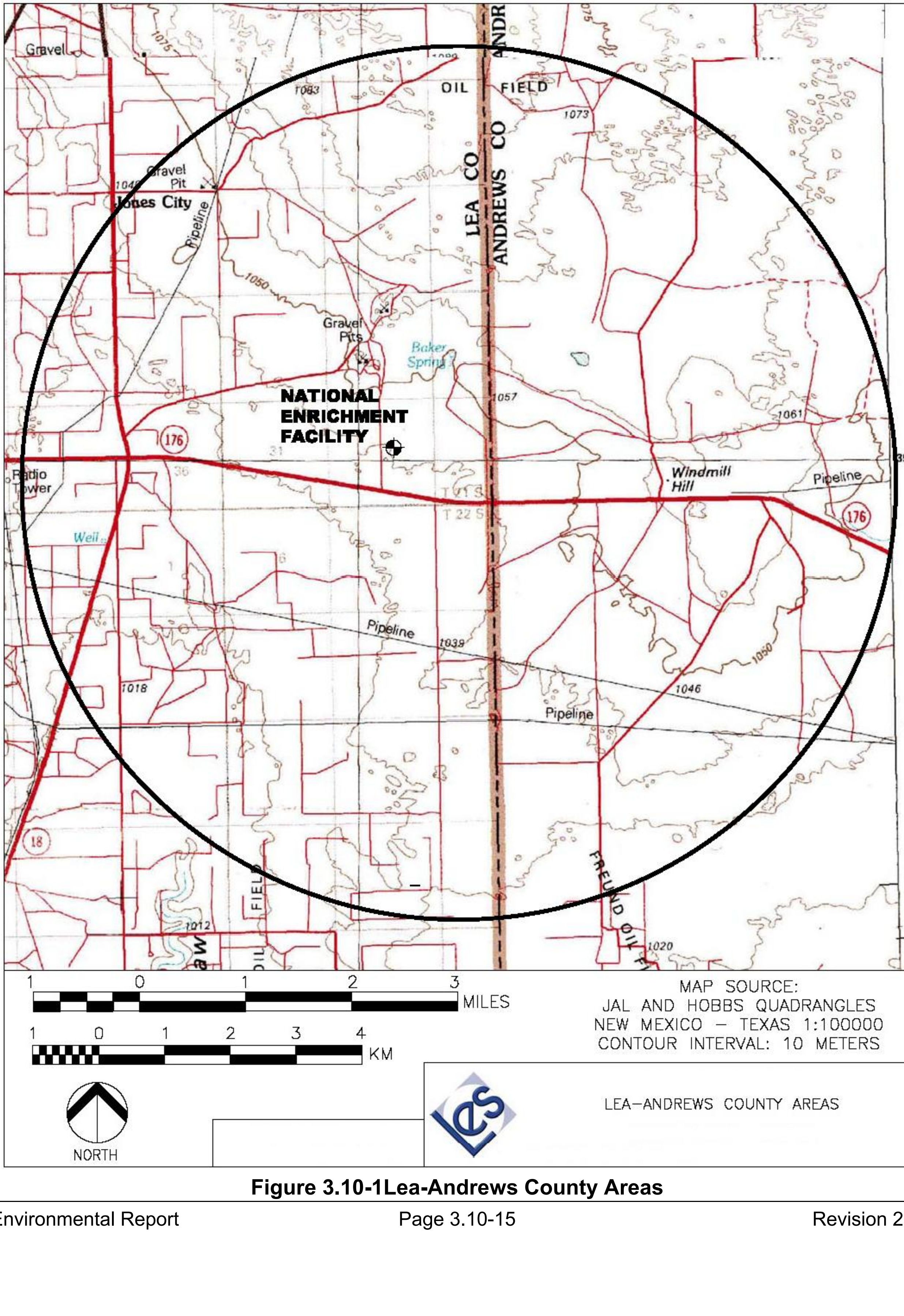


Figure 3.10-1Lea-Andrews County Areas

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).

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 (UF_4). 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 $\mu g/m^3$ (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 $UF_6 \Rightarrow U + 3F_2$ $UF_6 \Rightarrow UF_4 + F_2$	$+2.16x10^6$ $(+ 9.29x10^5)$ $+1.32x10^5$ $(+ 1.3x10^5)$	$+2.03x10^6$ $(+ 8.73x10^5)$ $+2.65x10^5$ $(+ 1.14x10^5)$
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:

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

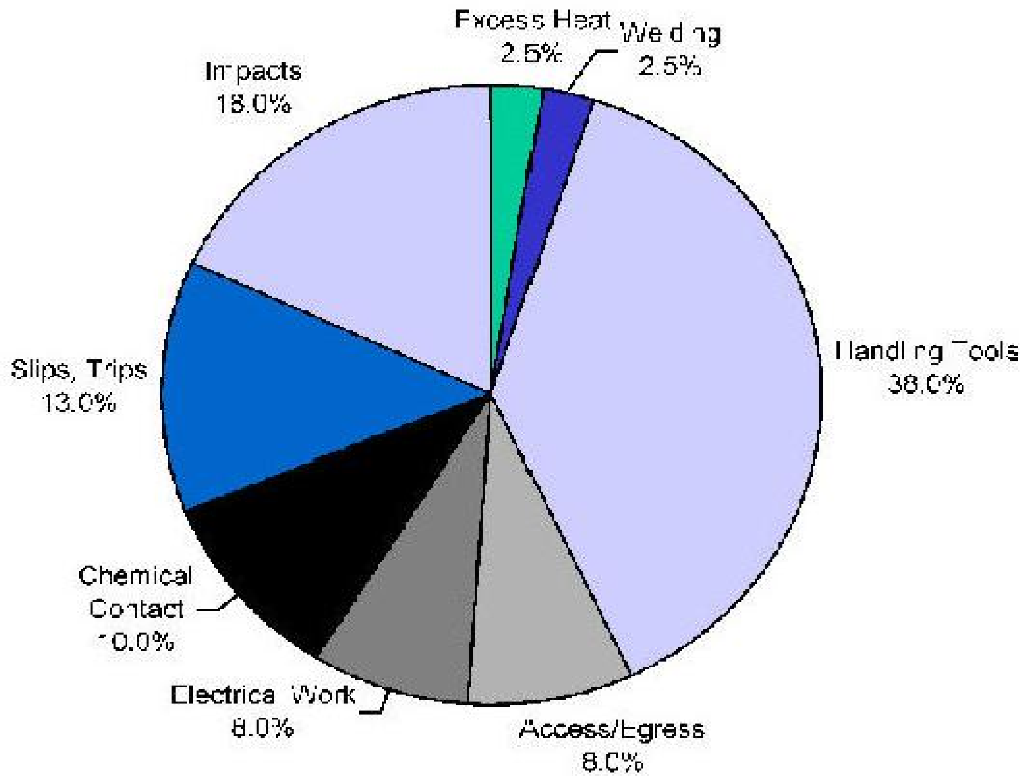
The reaction of UF_6 with nickel, copper and aluminum produces a protective fluoride film, which slows or stops the reaction.

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



2000–2002 ACCIDENTS BY CAUSE

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 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 carbon filters. The systems produce no gaseous effluents of their own, but discharge effluents from other systems after treatment to remove hazardous materials.

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

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 (PXGEVS)

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

A mimumum target velocity of 7 m/s (1380 ft/min) is 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 PXGEVS piping connects to an inlet header. Off the inlet header are two parallel filter 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.

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 both filter trains and exhaust fans. 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 PXGEVS 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, Tails Take-off System, 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.

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[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.

If the PXGEVS stops operating, material within the piping will not be released into the building because each of the PXGEVS 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 PXGEVS are available in the UF_6 Handling Area.

3.12.1.1.4 Local Extract GEVS (LXGEVS)

The LXGEVS, located on the second floor of the CRDB Bunker, provides flexible exhaust hoses strategically located throughout the SBM and CRDB to collect and filter potential releases from local work areas for connection and disconntection of cylinders and maintenance activities. The system is monitored from the Control Room.

A minimum target velocity of 7 m/s (1380 ft/min) is 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 air velocity.

The LXGEVS piping connects to an inlet header. Off the inlet header are two parallel filter trains. 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 consist 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, 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.

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 CRDB. One exhaust stack is common to both filter trains and exhaust fans. 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 1,190 m^3/hr (700 cfm).

If the LXGEVS stops operating, material within the piping will not be released into the building because each of the LXGEVS 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.

3.12.1.1.5 CRDB GEVS

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

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.

3.12.1.1.6 Design and Safety Features for all GEVS

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 detect the release of hazardous materials to the environment. Alpha monitors are installed in the exhaust stacks to detect 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 is based on the remaining absorption capacity (as determined by laboratory analysis). The prefilter and HEPA 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 PXGEVS 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).

3.12.1.1.7 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 SAR § 12.6) Liquid Effluent Collection and Treatment System (LECTS)

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 SBM. 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 Room 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 PFPE 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.

- 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.

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 PFPE 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 PFPE oil, it is not possible to send the degreaser water to the Precipitation Treatment Tank for treatment. Therefore, the PFPE oil must be removed first.

For PFPE 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 2,130 m^3/yr (562,631 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 Effluent.

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 Radiologically Controlled Area (RCA) 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 as defined in 40 CFR 261 (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 RCA. 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 as defined under the Resource Conservation and Recovery Act (40 CFR 261) (RCRA) 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 inspected 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 and to comply with RCRA regulations.

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 RCAs 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 PFPE 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 RCAs 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 SBM 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 Activated Sodium Fluoride

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

3.12.2.1.2.5 Filter Elements

Prefilters and HEPA filters are used in several places throughout the plant to remove dust and dirt, uranium compounds, and 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 an RCA 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 0.10 to 0.50 $^{w}/_{o}$ ^{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 cradles 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 SBM 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.

All materials are being handled following best management practices (BMPs) and a spill reporting procedure will be used to document the proper steps should a release occur. This procedure identifies the personnel responsible for evaluation, reporting requirements, and steps for remediation, if 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 primarily disposable protective clothing for employees, and as a result, there are no effluents.

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	
	Total Mass Kg (lb)	Uranium Content Kg (lb)	Total Mass Kg/lb	Uranium Content Kg/lb
Waste Type				
Activated Carbon	300 (662)	25 (55)	-	-
Activated Alumina	2,160 (4,763)	2.2 (4.9)	-	-
PFPE 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	3.96×10^8 (1.40×10^{10})
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 PXGEVS, LXGEVS, 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

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]
Hand Wash and Showers	2,100 (554,820)	None
Total Contaminated Effluent :	2,130 (562,631)	56.5 (125)[2]
Cooling Tower Blowdown:	8,168(2,119,278)	None
Sanitary:	7,253 (1,916,250)	None
Stormwater Discharge:		
Gross Discharge[3]	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 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.

3 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	69,803 L (18,440 gal)	Quantity reflects the fuel to be stored onsite for the Diesel Fire Water Pump, CUB Diesel Generators, and the Security Diesel Generator.
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

4.0 ENVIRONMENTAL IMPACTS

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

4.1 LAND USE IMPACTS

4.1.1 Construction Impacts

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

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

During the construction phase of the NEF site, conventional earthmoving and grading equipment will be used. The removal of very dense soil or caliche may require the use of heavy equipment with ripping tools. Soil removal work for foundations will be controlled to reduce over-excavation to minimize construction costs. In addition, loose soil and/or damaged caliche will be removed prior to installation of foundations for seismically designed structures. The maxium anticipated excavation depth for construction at the NEF site is 32 feet.

Though the entire site could be impacted, wildlife on the site will have an opportunity to move to areas of suitable habitat bordering the NEF site. The loss of cattle grazing lands represented by site construction will be minimal due to the abundance of other nearby grazing areas. No mitigation is necessary to offset this minimal impact.

The CO2 pipeline was relocated in accordance with all applicable regulations, so as to minimize any direct or indirect impacts on the environment.

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

Impacts to land and groundwater will be controlled during construction through compliance with the National Pollution Discharge Elimination System (NPDES) Construction General Permit obtained from Region 6 of the Environmental Protection Agency (EPA). BMPs will be used to prevent releases; however, should a release occur, site procedures will identify individuals and their responsibilities for implementation of corrective measures and provide instructions for prompt notifications of state and local authorities, as required.

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

4.1.2 Utilities Impacts

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

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

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

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

4.1.3 Comparative Land Use Impacts of No Action Alternative Scenarios

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

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

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

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

4.2 TRANSPORTATION IMPACTS

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

4.2.1 Construction of Access Road

Near the proposed NEF site, New Mexico Highway 234 is a two-lane highway with 3.7-m (12 ft) driving lanes, along with deceleration, acceleration, and turning lanes. At its widest, across from the facility, the highway is14.63 –m (48 ft) across with an 7 ft shoulder on its southern edge. Across from the facility, the shoulder varies from 2.4-m (8ft) 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. Access to the site is directly off of New Mexico Highway 234. An onsite, gravel covered road currently bisects the east and west halves of the site. Two construction access roadways off of New Mexico Highway 234 will be built to support construction. The materials delivery construction access road will run north off of New Mexico Highway 234 along the west side of the NEF. The personnel construction access road will run north off of New Mexico Highway 234 along the east side of the NEF. Both roadways will eventually be converted to permanent access roads upon completion of construction. Therefore, impacts from access road construction will be minimized.

4.2.2 Transportation Route

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

4.2.3 Traffic Pattern Impacts

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

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

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

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

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

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

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

Notes:

[a]At junction with New Mexico Highway 234

[b]Source: (NMSHTD, 2003)

[c]At junction with New Mexico Highway 18

[d]Source: (TDOT, 2002)

[e]Denoted as a major intersection

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

4.2.4 Construction Transportation Impacts

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

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

Air quality impacts from construction site preparation for the NEF were evaluated using emission factors and air dispersion modeling. Emission rates for fugitive dust were calculated using emission factors provided in AP-42, the U.S. Environmental Protection Agency's Compilation of Air Pollutant Emission Factors (EPA, 1995). More detailed discussions of air emissions and dispersion modeling can be found in ER Section 4.6.1, Air Quality Impacts from Construction, and ER Chapter 12, Appendix B, Air Quality Impacts of Construction Site Preparation Activities.

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

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

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

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

4.2.5 Mitigation Measures

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

- The use of water in the control of dust on dirt roads, when necessary, in clearing and grading operations, and construction activities. Water conservation will be considered when deciding how often dust suppression sprays will be applied. See ER Section 4.4.7, Control of Impacts for Water Quality, for a discussion of water conservation measures;
- The use of adequate containment methods during excavation and other similar operations;
- Open-bodied trucks transporting materials likely to give rise to airborne dust will be covered when in motion;

- The prompt removal of earthen materials on paved roads placed there by trucks or earth moving equipment, or by wind erosion; and
- Prompt stabilization or covering of bare areas once earthmoving activities are completed.

4.2.6 Agency Consultations

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

4.2.7 Radioactive Material Transportation

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

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

4.2.7.1 Uranium Feed

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

4.2.7.2 Uranium Product

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

4.2.7.3 Depleted Uranium and Uranium Wastes

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

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

4.2.7.4 Transportation Modes, Routes, and Distances

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

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

4.2.7.5 Radioactive Treatment and Packaging Procedure

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

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

4.2.7.6 Incident-Free Scenario Dose

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

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

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

- Natural uranium (in the feed to the process)
- Enriched uranium (final product, at 5 wt % ^{235}U)
- Depleted uranium (at 0.10 to 0.50 wt % ^{235}U), and
- Solid waste (at 370 Bq (10 nanocuries) of natural uranium per gram of waste).

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

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

4.2.7.7 Environmental Impacts from Transportation of Radioactive Material

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

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

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

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

4.2.8 Comparative Transportation Impacts of No Action Alternative Scenarios

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

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

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

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

4.2.9 Section 4.2 Tables

Table 4.2-1 Possible Radioactive Material Transportation Routes

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

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

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

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

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

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

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

1 Collective dose equivalent based on population density along route.

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

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

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

5 Type and number of containers shipped per year given parenthetically.

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

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

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

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

4.3 GEOLOGY AND SOIL IMPACTS

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

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

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

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

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

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

4.3.1 Comparative Geology and Soil Impacts of No Action Alternative Scenarios

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

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

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

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

4.4 WATER RESOURCE IMPACTS

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

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

- *A National Pollutant Discharge Elimination System (NPDES) General Permit for Industrial Stormwater:* This permit is required for point source discharge of stormwater runoff from industrial or commercial facilities to the waters of the state. All new and existing point source industrial stormwater discharges associated with industrial activity require a NPDES Stormwater Permit from the EPA Region 6 and an oversight review by the New Mexico Water Quality Bureau (NMWQB). The NEF is eligible to claim the “No Exposure” exclusion for industrial activity of the NPDES storm water Phase II regulations. As such, the LES would submit a No Exposure Certification immediately prior to initiating operational activities at the NEF site. LES also has the option of filing for coverage under the Multi-Section General Permit (MSGP) because the NEF is one of the 11 eligible industry categories. If this option is chosen, LES will file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the initiation of NEF operations. A decision regarding which option is appropriate for the NEF will be made in the future.
- *NPDES General Permit for Construction Stormwater:* Because construction of the NEF will involve the disturbance of more than 0.4 ha (1 acre) of land an NPDES Construction General Permit from the EPA Region 6 and an oversight review by the New Mexico Water Quality Bureau (NMWQB) are required. LES will develop a Storm Water Pollution Prevention Plan (SWPPP) and file a NOI with the EPA, Washington, D.C., at least two days prior to the commencement o construction activities.

- *Groundwater Discharge Permit/Plan:* The NMWQB requires that facilities that discharge an aggregate waste water of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems apply for and submit a groundwater discharge permit and plan. This requirement is based on the assumption that these discharges have the potential of affecting groundwater. NEF will discharge treated process water, stormwater, and cooling tower blowdown water to surface impoundments, and send domestic septic wastes to the City of Eunice Wastewater Treatment Plant. Six underground septic tanks may also be installed onsite as a backup to the sewage system. A groundwater discharge permit/plan will be required under 20.6.2.3104 NMAC. Section 20.6.2.3.3104 NMAC of the New Mexico Water Quality Control Commission (NMWQCC) Regulations (20.6.2 NMAC) requires that any person proposing to discharge effluent or leachate so that it may move directly or indirectly into groundwater must have an approved discharge permit, unless a specific exemption is provided for in the Regulations.
- *Section 401 Certification:* Under Section 401 of the federal Clean Water Act, states can review and approve, condition, or deny all federal permits or licenses that might result in a discharge to State waters, including wetlands. A 401 certification confirms compliance with the State water quality standards. Activities that require a 401 certification include Section 404 permits issued by the USACE. The State of New Mexico has a cooperative agreement and joint application process with the USACE relating to 404 permits and 401 certifications. By letter dated March 17, 2004, the USACE notified LES of its determination that there are no USAEC jurisdictional waters at the NEF site and for this reason the project does not require a 404 permit (USACE, 2004). As a result, a Section 401 certification is not required.

NEF site design addresses:

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

Discharge of operations waste water will be made exclusively to the Treated Effluent Evaporative Basin for only those liquids that meet physical and chemical criteria per prescribed standards. That basin, described in ER Section 3.4.1.2, is double-lined to prevent infiltration, provided with leak detection, and open to allow evaporation. An annual volume of about 2,130 m^3/yr (562,631 gal/yr) will be discharged to the Treated Effluent Evaporative Basin for evaporation.

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

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

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

4.4.1 Receiving Waters

The NEF will not obtain any water or discharge any process effluents onto the site or into surface waters other than into engineered basins. Sanitary waste water 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 underground septic tanks may also be installed onsite as a backup to the sewage system. Rain runoff from developed portions of the site will be collected in retention/detention basins, described previously and in ER Section 3.4, Water Resources. These include the Site Stormwater Detention Basin and the UBC Storage Pad Stormwater Retention Basin.

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

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

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

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

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

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

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

4.4.2 Impacts on Surface Water and Groundwater Quality

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

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

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

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

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

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

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

4.4.3 Hydrological System Alterations

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

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

4.4.4 Hydrological System Impacts

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

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

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

4.4.5 Ground and Surface Water Use

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

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

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

4.4.6 Identification of Impacted Ground and Surface Water Users

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

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

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

4.4.7 Control of Impacts to Water Quality

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

Wastes generated during site construction will be varied, depending on activities in progress. Any hazardous wastes from construction activities will be handled and disposed of in accordance with applicable state regulations. This includes proper labeling, recycling, controlling and protected storage and shipping offsite to approved disposal sites. Sanitary wastes generated at the site will be handled by portable systems until such time that it can be sent to the City of Eunice Wastewater Treatment Plant for processing via a system of lift stations and 8-inch sewage lines. Six underground septic tanks may also be installed onsite as a backup to the sewage system.

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

During operation, the NEF’s stormwater runoff detention/retention system will provide a means to allow controlled release of site runoff from the Site Stormwater Detention Basin only. Stormwater discharge will be periodically monitored in accordance with state and/or federal permits. This system will also be used for routine sampling of runoff as described in ER Section 6.1.1.2, Liquid Effluent Monitoring. A SWPP will also be implemented for the NEF to assure that runoff released to the environment will be of suitable quality. The SWPP is described in ER Section 4.1, Land Use Impacts.

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

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

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

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

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

- Construction equipment will be in good repair without visible leaks of oil, greases, or hydraulic fluids.
- Use of BPMs to prevent spills and releases.
- Use of the BMPs will assure stormwater runoff related to these activities will not release runoff into nearby sensitive areas (EPA, 2003g). See ER Sections 4.1.1 and 4.2.5 for construction BMPs.
- BMPs will also be used for dust control associated with excavation and fill operations during construction. Water conservation will be considered when deciding how often dust suppression sprays will be applied (EPA, 2003g).
- Silt fencing and/or sediment traps will be used.
- External vehicle washing (no detergents, water only).
- Stone construction pads will be placed at entrance/exits if unpaved construction access adjoins a state road.
- All temporary construction and permanent basins are arranged to provide for the prompt, systematic sampling of runoff in the event of any special needs.

- Water quality impacts will be controlled during construction by compliance with the National Pollution Discharge Elimination System – General Permit requirements and by applying BMPs as detailed in the site Stormwater Pollution Prevention (SWPP) plan.
- A procedure will be implemented for the reporting and response to releases and spills.
- All above-ground diesel storage tanks will be bermed.
- Any hazardous materials will be handled by approved methods and shipped offsite to approved disposal sites. Sanitary wastes generated during site construction will be handled by portable systems, until such time that plant sanitary facilities are available for site use. An adequate number of these portables systems will be provided.
- The NEF Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant including the collection, analysis, and processing of liquid wastes for disposal.
- Control of surface water runoff will be required for activities covered by the EPA Region 6 NPDES Construction General Permit.

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

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

4.4.8 Identification of Predicted Cumulative Effects on Water Resources

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

4.4.9 Comparative Water Resources Impacts of No Action Alternative Scenarios

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

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

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

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

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

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

4.4.10 Section 4.4 Figures

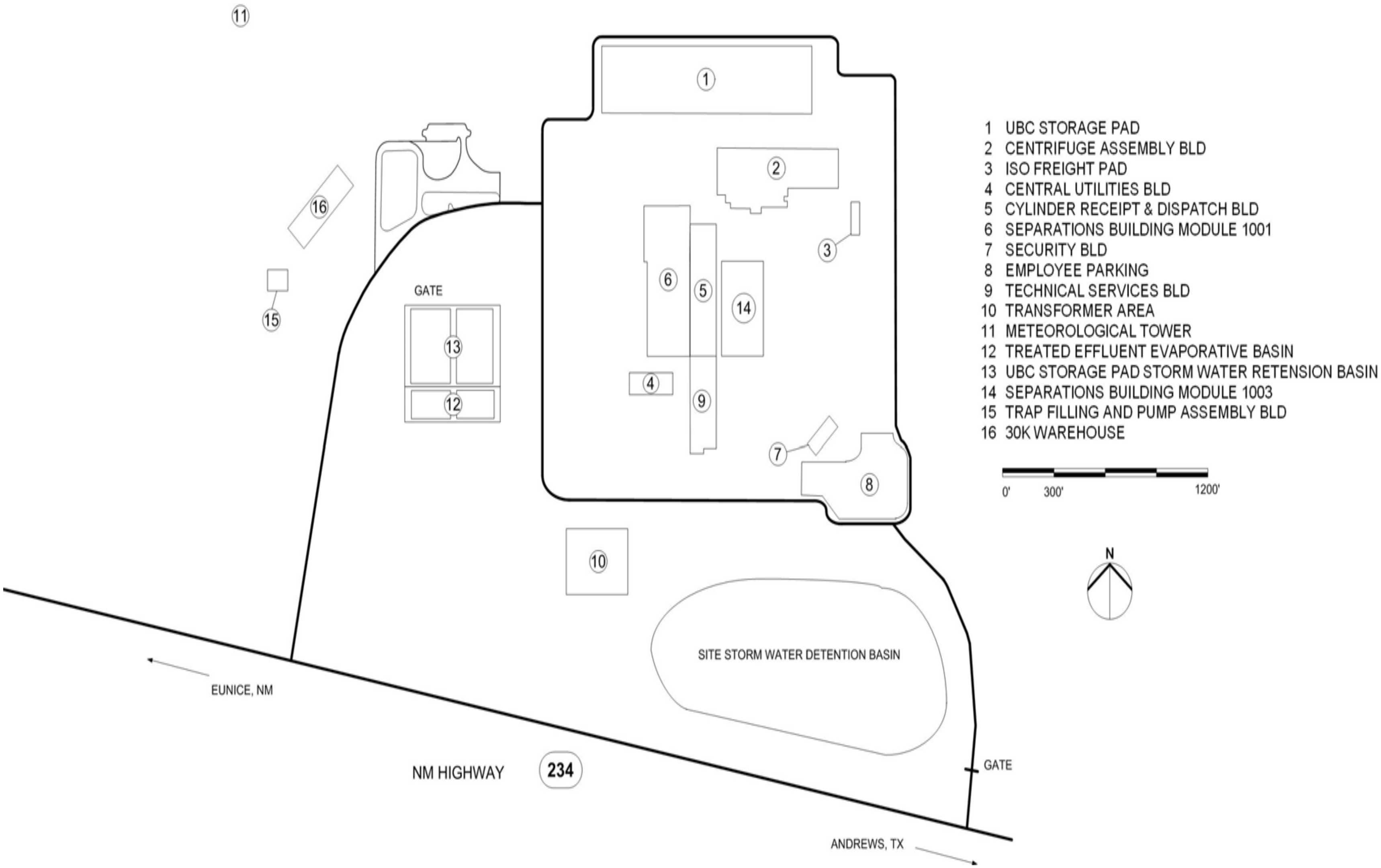


Figure 4.4-1 Site Plan with Stormwater Detention/Retention Basins

4.5 ECOLOGICAL RESOURCES IMPACTS

4.5.1 Maps

See Figure 4.5-1, Ecological Resource Impacts.

4.5.2 Proposed Schedule of Activities

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

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

4.5.3 Area of Disturbance

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

4.5.4 Area Of Disturbance By Habitat Type

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

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

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

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

4.5.5 Maintenance Practices

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

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

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

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

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

4.5.6 Short Term Use Areas And Plans For Restoration

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

4.5.7 Activities Expected To Impact Sensitive Communities Or Habitats

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

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

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

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

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

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

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

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

4.5.8 Impacts Of Elevated Construction Equipment Or Structures

The construction of new towers can create a potential impact on migratory birds, especially night-migrating species. Some of the species affected are also protected under the Endangered Species Act and Bald and Golden Eagle Act. However, the estimate of the potential impacts of elevated construction equipment or structures on species is extremely low for the NEF site. The tallest proposed structure is 40 m (130 ft), which is well under the 61 m (200 ft) threshold that requires lights for aviation safety. This avoidance of lights, which attract species, and the low above ground level structure height, also reduces the relative potential for impacts. Additionally, security lighting for all ground level facilities and equipment will be down-shielded to keep light within the boundaries of the site, also helping to reduce the potential for impacts (USFWS, 1998).

4.5.9 Tolerances And Susceptibilities Of Important Biota To Pollutants

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

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

4.5.10 Construction Practices

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

4.5.11 Special Maintenance Practices

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

4.5.12 Wildlife Management Practices

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

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

Proposed wildlife management practices include:

- The placement of a raptor perch in an unused open area.
- The placement of quail feeders in the unused open areas away from the NEF buildings.
- The use of native, low-water consumption landscaping in and around the stormwater retention/detention basins.
- The management of unused open areas (i.e. leave undisturbed), including areas of native grasses and shrubs for the benefit of wildlife.
- The use of native plant species to revegetate disturbed areas to enhance wildlife habitat.
- The use of netting or other suitable material to ensure migratory birds are excluded from evaporative ponds that do not meet New Mexico Water Quality Control Commission (NMWQCC) surface water standards for wildlife usage.
- The use of animal-friendly fencing around ponds or basins which may contain contaminated process water so that wildlife cannot be injured or entangled.
- During plant construction and relocation of the CO2 pipeline, minimize the amount of open trenches at any given time and keep trenching and backfilling crews close together.

- During plant construction and relocation of the CO_2 pipeline, trench during the cooler months (when possible).
- During plant construction and relocation of the CO_2 pipeline, avoid leaving trenches open overnight. Escape ramps will be constructed at least every 90 m (295 ft). The slope of the ramps will be less than 45 degrees. Trenches that are left open overnight will be inspected and animals removed prior to backfilling.

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

4.5.13 Practices And Procedures To Minimize Adverse Impacts

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

4.5.14 Comparative Ecological Resource Impacts of No Action Alternative Scenarios

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

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

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

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

4.5.15 Section 4.5 Figures

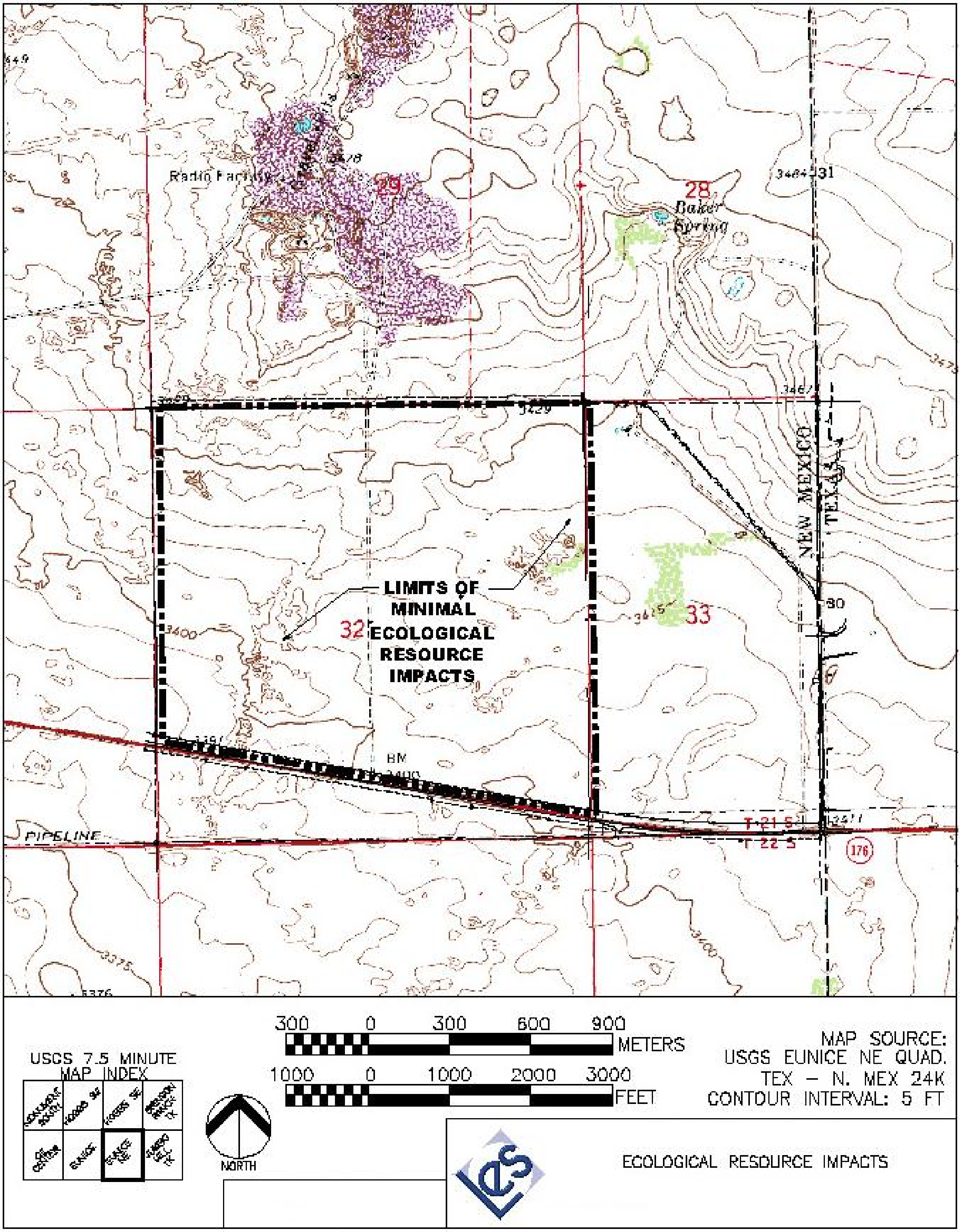


Figure 4.5-1 Ecological Resource Impacts

4.6 AIR QUALITY IMPACTS

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

4.6.1 Air Quality Impacts From Construction

Air quality impacts from site preparation for the NEF were evaluated using emission factors and air dispersion modeling. Emission rates of Clean Air Act Criteria Pollutants and non-methane hydrocarbons (a precursor of ozone, a Criteria Pollutant) were estimated for exhaust emissions from construction vehicles and for fugitive dust using emission factors provided in AP-42, the U.S. Environmental Protection Agency's Compilation of Air Pollutant Emission Factors (EPA, 1995). The total emission rates were used to scale the output from the Industrial Source Complex Short-Term (ISCST3) air dispersion model (air concentrations derived using a unit source term) to estimate both short-term and annual average air concentrations at the facility property boundary. ISCST3 is a refined, U.S. EPA-approved air dispersion model in the Users Network for Applied Modeling of Air Pollution (UNAMAP) series of air models (EPA, 1987). It is a steady-state Gaussian plume model that can be used to estimate ground-level air concentrations from industrial sources out to a distance of 50 km (31 mi). The air emissions calculations and air dispersion modeling are discussed in more detail in Chapter 12, Appendix B Air Quality Impacts of Construction Site Preparation Activities.

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

Of the combustion sources, vehicle exhaust will be the dominant source. Fugitive volatile emissions will also occur because vehicles will be refueled onsite. Estimated vehicles that will be operating on the site during construction consist of two types: support vehicles and construction equipment. Detailed air quality impact evaluation assumptions, including types and numbers of support vehicles and construction equipment, are given in Chapter 12.0, Appendix B Air Quality Impacts of Construction Site Preparation Activities. Emission factors in AP-42 for "highway mobile sources" were used to estimate emissions of criteria pollutants and non-methane hydrocarbons for support vehicles. Emission factors are also provided in AP-42 for diesel-powered construction equipment that will be operating on the site during peak construction.

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

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

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

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

4.6.2 Air Quality Impacts From Operation

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

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

4.6.2.1 Description of Gaseous Effluents

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

Nonradioactive gaseous effluents include HF, ethanol and methylene chloride. HF releases are estimated to be about 1.0 kg (2.2 lbs) each year. Approximately 40 L (10.6 gal) and 610 L (161 gal) of ethanol and methylene chloride, respectively, are estimated to be released each year. In addition, there will be three diesel generators onsite for use as standby power sources. However, the use of these diesel generators will be administratively controlled (i.e., only run a limited number of hours per year) and are exempt from air permitting requirements of the State of New Mexico.

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

4.6.2.2 Description of Gaseous Effluent Vent Systems (GEVS)

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

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

There are three GEVS for the plant: Pumped Extract GEVS (PXGEVS), Local Extract GEVS (LXGEVS), and CRDB GEVS. In addition, the Centrifuge Test and Post Mortem Facilities have an exhaust filtration system that serves the same purpose as the GEVS. These systems route potentially contaminated gaseous streams through filter systems prior to exhausting via roof mounted vent stacks to the atmosphere. The stacks contain continuous monitors to indicate radioactivity levels. Each GEVS and the Centrifuge Test and Post Mortem Facilites Exhaust Ventilation System is monitored from the Control Room.

PXGEVS, a Safe-By-Design[3] system, is located in the UF_6 Handling Area of SBM-1001, provides exhaust of potentially hazardous contaminants from all permanently connected vacuum pump and trap sets as well as temporary connections used by maintenance and sampling rigs in the SBMs.

LXGEVS is located on the second floor of the CRDB Bunker, provides flexible exhaust hoses strategically located throughout the SBM and CRDB to collect and filter potential releases from local work areas for connection and disconnection of cylinders and maintenance activities.

CRDB GEVS is located on the second floor of the CRDB Bunker, provides filtration of potentially contaminated gaseous streams in the CRDB from areas that include the Ventilated Room. Decontamination Workshop, Contamiated Material Handling Room, PFPE Oil Recovery System, Decontamination System, Chemical Laboratory, and Vacuum Pump Rebuild Work shop. The total air flow is handled by a central gaseous effluent distribution system that operates under negative pressure.

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

The Centrifuge Test and Post Mortem Exhaust Filtration System routes potentially contaminated exhaust gases from centrifuge test and post mortem activities through a filter system prior to exhausting through a roof mounted vent stack to the atmosphere. It also ensures the Centrifuge Test and Post Mortem Facility is maintained as a negative pressure with respect to adjacent areas during contaminated or potentially contraminated processes. The stack, located on the Centrifuge Assembly Building (CAB) roof, contains continuous monitors to indicate radioacitivity levels. The Centrifuge Test and Post Mortem Exhaust Filtration System is monitored from the Contrl Room. Operations that require the Centrifuge Test and Post Mortem Exhaust Filtration System to be operational are manually shut down if the system shuts down.

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

4.6.2.3 Calculation of Atmospheric Dispersion and Deposition Factors

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

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

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

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

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

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

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

The X/Q for the Centrifuge Assembly Building has been calculated following a similar methodology to the X/Q's calculated for the other facilities at NEF. The difference being the meteorological conditions for the CAB use a generic assumption of Pasquill Stability Class F with a wind speed of 0.6 m/s and no precipation to calculate the X/Q for a ground level release. This assumption is highly conservative and represents conditions beyond the 95th percentile 5-year site specific meteorological conditions. A correction factor for X/Q from ARCON96 is assumed for low wind speed correction in the enhahnced dispersion model.

4.6.3 Visibility Impacts

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

4.6.4 Air Quality Impacts from Decommissioning

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

4.6.5 Mitigative Measures for Air Quality Impacts

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

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

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

- The CRDB GEVS, LXGEVS, and PXGEVS are designed to collect and clean all potentially hazardous gases from the plant prior to release into the atmosphere. Instrumentation is provided to detect and signal via alarm, all non-routine process conditions, including the presence of radionuclides or HF in the exhaust stream that will trip the systems to a safe condition, in the event of effluent detection beyond routine operational limits.

- The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is designed to collect and clean all potentially hazardous gases from the serviced areas in the CAB prior to release into the atmosphere. Instrumentation is provided to detect and signal the Control Room via alarm, all non-routine process conditions, including the presence of radionuclides or HF in the exhaust stream. Operators will then take appropriate actions to mitigate the release.
- Construction BMPs will be applied as described previously to minimize fugitive dusts.
- Air concentrations of the criteria pollutants for vehicle emissions and fugitive dust will be below the National Ambient Air Quality Standards (NAAQS) and thus will not require further mitigation measures.

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

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

4.6.6 Comparative Air Quality Impacts of No Action Alternative Scenarios

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

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

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

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

4.6.7 Section 4.6 Tables

Table 4.6-1 Peak Emission Rates

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

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

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

(a) Secondary standard

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

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

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

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

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

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

NOTES:

TSB = Technical Services Building
SB = Site Boundary
NRESTRES = Nearest Resident
BUSINESS = Nearest Business
CAB = Centrifuge Assembly Building

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

No Decay, Undepleted

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

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

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

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

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

Decay, Depleted

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

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

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

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

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

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

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

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

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

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

Table 4.6-4Construction Emission Types

Emission Type	Source Location	Quantity
Fugitive Dust	On site	2.4 g/s (19.1 lb/hr)
Vehicle Exhaust	On site	4,535 kg/yr (5 tons/yr)
Portable Generator Exhaust	NA[1]	NA[1]
Paint Fumes	On site buildings	NA[1]
Welding Torch Fumes	On site buildings	NA[1]
Solvent Fumes	NA[1]	NA[1]
Air Compressors	NA[1]	NA[1]

[1]Information is not available at this time.

Table 4.6-5Offsite Vehicle Air Emissions During Construction

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

Table 4.6-6Air Emissions During Operations

Table 4.6-7Offsite Vehicle Air Emissions During Operations

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

Table 4.6-8Decommissioning Emission Types

Emission Type[1]	Source Location	Quantity
Fugitive Dust	On site	2.4 g/s (19.1 lb/hr)
Vehicle Exhaust	On site	4,535 kg/yr (5 tons/yr)
Portable Generator Exhaust	NA[2]	NA[2]
Cutting Torch Fumes	On site buildings	NA[2]
Solvent Fumes	NA[2]	NA[2]
Air Compressors	NA[2]	NA[2]

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

2 Information is not available at this time.

4.7 NOISE IMPACTS

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

4.7.1 Predicted Noise Levels

4.7.1.1 Construction Impacts

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

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

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

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

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

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

4.7.1.2 Operational Impacts

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

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

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

4.7.2 Noise Sources

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

4.7.3 Sound Level Standards

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

4.7.4 Potential Impacts to Sensitive Receptors

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

4.7.5 Mitigation

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

4.7.6 Cumulative Impacts

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

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

4.7.7 Comparative Noise Impacts of No Action Alternative Scenarios

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

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

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

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

4.8 HISTORIC AND CULTURAL RESOURCE IMPACTS

4.8.1 Direct Impacts

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

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

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

4.8.2 Indirect Impacts

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

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

4.8.3 Agency Consultation

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

4.8.4 Historic Preservation

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

4.8.5 Potential For Human Remains

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

4.8.6 Minimizing Adverse Impacts

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

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

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

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

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

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

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

4.8.7 Cumulative Impacts

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

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

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

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

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

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

4.9 VISUAL/SCENIC RESOURCES IMPACTS

4.9.1 Photos

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

4.9.2 Aesthetic and Scenic Quality Rating

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

4.9.3 Significant Visual Impacts

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

4.9.3.1 Physical Facilities Out Of Character With Existing Features

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

4.9.3.2 Structures Obstructing Existing Views

None of the proposed onsite structures will be taller than 40 m (130 ft). Due to the relative flatness of the site and vicinity, the structures will be observable from New Mexico Highway 234 and from nearby properties, partially obstructing views of existing landscape. However, considering that there are no high quality viewing areas (see ER Section 3.9.7, High Quality View Areas) and the many existing, manmade structures (pump jacks, high power lines, industrial buildings, above-ground tanks) near the NEF, the obstruction of existing views due to proposed structures will be comparable to current conditions. Refer to ER Figures 3.9-1A through 3.9-1H.)

4.9.3.3 Structures Creating Visual Intrusions

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

4.9.3.4 Structures Requiring The Removal Of Barriers, Screens Or Buffers

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

4.9.3.5 Altered Historical, Archaeological Or Cultural Properties

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

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

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

4.9.4 Visual Compatibility And Compliance

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

4.9.5 Potential Mitigation Measures

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

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

4.9.6 Cumulative Impacts To Visual/Scenic Quality

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

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

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

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

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

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

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

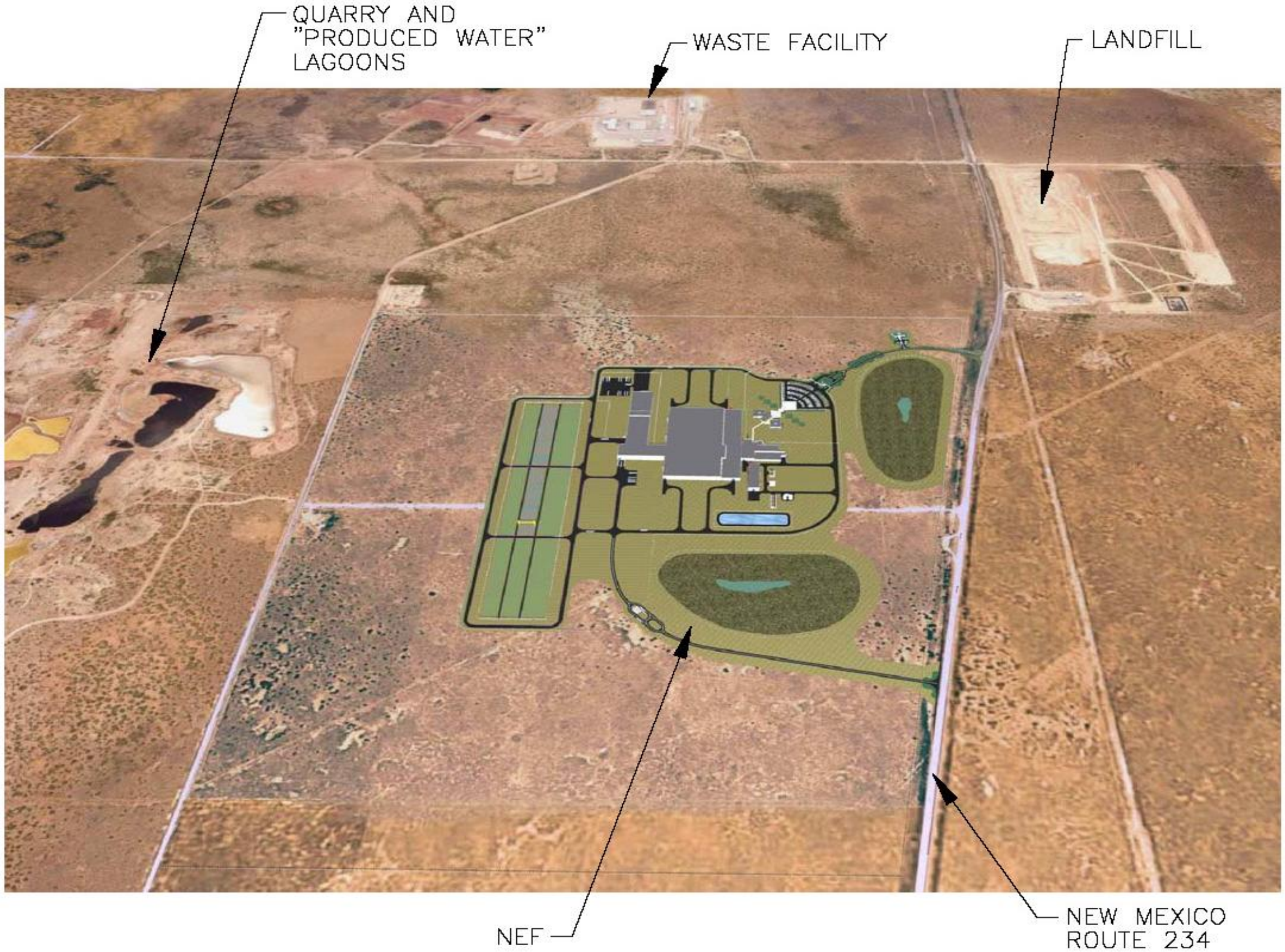
ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of “no action,” i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection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

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

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

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

4.9.8 Section 4.9 Figures



NOTE:
THE GREEN SHADING IS MEANT TO HIGHLIGHT THE NEF FOOTPRINT. IT IS NOT INDICATIVE OF VEGETATION.

NORTH

AERIAL VIEW

Figure 4.9-1 Aerial View

4.10 SOCIOECONOMIC IMPACTS

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

4.10.1 Facility Construction

4.10.1.1 Worker Population

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

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

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

4.10.1.2 Impacts on Human Activities

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

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

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

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

4.10.2 Facility Operation

4.10.2.1 Jobs, Income, and Population

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

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

An increase in the number of jobs would also lead to a population increase in the surrounding areas. Lea and Andrews Counties probably would experience the most noticeable population increases. However, these increases would be less than during facility construction and, accordingly, have commensurate lesser impacts. In particular, the region would avoid a boomtown effect, which generally describes the consequence of rapid increases in population (at least 5 to 10% per year) in small (populations of a few thousand to a few tens of thousands), rural 48 to 80 km (30 to 50 mi) or more from a major city communities undergoing rapid increases in economic activity (NRC, 1994a). The overall change in population density and population characteristics in Lea County, New Mexico and Andrews County, Texas due to operation of the NEF will be insignificant.

4.10.2.2 Community Characteristic Impacts

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

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

4.10.3 Regional Impact Due to Construction and Operation

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

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

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

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

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

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

4.10.4 Comparative Socioeconomic Impacts of No Action Alternative Scenarios

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

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

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

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

4.10.5 Section 4.10 Tables

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

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

Table 4.10-2Estimated Tax Revenue

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

(1) Based on average income

(2) Average

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

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

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

4.11 ENVIRONMENTAL JUSTICE

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

4.11.1 Procedure and Evaluation Criteria

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

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

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

4.11.2 Results

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

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

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

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

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

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

4.11.3 Comparative Environmental Justice Impacts of No Action Alternative Scenarios

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

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

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

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

4.11.4 Section 4.11 Tables

Table 4.11-1Minority Population, 2000

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

Table 4.11-1Minority Population, 2000

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

Table 4.11-1Minority Population, 2000

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

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

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

4.11.5 Section 4.11 Figures

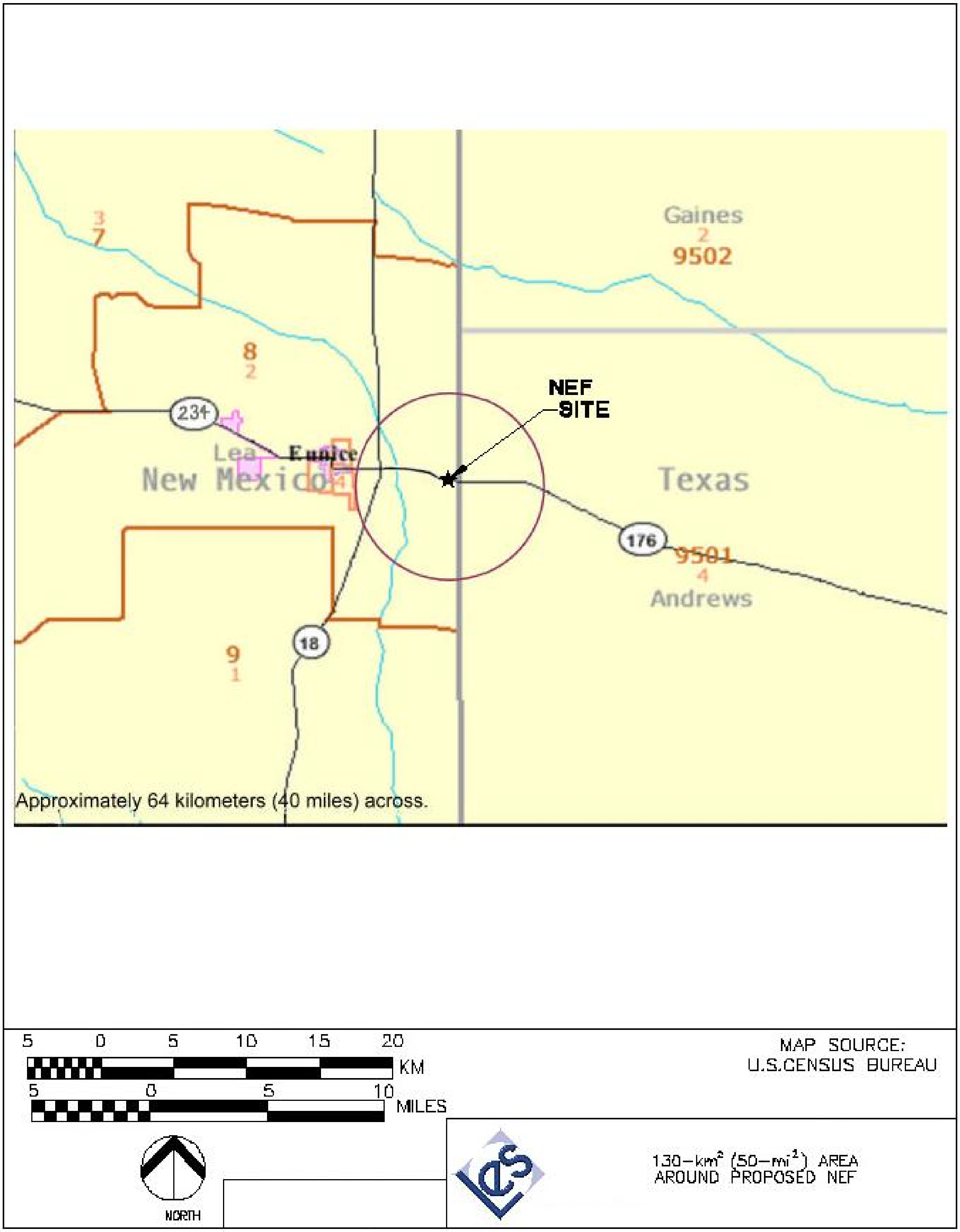


Figure 4.11-1130-km^2 (50-mi^2) Area Around Proposed NEF

4.12 PUBLIC AND OCCUPATIONAL HEALTH IMPACTS

4.12.1 Nonradiological Impacts

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

4.12.1.1 Routine Gaseous Effluent

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

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

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

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

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

4.12.1.2 Routine Liquid Effluent

Routine liquid effluents are listed in Table 3.12-4, Estimated Annual Liquid Effluent. All effluents are contained on the NEF site except sanitary waste. Sanitary wastewater will be sent to the City of Eunice Wastewater Treatment Plant via a system of lift stations and 8 inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system. See ER Section 2.1.2.3.4 for further discussion of the Liquid Effluent Collection and Treatment System. There is no water intake for surface water systems in the region. Water supplies in the region are from distant groundwater sources and are thus protected from any immediate impact due to potential releases. ER Section 3.4 provides further information about water wells in the site area. No public impact is expected from routine liquid effluent discharge.

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

4.12.2 Radiological Impacts

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

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

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

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

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

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

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

The enrichment process system operates sub-atmospherically such that any air leaks are into the equipment and not into the building environment. In addition to building HVAC, the plant design includes three separate GEVS for treatment of potentially contaminated gas streams as described in Section 4.6.2.2, Description of Gaseous Effluent Vent Systems (GEVS). Each GEVS includes two trains of exhaust filters (made up of a pre-filter bank, HEPA filter bank, impregnated activated carbon filter bank, and a final HEPA filter bank) before gaseous effluent is discharged to the environment. In addition, gaseous effluent from the GEVS is continuously monitored (refer to ER Section 6.1, Radiological Monitoring, for details regarding the effluent monitoring system).

The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System performs a similar function as the GEVS. It exhausts through a stack on the roof of the CAB. Discharges of gaseous effluent from both GEVS and the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System result in ground-level plumes because the release points are at roof top level on the SBM-1001, CRDB, or CAB, as applicable. Consequently, airborne concentrations of uranium present in gaseous effluent continually decrease with distance from the release point. Therefore, the greatest offsite radiological impact is expected at or near the site boundary locations in each sector. Site boundary distances have been determined for each sector (refer to ER Section 4.6 for details). The nearest resident has been identified at a distance of about 4.3 km (2.63 miles) in the west sector. Other important receptor locations, such as schools, have also been identified within an 8-km (5-mi) radius of the NEF site (refer to ER Section 3.10). With respect to ingestion pathways, there is little in the way of food crops grown within an 8-km (5-mi) radius due to semi-arid nature and minimal development of the local area for agriculture. Cattle grazing across the open range has been observed in the vicinity of the site (refer to ER Section 3.1). The radiological impacts on members of the public and the environment at these potential receptor locations are expected to be only small fractions of the radiological impacts that have been estimated for the site boundary locations because of the low initial concentrations in gaseous effluent and the high degree of dispersion that takes place as the gaseous effluent is transported.

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

4.12.2.1 Pathway Assessment

4.12.2.1.1 Routine Gaseous Effluent

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

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

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

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

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

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

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

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

Three groups of individuals (members of the public) or exposure scenarios were evaluated for both potential and real receptors located at or beyond the site boundary. For the first group, the dose impact to the nearest (and highest potentially impacted) residence was evaluated for all exposure pathways (inhalation and plume immersion, direct dose from ground plane deposition, and ingestion of food products which include fresh and stored vegetables, milk and meat postulated to be grown or raised at this location). The analysis included dose equivalent assessments for all four age groups (adults, teens, children and infants) for these pathways. The location of this residence is identified to be approximately 4.3 km (2.63 mi) west of the NEF site in the W sector as measured from the main plant vent systems situated on top of the SBM-1001 and CRDB (see Figures 4.12-1 and 6.1-2). The occupancy time was assumed to be continuous for a full year, along with a residential shielding factor of 0.7 (Regulatory Guide 1.109). This location provides for an assessment of doses to real members of the public.

The second group of individuals (critical populations) are those associated with local businesses situated near the plant site in the SE and N-NNW sectors about the plant (see Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Locations). Two locations were evaluated for impact assessment based on the most limiting offsite atmospheric dispersion factors, or where the combination of direct dose from fixed sources and plant effluents would maximize the projected total dose. The location of most limiting dispersion is for a small landfill site situated 0.93 km (0.57 mile) from the SBM-1001 and CRDB in the SE sector. The second business location is a quarry operation located approximately 1.8 km (1.1 mi) in the N-NNW sectors around the NEF. The combination of effluents and direct (including scatter) dose from fixed sources is potentially highest here for actually occupied locations. Since these two locations reflect outdoor businesses, the annual occupancy time is taken as the standard 2,000 hours for work environments. Also, the residential shielding factor of 0.7 was replaced with 1.0 (no shielding credit) since the nature of both operations is mainly outdoor work. In addition, only the inhalation and plume immersion pathways along with direct dose equivalent from ground plane deposition are applied since no food products (gardens or animals) are associated with these types of businesses. As these are work locations, the age group of interest, adults (>17 years), is the only significant group assumed to spend substantial time at these places.

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

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

4.12.2.1.2 Routine Liquid Effluent

The design of the NEF includes liquid waste processing to concentrate and filter out the majority of uranic materials that are collected as part of liquid waste treatment of various process streams. ER Section 2.1.2, Proposed Action, provides an overview of the liquid waste treatment systems. From an effluent standpoint, the main feature of the liquid waste treatment is that there is no direct liquid effluents discharged offsite. The primary liquid waste effluents that could contain residual uranic waste include (1) decontamination, laboratory and miscellaneous waste streams and (2) hand wash and shower effluents. Liquids discharged from these paths are collected and sent to an onsite basin (the Treated Effluent Evaporative Basin) that allows for natural evaporation of the liquid with the residual uranic material left behind in the bottom of the basin. The waste treatment system's design annual liquid uranic waste discharge to the basin is estimated to be 570 g (1.3 lb) of uranium, or approximately 14.4 MBq (390 μCi) of radioactivity. As with the gaseous waste effluents, the major radionuclides in the liquid waste stream are the three isotopes of uranium, ^{238}U, ^{235}U and ^{234}U. Of these, ^{238}U and ^{234}U account for about 97% of the total uranic radioactivity and dominate the dose contribution resulting from offsite releases. Similar to the treated liquid waste stream, water from other sources, such as site area rain runoff, are also collected on site in separate collection basins which allow for evaporation instead of liquid discharges across the site boundary.

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

The release pathway assumed for this evaluation is the airborne resuspension of particulate activity from the bottom of the basin after the waste water evaporates off.

As initial operating parameters, the Treated Effluent Evaporative Basin is assumed to be dry no more than 10% of the time. This assumption was made in order to estimate the duration of dust resuspension from the basin into the air. The actual duration that the basin remains dry over a year is dependent on the final design of the Treated Effluent Evaporative Basin. Final design considerations will take into account the As Low As Reasonably Achievable (ALARA) aspects of maximizing the duration that the basin remains wet in order to minimize, to the extent practicable, the potential resuspension of solids from the basin into the air, thereby minimizing the dose impact. The resuspension rate is taken as $4.0x10^{-6}$/hr based on information from a Department of Energy handbook (DOE, 1994) on various release scenarios of radioactivity to the atmosphere. The selected resuspension rate was taken from a very similar set of conditions to the NEF evaporative basin that addressed large pools of liquids outdoors that deposited uranic waste content into a soil layer that subsequently evaporated with a resulting resuspension of contaminants into the atmosphere. This resuspension rate was applied as a constant over the entire 30-year operating period of liquid waste buildup in the basin. The use of the $4x10^{-6}$/hr resuspension rate over this entire period is conservative according to a DOE handbook (DOE, 1994) on various release scenarios of radioactivity to the atmosphere, the resuspension rate was assessed only for freshly deposited contaminants that is not heavily intermingled with the overall soil or waste matrix. A review of resuspension literature (NRC, 1975a) also noted that resuspension factors for deposited material in soils reduces over time as the waste becomes fixed within the soil matrix. This reference (NRC, 1975a) provides an algorithm to correct for this time dependent reduction in the resuspension factor which would reduce the amount of resuspended material from the buildup of solid particles deposited over time. The end of plant license period release rates are thereby limited. For conservatism, no time-dependent reduction in the effective resuspension rate over the 30 years of waste deposits has been applied to the calculated offsite releases to the atmosphere. The actual long-term resuspension rate is a site-specific value that depends on environmental factors such as soil type, duration of dry conditions in the basin, and local weather conditions. The site's radiological monitoring program will include measurements of observed resuspension rates from the Treated Effluent Evaporative Basin over time in order to assess the site specific airborne releases from the basin for both the immediate onsite area around the basin and for offsite releases. This information will provide a basis to determine any specific control means needed to ensure that the buildup of radioactivity in the basin over time will not cause unexpected airborne levels of radioactive materials.

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

4.12.2.1.3 Direct Radiation Impacts

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

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

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

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

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

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

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

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

4.12.2.1.4 Population Dose Equivalents

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

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

4.12.2.1.5 Mitigation Measures

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

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

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

4.12.2.2 Public and Occupational Exposure Impacts

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

For gaseous effluents, the location of highest calculated offsite dose is the South site boundary with an annual effective dose equivalent of $1.7x10^{-4}$ mSv ($1.7x10^{-2}$ mrem), with a maximum annual organ (lung) committed dose of $1.4x10^{-3}$ mSv ($1.4x10^{-1}$ mrem). The nearest resident location had maximum annual effective dose equivalents of (teenager) $1.7x10^{-5}$ mSv ($1.7x10^{-3}$ mrem), or about a factor of 10 lower than the site boundary. The maximum annual organ (lung) at the nearest resident was estimated to be $1.2x10^{-4}$ mSv ($1.2x10^{-2}$ mrem) and was to the teenager age group. The nearest business, which exhibited the highest calculated annual effective dose equivalent, was at a location southeast, approximately 925 m (0.57 mi) from the SBM-1001 and CRDB release points. The annual effective dose equivalent for this location from liquid releases is $2.8x10^{-5}$ mSv ($2.8x10^{-3}$ mrem). The maximum organ (lung) committed dose for this receptor was estimated at $2.3x10^{-4}$ mSv ($2.3x10^{-2}$ mrem) from one year's exposure and intake. Tables 4.12-5 through 4.12-7 provide a breakdown of organ and effective doses by exposure pathway for gaseous effluents.

For liquid effluents which result in resuspended airborne particles from the dry out of the Treated Effluent Evaporative Basin, the location of highest calculated offsite dose is also the south site boundary with an annual effective dose equivalent of $1.7x10^{-5}$ mSv ($1.7x10^{-3}$ mrem), with a maximum annual organ (lung) committed dose of $1.5x10^{-4}$ mSv ($1.5x10^{-2}$ mrem). The nearest resident location had maximum annual effective dose equivalents of (teenager)

$1.7x10^{-6}$ mSv ($1.7x10^{-4}$ mrem), or about a factor of 10 lower that the site boundary liquid pathway doses, and about a factor of 10 below the equivalent gaseous dose impacts at the same local. The liquid impact assessments assumed that the evaporative basin was dry only 10% of the year, thereby limiting the dose impact. Even if the evaporative basin were assumed to be dry for a full year, the increase in the resuspended material into the air would increase the liquid pathway dose by a factor of 10, making it about the same impact as the gaseous pathway contribution to the total offsite dose. If it is assumed that the basin is dry almost an entire year allowing for a ten-fold increase in the projected dose, the resulting maximum dose equivalent (south site boundary) of 1.7E-04 mSv/yr (1.7E-02 mrem/yr) is still a small fraction of the 10 CFR 20.1301 (CFR, 2003q) dose limits for members of the public. Similarly, the maximum organ committed dose equivalent from liquid releases would increase from 1.5E-04 mSv/yr (1.5E-02 mrem/yr) to 1.5E-03 mSv/yr (1.5E-01 mrem/yr), which is below the 40 CFR 190 (CFR, 2003f) dose limits for members of the public.

The maximum annual organ (lung) dose equivalent at the nearest resident from liquid effluents was estimated to be $1.3x10^{-5}$ mSv ($1.3x10^{-3}$ mrem) and was to the teenager age group. The nearest business, which exhibited the highest calculated annual effective dose equivalent, was also the southeast location, approximately 925 m (0.57 mi) from the SBM-1001 and CRDB release points. The estimated annual effective dose equivalent for this location from liquid releases is $2.9x10^{-6}$ mSv ($2.9x10^{-4}$ mrem). The maximum organ (lung) committed dose for this receptor was estimated at $2.4x10^{-5}$ mSv ($2.4x10^{-3}$ mrem) from one year's exposure and intake. Tables 4.12-8 through 4.12-10 provide a breakdown of organ and effective doses by exposure pathway for the liquid effluent contribution to the offsite dose.

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

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

Table 4.12-3, Collective Dose Equivalents to All Ages Population (Person-Sieverts) and Table 4.12-4, Collective Dose Equivalents to All Ages Population (Person-rem) provide the estimated collective effective dose equivalent to the 80-km (50-mi) population (all age and exposure pathways). The estimated dose is 5.2×10^{-5} Person-Sv (5.2×10^{-3} Person-rem). This is a small fraction of the collective dose from natural background for the same population.

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

4.12.3 Environmental Effects of Accidents

4.12.3.1 Accident Scenarios

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

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

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

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

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

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

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

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

4.12.3.2 Accident Mitigation Measures

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

4.12.3.3 Non-Radiological Accidents

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

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

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

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

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

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

4.12.4 Section 4.12 Tables

Table 4.12-1Direct Radiation Annual Dose Equivalent by Source

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

* Distance from the closest edge of the pad.

**Distance from the center of the site.

Table 4.12-2Population Data for the Year 2000

Population (All Ages) Distribution (2000 Census) Within 80 km (50 mi)

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

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

(liquid and gas release pathways)

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

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

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

(liquid and gas release pathways)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 4.12-11Maximum Annual Liquid and Gas Radiological Impacts

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

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

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

Table 4.12-13Estimated NEF Occupational Dose Equivalent Rates

Area or Component	Dose Rate, mSv/hr (mrem/hr)
Plant general area (excluding SBMs)	< 1E-04 (<1E-02)
SBM-1001 – Cascade Halls	5E-04 (5E-02)
SBM-1001 – UF_6 Handling Area and Process Services Corridor	1E-03 (0.1)
SBM-1003 – Cascade Halls	TBD
SBM-1003 – UF_6 Handling Area and Process Services Corridor	TBD
Empty used UF_6 shipping cylinder	0.1 on contact (10.0) 0.010 at 1 m (3.3 ft) (1.0)
Full UF_6 Shipping cylinder	0.05 on contact (5.0) 0.002 at 1 m (3.3 ft) (0.2)

Table 4.12-14Estimated NEF Occupational (Individual) Exposures

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

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

Table 4.12-15Accident Criteria Chemical Exposure Limits by Category

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

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

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

4.12.5 Section 4.12 Figures

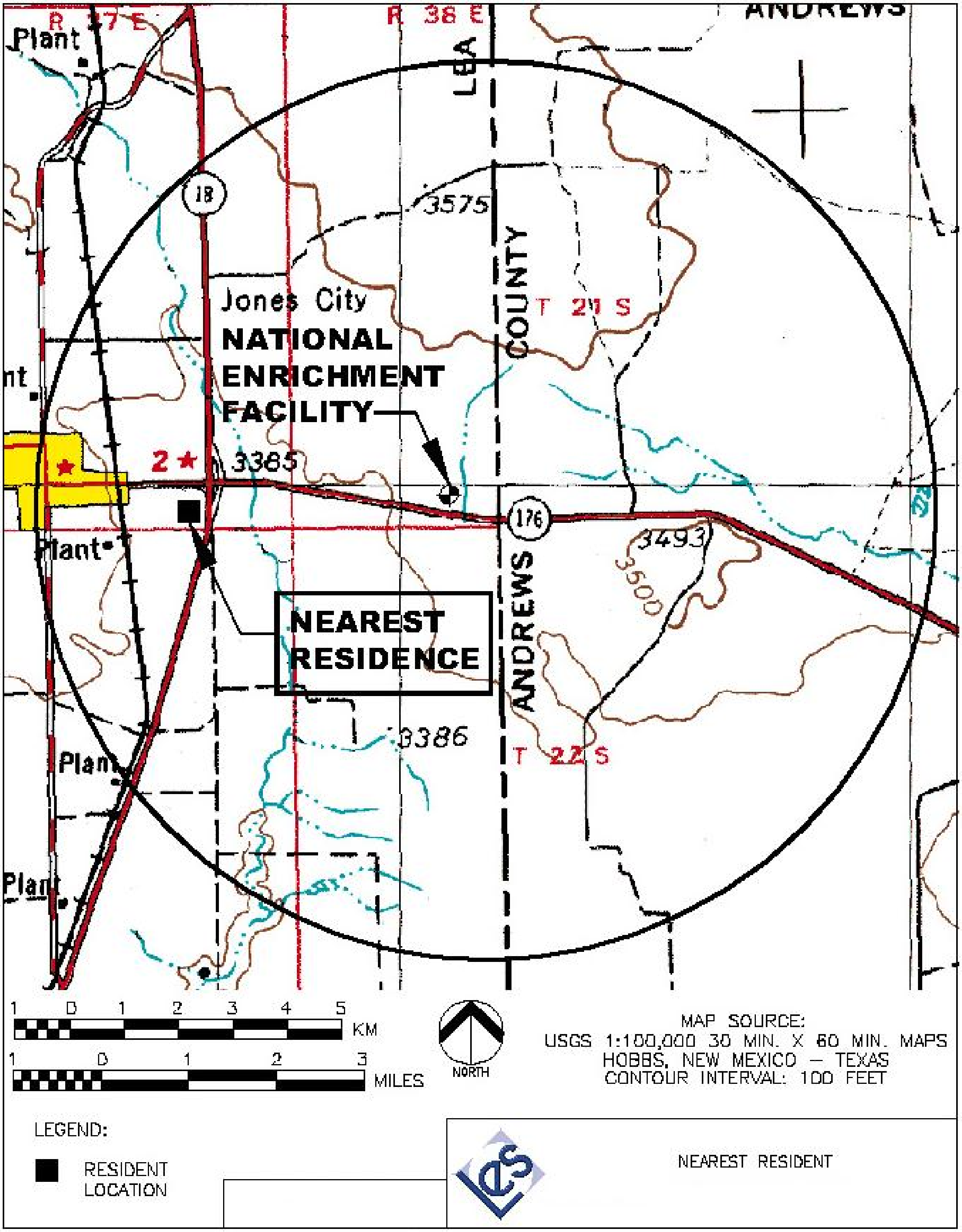


Figure 4.12-1Nearest Resident

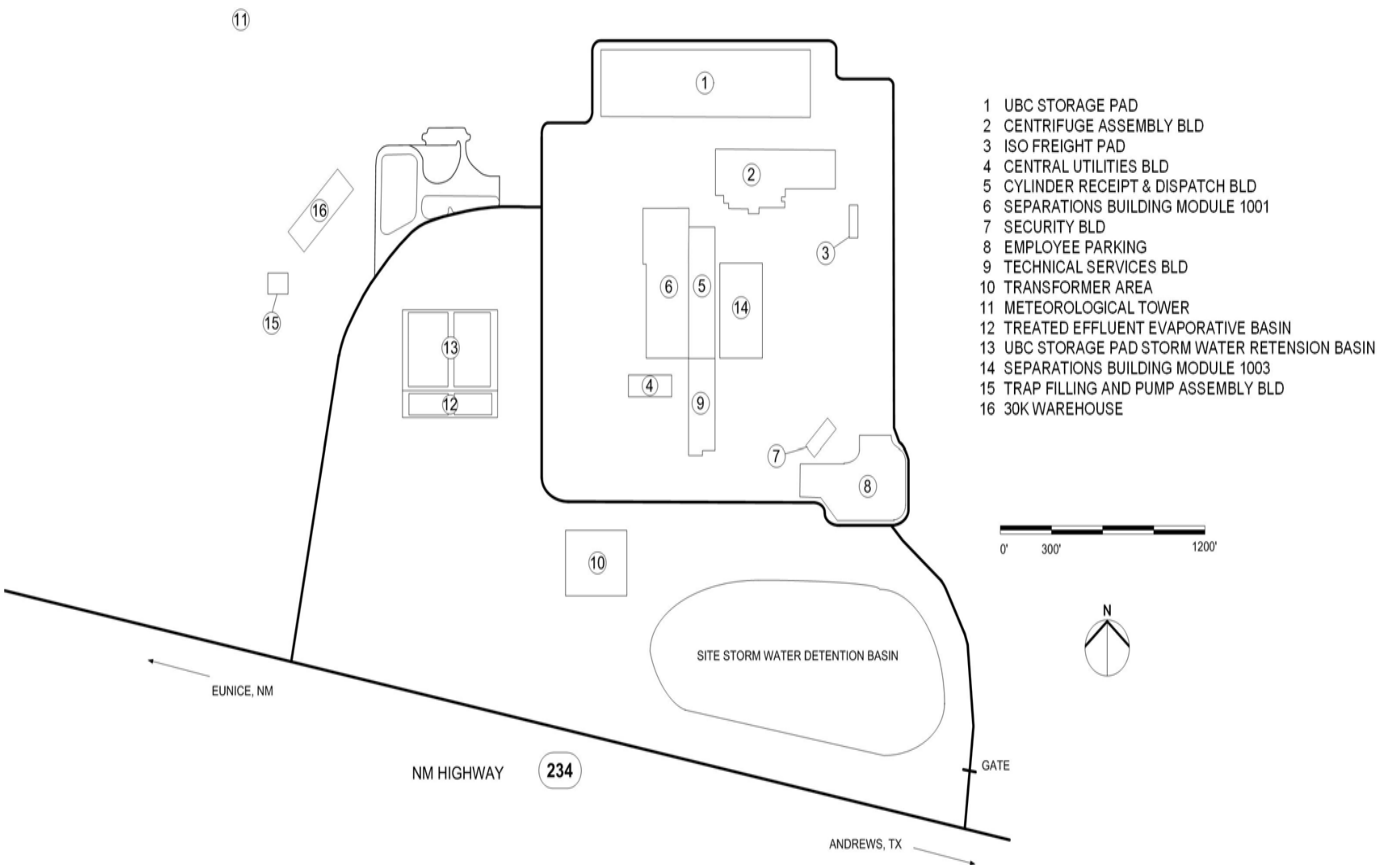


Figure 4.12-2Site Layout for NEF

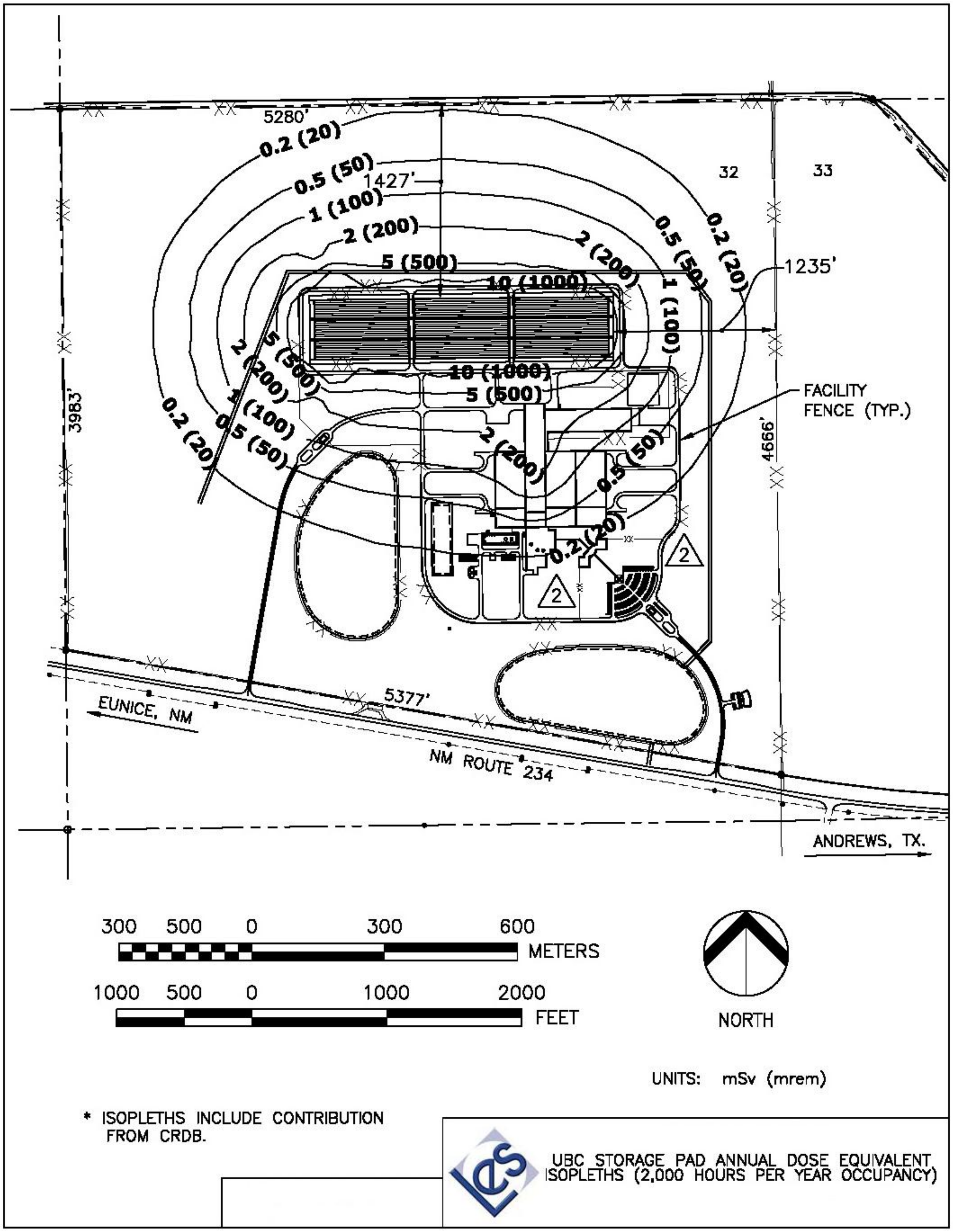


Figure 4.12-3UBC Storage Pad Annual Dose Equivalent Isopleths (2,000 Hours per Year Occupancy)

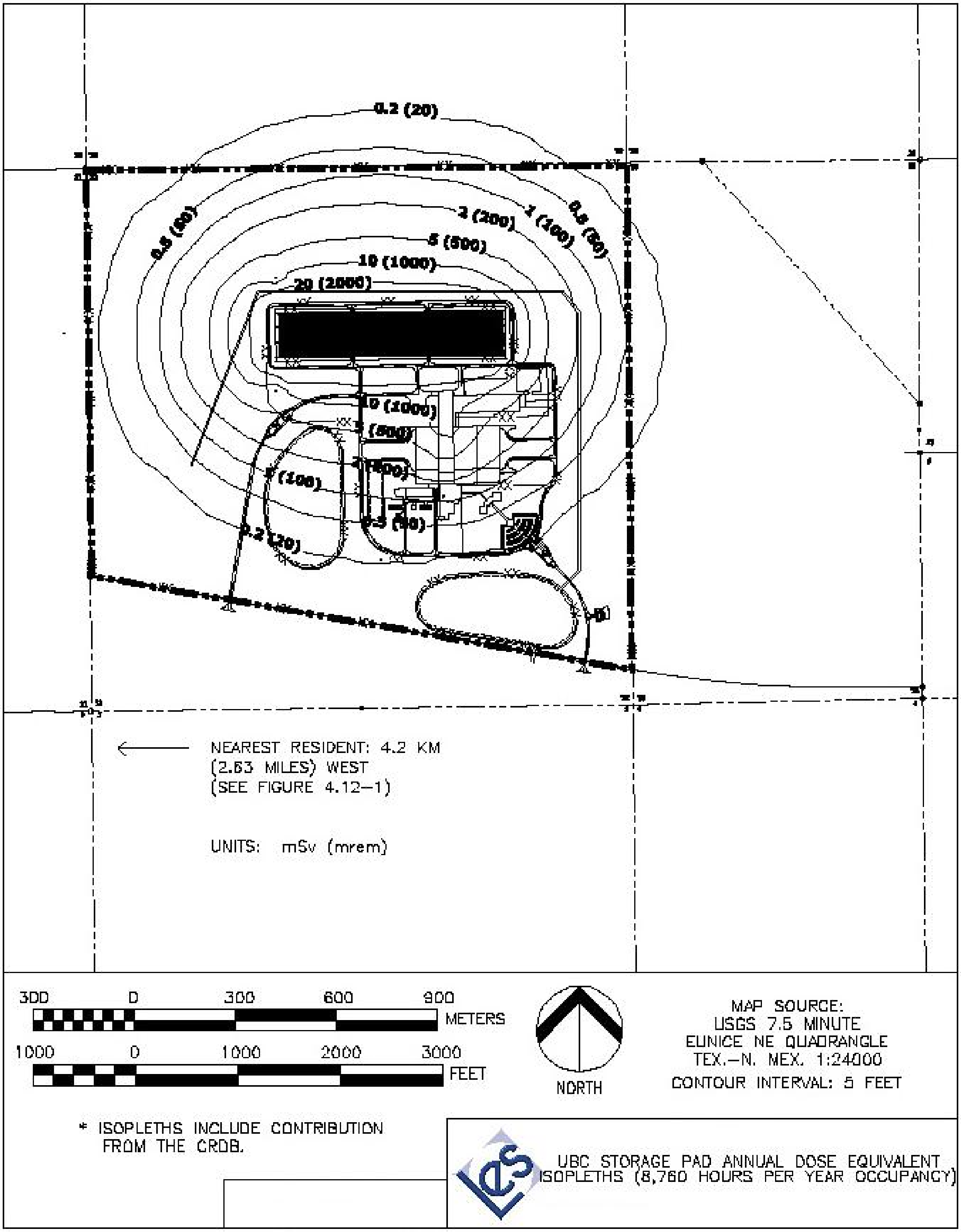


Figure 4.12-4UBC Storage Pad Annual Dose Equivalent Isopleths (8,760 Hours per Year Occupancy)

4.13 WASTE MANAGEMENT IMPACTS

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

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

4.13.1 Waste Descriptions

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

4.13.2 Waste Management System Description

Descriptions of the proposed NEF waste management systems are provided in ER Section 3.12.

4.13.3 Waste Disposal Plans

4.13.3.1 Radioactive and Mixed Waste Disposal Plans

Solid radioactive wastes are produced in a number of plant activities and require a variety of methods for treatment and disposal. These wastes, as well as the generation and handling systems, are described in detail in ER Section 3.12, Waste Management.

All radioactive and mixed wastes will be disposed of at offsite, licensed facilities. The impacts on the environment due to these offsite facilities are not addressed in this report. Table 4.13-1, Possible Radioactive Waste Processing/Disposal Facilities, summarizes the facilities that may be used to process or dispose of NEF radioactive or mixed waste.

Radioactive waste will be shipped to any of the three listed radioactive waste processing / disposal sites. Other offsite processing or disposal facilities may be used if appropriately licensed to accept NEF waste types. Depleted UF_6 will most likely be shipped to one of the UF_6 Conversion Facilities subsequent to temporary onsite storage. The remaining mixed waste will either be pretreated in its collection container onsite prior to offsite disposal, or shipped directly to a mixed waste processor for ultimate disposal.

The Barnwell site, located in Barnwell, South Carolina, is a low-level radioactive waste disposal facility licensed in an agreement state in association with 10 CFR 61, (CFR, 2003r). This facility is licensed to accept NEF low-level waste either directly from the NEF site or as processed waste from offsite waste processing vendors. The disposal site is approximately 2,320 km (1,441 mi) from the NEF.

The Clive site, located in South Clive, Utah, is owned and operated privately by Envirocare of Utah. This low-level waste disposal site is also licensed in an agreement state in association with 10 CFR 61 (CFR, 2003r), and 40 CFR 264 (CFR, 2003v). Currently, the license allows acceptance of Class A waste only. In addition to accepting radioactive waste, the Clive facility may accept some mixed wastes. This facility is licensed to accept NEF low-level waste either directly from the NEF site or as processed waste from offsite waste processing vendors. The disposal site is approximately 1,636 km (1,016 mi) from the NEF.

Waste processors such as GTS Duratek, primarily located in Oak Ridge, Tennessee, have the ability to volume reduce most Class A low level wastes. GTS Duratek also has the capability to process contaminated oils and some mixed wastes. The NEF may send wastes that are candidates for volume reduction, recycling, or treatment to the GTS Duratek facilities. Other processing vendors may be used to process NEF waste depending on future availability. The processing facilities are approximately 1,993 km (1,238 mi).

With regard to depleted UF_6 disposal, DOE has recently contracted for the construction and operation of depleted UF_6 conversion facilities in Paducah, Kentucky, and Portsmouth, Ohio. This action was taken following the earlier enactment of Section 3113 of the USEC Privatization Act, which requires the Secretary of Energy to "accept" for disposal depleted UF_6 generated by an NRC-licensed facility such as the NEF, and related subsequent legislation. DOE facilities for conversion and ultimate offsite disposal of LES generated depleted UF_6 is one of the options available for the disposition of depleted UF_6. Such disposal will be accomplished either by sale of converted depleted UF_6 for reuse or by shipment of the depleted UF_6 to a licensed disposal facility for burial. As described later in this chapter, other options are available for depleted UF_6 disposal. The environmental impact of a UF_6 conversion facility was previously evaluated generically for the Claiborne Enrichment Center (CEC) and is documented in Section 4.2.2.8 of the NRC Final Environmental Impact Statement (FEIS) (NRC, 1994a). After scaling to account for the increased capacity of the NEF compared to the CEC, this evaluation remains valid for NEF. In addition, the Department of Energy has recently issued FEISs (DOE, 2004a; DOE, 2004b) for the UF_6 conversion facilities to be constructed and operated at Paducah, KY and Portsmouth, OH. These FEISs consider the construction, operation, maintenance, and decontamination and decommissioning of the conversion facilities and are also valid evaluations for the NEF.

4.13.3.1.1 (*See SAR § 12.2 and 12.3)* Uranium Byproduct Cylinder (UBC) Storage

The NEF yields a depleted UF_6 stream that will be temporarily stored onsite in containers before transfer to the conversion facility and subsequent reuse or disposal. The storage containers are referred to as Uranium Byproduct Cylinders (UBC). The storage location is designated the UBC Storage Pad. The UBC Storage Pad will have minimal environmental impacts.

The NEF's preferred option for disposition of the UBCs includes temporary onsite storage of cylinders. See ER Section 4.13.3.1.3. There will be no disposal onsite. The NEF will pursue economically viable disposal paths for the UBCs as soon as they become available. In addition, the NEF will look to private deconversion facilities to render the UF_6 into U_3O_8.

LES is committed to the following storage and disposition of UBCs on the NEF site (LES, 2003b):

- Only temporary onsite storage will be utilized.
- No long-term storage beyond the life of the plant.
- Aggressively pursue economically viable disposal paths.
- Setting up a financial surety bonding mechanism to assure adequate funding is in place to dispose of all UBCs.

Since UBCs will be stored for a time on the pad, the potential impact of this preferred option is the remote possibility of stormwater runoff from the UBC Storage Pad becoming contaminated with UF_6 or its derivatives. Cylinders placed on the UBC Storage Pad normally have no surface contamination due to restrictions placed on surface contamination levels by plant operating procedures . Because of the remote possibility of contamination, the runoff water will be directed to an onsite lined retention basin, designed to minimize ground infiltration. The site soil characteristics greatly minimize the migration of materials into the soil over the life of the plant. However, the basin is sampled under the site's environmental monitoring plan. The sources of the potential water runoff contamination (albeit unlikely) would be either residual contamination on the cylinders from routine handling, or accidental releases of UF_6 and its derivatives resulting from a leaking cylinder or cylinder valve (caused by corrosion, transportation or handling accidents, or other factors). Operational evidence suggests that breaches in cylinders and the resulting leaks are "self-sealing." (See ER Section 4.13.3.1.2.)

The chemical and physical properties of UF_6 can pose potential health risks, and the material is handled accordingly. Uranium and its decay products emit low-levels of alpha, beta, gamma and neutron radiation. If UF_6 is released to the atmosphere, it reacts with water vapor in the air to form HF and the uranium oxyfluoride compound called uranyl fluoride (UO_2F_2). These products are chemically toxic. Uranium is a heavy metal that, in addition to being radioactive, can have toxic chemical effects (primarily on the kidneys) if it enters the bloodstream by means of ingestion or inhalation. HF is an extremely corrosive gas that can damage the lungs and cause death if inhaled in high concentrations.

The NEA/IAEA (NEA, 2002) reports that there is widespread experience with the storage of UF_6 in steel cylinders in open-air storage yards. It is reported that even without routine treatment of localized corrosion, containers have maintained structural integrity for more than 50 years. The most extreme conditions experienced were in Russian Siberia where temperatures ranged from +40°C to -40°C (+104°F to –40°F), and from deep snow to full sun.

Depleted UF_6 can be safely stored for decades in painted steel cylinders in open-air storage yards. Internal corrosion does not represent a problem. A reaction between the UF_6 and inner surface of the cylinder forms a complex uranium oxifluoride layer between the UF_6 and cylinder wall that limits access of water moisture to the inside of the cylinder, thus further inhibiting internal corrosion. Moreover, while limiting factors are the external corrosion of the steel containers and the integrity of the "connection" seals, their impact can be minimized with an adequate preventive maintenance program. The three primary causes of external corrosion, all of which are preventable, are: (1) standing water on metal surfaces, (2) handling damaged cylinders and (3) the aging of cylinder paint.

Standing water problems can be minimized through proper yard drainage, use of support cradles, and periodic inspection. Handling damage can be minimized by appropriate labor training and yard access design. Aging can be minimized through the use of periodic inspection and repainting and the use of quality paint. At the NEF UBCs are placed on an outdoor storage pad of reinforced concrete. The pad is provided with a UBC Storage Pad Stormwater Retention Basin, cradles on which the cylinders rest, and a mobile cylinder transporter. The stormwater collection system has sampling capabilities. The mobile transporter transfers cylinders from the UF_6 Handling Area of the SBM to the UBC Storage Pad where they rest on cradles for storage. UBC transport between the SBM and the storage area is discussed in greater detail in the Safety Analysis Report Section 3.4.11, Material Handling Processes.

The Depleted Uranium Hexafluoride Management Study (LES, 1991b) provides a plan for the storage of UBCs in a safe and cost-effective manner in accordance with all applicable regulations to protect the environment. The NEF will maintain an active cylinder management program to improve storage conditions in the cylinder yard, to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs to cylinders and the Storage Pad, as needed. The UBC Storage Pad has been sited to minimize the potential environmental impact from external radiation exposure to the public at the site boundary. The concrete pad to be initially constructed onsite for the storage of UBCs will only be of a size necessary to hold a few years worth of UBCs. It will be expanded, only if necessary. The dose equivalent rate from the UBC Storage Pad at the site boundary will be below the regulatory limits of 10 CFR 20 (CFR 2003q) and 40 CFR 190 (CFR, 2003f). The direct dose equivalent comes from the gamma-emitting progeny within the uranium decay chain. In addition, neutrons are produced by spontaneous fission in uranium and by the ${}^{19}_{9}F$ (alpha, n) ${}^{22}_{11}Na$ reaction. Thermoluminescent Dosimeters (TLDs) will be distributed along the site boundary fence line to monitor this impact due to photons (see ER Section 6.1), and ensure that the estimated dose equivalent is not exceeded. See ER Section 4.12.2.1.3 for more detailed information on the impact of external dose equivalents from UBC Storage Pad.

The overall impact of the preferred UBC Storage Pad option is believed to be small given the comprehensive cylinder maintenance and inspection programs that have been instituted in Europe over the past 30 years. This experience has shown that outdoor UF_6 cylinder storage will have little or no adverse environmental impact when it is coupled with an effective and protective cylinder management program. In more than 30 years of operation at three different enrichment plants, the European cylinder management program has not resulted in any significant releases of UF_6 to the environment (see ER Section 3.11.2.2, Public and Occupational Exposure Limits, for information of the types of releases that have occurred at Urenco plants).

4.13.3.1.2 Mitigation for Depleted UF_6 Storage

Since UF_6 is a solid at ambient temperatures and pressures, it is not readily released from a cylinder following a leak or breach. When a cylinder is breached, moist air reacts with the exposed UF_6 solid and iron, resulting in the formation of a dense plug of solid uranium and iron compounds and a small amount of HF gas. This “self-healing” plug limits the amount of material released from a breached cylinder. When a cylinder breach is identified, the cylinder is typically repaired or its contents are transferred to a new cylinder.

LES will maintain an active cylinder management program to maintain optimum storage conditions in the cylinder yard, to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs to cylinders and the storage yard, as needed. The following handling and storage procedures and practices shall be adopted at the NEF to mitigate adverse events, by either reducing the probability of an adverse event or reducing the consequence should an adverse event occur (LES, 1991b).

- All filled UBCs will be stored in designated areas of the storage yard on cradles that do not cause cylinder corrosion. These cradles shall be placed on a stable concrete surface.
- The storage array shall permit easy visual inspection of all cylinders.

- The UBCs shall be surveyed for external contamination (wipe tested) prior to being placed on the UBC Storage Pad. The maximum level of removable contamination allowed on the external surface of the cylinder shall be no greater than 16.7 Bq/100cm^2 (1,000 dpm/100 cm^2) of alpha or beta/gamma activity.
- Provisions are in place to ensure that UBCs do not have the defective valves (identified in NRC Bulletin 2003-03, "Potentially Defective 1-Inch Valves for Uranium Hexafluoride Cylinders" installed.
- All UBCs shall be abrasive-blasted and coated with a minimum of one coat of zinc chromate primer plus one zinc-rich topcoat or equivalent anti-corrosion treatment.
- Only designated vehicles with less than 280 L (74 gal) of fuel shall be allowed in the UBC Storage Pad area.
- Only trained and qualified personnel shall be allowed to operate vehicles on the UBC Storage Pad area.
- UBCs shall be inspected for damage prior to placing a filled cylinder on the Storage Pad.
- UBCs shall be re-inspected annually for damage or surface coating defects. These inspections shall verify that:
  - Lifting points are free from distortion and cracking.
  - Cylinder skirts and stiffener rings are free from distortion and cracking.
  - Cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion.
  - Cylinder valves are fitted with the correct protector and cap, the valve is straight and not distorted, 2 to 6 threads are visible, and the square head of the valve stem is undamaged.
  - Cylinder plugs are undamaged and not leaking.
  - If inspection of a UBC reveals significant deterioration (i.e., leakage, cracks, excessive, distortion, bent or broken valves or plugs, broken or torn stiffening rings or skirts, or other conditions that may affect the safe use of the cylinder), the contents of the affected cylinder shall be transferred to another undamaged cylinder and the defective cylinder shall be discarded. The root cause of any significant deterioration shall be determined and, if necessary, additional inspections of cylinders shall be made.
  - Proper documentation on the status of each UBC shall be available on site, including content and inspection dates.
  - Cylinders containing liquid depleted UF_6 shall not be transported.
- Site stormwater runoff from the UBC Storage Pad is directed to a lined retention basin, which will be included in the site environmental monitoring plan. (See ER Section 6.1.)

4.13.3.1.3 Depleted UF_6 Disposition Alternatives

LES is committed to the temporary storage of UBCs on the NEF site as described in ER Section 4.13.3.1.1, Uranium Byproduct Cylinder (UBC) Storage. The preferred option and a "plausible strategy" for disposition of the UBCs is private sector conversion and disposal as described below. The disposition of UBCs by DOE conversion and disposal is described below since it is also a "plausible strategy," but is not considered the preferred option.

On April 24, 2002, LES submitted to the NRC information addressing depleted uranium disposition (LES, 2002). LES recommended that the NRC consider that the Section 3113 requirements of the U.S. Enrichment Corporation Privatization Act mandate, in LES's view, that DOE dispose of depleted uranium from a uranium enrichment facility licensed by the NRC. LES's position is that this approach constitutes a "plausible strategy" for dispositioning these materials. Subsequently, the NRC in its response to the LES submittal (NRC, 2003b) dated March 24, 2003, stated that the NRC "[c]onsiders that Section 3113 would be a "plausible strategy" for dispositioning depleted uranium tails if the NRC staff determines the depleted uranium is a low-level radioactive waste."

The NRC March 24, 2003 letter (NRC, 2003b) stated that the NRC expects LES to indicate in its NEF license application whether the depleted uranium tails will be treated as a waste or a resource. LES will make a determination as to whether the depleted uranium is a resource or a waste and notify the NRC.

The NRC also noted in its letter to LES (NRC, 2003b), that the NEF license application should demonstrate that, given the expected constituents of the LES depleted uranium, the material meets the definition of low-level radioactive waste given in 10 CFR Part 61 (CFR, 2003r). The definition of low-level waste in 10 CFR 61 (CFR, 2003r) is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste), 10 CFR 30 (CFR, 2003c), and 10 CFR 40 (CFR, 2003d). High-level radioactive waste (HLW) is primarily in the form of spent fuel discharged from commercial nuclear power reactors. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride. No spent fuel is used in the NEF. Therefore, the LES depleted uranium is not high-level waste nor does it contain any high-level waste.

A transuranic element is an artificially made, radioactive element that has an atomic number higher than uranium in the Periodic Table of Elements such as neptunium, plutonium, americium, and others. Transuranic waste is material contaminated with transuranic elements. It is produced primarily from reprocessing spent fuel and from the use of plutonium in the fabrication of nuclear weapons. Since the LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride, it contains no transuranic waste.

Spent nuclear fuel is fuel that has been removed from a nuclear reactor because it can no longer sustain power production for economic or other reasons. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride. Therefore, the LES depleted uranium is not nuclear fuel.

Section 11e.(2) of the Atomic Energy Act classifies tailings produced from uranium ore as byproduct material. Tailings are the waste left after ore has been extracted from rock. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride, not from uranium ore or rock tailings. Therefore, the NEF depleted uranium is not byproduct material per section 11e.(2) of the Atomic Energy Act.

10 CFR 30 (CFR, 2003c) states that byproduct material is any radioactive material, except special nuclear material, yielded in or made radioactive by exposure to the process of producing or utilizing special nuclear material. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride and is not made radioactive by exposure to radiation incident to the process of producing or utilizing special nuclear material.

10 CFR 40 (CFR, 2003c) states that byproduct material is the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute “byproduct material” within this definition. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride and is not produced by extraction or concentration of uranium or thorium from ore.

The NEF depleted uranium is not high-level radioactive waste, contains no transuranic waste, spent nuclear fuel, or byproduct material as defined in Section 11e.(2) of the Atomic Energy Act, 10 CFR 30 (CFR, 2003c) and 10 CFR 40 (CFR, 2003d); therefore, once NEF depleted uranium is determined by LES to be a waste and not a resource, it meets the 10 CFR 61 definition of low-level radioactive waste.

Disposition of the UBCs has several potential impacts that depend on the particular approach taken. Currently, the preferred options are short-term onsite storage followed by conversion and underground burial (Option 1 below) or transportation of the UBCs to a DOE conversion facility (Option 2 below). LES considered several other options in addition to the preferred options that could have implications on the number of UBCs stored at the NEF and the length of storage for the cylinders. All of these options are discussed below along with some of their impacts. However, at this time, LES considers only Options 1 and 2 below to represent plausible strategies for the disposition of its UBCs.

Option 1 –U.S. Private Sector Conversion and Disposal (Preferred Plausible Strategy)

Transporting depleted UF_6 from the NEF to a private sector conversion facility and depleted U_3O_8 permanent disposal in a western U.S. exhausted underground uranium mine is the preferred “plausible strategy” disposition option. The NRC repeatedly affirmed its acceptance of this option during its licensing review of the previous LES license application. In Section 4.2.2.8 of its final environmental impact statement (FEIS) for that application, the NRC staff noted that “it is plausible to assume that depleted UF_6 converted into U_3O_8 may be disposed by emplacement in near surface or deep geological disposal units” (NRC, 1994a). And during the subsequent adjudicatory hearing on that application, an NRC Atomic Safety and Licensing Board held that “[LES] has presented a plausible disposal strategy. [Its] plan to convert depleted UF_6 to U_3O_8 at an offsite facility in the United States and then ship that material as waste to a final site for deeper than surface burial is a reasonable and credible plan for depleted UF_6 disposal (NRC, 1997).

LES has committed to the Governor of New Mexico (LES, 2003b) that: (1) there will be no long-term disposal or long-term storage (beyond the life of the plant) of UBCs in the State of New Mexico; (2) a disposal path outside the State of New Mexico is utilized as soon as possible; (3) LES will aggressively pursue economically viable paths for UBCs as soon as they become available; (4) LES will work with qualified vendors pursuing construction of private deconversion facilities by entering in good faith discussions to provide such vendor long-term UBC contracts to assist them in their financing efforts; and (5) LES will put in place as part of the NRC license a financial surety bonding mechanism that assures funding will be available in the event of any default by LES.

ConverDyn, a company that is engaged in converting U_3O_8 material to UF_6 for enrichment, has the technical capability to construct and operate a depleted UF_6 to depleted U_3O_8 facility at its facility in Metropolis, Illinois in the future if there is an assured market. One of the two ConverDyn partners, General Atomics, may have access to an exhausted uranium mine (the Cotter Mines in Colorado) where depleted U_3O_8 could be disposed. Furthermore, discussions have recently been held with Cogema concerning a private conversion facility. Cogema has experience with such a facility currently processing depleted UF_6 in France. These factors support LES's position that this option is the preferred "plausible strategy" option.

Any deconversion facility used by NEF will not be located in the State of New Mexico.

Option 2 – DOE Conversion and Disposal (Plausible Strategy)

Transporting depleted UF_6 from the NEF to DOE conversion facilities for ultimate disposition is a plausible disposition option. Pursuant to Section 3113 of the USEC Privatization Act, DOE is instructed to "accept for disposal" depleted UF_6, such as those that will be generated by the NRC-licensed NEF. To that end, DOE has recently contracted for the construction and operation of two UF_6 conversion facilities to be located in Paducah, Kentucky and Portsmouth, Ohio.

DOE has recently reaffirmed the plausibility of this option. In a July 25, 2002 letter to Martin Virgilio, Director of the NRC Office of Nuclear Material Safety and Safeguards, William Magwood IV, Director of DOE's Office of Nuclear Energy, Science and Technology, unequivocally stated that "in view of [DOE's] plans to build depleted uranium disposition facilities and the critical importance [DOE] places on maintaining a viable domestic uranium enrichment industry, [DOE] acknowledges that Section 3113 may constitute a "plausible strategy" for the disposal of depleted uranium from the private sector domestic uranium enrichment plant license applicants and operators." (DOE, 2002a)

Moreover, this plausible strategy is virtually identical to one considered by LES during its earlier licensing efforts before the NRC. During the adjudicatory hearing on LES's application, an NRC Atomic Safety and Licensing Board noted that "all parties apparently agree that LES's actual disposal method will be to transfer the tails to DOE and pay DOE's disposal charges" (footnote omitted) (NRC, 1997). LES considers that given the NRC's earlier acceptance of this option, DOE's current acceptance, and DOE's existing contractual commitment to ensure construction and operation of two depleted UF_6 conversion plants, this option to disposition its depleted UF_6 by way of DOE conversion and disposal remains plausible.

Option 3 - Foreign Re-Enrichment or Conversion and Disposal

The shipment of depleted UF_6 to either Canada, Europe or the Confederation of Independent States (CIS) (the former Soviet Union) for either re-enrichment or conversion and disposal would require that a bilateral agreement for cooperation exist between the U.S. and the subject foreign country so long as the depleted UF_6 continues to be classified as source material.

Option 3A – Russian Re-Enrichment

Because the U.S. does not yet have a bilateral agreement for cooperation with Russia, U.S. depleted UF_6, as source material, cannot be shipped to Russia for re-enrichment. However, once there is a bilateral agreement in effect, source material could be re-enriched in Russia to about 0.7 $^{w}/_{o}$ and returned to the U.S. or elsewhere, with the re-enrichment depleted UF_6 remaining in Russia.

Option 3B – French Conversion or Re-Enrichment

The shipment of depleted UF_6 to France for conversion to depleted U_3O_8 by Cogema and its return to the U.S. for disposal is a possible, though unlikely, option. However, the viability of this option would depend on Cogema's available capacity, the economics of transportation back and forward across the Atlantic, and the willingness of Areva, Cogema's parent company, to participate in a Urenco-sponsored venture.

There may be a French interest in re-enriching depleted UF_6, for a price, and keeping the depleted UF_6 just as it would for a regular utility customer. Though Eurodif has excess capacity, its use would be electricity cost-dependent. This option is less likely to be implemented than either Option 1 or Option 2 above.

Option 3C – Kazakhstan Conversion and Disposal

While there may be an interest in Kazakhstan in converting depleted UF_6 to depleted U_3O_8 and disposing of it there, such interest is only speculative at this time. One way transportation economics costs could be a factor weighing against this option's employment.

4.13.3.1.4 Converted Depleted UF_6 Disposal Options

The following provides a brief summary of the different disposal options considered in the Programmatic Environmental Impact Statement (PEIS) for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (DOE, 1999). Appendix I of the PEIS assessed disposal impacts of converted depleted UF_6. The information is based on pre-conceptual design data provided in the engineering analysis report (LLNL, 1997a). The PEIS was completed in April 1999 and identified conversion of depleted UF_6 to another chemical form for use or long-term storage as part of a preferred management alternative. In the corresponding Record of Decision (ROD) for the Long-Term Management and Use of Depleted Uranium Hexafluoride (FR, 1999), DOE decided to promptly convert the depleted UF_6 inventory to depleted uranium oxide, depleted uranium metal, or a combination of both.

Under the uranium oxide disposal alternative, depleted UF_6 would be chemically converted to a stable oxide form and disposed of below ground as LLW. The ROD further explained that depleted uranium oxide will be used as much as possible, and the remaining depleted uranium oxide will be stored for potential future uses or disposal, as necessary. In addition, according to the ROD, conversion to depleted uranium metal will occur only if uses for such metal are available. Disposal is defined as the emplacement of material in a manner designed to ensure isolation for the foreseeable future. Compared with long-term storage, disposal is considered to be permanent, with no intent to retrieve the material for future use. In fact, considerable and deliberate effort would be required to regain access to the material following disposal.

The PEIS considered several disposal options, including disposal in shallow earthen structures, below-ground vaults, and an underground mine. In addition, two physical waste forms were considered in the PEIS: ungrouted waste and grouted waste. Ungrouted waste refers to U_3O_8 or UO_2 in the powder or pellet form produced during the deconversion process. This bulk material would be disposed of in drums. Grouted waste refers to the solid material obtained by mixing the uranium oxide with cement and repackaging it in drums. Grouting is intended to increase structural strength and stability of the waste and to reduce the solubility of the waste in water. However, because cement would be added to the uranium oxide, grouting would increase the total volume of material requiring disposal. Grouting of waste was assumed to occur at the disposal facility. For each option, the U_3O_8 and UO_2 would be packaged for disposal as follows:

- U_3O_8 would be disposed of in 208 L (55-gal) drums. If ungrouted, approximately 714,000 drums would be required; if grouted, approximately 1,500,000 drums would be required.
- UO_2 would be disposed of in 110 L (30-gal) drums. These small drums would be used because of the greater density of UO_2, a filled 110-L (30-gal) drum would weigh about 605 kg (1,330 lbs). If ungrouted, approximately 740,000 drums would be required; if grouted, approximately 1,110,000 drums would be required.

All disposal options would include a central waste-form facility where drums of uranium oxide would be received from the deconversion facility and prepared for disposal. The waste-form facility would include an administration building, a receiving warehouse, and cementing/curing/ short-term storage buildings (if necessary). Grouting of waste would be performed by mechanically mixing the uranium oxide with cement in large tanks and then pouring the mixture into drums. Once prepared for disposal (if necessary), drums would be moved into disposal units. For the grouted U_3O_8 option, the area of the waste-form facility would be approximately 3.6 ha (9 acres); for the grouted UO_2 option, the area would be about 4.5 ha (11 acres). For ungrouted disposal options, only about 3 ha (7 acres) would be required because the facilities for grouting, curing, and additional short-term storage would not be needed. The unique features of each disposal option are described below.

4.13.3.1.4.1 Disposal in Shallow Earthen Structures

Shallow earthen structures, commonly referred to as engineered trenches, are among the most commonly used forms of low-level waste disposal, especially in dry climates. Shallow earthen structures would be excavated to a depth of about 8 m (26 ft), with the length and width determined by site conditions and the annual volume of waste to be disposed of. Disposal in shallow earthen structures would consist of placing waste on a stable structural pad with barrier walls constructed of compacted clay. Clay would be used because it prevents the walls from collapsing or caving in, and it presents a relatively impermeable barrier to waste migration. The waste containers (i.e., drums) would be tightly stacked three pallets high in the bottom of the structure with forklifts. Any open space between containers would be filled with earth, sand, gravel, or other similar material as each layer of drums was placed. After the structure was filled, a 2-m (6-ft) thick cap composed of engineered fill dirt and clay would be placed on top and compacted. The cap would be mounded at least 1 m (3 ft) above the local grade and sloped to minimize the potential for water infiltration. Disposal would require about 30 ha (74 acres).

4.13.3.1.4.2 Disposal in Vaults

Concrete vaults for disposal would be divided into five sections, each section approximately 20 m (66 ft) long by 8 m (26 ft) wide and 4 m (13 ft) tall. As opposed to shallow earthen structures, the walls and floor of a vault would be constructed of reinforced concrete. A crane would be used to place the depleted U_3O_8 within each section. Once a vault was full, any open space between containers would be filled with earth, sand, gravel, or other similar material. A permanent roof slab of reinforced concrete that completely covers the vault would be installed after all five sections were filled. A cap of engineered fill dirt and clay would be placed on top of the concrete cover and compacted. The cap would be mounded above the local grade and sloped to minimize the potential for water infiltration. Disposal would require about 51 ha (125 acres).

4.13.3.1.4.3 Disposal in a Mine

An underground mine disposal facility would be a repository for permanent deep geological disposal. A mined disposal facility could possibly use a previously existing mine, or be constructed for the sole purpose of waste disposal. For purposes of comparing alternatives, the conservative assumption of constructing a new mine was assessed in the PEIS. A mine disposal facility would consist of surface facilities that provide space for waste receiving and inspection (the waste-form facility), and shafts and ramps for access to and ventilation of the underground portion of the repository. The underground portion would consist of tunnels (called “drifts”) for the transport and disposal of waste underground. The dimensions of the drifts would be similar to those described previously for the storage options, except that each drift would have a width of 6.5 m (21 ft). Waste containers would be placed in drifts and back-filled. Disposal of ungrouted and grouted U_3O_8 would require about 91 ha (228 acres) and 185 ha (462 acres) of underground disposal space, respectively. Disposal of ungrouted and grouted UO_2 would require about 70 ha (172 acres) and 102 ha (252 acres), respectively.

4.13.3.1.5 Potential Impacts of Each Disposal Option

This section provides a summary of the potential environmental impacts associated with the disposal of depleted uranium oxides in shallow earthen structures, vaults, and a mine during two distinct phases: (1) the operational phase and (2) the post-closure phase. Analysis of the operational phase included facility construction and the time during which waste would be actively placed in disposal units. Analysis of the post-closure phase considered potential impacts 1,000 years after the disposal units fail (i.e., release uranium material to the environment). For each phase, impacts were estimated for both generic wet and dry environmental settings. The following is presented as a general summary of potential environmental impacts during the operational phase:

- ***Potential Adverse Impacts.*** Potential adverse impacts during the operational phase would be small and generally similar for all options. Minor to moderate impacts would occur during construction activities, although these impacts would be temporary and easily mitigated by common engineering and good construction practices. Impacts during waste emplacement activities also would be small and limited to workers.
- ***Wet or Dry Environmental Setting.*** In general, potential impacts would be similar for generic wet and dry environmental settings during the operational phase.
- ***U_3O_8 or UO_2.*** The potential disposal impacts tend to be slightly larger for U_3O_8 than for UO_2 because the volume of U_3O_8 would be greater and most environmental impacts tend to be proportional to the volume.
- ***Grouted or Ungrouted Waste.*** For both U_3O_8 and UO_2, the disposal of grouted waste would result in larger impacts than disposal of ungrouted waste during the operational phase for two reasons: (1) grouting increases the volume of waste requiring disposal (by about 50%) and (2) grouting operations result in small emissions of uranium material to the air and water.
- ***Shallow Earthen Structure, Vault, or Mine.*** The potential impacts are essentially similar for disposal in a shallow earthen structure, vault, or mine. However, disposal in a mine could create slightly larger potential impacts if excavation of the mine was required (use of an existing mine would minimize impacts).

For the post-closure phase, impacts from disposal of U_3O_8 and UO_2, were calculated for a post-failure time of 1,000 years. The potential impacts estimated for the post-closure phase are subject to a great deal of uncertainty because of the extremely long time period considered and the dependence of predictions on the behavior of the waste material as it interacts with soil and water in a distant future environment. The post-closure impacts would depend greatly on the specific disposal facility design and site-specific characteristics. Because of these uncertainties, the assessment assumptions are generally selected to produce conservative estimates of impact, i.e., they tend to overestimate the expected impact. Changes in key disposal assumptions could yield significantly different results.

The following is presented as a general summary of potential environmental impacts during the post-closure phase:

- ***Potential Adverse Impacts.*** For all disposal options, potentially large impacts to human health and groundwater quality could occur within 1,000 years after failure of a facility in a wet setting, whereas essentially no impacts would occur from a dry setting in the same time frame. Potential impacts would result primarily from the contamination of groundwater. The maximum dose to an individual assumed to live at the edge of the disposal site and use the contaminated water was estimated to be about 1.1 mSv/yr (110 mrem/yr), which would exceed the 0.25 mSv/yr (25-mrem/yr) limit specified in 10 CFR 61 (CFR, 2003r) and DOE Order 5820.2A (DOE, 1988). (For comparison, the average dose equivalent to an individual from background radiation is about 2 to 3 mSv/yr (200 to 300 mrem/yr). Possible exposures (on the order of 0.1 Sv/yr (10 rem/yr) could occur for shallow earthen structures and vaults if the cover material were to erode and expose the uranium material; however, this would not arise until several thousand years later, and such exposure could be eliminated by adding new cover material to the top of the waste area.
- ***Wet or Dry Environmental Setting.*** The potential impacts would be significantly greater in a wet setting than in a dry setting. Specifically virtually no impacts would be expected in a dry setting for more than 1,000 years due to the low water infiltration rate and greater depth to the water table.
- ***U_3O_8 or UO_2.*** Overall, the potential environmental impacts tend to be slightly larger for U_3O_8 than for UO_2 because the volume of U_3O_8 requiring disposal would be greater than that of UO_2. A larger volume of waste essentially exposes a greater area of it to infiltrating water.
- ***Grouted or Ungrouted Waste.*** For both U_3O_8 and UO_2, the disposal of grouted waste would have larger environmental impacts than disposal of ungrouted waste, once the waste was exposed to the environment, because grouting would increase the waste volume. However, further studies using site-specific soil characteristics are necessary to determine the effect of grouting on long-term waste mobility. Grouting might reduce the dissolution rate of the waste and subsequent leaching of uranium into the groundwater in the first several hundred years after failure. However, over longer periods the grouted form would be expected to deteriorate and, because of the long half-life of uranium, the performance of grouted and ungrouted waste would be essentially the same. Depending on soil properties and characteristics of the grout material, it is also possible that grouting could increase the solubility of the uranium material by providing a carbonate-rich environment.
- ***Shallow Earthen Structure, Vault, or Mine.*** Because of the long time periods considered and the fact that the calculations were performed to characterize a time of 1,000 years after each facility was assumed to fail, the potential impacts are very similar among the options of for disposal in a shallow earthen structure, vault, or mine. However, shallow earthen structures would be expected to contain the waste material for a period of at least several hundred years before failure, whereas vaults and a mine would be expected to last even longer — from several hundred years to a thousand years or more. Therefore, vault and mine disposal would provide greater protection of waste in a wet environment. In addition, both vault and a mine would be expected to provide additional protection against erosion of the cover material (and possible resultant surface exposure of the waste material) as compared to shallow earthen structures. The exact time that any disposal facility would perform as designed would depend on the specific facility design and site characteristics.

In NUREG-1484 (NRC, 1994a), Section 4.2.2.8, the NRC provided a generic evaluation of the impacts of disposal of depleted uranium oxides. This generic evaluation was done since there are no actual disposal facilities for large quantities of depleted UF_6. The depleted UF_6 disposal impact analysis method included selection of assumed generic disposal sites, development of undisturbed performance and deep well water use exposure scenarios, and estimation of potential doses.

Exposure pathways used for the near-surface disposal case included drinking shallow well water and consuming crops irrigated with shallow well water. Evaluation of the deep disposal case included undisturbed performance and deep well water exposure scenarios. In the undisturbed performance scenario, groundwater flows into a river that serves as a source of drinking water and fish. For the well water use exposure scenario, an individual drills a well into an aquifer down gradient from the disposal facility and uses groundwater for drinking and irrigation.

The release of uranium isotopes and their daughter nuclides from the disposal facility is limited by their solubility in water. Using the environmental characteristics of a humid southeastern U.S. site and the methods of the EIS, drinking water and agricultural doses were conservatively estimated, for a near surface disposal facility, to exceed 10 CFR 61 limits (CFR, 2003r).

In order to compensate for the lack of knowledge of a specific deep disposal site, two representative sites whose geological structures have previously been characterized were selected for the NRC analysis. Potential consequences of emplacement of U_3O_8 in a geological disposal unit include intake of radionuclides from drinking water, irrigated crops, and fish. Under the assumed conditions for the undisturbed performance scenario, groundwater would be discharged to a river. Under conditions not expected to occur, an individual would obtain groundwater by drilling a well down gradient from the disposal unit.

The estimated impacts for a deep disposal facility were less than the 0.25 mSv/yr (25 mrem/yr) level adopted from 10 CFR 61 (CFR, 2003r) as a basis for comparison. The assumptions used in the analysis, included neglect of potential engineered barriers, mass transfer limitations in releases, and decay and retardation during vertical transfer contribute to a conservative analysis.

The evaluation also concluded that UBCs can be stored indefinitely in a retrievable surface facility with minimal environmental impacts. The environmental impacts associated with such storage would be commitment of the land for a storage area, and a small offsite radiation dose.

4.13.3.1.6 Costs Associated with Depleted UF_6 Conversion and Disposal

This section presents cost estimates for the conversion of depleted uranium hexafluoride (depleted UF_6) and the disposal of the depleted triuranium octoxide (depleted U_3O_8) produced during deconversion. It also presents cost estimates for the associated transportation of depleted UF_6 to the conversion plant and the transportation of depleted U_3O_8 to the disposal site. The cost estimates were obtained from analyses of four sources: a 1997 study by the Lawrence Livermore National Laboratory (LLNL), the Uranium Disposition Services, LLC (UDS) contract with the Department of Energy (DOE) dated August 29, 2002, information from Urenco related to depleted UF_6 disposition costs including conversion, and the costs submitted to the Nuclear Regulatory Commission (NRC) by LES as part of the Claiborne Energy Center (CEC) license application in the early 1990s (LES, 1993). The estimated cost to dispose of depleted U_3O_8 in an exhausted uranium mine was also assessed.

This section reviews cost estimates developed by LLNL for the interim storage of the current very large United States (U.S.) inventory of depleted UF_6 at DOE conversion facilities, the DOE preferred option of conversion of depleted UF_6 to depleted U_3O_8 at DOE facilities, the ultimate disposal of depleted U_3O_8 at DOE sites, and the transportation of depleted UF_6 and depleted U_3O_8 (LLNL, 1997a). While cost estimates for other disposition alternatives (e.g. conversion to uranium oxide (UO_2)) were reviewed they are not addressed in this section since they were not considered as being applicable to LES. It is noted that the LLNL study estimates are reported in 1996 discounted dollars.

This section reviews the UDS-DOE contract since it is regarded as being more credible than an estimate because it represents actual U.S. cost data (DOE, 2002b). Unfortunately the UDS contract does not provide a breakdown of the conversion and disposal cost components.

This section also reflects information on depleted UF_6 disposition cost by European fuel cycle supplier, Urenco. The disposal costs, submitted to the NRC in support of the Claiborne Energy Center license application to the NRC in the early 1990s, were also reviewed (LES, 1993).

This section is based on an analysis of reports and literature in the public domain as well as information provided by Urenco and the experience of expert consultants.

In August 2001 the DOE reported that it had an inventory of depleted UF_6 enrichment tails material amounting to 55,000 (60,627), 193,000 (212,746) and 449,000 (494,938) metric tons (tons) stored at its enrichment sites at Oak Ridge in Tennessee, at Portsmouth in Ohio, and at Paducah in Kentucky, respectively (DOE, 2001d). This total of approximately 700,000 MT (771,617 tons) of depleted UF_6 corresponds to about 470,000 MT (518,086 tons) of uranium (MTU) as UF_6, a figure that is obtained by multiplying the mass of depleted UF_6 by the mass fraction of U to UF_6; i.e., 0.676. The depleted UF_6 is stored in approximately 60,000 steel cylinders, some dating back to about 1947 (DOE, 2001e). On October 31, 2000, the DOE issued a Request for Proposal (RFP) to construct depleted UF_6 to depleted U_3O_8 conversion facilities at the Portsmouth and Paducah sites in order to begin management and disposition of the UBCs accumulated at its three sites (DOE, 2000a). The DOE plans to ship the depleted UF_6 stored at the East Tennessee Technology Park (ETTP) at Oak Ridge to Portsmouth for conversion.

Since the 1950s, the government has stored depleted UF_6 in an array of large steel cylinders at Oak Ridge, Paducah, and Portsmouth. Several different cylinder types, including 137 nominal 19-ton cylinders (Paducah) made of former UF_6 gaseous diffusion conversion shells, are in use, although the vast majority of cylinders have a 12 MT (14 ton) capacity. The cylinders are typically 3.7 m (12 ft) long by 1.2 m (4 ft) in diameter, with most having a thin wall thickness of 0.79 cm (5/16 in) of steel. Similar but smaller cylinders are also in use. Thick-walled cylinders, 48Ys that have a 1.6 cm (5/8 in) wall thickness, will be used by LES for storage and transport. The cylinders managed by DOE at the three sites are typically stacked two cylinders high in large areas called yards.

The DOE and USEC Inc. cylinders considered acceptable for UF_6 handling and shipping are referred to as conforming cylinders in the LLNL study. LLNL notes that the old or corroded cylinders that will not meet the American National Standards Institute (ANSI) specifications (ANSI N14.1), non-conforming cylinders, will require either special handling and special over-packs or transfer of contents to approved cylinders, and approval by regulatory agencies such as the Department of Transportation (DOE, 2001d). The LLNL report estimated high costs for the management and transporting of 29,083 non-conforming cylinders in the study's reference case, approximately 63% of the total of 46,422 cylinders in the study. There are approximately 4,683 cylinders at the Oak Ridge ETTP that the DOE has determined should be transported to the Portsmouth site for disposition. The LLNL report estimated that the life-cycle cost of developing special over-packs and constructing and operating a transfer facility for the DOE's non-conforming cylinders could be as much as $604 million, in discounted 1996 dollars (LLNL, 1997a).

On August 29, 2002, the DOE announced the competitive selection of UDS to design, construct, and operate conversion facilities near the Paducah and Portsmouth gaseous diffusion plants. UDS will operate these facilities for the first five years, beginning in 2005. The UDS contract runs from August 29, 2002 to August 3, 2010. UDS will also be responsible for maintaining the depleted uranium and product inventories and transporting depleted uranium from ETTP to the Portsmouth for conversion. The DOE-UDS contract scope includes packaging, transporting and disposing of the conversion product depleted U_3O_8 at a government waste disposal site such as the Nevada Test Site (NTS) (DOE, 2002b).

UDS is a consortium formed by Framatome ANP, Inc., Duratek Federal Services, Inc., and Burns and Roe Enterprises, Inc. The estimated value of the cost reimbursement contract is $558 million (DOE, 2002c). Design, construction and operation of the facilities will be subject to appropriations of funds from Congress. On December 19, 2002, the White House confirmed that funding for both conversion facilities will be included in President Bush's 2004 budget. President Bush signed the Energy and Water Appropriations Bill on December 1, 2003 which included funding for both conversion facilities.

The NEF UBCs will all be thick-walled conforming 48Y cylinders. The 48Y cylinders have a gross weight of about 14.9 MT (16.4 tons), and when filled, will normally contain 12.5 MT (13.8 tons) of UF_6 or about 8.5 MTU (9.4 tons). The management and transporting of the LES UBCs will not involve unusual costs such as those that will be required for the majority of the DOE-managed cylinders currently stored at the three government sites.

In May 1997, LLNL published a cost analysis report for the long-term management of depleted uranium hexafluoride (LLNL, 1997a). The report was prepared to provide comparative life-cycle cost data for the Department of Energy's (DOE) Draft 1997 Programmatic Environmental Impact Statement (PEIS) on alternative strategies for management and disposition of depleted UF_6 (DOE, 1997a). The LLNL report appears to be the most comprehensive recent assessment of depleted UF_6 disposition costs available in the public domain. The technical data on which the LLNL cost analysis report is based, is principally the May 1997 Engineering Analysis Report, also by LLNL (LLNL, 1997b). The April 1999 Final PEIS identified as soon as practicable conversion of DUF6 to another stable chemical form, uranium oxide (or metal if there is a use for it), the DOE-preferred management alternative (DOE, 1999).

The LLNL costs, which are reported in discounted 1996 dollars (first quarter), were undiscounted and adjusted upward by 11% to 2002 dollars using the U.S. Gross Domestic Product (GDP) Implicit Price Deflator (IPD).

When the LLNL report was prepared in 1997, more than five years ago, the cost estimates in it were based on an inventory of 560,000 MT (617,294 tons) of depleted UF_6, or 378,600 MTU (417,335 tons uranium) after applying the 0.676 mass fraction multiplier. This inventory equates over the 20 years of the study to an annual throughput rate of 28,000 MT (30,865 tons) of UF_6 or about 19,000 MT (20,943 tons) of depleted uranium, which is approximately 3.6 times the expected annual UBC output of the proposed NEF. The costs in the LLNL report are based on the life-cycle quantity of 378,600 MTU (417,335 tons uranium), beginning in 2009.

The LLNL cost analyses assumed that the depleted UF_6 would be converted to depleted U_3O_8, the DOE's preferred disposal form, using one of two dry process conversion alternatives. The first alternative, the anhydrous hydrogen fluoride (AHF) option, upgrades the HF product to AHF (<1.0% water). In the second option, the HF neutralization alternative, the HF would be neutralized with lime to produce calcium fluoride (CaF2). The LLNL cost analyses assumed that the AHF and CaF2 conversion products' would have negligible uranium contamination and could be sold for unrestricted use. LES will not use a deconversion facility that employs a process that results in the production of anhydrous HF.

Table 4.13-2, LLNL Estimated Life-Cycle Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion, presents the LLNL-estimated life-cycle capital, operating, and regulatory discounted costs in 1996 dollars, for conversion of 378,600 MTU (417,335 tons uranium) over 20 years, of depleted UF_6 to depleted U_3O_8 by AHF and HF neutralization processing. The costs were extracted from Table 4.8 in the LLNL report. The discounted LLNL life-cycle costs in 1996 dollars were undiscounted and converted to per kg unit costs and adjusted to 2002 dollars using the Gross Domestic Product (GDP) Implicit Price Deflator (IPD), as shown in the table. The escalation adjustment resulted in the 1996 costs being increased by 11%.

The AHF conversion option for which LLNL provides a cost estimate assumes that the AHF by-product is saleable, and that total sales revenues over the 20 years of operation would amount to $77.32 million, in discounted dollars. LLNL also assumed that the life-cycle sale of CaF2 obtained from neutralizing HF with lime would result in discounted revenues of $11.02 million.

The cost estimates for the conversion facility assumed that all major buildings are to be structural steel frame construction, except for the process building which is a two story reinforced concrete structure. Most of this building is assumed to be "special construction" with 0.3-m (1-ft) thick concrete perimeter walls and ceilings, 8-in concrete interior walls, and 0.6-m (2-ft) thick concrete floor mat. The "standard construction" area walls were taken to be 8-in thick concrete with 15-cm (6-in) elevated floors and 20 cm (8-in) concrete floors slabs on grade.

Table 4.13-3, Summary of LLNL Estimated Capital, Operating and Regulatory Unit Costs for DOE depleted UF_6 to Depleted U_3O_8 Conversion, presents a summary of estimated capital, operating and regulatory costs for depleted UF_6 to depleted U_3O_8 conversion on a dollars per kgU basis, in both 1996 and 2002 dollars, undiscounted. It can be seen that in either case the conversion process is operations and maintenance intensive.

Table 4.13-4, LLNL Estimated Life Cycle Costs for DOE Depleted UF_6 Disposal Alternatives, presents LLNL-estimated life-cycle costs for the waste form preparation and disposal of DOE depleted U_3O_8 produced by conversion of depleted UF_6. The table presents estimated costs for two depleted U_3O_8 disposal alternatives: shallow earthen structures (engineered "trenches") and concrete vaults. The waste form preparation for each alternative consists primarily of loading, compacting, and sealing the depleted U_3O_8 into 208-L (55-gal) steel drums.

The LLNL-estimated life-cycle costs for depleted U_3O_8 disposal range from $86 million, in discounted 1996 dollars, for the engineered trench alternative to $180 million for depleted U_3O_8 disposal in a concrete vault. The disposal unit costs range from $1.46 per kgU to $2.17 per kgU, in 2002 dollars. As discussed later in this section, the LLNL-estimated concrete vault costs are higher than those that would be required to either sink a new underground mine or to refurbish and operate an existing exhausted mine, an alternative that the NRC has indicated to be acceptable (ORNL, 1995). For example, the capital cost for the concrete vault alternative of

$130.75 million in discounted 1996 dollars or $349.7 million in undiscounted 2002 dollars is far greater than the $12.4 million cost of a new 200 MT (220 tons) per day underground mine, as shown later in this section.

Table 4.13-5, Summary of Total Estimated Conversion and Disposal Costs presents the depleted UF_6 conversion and depleted U_3O_8 disposal costs already discussed on a dollar per kgU basis, in undiscounted 2002 dollars. In addition it also includes the LLNL-estimated cost to DOE of rail transportation (including loading and unloading) of conforming depleted UF_6 cylinders to the conversion facility site and drummed depleted U_3O_8 to the disposal sites. It does not include interim storage costs since it may reasonably be assumed that LES UBCs may be shipped directly to the deconversion facility. The table indicates that the total costs for depleted UF_6 disposal in, in 2002 dollars, based on the LLNL study estimates, is likely to range from about $5.06 to $5.81 per kgU.

On August 29, 2002, the DOE announced the competitive selection of UDS to design and construct conversion facilities near the DOE enrichment plants at Paducah, Kentucky and Portsmouth, Ohio, and to operate these facilities from 2006 to 2010. UDS will also be responsible for maintaining the depleted uranium and conversion product inventories and transporting depleted uranium from Oak Ridge East Tennessee Technology Park (ETTP) to the Portsmouth site for conversion. The contract scope includes packaging, transporting and disposing of the conversion product depleted U_3O_8. Table 4.13-6, DOE UDS August 29, 2002 Contract Quantities and Costs presents a summary of the UDS contract quantities and costs.

The DOE-estimated value of the cost reimbursement incentive fee contract, which runs from August 29, 2002 to August 3, 2010, is $558 million (DOE, 2002c). Design, construction and operation of the facilities will be subject to appropriations of funds from Congress. On December 19, 2002, the White House confirmed that funding for both conversion facilities will be included in President Bush's 2004 budget. However, the Office of Management and Budget has not yet indicated how much funding will be allocated. Framatome is a subsidiary of Areva, the French company whose subsidiary Cogema has operated the world's only existing commercial depleted UF_6 conversion plant since 1984.

The table shows the target deconversion quantities and the estimated fee. The contract calls for the construction of a 12,200 MTU (13,448 tons uranium) per year conversion plant at Paducah and a 9,100 MTU (10,031 tons uranium) per year conversion plant at Portsmouth, for an annual nominal total capacity of 21.3 million kgU (23,479 tons uranium), which is also the target conversion rate per year. Based on the target conversion rate the UDS contract total unit capital cost is estimated to be $0.77 per kgU ($0.35 per lb U). This unit cost is based on plant operation over 25 years and 6% government cost of money. The conversion, disposal and material management total operating cost during the first five years of operation corresponds to $3.15 per kgU. The total unit capital and operating cost is $3.92 per kgU. As noted earlier in this section, the DOE has indicated that the disposal of the depleted U_3O_8 may take place at the Nevada Test Site. The cost to DOE of depleted U_3O_8 disposal at NTS is currently estimated at $7.50 per ft3 or about $0.11 per kgU ($.0.05 per lb U). In 1994 it was reported that the NTS charge to the DOE of $10 per ft3 ($0.15 per kgU) was not a full cost recovery rate (EGG, 1994).

It is of interest to note that USEC entered into an agreement with the DOE on June 30, 1998, wherein it agreed to pay the DOE $50,021,940 immediately prior to privatization for a commitment by the DOE “for storage, management and disposition of the transferred depleted uranium…” generated by USEC during the FY 1999 to FY 2004 time period (DOE, 1998).

Under the terms of the agreement, the DOE also committed to perform “…research and development into the beneficial use of depleted uranium, and related activities and support services for depleted uranium-related activities”. The agreement specifies that USEC will transfer to the DOE title to and possession of 2,026 48G cylinders containing approximately 16,673,980 kgU (18,380 tons of uranium). Under this agreement, DOE effectively committed to dispose of the USEC DUF6 at an average rate of approximately 3.0 million kgU per year between the middle of calendar 1998 and the end of 2003 at a cost of exactly $3.00 per kgU ($1.36 per lb U), in 1998 dollars.

According to Urenco its depleted UF_6 disposal will be similar to those that will be generated by LES at the NEF. Urenco contracts with a supplier for depleted UF_6 to depleted U_3O_8 conversion. The supplier has been converting depleted UF_6 to depleted U_3O_8 on an industrial scale since 1984.

The Claiborne Energy Center costs given in Table 4.13-7, Summary of Depleted UF_6 Disposal Costs from Four Sources are based upon those presented to John Hickey of the NRC in the LES letter of June 30, 1993 (LES, 1993) as adjusted for changes in units and escalated to 2002. A conversion cost of $4.00 per kgU was provided to LES by Cogema at that time. A value of $1.00 per kgU U_3O_8 ($0.45 lb U_3O_8) depleted U_3O_8 disposal cost was based on information provided by Urenco at the time.

As indicated earlier in this section, the NRC has noted that an existing exhausted underground uranium mine would be a suitable repository for depleted U_3O_8 (NRC, 1995). For purposes of comparing alternatives, the conservative assumption of constructing a new mine was assessed. A mine disposal facility would consist of surface facilities for waste receiving and inspection (the waste-form facility), and shafts and ramps for access to and ventilation of the underground portion of the repository, and appropriate underground transport and handling equipment. The mine underground would consist of tunnels (called “drifts”) and cross-cuts for the transport and storage of stacked 208-L (55-gal) steel drums which are then back-filled. A great many features of a typical underground mine would be applicable to this disposal alternative.

The NEF, when operating at its nominal full capacity of 3.0 million Separative Work Units (SWUs) per year will produce 7,800 MT (8.598 tons) of depleted UF_6 . A typical U.S. underground mine, operating for five days per week over fifty weeks of the year, excepting ten holiday days per year, would operate for 240 days per year. Thus, if LES UBCs were disposed uniformly over the year, the average disposal rate would be 32.5 MT (35.8 tons) of depleted UF_6 per day. This is much less than the rate of ore production in even a typical small under ground mine. However, it may reasonably assumed that the rate of emplacement of the drummed depleted U_3O_8 would be less than the rate of ore removal from a typical underground mine.

The estimated capital and operating costs for a 200 MT per day underground metal mine in a U.S. setting was provided by a U.S. mining engineering company, Western Mine Engineering, Inc. The costs are for a vein type mine accessed by a 160-m (524-ft) deep vertical shaft with rail type underground haulage transport. The operating costs for the 200 MT per day mine is estimated to be \$0.07 per kg (\$0.03 per lb) of ore and the capital cost is estimated to be approximately \$0.04 per kg (\$0.02 per lb) of ore, for a total cost of \$0.11 per kg (\$0.05 per lb) of ore. The capital cost of the mine is \$12.4 million 2002 dollars. In the case of an existing exhausted mine the capital costs could be much less.

The mine cost estimates presented indicate that the assumption of the much higher costs presented in Table 4.13-4, LLNL Estimated Life Cycle Costs for DOE Depleted UF_6 Disposal

Alternatives for the concrete vault alternative, represents an upper bound cost estimate for depleted U_3O_8 disposal. For example, the capital cost of the concrete vault alternative, which may be obtained by undiscounting the LLNL estimate costs presented in Table 4.13-4, is \$350 million in 2002 dollars, or 28 times the capital cost of the 200 MT (220 tons) mine discussed above.

The four sets of cost estimates obtained are presented in Table 4.13-7 in 2002 dollars per kgU. Note that the Claiborne Enrichment Center cost had a greater uncertainty associated with it. The UDS contract does not allow the component costs for conversion, disposal and transportation to be estimated. The costs in the table indicate that \$5.50 per kgU (\$2.50 per lb U) is a conservative and, therefore, prudent estimate of total depleted UF_6 disposition cost for the LES NEF. That is, the historical estimates from LLNL and CEC and the more recent actual costs from the UDS contract were used to inform the LES cost estimate. Urenco has reviewed this estimate and, based on its current cost for UBC disposal, finds this figure to be prudent.

Based on information from corresponding vendors, the value of \$5.50 per kgU (2002 dollars), which is equal to \$5.70 per kgU when escalated to 2004 dollars, was revised in December 2004 to \$4.68 per kgU (2004 dollars). The value of \$4.68 per kgU was derived from the estimates of costs from the three components that make up the total disposition cost of DUF6 (i.e., deconversion, disposal, and transportation). The estimate of \$4.68 per kgU supports the Preferred Plausible Strategy of U.S. Private Sector Conversion and Disposal identified in section 4.13.3.1.3 of the ER as Option 1. In addition, \$0.60 per kgU has been added to this estimate to cover the cost of managing the empty UBCs once the DUF6 has been removed for conversion.

In support of the Option 2 Plausible Strategy identified in Section 4.13.3.1.3 of the ER, "DOE Conversion and Disposal," considered the backup option, LES requested a cost estimate from the Department of Energy (DOE). On March 1, 2005, DOE provided a cost estimate to LES for the components that make up the total disposition cost (i.e., deconversion, disposal, and transportation, excluding the cost of loading the UBCs at the NEF site) (DOE, 2005). This estimate, which was based upon an independent analysis undertaken by DOE's consultant, LMI Government Consulting, estimated the cost of disposition to total approximately $4.91 per kgU (2004 dollars). This estimate was subsequently corrected to $4.68 per kgU (2004 dollars) and no additional amounts were added to account for UBC loading at the NEF site since this cost is minimal and the DOE transportation estimate is highly conservative. The Department's cost estimate for deconversion, storage, and disposal of the DU is consistent with the contract between UDS and DOE. The cost estimate does not assume any resale or reuse of any products resulting from the conversion process.

For purposes of determining the total tails disposition funding requirement and the amount of financial assurance required for this purpose, the value of $5.28 per kgU (based upon the cost estimate for the Preferred Plausible Strategy) was selected. Furthermore, this financial assurance will always cover the backup DOE option cost estimate, plus a 25% contingency, via the periodic update mechanism. See Safety Analysis Report Table 10.1-14, Total Decommissioning Costs, for the total tails disposition funding cost.

4.13.3.2 Water Quality Limits

All plant effluents are contained on the NEF site except sanitary waste. A series of evaporation retention/detention basins are used to contain the plant effluents. Sanitary wastewater will be sent to the City of Eunice Wastewater Treatment Plant via a system of lift stations and 8 inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system. Contaminated water is treated to the limits in 10 CFR 20, Appendix B, Table 2 and to administrative levels recommended by Regulatory Guide 8.37 (CFR, 2003q). Refer to ER Section 4.4, Water Resource Impacts, for additional water quality standards and permits for the NEF. ER Section 3.12, Waste Management, also contains information on the NEF systems and procedures to ensure water quality.

4.13.4 Waste Minimization

The highest priority has been assigned to minimizing the generation of waste through reduction, reuse or recycling. The NEF incorporates several waste minimization systems in its operational procedures that aim at conserving materials and recycling important compounds. For example, all PFPE Oil will be recovered where practical. PFPE Oil is an expensive, highly fluorinated, inert oil selected specifically for use in UF_6 systems to avoid reactions with UF_6. The NEF will also have in place a Decontamination Workshop designed to remove radioactive contamination from equipment and allow some equipment to be reused rather than treated as waste.

In addition, the NEF process systems that handle UF_6, other than the Product Liquid Sampling System, will operate entirely at subatmospheric pressure to prevent outward leakage of UF_6. Cylinders, initially containing liquid UF_6, will be transported only after being cooled, so that the UF_6 is in solid form, to minimize the potential risk of accidental releases due to mishandling.

The NEF is designed to minimize the usage of natural and depletable resources. Closed-loop cooling systems have been incorporated in the designs to reduce water usage. Power usage will be minimized by efficient design of lighting systems, selection of high-efficiency motors, and use of proper insulation materials.

ALARA controls will be maintained during facility operation to account for standard waste minimization practices as directed in 10 CFR 20 (CFR, 2003q). The outer packaging associated with consumables will be removed prior to use in a contaminated area. The use of glove boxes will minimize the spread of contamination and waste generation.

Collected waste such as trash, compressible dry waste, scrap metals, and other candidate wastes will be volume reduced at a centralized waste processing facility. This facility could be operated by a commercial vendor such as GTS Duratek. This facility would further reduce generated waste to a minimum quantity prior to final disposal at a land disposal facility or potential reuse.

4.13.4.1 Control and Conservation

The features and systems described below serve to limit, collect, confine, and treat wastes and effluents that result from the UF_6 enrichment process. A number of chemicals and processes are used in fulfilling these functions. As with any chemical/industrial facility, a wide variety of waste types will be produced. Waste and effluent control is addressed below as well as the features and systems used to conserve resources.

4.13.4.1.1 Mitigating Effluent Releases

The equipment and design features incorporated in the NEF are selected to keep the release of gaseous and liquid effluent contaminants as low as practicable, and within regulatory limits. They are also selected to minimize the use of depletable resources. Equipment and design features for limiting effluent releases during normal operation are described below:

The process systems that handle UF_6 operate almost entirely at sub-atmospheric pressures. Such operation results in no outward leakage of UF_6 to any effluent stream.

- The one location where UF_6 pressure is raised above atmospheric pressure is in the piping and cylinders inside the sampling autoclave. The piping and cylinders inside the autoclave confine the UF_6. In the event of leakage, the sampling autoclave provides secondary containment of UF_6.
- Cylinders of UF_6 are transported only when cool and when the UF_6 is in solid form. This minimizes risk of inadvertent releases due to mishandling.
- Process off-gas, from UF_6 purification and other operations, is discharged through desublimers to solidify and reclaim as much UF_6 as possible. Remaining gases are discharged through high-efficiency filters and chemical adsorbent beds. The filters and adsorbents remove HF and uranium compounds left in the gaseous effluent stream.
- Liquids and solids in the process systems collect uranium compounds. When these liquids and solids (e.g., oils, damaged piping, or equipment) are removed for cleaning or maintenance, portions end up in wastes and effluent. Different processes are employed to separate uranium compounds and other materials (such as various heavy metals) from the resulting wastes and effluent. These processes are described in ER Section 4.13.4.2 below.

- Processes used to clean up wastes and effluents create their own wastes and effluent as well. Control of these is also accomplished by liquid and solid waste handling systems and techniques, which are described in detail in the Sections below. In general, careful applications of basic principles for waste handling are followed in all of the systems and processes. Different waste types are collected in separate containers to minimize contamination of one waste type with another. Materials that can cause airborne contamination are carefully packaged; ventilation and filtration of the air in the area is provided as necessary. Liquid wastes are confined to piping, tanks, and other containers; curbing, pits, and sumps are used to collect and contain leaks and spills. Hazardous wastes are stored in designated areas in carefully labeled containers; mixed wastes are also contained and stored separately. Strong acids and caustics are neutralized before entering an effluent stream. Radioactively contaminated wastes are decontaminated insofar as possible to reduce waste volume.
- Following handling and treatment processes to limit wastes and effluent, sampling and monitoring is performed to assure regulatory and administrative limits are met. Gaseous effluent is monitored for HF and is sampled for radioactive contamination before release; liquid effluent is sampled and/or monitored in liquid waste systems; solid wastes are sampled and/or monitored prior to offsite treatment and disposal. Samples are returned to their source where feasible to minimize input to waste streams.

4.13.4.1.2 Conserving Depletable Resources

The NEF design serves to minimize the use of depletable resources. Water is the primary depletable resource used at the facility. Electric power usage also depletes fuel sources used in the production of the power. Other depletable resources are used only in small quantities. Chemical usage is minimized not only to conserve resources, but also to preclude excessive waste production. Recyclable materials are used and recycled wherever practicable.

The main feature incorporated in the NEF to limit water consumption is the use of closed-loop cooling systems.

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

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

Power usage is minimized by efficient design of lighting systems, selection of high-efficiency motors, use of appropriate building insulation materials, and other good engineering practices. The demand for power in the process systems is a major portion of plant operating cost; efficient design of components is incorporated throughout process systems.

4.13.4.1.3 Prevention and Control of Oil Spills

Due to the distance to the nearest navigable waterway, NEF is exempt from requiring a Spill Prevention, Control and Countermeasure Plan (40 CFR 112.1 (d) (CFR, 2003aa). However, BMPs will be used to ensure that fuel oil and other chemicals are handled appropriately during storage, transfer and use, and that the integrity of the tanks meet applicable regulations and industry standards. Site procedures will be in place to provide instruction for reporting releases, and determining reporting requirements and if corrective actions are warranted.

4.13.4.2 Reprocessing and Recovery Systems

Systems used to allow recovery, or reuse of materials, are described below.

4.13.4.2.1 (*See SAR § 12.8)* PFPE Oil Recovery System

PFPE oil is an expensive, highly fluorinated, inert oil selected specifically for use in UF_6 systems to avoid reaction with UF_6. The PFPE Oil Recovery System recovers used PFPE oil from pumps used in UF_6 systems. All PFPE oil is recovered; none is normally released as waste or effluent.

Used PFPE oil is recovered by removing impurities that inhibit the oil's lubrication properties. The impurities collected are primarily uranyl fluoride (UO_2F_2) and uranium tetrafluoride (UF_4) particles. The recovery process also removes trace amounts of hydrocarbons, which if left in the oil would react with UF_6. The PFPE Oil Recovery System components are located in the Decontaminated Workshop in the CRDB. The total annual volume of oil to be processed in this system is approximately 535 L (141 gal).

The PFPE oil recovery process consists of oil collection, uranium precipitation, trace hydrocarbon removal, oil sampling, and storage of cleaned oil for reuse. Each step is performed manually.

PFPE oil is collected in the Vacuum Pump Rebuild Workshop as part of the pump disassembly process. The oil is the transferred for processing to the Decontamination Workshop in plastic containers. The containers are labeled so each can be tracked through the process. Used oil awaiting processing is stored in the used oil storage receipt array to eliminate the possibility of accidental criticality.

Uranium compounds are removed from the PFPE oil in the PFPE oil fume hood to minimize personnel exposure to airborne contamination. Dissolved uranium compounds are removed by the addition of anhydrous sodium carbonate (Na_2CO_3) to the oil container which causes the uranium compounds to precipitate into sodium uranyl carbonate $Na_4UO_2(CO_3)_3$. The mixture is agitated and then filtered through a coarse screen to remove metal particles and small parts such as screws and nuts. These are transferred to the Solid Waste Collection System. The oil is then heated to 90°C (194°F) and stirred for 90 minutes to speed the reaction. The oil is then centrifuged to remove UF_4, sodium uranyl carbonate, and various metallic fluorides. The particulate removed from the oil is collected and transferred to the Solid Waste Collection Room for disposal.

Trace amounts of hydrocarbons are next removed in the PFPE oil fume hood next by adding activated carbon to the PFPE oil and heating the mixture at 100°C (212°F) for two hours. The activated carbon absorbs the hydrocarbons, and the carbon in turn is removed by filtration through a celite bed. The resulting sludge is transferred to the Solid Waste Disposal Collection Room for disposal.

Recovered PFPE oil is sampled. Oil that meets the criteria can be reused in the system while oil that does not meet the criteria will be reprocessed. The following limits have been set for evaluating recovered PFPE oil purity for reuse in the plant:

- Uranium - 50 ppm by volume
- Hydrocarbons - 3 ppm by volume

Recovered PFPE oil is stored in plastic containers in the Chemical Storage Area.

Failure of this system will not endanger the health and safety of the public. Nevertheless, design and operating features are included that contribute to the safety of plant workers. Containment of waste is provided by components, designated containers, and air filtration systems. Criticality is precluded through the control of geometry, mass, and the selection of appropriate storage containers. To minimize worker exposure, airborne radiological contamination resulting from dismantling is extracted. Where necessary, air suits and portable ventilation units are available for further worker protection.

4.13.4.2.2 (See SAR § 12.6*)* Decontamination System

The Contaminated Workshop and Decontamination System are located in the same room in the CRDB. This room is called the Decontamination Workshop. The Decontamination Workshop in the CRDB will contain the area to break down and strip contaminated equipment and to decontaminate that equipment and its components. The decontamination systems in the workshop are designed to remove radioactive contamination from contaminated materials and equipment. The only significant forms of radioactive contamination found in the plant are uranium hexafluoride (UF_6), uranium tetrafluoride (UF_4) and uranyl fluoride (UO_2F_2).

One of the functions of the Decontamination Workshop is to provide a maintenance facility for both UF_6 pumps and vacuum pumps. The workshop will be used for the temporary storage and subsequent dismantling of failed pumps. The dismantling area will be in physical proximity to the decontamination train, in which the dismantled pump components will be processed. Full maintenance records for each pump will be kept.

The process carried out within the Decontamination Workshop begins with receipt and storage of contaminated pumps, out-gassing, PFPE oil removal and storage, and pump stripping. Activities for the dismantling and maintenance of other plant components are also carried out. Other components commonly decontaminated besides pumps include valves, piping, instruments, sample bottles, tools, and scrap metal. Personnel entry into the facility will be via a sub-change facility. This area has the required contamination controls, washing and monitoring facilities.

The decontamination part of the process consists of a series of steps following equipment disassembly including degreasing, decontamination, drying, and inspection. Items from uranium hexafluoride systems, waste handling systems, and miscellaneous other items are decontaminated in this system. The decontamination process for most plant components is described below, with a typical cycle time of one hour. For smaller components the decontamination process time is slightly less, about 50 minutes. Sample bottles and flexible hoses are handled under special procedures due to the difficulty of handling the specific shapes. Sample bottle decontamination and decontamination of flexible hoses are addressed separately below.

Criticality is precluded through the control of geometry, mass, and the selection of appropriate storage containers. Administrative measures are applied to uranium concentrations in the Citric Acid Tank and Degreaser Tank to maintain these controls. To minimize worker exposure, airborne radiological contamination resulting from dismantling is extracted. Air suits and portable ventilation units are available for further worker protection.

Containment of chemicals and wastes is provided by components, designated containers, and air filtration systems. All pipe work and vessels in the Decontamination Workshop are provided with design measures to protect against spillage or leakage. Hazardous wastes and materials are contained in tanks and other appropriate containers, and are strictly controlled by administrative procedures. Chemical reaction accidents are prevented by strict control on chemical handling.

4.13.4.2.3 General Decontamination

Prior to removal from the plant, the pump goes through an isolation and de-gas process. This removes the majority of UF_6 from the pump. The pump flanges are then sealed prior to movement to the Decontamination Workshop. The pumps are labeled so each can be tracked through the process. Pumps enter the Decontamination Workshop through airlock doors. The internal and external doors are electrically interlocked such that only one door can be opened at a given time. Pumps may enter the workshop individually or in pairs. Valves, pipework, flexible hoses, and general plant components are accepted into the room either within plastic bags or with the ends blinded.

Pumps waiting to be processed are stored in the pump storage array to eliminate the possibility of accidental criticality. The array maintains a minimum edge spacing of 600 mm (2 ft). Pumps are not accepted if there are no vacancies in the array.

Before being broken down and stripped, all pumps are placed in the Outgas Area and the local ventilation hose is positioned close to the pump flange. The flange cover is then removed. HF and UF_6 fumes from the pump are extracted via the exhaust hose, typically over a period of several hours. While in the Outgas Area, the oil will be drained from the pumps and the first stage roots pumps will be separated from the second stage roots pumps. The oil is drained into 5-L (1.3 gal) plastic containers that are labeled so each can be tracked through the process.

Prior to transfer from the Outgas Area, the outside of the bins, the pump frames, and the oil bottles are all monitored for radiological contamination. The various items will then be taken to the decontamination system or PFPE oil storage array as appropriate.

Oil waiting to be processed is stored in the PFPE oil storage array to eliminate the possibility of accidental criticality. The array maintains a minimum edge spacing of about 600 mm (2 ft) between containers. When ready for processing, the oil is transferred to the PFPE Oil Recovery System where the uranics and hydrocarbon contaminants can be separated prior to reuse of the oil.

After out-gassing, individual pumps are removed from the Outgas Area and placed on either of the two hydraulic stripping tables. An overhead crane is utilized to aid the movement of pumps and tools over the stripping table. The tables can be height-adjusted and the pump can be moved and positioned on the table. Hydraulic stripping tools are then placed on the stripping tables using the overhead crane or mobile jig truck. The pump and motor are stripped to component level using various hydraulic and hand tools. Using the overhead crane or mobile jig truck, the components are placed in bins ready for transportation to the General Decontamination Cabinet.

Degreasing is performed following disassembly of equipment. Degreasing takes place in the hot water Degreaser Tank of the decontamination facility system. The degreased components are inspected and then transferred to the next decontamination tank.

Following disassembly and degreasing, decontamination is accomplished by immersing the contaminated component in a citric acid bath with ultrasonic agitation. After 15 minutes, the component is removed, and is rinsed with water to remove the citric acid.

The tanks are sampled periodically to determine the condition of the solution and any sludge present. The Citric Acid Tank contents are analyzed for uranium concentration and citric acid concentration. A limit on ^{235}U of 0.2 g/L (0.02 ounces/gal) of bath has been established to prevent criticality. Additional citric acid is added as necessary to keep the citric acid concentration between 5% and 7%. Spent solutions, consisting of citric acid and various uranyl and metallic citrates, are transferred to a citric acid collection tank. The Rinse Water Tanks are checked for satisfactory pH levels; unusable water is transferred to an effluent collection tank.

All components are dried after decontamination. This is performed manually using compressed air.

The decontaminated components are inspected prior to release. The quantity of contamination remaining shall be “as-low-as-reasonably practicable." Components released for unrestricted use do not have contamination exceeding 83.3 Bq/100 cm^2 (5,000 dpm/100 cm^2) for average fixed alpha or beta/gamma contamination and 16.7 Bq/100 cm^2 (1,000 dpm/100 cm^2) removable alpha or beta/gamma contamination. However, if all the component surfaces cannot be monitored then the consignment will be disposed of as a low-level waste.

4.13.4.2.4 Sample Bottle Decontamination

Sample bottle decontamination is handled somewhat differently than the general decontamination process. The Decontamination Workshop has a separate area dedicated to sample bottle storage, disassembly, and decontamination. Used sample bottles are weighed to confirm the bottles are empty. The valves are loosened, and the remainder of the decontamination process is performed in the sample bottle decontamination hood. The valves are removed inside the fume hood. Any loose material inside the bottle or valve is dissolved in a citric acid solution. Spent citric acid is transferred to the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment System.

Initially, sample bottles and valves are flushed with a 10% citric acid solution and then rinsed with deionized water. In the case of sample bottles, these are filled with deionized water and left to stand for an hour, while the valves are grouped together and citric acid is recirculated in a closed loop for an hour. These used solutions are collected and taken to the Citric Acid Collection Tank in the General Decontamination Cabinet. Any liquid spillages / drips are soaked away with paper tissues that are disposed of in the Solid Waste Collection Room. Bottles and valves are then rinsed again with deionized water. This used solution is collected in a small plastic beaker, and then poured into the Citric Acid Tank in the decontamination train. Both the bottles and valves are dried manually, using compressed air, and inspected for contamination and rust. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. The bottles are then put into an electric oven to ensure total dryness, and on removal are ready for reuse. The cleaned components are transferred to the clean workshop for reassembly and pressure and vacuum testing.

4.13.4.2.5 Flexible Hose Decontamination

The decontamination of flexible hoses is handled somewhat differently than the general process and has a separate area. The decontamination process is performed in a Flexible Hose Decontamination Cabinet. This decontamination cabinet is designed to process only one flexible hose at a time and is comprised of a supply of citric acid, deionized water and compressed air.

Initially, the flexible hose is flushed with a 10% citric acid solution at 60°C (140°F) and then rinsed with deionized water (also at 60°C) (140°F) in a closed loop recirculation system. The used solutions (citric acid and deionized water) are transferred into the contaminated Citric Acid Tank for disposal. Interlocks are provided in the recirculation loop to prevent such that the recirculation pumps from starting if the flexible hose has not been connected correctly at both ends. Both the citric acid and deionized water recirculation pumps are equipped with a 15-minute timer device. The extracted air exhausts to the CRDB GEVS to ensure airborne contamination is controlled. Spill from the drip tray are routed to either the Citric Acid Tank or the hot water recirculation tank, depending upon the decontamination cycle. Each flexible hose is then dried in the decontamination cupboard using hot compressed air at 60°C (140°F) to ensure complete dryness. The cleaned dry flexible hose is then transferred to the Vacuum Pump Rebuild Workshop for reassembly and pressure testing prior to reuse in the plant.

4.13.4.2.6 Decontamination Equipment

The following major components are included in the Decontamination System:

- Citric Acid Baths: An open top Citric Acid Tank with a sloping bottom in hastelloy is provided for the primary means of removing radioactive contamination. The sloping-bottom construction is provided for ease of emptying and draining the tank completely. The tank has a liquid capacity of 800 L (211 gal). The tank is located in a cabinet and is furnished with ultrasonic agitation, a thermostatically controlled electric heater to maintain the content's temperature at 60°C (140°F), and a recirculation pump. Mixing is provided to accommodate sampling for criticality prevention. Level control with a local alarm is provided to maintain the acid level. The tank has a ring header and a manual hose to rinse out residual solids/sludge with deionized water after the batch has been pumped to the Liquid Effluent Collection and Treatment System. In order to minimize uranium concentration, the rinse water from the Rinse Water Tank that receives deionized water directly is pumped into the other Rinse Water Tank, which in turn is pumped into the Citric Acid Tank. The counter-current system eliminates a waste product stream by concentrating the uranics only in the Citric Acid Tank. The rinse water transfer pump is linked with the level controller of the Citric Acid Tank, which prevents overfilling of this tank during transfer of the rinse water. During transfer, the rinse water transfer pump trips at a high tank level resulting in a local alarm. The extracted air exhausts to the CRDB GEVS to assure airborne contamination is controlled. The Citric Acid Tank contents are monitored and then emptied by an air-driven double diaphragm pump into the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment System.
- Rinse Water Baths: Two open top Rinse Water Tanks with stainless steel sloping bottoms are provided to rinse excess citric acid from decontaminated components. Each of the tanks has a liquid capacity of 800 L (211 gal). Both tanks are located in an enclosure, and each tank is furnished with ultrasonic agitation, a thermostatically controlled electric heater to maintain the contents temperature at 60°C (140°F), and a recirculation pump to accommodate sampling for criticality prevention. The sloping-bottom is provided of emptying and draining the tank completely. Fresh deionized water is added to the tank. In order to minimize uranium concentration, the rinse water from the tank that receives deionized water directly is pumped into the other Rinse Water Tank, which in turn is pumped into the Citric Acid Tank. Level control is provided to maintain the deionized (rinse) water level. During transfer, the rinse water transfer pump trips at tank high level resulting in a local alarm. The Rinse Water Tank that directly receives deionized water is topped up manually with the water as necessary. The extracted air exhausts to the CRDB GEVS to assure airborne contamination is controlled. A manual spray hose is available for rinsing the tank after it has been emptied.

- Decontamination Degreasing Unit: An open top Degreaser Tank with a sloping bottom in hastelloy is provided for the primary means of removing the PFPE oil and greases that may inhibit the decontamination process. Components requiring degreasing are cleaned manually and then immersed into the Degreaser Tank. The sloping-bottom construction is provided for ease of emptying and draining the tank completely. During the decontamination process, the tank contents are continuously recirculated using a pump. Recirculation is provided to accommodate sampling for criticality prevention. The tank has a capacity of 800 L (211 gal) and is located in a cabinet. It is furnished with an ultrasonic agitation facility, and a thermostatically-controlled electric heater to maintain the temperature at 60°C (140°F). The tank has a ring header and a manual hose to rinse out residual solids/sludge with deionized water after the batch has been pumped to the Liquid Effluent Collection and Treatment System. The extracted air exhausts to theCRDB GEVS to ensure airborne contamination is controlled. Level control with a local alarm is provided to maintain the liquid level. The Degreaser Tank contents are monitored and then emptied by an air-driven double diaphragm pump into the Degreaser Water Collection Tank in the Liquid Effluent Collection and Treatment System.
- The activities carried out in the Decontamination Workshop may create potentially contaminated gaseous streams, which would require treatment before discharging to the atmosphere. These streams consist of air with traces of UF_6, HF, and uranium particulates (mainly UO_2F_2). The CRDB GEVS is designed to route these streams to a filter system and to monitor, on a continuous basis, the resultant exhaust stream discharged to the atmosphere. Air exhausted from the General Decontamination Cabinet, the Sample Bottle Decontamination Cabinet, and the Flexible Hose Decontamination Cabinet is vented to the CRDB GEVS. There will be local ventilation ports in the stripping area and Outgas Area that operate under vacuum with all air discharging through the CRDB GEVS. The room itself will have other HVAC ventilation.
- Vapor Recovery Unit and distillation still.
- Drying Cabinet: One drying cabinet is provided to dry components after decontamination.
- Decontamination System for Sample Bottles (in a cabinet) - a small, fresh citric acid tank; a small, deionized water tank; and 5 L (1.3 gal) containers for citric acid/uranic waste
- Decontamination System for Flexible Hoses (in a cabinet) - a small citric acid tank for fresh and waste citric acid, an air diaphragm pump and associated equipment
- Various tools for moving equipment (e.g., cranes)
- Various tools for stripping equipment
- An integral monorail hoist with a lifting capacity of one ton, located within the decontamination enclosure, is provided to lift the basket and its components into and out of the Degreaser Tank, Citric Acid Tank, and the two Rinse Water Tanks as part of the decontamination activity sequence.
- Citric Acid Tank and Degreaser Tank clean-up ancillary items, comprised for each tank, a portable air driven transfer pump and associated equipment
- Radiation monitors.

4.13.5 Comparative Waste Management Impacts of No Action Alternative Scenarios

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

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The waste management impact would be greater since a greater amount of waste results from GDP operation.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The waste management impact would be greater in the short term because the GDP produces a larger waste stream. In the long term, the waste management impact would be the same once the GDP production is terminated.

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

4.13.6 Section 4.13 Tables

Table 4.13-1Possible Radioactive Waste Processing / Disposal Facilities

Radioactive Waste Processing / Disposal Facility	Acceptable Wastes	Approximate Distance km (miles)
Barnwell Disposal Site Barnwell, SC	Radioactive Class A, B, C Processed Mixed	2,320 (1,441)
Envirocare of Utah South Clive, UT	Radioactive Class A Mixed	1,636 (1016)
GTS Duratek[1] Oak Ridge, TN	Radioactive Class A Some Mixed	1,993 (1,238)
Depleted UF_6 Conversion Facility[2] Paducah, Kentucky	Depleted UF_6	1,670 (1037)
Depleted UF_6 Conversion Facility[2] Portsmouth, Ohio	Depleted UF_6	2,243 (1,393)

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

[2]Per DOE-UDS contract, to begin operation in 2005.

Table 4.13-2LLNL-Estimated Life-Cycle Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion

LLNL-ESTIMATED LIFE-CYCLE COSTS FOR DOE DEPLETED UF_6 TO DEPLETED U_3O_8 CONVERSION (A) (MILLION DOLLARS FOR 378,600 MTU OF DEPLETED UF_6 OVER 20 YEARS; DISCOUNTED 1996 DOLLARS)		
Conversion Capital & Operating Activities	AHF Conversion Alternative	HF Neutralization Conversion Alternative
Technology Department	9.84	5.74
Process Equipment	22.36	20.88
Process Facilities	46.33	45.53
Balance of Plant	29.20	30.25
Regulatory Compliance	22.70	22.70
Operations & Maintenance	134.76	198.40
Decontamination & Decommissioning	1.76	1.73
Total Discounted Costs (1996 Dollars):	266.95	325.23
Total Undiscounted Costs (1996 Dollars):	902.6	1,160.1
Undiscounted Unit Costs ($/kgU):		
TOTAL (1996 Dollars)	2.38	3.05
TOTAL (2002 Dollars per GDP IPD)	2.64	3.39
(a) Source: (LLNL, 1997a)		
AHF: Assumes sale of anhydrous hydrogen fluoride; $77.32 million credit assumed. HF: Assumes sale of calcium fluoride (CAF_2) produced from hydrogen fluoride (HF); $11.02 million credit assumed.		

Table 4.13-3Summary of LLNL-Estimated Capital, Operating and Regulatory Unit Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion

SUMMARY OF LLNL-ESTIMATED CAPITAL, OPERATING, AND REGULATORY UNIT COSTS FOR DOE DEPLETED UF_6 TO DEPLETED U_3O_8 CONVERSION (A) (UNDISCOUNTED DOLLARS PER KILOGRAMS OF U AS DEPLETED UF_6)				
Cost Breakdown	AHF Alternative		HF Neutralization Alternative	
	1996$	2002$	1996$	2002$
Capital (b)	0.72	0.80	0.69	0.76
Operating & Maintenance	1.51	1.67	2.22	2.46
Regulatory Compliance	0.14	0.16	0.14	0.16
Total:	2.38	2.64	3.05	3.39

(a) Unit costs based on Table 4.13-2 costs.

(b) Technology development, process equipment, process facilities, balance of plant and decontamination and decommissioning.

Source: (LLNL, 1997a)

Note: Summation may be affected by rounding.

Table 4.13-4LLNL-Estimated Life-Cycle Costs for DOE Depleted UF_6 Disposal Alternatives

LLNL-ESTIMATED LIFE-CYCLE COSTS FOR DOE DEPLETED U_3O_8 DISPOSAL ALTERNATIVES (MILLION DOLLARS FOR 378,600 MTU OF DEPLETED UF_6 OVER 20 YEARS; UNDISCOUNTED 1996 DOLLARS)		
	Depleted U_3O_8 Disposal Alternatives	
Depleted U_3O_8 Disposal Capital & Operating Activities	Engineered Trench	Concrete Vault
Waste Form Preparation:		
Technology Development		
Balance of Plant	6.56	6.56
Regulatory Compliance	26.43	26.43
Operations & Maintenance	2.02	2.02
Decontamination & Decommissioning	33.23	33.23
	0.60	0.60
Subtotal (1996 Discounted Dollars)		
Waste Disposal:	68.84	68.84
Facility Engineering & Construction		
Site Preparation & Restoration		
Emplacement & Closure		
Regulatory Compliance	12.22	96.08
Surveillance & Maintenance	0.89	1.68
	30.61	39.2
Subtotal (1996 Discounted Dollars)	40.35	40.35
Preparation & Disposal Discounted Total Costs (1996 Dollars):	2.29	2.86
	86.36	180.17
	155.20	249.01
Preparation & Disposal Undiscounted Total Costs (1996 Dollars):	499.60	742.50
Undiscounted Unit Costs ($/kgU):		
TOTAL (1996 Dollars)		
TOTAL (2002 Dollars per GDP IPD)	1.31	1.95
	1.46	2.17
Source: (LLNL, 1997a)		

Table 4.13-5Summary of Total Estimated Conversion and Disposal Costs

SUMMARY OF TOTAL ESTIMATED CONVERSION AND DISPOSAL COSTS (UNDISCOUNTED 2002 DOLLARS PER KGU OF DEPLETED UF_6)				
	AHF Alternative		HF Neutralization Alternative	
Cost Items	Engineered Trench	Concrete Vault	Engineered Trench	Concrete Vault
Depleted UF_6 Conversion to Depleted U_3O_8	2.64	2.64	3.39	3.39
Waste Preparation & Disposal	1.46	2.17	1.46	2.17
Depleted UF_6 & Depleted U_3O_8 Transportation	0.25	0.25	0.25	0.25
Total Cost:	4.35	5.06	5.1	5.81

Table 4.13-6DOE-UDS August 29, 2002 Contract Quantities and Costs

DOE-UDS AUGUST 29, 2002, CONTRACT QUANTITIES & COSTS		
	Target Million kgU	
UDS Conversion & Disposal Quantities:	Depleted UF_6 (a)	U (b)
FY 2005 (Aug. – Sept.)	1.050	0.710
FY 2006	27.825	18.8
FY 2007	31.500	21.294
FY 2008	31.500	21.294
FY 2009	31.500	21.294
FY 2010 (Oct.-July)	26.250	17.745
Total:	149.625	101.147
Nominal Conversion Capacity (c) and Target Conversion Rate (Million kgU/yr)		21.3
UDS Contract Workscope Costs (d):		Million $
Design, Permitting, Project Management, etc.		27.99
Construct Paducah Conversion Facility		93.96
Construct Portsmouth Conversion Facility		90.40
Operations for First 5 Years Depleted UF_6 & Depleted U_3O_8 (e)		283.23
Contract Estimated Total Cost w/o Fee		495.58
Contract Estimated Value per DOE PR, August 29, 2003		558.00
Difference Between Cost & Value is the Estimated Fee of 12.6%		62.42
Capital Cost without Fee		212.35
Capital Cost with Fee		239.10
First 5 Years Operating Cost with Fee		318.92
Estimated Unit Conversion & Disposal Costs:		
Unit Capital Cost (f)		$0.77/kgU
2005-2010 Unit Operating Costs in 2002$		$3.15/kgU
Total Estimated Unit Cost		$3.92kgU

(a) As on page B-10 of the UDS contract.
(b) Depleted UF_6 weight multiplied by the uranium atomic mass fraction, 0.676.
(c) Based on page H-34 of the UDS contract.
(d) Workscope costs on an UDS contract pages B-2 and B-3.
(e) Does not include any potential off-set credit for HF sales.
(f) Assumed operation over 25 years, 6% government cost of money, and no taxes.

Table 4.13-7Summary of Depleted UF_6 Disposal Costs From Four Sources

SUMMARY OF Depleted UF_6 DISPOSAL COSTS FROM FOUR SOURCES				
Source	Costs in 2002 Dollars per kgU			
	Conversion	Disposal	Transportation	Total
LLNL (UCRL-AR-127650 (a)	2.64	2.17	0.25	5.06
UDS Contract (b)	(d)	(d)	(d)	3.92
URENCO (e)	(d)	(d)	(d)	(d)
CEC Cost Estimate (c)	4.93	1.47	0.34	6.74

(a) 1997 Lawrence Livermore National Laboratory cost estimate study for DOE; discounted costs in 1996 dollars were undiscounted and escalated to 2002 by ERI.

(b) Uranium Disposition Services (UDS) contract with DOE for capital and operating costs for first five years of Depleted UF_6 conversion and Depleted U_3O_8 conversion product disposition.

(c) Based upon depleted UF_6 and depleted U_3O_8 disposition costs provided to the NRC during Claiborne Energy Center license application in 1993.

(d) Cost component proprietary or not made available.

(e) The average of the three costs is $5.24/kg U. LES has selected $5.50/kgU as the disposal cost for the National Enrichment Facility. Urenco has reviewed this cost estimate, and based on its current experience with UF_6 disposal, finds this figure to be prudent.

5.0 MITIGATION MEASURES

This chapter summarizes the mitigation measures that will be in place to reduce adverse impacts that occur during construction, routine and non-routine operation of the National Enrichment Facility (NEF).

5.1 IMPACT SUMMARY

This section summarizes the environmental impacts that may result from the construction and operation of the NEF. Complete details of these potential impacts are provided in Chapter 4 of this Environmental Report.

5.1.1 Land Use

Land use impact has been characterized in ER Section 4.1, Land Use Impacts. No substantive impacts exists as related to the following:

- Land-use impact, and impact of any related Federal action that may have cumulatively significant impacts
- Area and location of land that will be disturbed on either a long-term or short-term basis.

Minor impacts related to erosion control on the site may occur, but are short-term and limited. Mitigation measures associated with these impacts are listed in ER Section 5.2.1, Land Use.

5.1.2 Transportation

Transportation impact has been characterized in ER Section 4.2, Transportation Impacts.

With respect to construction-related transportation, no substantive impacts exist as related to the following:

- Construction of the access roads to the facility. Two construction access roads will be constructed from New Mexico Highway 234. Both roads will be converted to permanent site access roads upon completion of construction.
- Transportation route and mode for conveying construction material to the facility
- Traffic pattern impacts (e.g., from any increase in traffic from heavy haul vehicles and construction worker commuting)
- Impacts of construction transportation such as fugitive dust, scenic quality, and noise.

Minor impacts related to construction traffic such as fugitive dust, noise, and emissions are discussed in ER Section 4.2.4, Construction Transportation Impacts. Additional information on noise impacts is contained in ER Section 4.7.1, Predicted Noise Levels. Mitigation measures associated with transportation impacts are listed in ER Section 5.2.2, Transportation.

With respect to the transport of radioactive materials, no substantive impacts exist as related to the following activities:

- Transportation mode (i.e., truck), and routes from originating site to the destination
- Estimated transportation distance from the originating site to the destination
- Treatment and packaging procedure for radioactive wastes
- Radiological dose equivalents for incident-free scenarios to public and workers
- Impacts of operating transportation vehicles on the environment (e.g., fire from equipment sparking).

Impacts related to the transport of radioactive material are addressed in ER Section 4.2.7, Radioactive Material Transportation. The materials that will be transported to and from the NEF

are well within the scope of the environmental impacts previously evaluated by the Nuclear Regulatory Commission (NRC). Because these impacts have been addressed in a previous NRC environmental impact statement (NUREG/CR-0170) (NRC, 1977a), no additional mitigation measures are proposed in ER Section 5.2.2, Transportation.

5.1.3 Geology and Soils

The potential impacts to the geology and soils have been characterized in ER Section 4.3, Geology and Soils Impact. No substantive impacts exist as related to the following activities:

- Soil resuspension, erosion, and disruption of natural drainage
- Excavations to be conducted during construction.

Impacts to geology and soils will be limited to surface runoff due to routine operation. Construction activities may cause some short-term increases in soil erosion at the site. Mitigation measures associated with these impacts are listed in ER Section 5.2.3, Geology and Soils.

5.1.4 Water Resources

The potential impacts to the water resources have been characterized in ER Section 4.4, Water Resources Impacts. No substantive impacts exists as related to the following:

- Impacts on surface water and groundwater quality
- Impacts of consumptive water uses (e.g., groundwater depletion) on other water users and adverse impacts on surface-oriented water users resulting from facility activities. Site groundwater will not be utilized for any reason, and therefore, should not be impacted by routine NEF operations. The NEF water supply will be obtained from the town of Eunice, New Mexico. Current capacity for the Eunice municipal water supply system is 16,350 m^3/day (4.32 million gpd), respectively and current usage is 5,600 m^3/day (1.48 million gpd). Average and peak potable water requirements for operation of the NEF are expected to be approximately 240 m^3/day (63,423 gpd) and 85 m^3/hour (378 gpm), respectively. These usage rates are well within the capacity of the water system. For both peak and the normal usage rates, the needs of the NEF facility should readily be met by the municipal water system. Impacts to water resources on site and in the vicinity of NEF are expected to be negligible.
- Hydrological system alterations or impacts
- Withdrawals and returns of ground and surface water
- Cumulative effects on water resources.

The NEF will not obtain any water from onsite surface or groundwater resources. Process effluents will be discharged to the double-lined Treated Effluent Evaporative Basin with leak detection. Sanitary waste water will be sent to the City of Eunice Wastewater Treatment Plant for processing via a systems of lift stations and 8-inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system. Stormwater from developed portions of the site will be collected in retention/detention basins, as described in ER Section 3.4, Water Resources. These include the Site Stormwater Detention Basin and the UBC Storage Pad Stormwater Retention Basin. Minor impacts to water resources are discussed in ER Section 4.4. Mitigation measures associated with these impacts are listed in ER Section 5.2.4, Water Resources.

5.1.5 Ecological Resources

The potential impacts to the ecological resources have been characterized in ER Section 4.5, Ecological Resources Impacts. No substantive impacts exists as related to the following:

- Total area of land to be disturbed
- Area of disturbance for each habitat type
- Use of chemical herbicides, roadway maintenance, and mechanical clearing
- Areas to be used on a short-term basis during construction
- Communities or habitats that have been defined as rare or unique or that support threatened and endangered species
- Impacts of elevated construction equipment or structures on species (e.g., bird collisions, nesting areas)
- Impact on important biota.

Impacts to ecological resources will be minimal. Mitigation measures associated with these impacts are listed in ER Section 5.2.5, Ecological Resources.

5.1.6 Air Quality

The potential impacts to the air quality have been characterized in ER Section 4.6, Air Quality Impacts. No substantive impacts exist as related to the following activities:

- Gaseous effluents
- Visibility impacts.

Impacts to air quality will be minimal. Construction activities will result in interim increases in hydrocarbons and particulate matter due to vehicle emissions and dust. Impacts due to plant operation consist of cooling tower plumes, small quantities of volatile organic components (VOC) emissions and trace amounts of HF, UO_2F_2, and other uranic compound effluents remaining in treated air emissions from plant ventilation systems. These effluents are significantly below regulatory limits. Mitigation measures associated with air quality impacts are listed in ER Section 5.2.6, Air Quality.

5.1.7 Noise

The potential impacts related to noise generated by the facility have been characterized in ER Section 4.7, Noise Impacts. No substantive impacts exists as related to the following activities:

- Predicted typical noise levels at facility perimeter
- Impacts to sensitive receptors (i.e., hospitals, schools, residences, wildlife).

Noise levels will increase during construction and due to operation of the NEF, but not to a level that will cause significant impact to nearby residents. The nearest residence is 4.3 km (2.63 mi) from the site. Mitigation measures associated with noise impacts are listed in ER Section 5.2.7, Noise.

5.1.8 Historical and Cultural Resources

The potential impacts to historical and cultural resources have been characterized in ER Section 4.8, Historical and Cultural Resources Impacts. Only minor impacts exists as related to the following activities:

- Construction, operation, or decommissioning
- Impact on historic properties
- Potential for human remains to be present in the project area
- Impact on archeological resources.

Impacts to Historical and Cultural Resources will be minimal. Mitigation measures associated with these impacts, if required, are listed in ER Section 5.2.8, Historical and Cultural Resources.

5.1.9 Visual/Scenic Resources

The potential impacts to visual/scenic resources have been characterized in ER Section 4.9, Visual/Scenic Resources Impacts. No substantive negative impacts exists as related to the following:

- The aesthetic and scenic quality of the site
- Impacts from physical structures
- Impacts on historical, archaeological or cultural properties of the site
- Impacts on the character of the site setting.

Visual/scenic impacts due to the development of the NEF result from visual intrusions in the existing landscape character. Except possibly for a section of the proposed, westernmost access road, no structures are proposed that may require the removal of natural or built barriers, screens or buffers. Mitigation measures associated with these impacts are listed in ER Section 5.2.9, Visual/Scenic Resources.

5.1.10 Socioeconomic

The potential socioeconomic impacts to the community have been characterized in ER Section 4.10, Socioeconomic Impacts. No substantive negative impacts exist as related to the following:

- Impacts to population characteristics (e.g., ethnic groups, and population density)
- Impacts to housing, health and social services, or educational and transportation resources
- Impacts to area's tax structure and distribution.

The anticipated cumulative socioeconomic negative impacts of the proposed operation of NEF are expected to be insignificant. The positive socioeconomic impacts are substantial (see ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation). See ER Section 4.10, Socioeconomic Impacts, for a detailed discussion on socioeconomic impacts.

5.1.11 Environmental Justice

The potential impacts with respect to environmental justice have been characterized in ER Section 4.11, Environmental Justice. No substantive impacts exist as related to the following:

- Disproportionate impact to minority or low-income population.

Based on the data analyzed and the NUREG-1748 guidance by which that analysis was conducted, LES determined that no further evaluation of potential Environmental Justice concerns was necessary, as no Census Block Group within the 6.4-km (4-mi) radius, i.e., 128 km^2 (50 mi^2), of the NEF site contained a minority or low-income population exceeding the NUREG-1748 "20%" or "50%" criteria. See ER Section 4.11, Environmental Justice.

5.1.12 Public and Occupational Health

This section describes public and occupational health impacts from both nonradiological and radiological sources.

5.1.12.1 Nonradiological – Normal Operations

The potential impacts to public and occupational health for nonradiological sources have been characterized in ER Section 4.12.1, Nonradiological Impacts. No substantive impacts exist as related to the following:

- Impact to members of the public from nonradiological discharge of liquid or gaseous effluents to water or air
- Impact to facility workers as a result of occupational exposure to nonradiological chemicals, effluents, and wastes
- Cumulative impacts to public and occupational health.

Impacts to the public and workers from nonradiological gaseous and liquid effluents will be minimal. Mitigation measures associated with these impacts are listed in ER Section 5.2.12.1, Nonradiological – Normal Operations.

5.1.12.2 Radiological – Normal Operations

This subsection describes public and occupational health impacts from radiological sources. It provides a brief description of the methods used to assess the pathways for exposure and the potential impacts.

5.1.12.2.1 Pathway Assessment

The potential for exposure to radiological sources included an assessment of pathways that could convey radioactive material to members of the public. These are briefly summarized below.

Potential points or areas were characterized to identify:

- Nearest site boundary
- Nearest full time resident
- Location of average member of the critical group
- In addition, important ingestion pathways such as stored and fresh vegetables, milk and meat, assumed to be grown or raised at the nearest resident location have been analyzed.

5.1.12.2.2 Public and Occupational Exposure

The potential impacts to public and occupational health for radiological sources have been characterized in ER Section 4.12, Public and Occupational Health Impacts. No substantive impacts exist as related to the following:

- Impacts based on the average annual concentration of radioactive and hazardous materials in gaseous and liquid effluents
- Impacts to the public (as determined by the critical group)
- Impacts to the workforce based on radiological and chemical exposures
- Impacts based on reasonably foreseeable (i.e., credible) accidents with the potential to result in environmental releases.

Routine operations at the NEF create the potential for radiological and nonradiological public and occupational exposure. Radiation exposure is due to the plant's use of the isotopes or uranium and the presence of associated decay products. Chemical and radiological exposures are primarily from byproducts of UF_6;UO_2F_2, HF and related uranic compounds, that will form inside plant equipment and from reaction with components. These are the primary products of concern in gaseous effluents that will be released from the plant and liquid effluents that will be released to the onsite retention basin. Mitigation measures associated with these impacts are listed in ER Section 5.2.12, Public and Occupational Health.

5.1.12.3 Accidental Releases

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

During the ISA process, evaluation of most accident sequences resulted in identification of design bases and design features that prevent a criticality event or HF release to the environment. Table 4.12-15, Accident Criteria Chemical Exposure Limits by Category, lists the accident criteria chemical exposure limits (HF) by category for an immediate consequence and high consequence categories.

Several accident sequences involving HF releases to the environment due to seismic or fire events were mitigated using design features to delay and reduce the UF_6 releases inside the buildings from reaching the outside environment. The seismic accident scenario considers an earthquake event of sufficient magnitude to fail portions of the UF_6 process piping and some UF_6 components resulting in a gaseous UF_6 release inside the buildings housing UF_6 process systems. The fire accident scenario considers a fire within the Cylinder Receipt and Dispatch Building (CRDB) that causes the release of uranic material from open waste containers and chemical traps during waste drum filling operations.

Potential adverse impacts for accident conditions are described in ER Section 4.12.3, Environmental Effects of Accidents. Mitigation measures associated with these impacts are listed in ER Section 5.2.12.3, Accidental Releases.

5.1.13 Waste Management

The potential impacts of waste generation and waste management have been characterized in ER Section 4.13, Waste Management Impacts. No substantive impacts exist as related to the following:

- Impact to the public due to the composition and disposal of solid, hazardous, radioactive and mixed wastes
- Impact to facility workers due to storage, processing, handling, and disposal of solid, hazardous, radioactive and mixed wastes
- Cumulative impacts of waste management.

Waste generated at the NEF will be comprised of industrial (nonhazardous), radioactive and mixed, and hazardous waste categories. In addition, radioactive and mixed waste will be further segregated according to the quantity of liquid that is not readily separable from the solid material. Gaseous and liquid effluent impacts are discussed in ER Section 5.1.12.2, Radiological – Normal Operations. Uranium Byproduct Cylinders (UBCs) are stored onsite at an outdoor storage area and will minimally impact the environment. (See ER Section 5.2.13, Waste Management.)

Mitigation measures associated with waste management are listed in ER Section 5.2.13, Waste Management.

5.2 MITIGATIONS

This section summarizes the mitigation measures that are in place to reduce adverse impacts that may result from the construction and operation of the NEF. The residual and unavoidable adverse impacts, which will remain after application of the mitigation measures, are of such a small magnitude that LES considers that additional analysis is not necessary.

5.2.1 Land Use

The anticipated effects on the soil during construction activities are limited to a potential short-term increase in soil erosion. However, this impact will be mitigated by following proper construction best management practices (BMPs) including:

- Minimizing the construction footprint to the extent possible
- Limiting site slopes to a horizontal-vertical ratio of three to one or less
- Use of a sedimentation detention basin
- Protection of undisturbed areas with silt fencing and straw bales as appropriate
- Site stabilization practices such as placing crushed stone on top of disturbed soil in areas of concentrated runoff

Site stabilization practices to reduce the potential for erosion and sedimentation. Additional discussion is provided in ER Section 5.2.3, Geology and Soils.

After construction is complete, the site will be stabilized with natural, low-water maintenance landscaping and pavement.

5.2.2 Transportation

Mitigation measures will be in place to minimize potential impact of construction-related transportation activities. To control fugitive dust production, all reasonable precautions will be taken to prevent particulate matter from becoming airborne including the following actions:

- The use of water (controlled to minimize use) in the control of dust on dirt roads, in clearing and grading operations and construction activities.
- The use of adequate containment methods during excavation and/or other similar operations.
- Open bodied trucks transporting materials likely to give rise to airborne dust, shall be covered at all times when in motion.
- The prompt removal of earthen materials from paved roads, onto which, earth or other material has been transported by trucking or earth moving equipment, erosion by water, wind, or other means.
- Prompt stabilization or covering of bare areas once earth moving activities are completed.
- The operation of construction equipment and related vehicles with standard pollution control devices maintained in good working order.
- Washing of construction trucks with water only (controlled to minimize use) when required.
- Personnel will be designated to monitor dust emissions and to direct increased surface watering where necessary.

- If during the course of construction short duration activities (e.g., concrete trucks, multiple deliveries) with traffic impact are required, these will be scheduled to minimize traffic impacts.
- Work shifts will be implemented throughout the construction period to minimize impacts to traffic in the site vicinity. Car pooling will also be encouraged.

5.2.3 Geology and Soils

Mitigation measures will be in place to minimize potential impact on geology and soils. These include the following items:

- Erosional impacts due to site clearing and grading will be mitigated by utilization of construction and erosion control BMPs, some of which are further described below.
- Disturbed soils will be stabilized by acceptable means as part of construction work.
- Earthen berms, dikes and sediment fences will be utilized as necessary during all phases of construction to limit suspended solids in runoff.
- Cleared areas not covered by structures or pavement will be stabilized by acceptable means as soon as practical.
- Watering (controlled to minimize use) will be used to control fugitive construction dust.
- Surface runoff will be collected in temporary (during construction) and permanent retention/detention basins.
- Standard drilling and blasting techniques, if required, will be used to minimize impact to bedrock; reducing the potential for over-excavation thereby minimizing damage to the surrounding rock; and protecting adjacent surfaces that are intended to remain intact.
- Drainage culverts and ditches will be stabilized and lined with rock aggregate/rip-rap, as necessary, to reduce flow velocity and prohibit scouring.
- Soil stockpiles generated during construction will be placed in a manner to reduce erosion.
- Excavated materials will be reused when ever possible.

5.2.4 Water Resources

Mitigation measures will be in place to minimize potential impact on water resources. As discussed in ER Section 4.4.7, Control of Impacts to Water Quality, there is little potential to impact any groundwater or surface water resources. These mitigation measures also prevent soil contamination. These include employing BMPs and the control of hazardous materials and fuels. In addition, the following controls are also implemented:

- Construction equipment will be in good repair without visible leaks of oil, greases, or hydraulic fluids.
- Use of BMPs during construction and operations to prevent fuel oil spills and/or releases.
- Use of the BMPs will assure stormwater runoff related to these activities will not release runoff into nearby sensitive areas.
- BMPs will also be used for dust control associated with excavation and fill operations during construction.
- Silt fencing and/or sediment traps.
- External vehicle washing (water only and controlled to minimize use).

- Stone construction pads will be placed at entrance/exits if unpaved construction access adjoins a state road.
- All basins are arranged to provide for the prompt, systematic sampling of runoff in the event of any special needs.
- Water quality impacts will be controlled during construction by compliance with the National Pollution Discharge Elimination System – Construction General Permit requirements and by applying BMPs as detailed in the site Stormwater Pollution Prevention Plan (SWPPP).
- BMPs will be implemented for the facility to identify potential spill substances, sources and responsibilities.
- All above ground diesel storage tanks will be bermed.
- Any hazardous materials will be handled by approved methods and shipped offsite to approved disposal sites. Sanitary wastes generated during site construction will be handled by portable systems, until such time thatsanitary waste water will be sent to the City of Eunice Wastewater Treatment Plant for processing via a systems of lift stations and 8-inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system. An adequate number of these portables systems will be provided.
- The facility's Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant including the collection, analysis, and processing of liquid wastes for disposal.
- Liquid effluent concentration releases to the Treated Effluent Evaporative Basin and the UBC Storage Pad Stormwater Retention Basin will both be below the 10 CFR 20 (CFR, 2003q) uncontrolled release limits. Both basins are included in the site environmental monitoring plan.
- Periodic visual inspections of the NEF basins for high level will be performed to verify proper functioning. The visual inspections will be performed on a frequency that is sufficient to allow for identification of basin high water level conditions and implementation of corrective actions to restore water level of the associated basin(s) prior to overflowing.
- Control of surface water runoff will be required for activities as covered by the National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As a result, no impacts are expected to surface or groundwater bodies.

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

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

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

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin.

Discharge of operations-generated potentially contaminated waste water is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on prescribed standards) and discharged to this basin. The basin is double-lined, open to allow evaporation, has no flow outlet and has leak detection.

5.2.5 Ecological Resources

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

- Use of BMPs recommended by the State of New Mexico to minimize the construction footprint to the extent possible
- The use of detention and retention ponds
- Site stabilization practices to reduce the potential for erosion and sedimentation.
- Proposed wildlife management practices include:
- The placement of a raptor perch in an unused open area.
- The placement of quail feeders in the unused open areas away from the NEF buildings.
- The management of unused open areas (i.e. leave undisturbed), including areas of native grasses and shrubs for the benefit of wildlife.
- The use of native plant species (i.e., low-water consuming plants) to revegetate disturbed areas to enhance wildlife habitat.
- The use of netting, or other suitable material, to ensure migratory birds are excluded from evaporative ponds that do not meet New Mexico Water Quality Control Commission (NMAC 20.6.4) surface water standards for wildlife usage.
- The use of animal-friendly fencing around ponds or basins which may contain contaminated process water so that wildlife cannot be injured or entangled.
- Minimize the amount of open trenches at any given time and keep trenching and backfilling crews close together.
- Trench during the cooler months (when possible).
- Avoid leaving trenches open overnight. Escape ramps will be constructed at least every 90 m (295 ft). The slope of the ramps will be less than 45 degrees. Trenches that are left open overnight will be inspected and animals removed prior to backfilling.

In addition to proposed wildlife management practices above, LES will consider all recommendations of appropriate state and federal agencies, including the United States Fish and Wildlife Service and the New Mexico Department of Game and Fish.

5.2.6 Air Quality

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

- The design of the NEF cooling towers combines adiabatic and evaporative heat transfer processes to significantly reduce visible plumes.
- The CRDB GEVS, LXGEVS, and PXGEVS are designed to collect and clean potentially hazardous gases from the plant prior to release into the atmosphere. Instrumentation is provided to detect and signal via alarm, all non-routine process conditions, including the presence of radionuclides or HF in the exhaust stream utilizing independent alpha and HF detectors that will trip the system to a safe condition, in the event of effluent detection beyond routine operational limits. All GEVS fans are connected to the standby diesel generators through the short break load system and the systems' instrumentation is connected to the UPS.
- The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is designed to collect and clean all potentially hazardous gases from the serviced areas in the CAB prior to release into the atmosphere. Instrumentation is provided to detect and signal the Control Room via alarm, all non-routine process conditions, including the presence of radionuclides or HF in the exhaust stream. Operators will then take appropriate actions to mitigate the release.
- Construction BMPs will be applied as described previously to minimize fugitive dusts.
- Air concentrations of the Criteria Pollutants for vehicle emissions and fugitive dust will be below the National Ambient Air Quality Standards (NAAQS) (CFR, 2003w) and thus will not require further mitigation measures.

5.2.7 Noise

Mitigation of the operational noise sources will occur primarily from the plant design, whereby cooling systems, valves, transformers, pumps, generators, and other facility equipment, will mostly reside inside plant structures. The buildings themselves will absorb the majority of the noise located within. Natural land contours, vegetation (such as scrub brush), and site buildings and structures will mitigate the impact of other equipment located outside of structures that contribute to site noise levels.

Noise from construction activities will have the highest sound levels, but the nearest home is located 4.3 km (2.63 mi) from the site and due to distance, it is not expected that residents will perceive an increase in noise levels. However, heavy truck and earth moving equipment usage will be restricted after twilight and during early morning hours. All noise suppression systems on construction vehicles shall be kept in proper operation.

5.2.8 Historical and Cultural Resources

Mitigation measures will be in place to minimize any potential impact on historical and cultural resources. In the event that any inadvertent discovery of human remains or other item of archeological significance is made during construction, the facility will cease construction activities in the area around the discovery and notify the New Mexico State Historic Preservation Officer, to make the determination of appropriate measures to identify, evaluate, and treat these discoveries.

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

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

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

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

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

5.2.9 Visual/Scenic Resources

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

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

5.2.10 Socioeconomic

No socioeconomic mitigation measures are anticipated.

5.2.11 Environmental Justice

No environmental justice mitigation measures are anticipated.

5.2.12 Public and Occupational Health

This section describes the mitigation measures to minimize public and occupational health impacts, from both nonradiological and radiological sources.

5.2.12.1 Nonradiological – Normal Operations

Mitigation measures will be in place to minimize the impact of nonradiological gaseous and liquid effluents to well below regulatory limits. The plant design incorporates numerous features to minimize potential gaseous and liquid effluent impacts including:

- Process systems that handle UF_6 operate at sub-atmospheric pressure minimizes outward leakage of UF_6.
- UF_6 cylinders are moved only when cool and when UF_6 is in solid form minimizing the risk of inadvertent release due to mishandling.
- Process off-gas from UF_6 purification and other operations passes through cold traps to solidify and reclaim as much UF_6 as possible. Remaining gases pass through high-efficiency filters and chemical absorbers removing HF and uranic compounds.
- Waste generated by decontamination of equipment and systems are subjected to processes that separate uranic compounds and various other heavy metals in the waste material.
- Liquid and solid waste handling systems and techniques are used to control wastes and effluent concentrations.
- Gaseous effluent passes through pre-filters, high efficiency particulate air (HEPA) filters, and activated carbon filters, all of which reduce the radioactivity and hazardous chemicals in the final discharged effluent to very low concentrations.
- Liquid waste is routed to collection tanks, and treated through a combination of precipitation, evaporation, and ion exchange to remove most of the radioactive material prior to release of waste water to the onsite Treated Effluent Evaporative Basin (double-lined with leak detection).
- Liquid effluent pathways are monitored and sampled to assure compliance with regulatory discharge limits.
- All UF_6 process systems are monitored by instrumentation, which will activate alarms in the Control Room and will either automatically shut down the plant to a safe condition or alert operators to take the appropriate action (i.e., to prevent release) in the event of operational problems.
- LES will investigate alternative solvents or will apply control technologies for methylene chloride solvent use.

Administrative controls, practices, and procedures are used to assure compliance with the NEFs' Health, Safety, and Environmental Program. This program is designed to ensure safe storage, use, and handling of chemicals to minimize the potential for worker exposure.

5.2.12.2 Radiological – Normal Operations

Mitigation measures to minimize the impact of radiological gaseous and liquid effluents are the same as those listed in ER Section 5.2.12.1, Nonradiological – Normal Operations. Additional measures to minimize radiological exposure and release are listed below.

Radiological practices and procedures are in place to ensure compliance with the NEFs' Radiation Protection Program. This program is designed to achieve and maintain radiological exposure to levels that are "As Low as Reasonably Achievable" (ALARA). These measures include:

- Routine plant radiation and radiological surveys to characterize and minimize potential radiological dose/exposure.
- Monitoring of all radiation workers via the use of dosimeters and area air sampling to ensure that radiological doses remain within regulatory limits and are ALARA.
- Radiation monitors are provided in the gaseous effluent stacks to detect and alarm, and affect the automatic safe shutdown of process equipment in the event contaminants are detected in the system exhaust. Systems will either automatically shut down, switch trains or rely on operator actions to mitigate the potential release.

5.2.12.3 Accidental Releases

Mitigation measures will be in place to minimize the impact of a potential accidental release of radiological and/or nonradiological effluents. For example, several accident sequences involving UF_6 releases to the environment due to seismic or fire events were mitigated using design features to delay and reduce the UF_6 releases from reaching the outside environment. The mitigative measures for seismic secenarios are:seismically designed buildings, autoclaves, and portions of the UF_6 process piping and UF_6 process components. Fire events are mitigated though measures that include automatic shutoff of building heating, ventilation and air conditioning (HVAC) systems.

With mitigation, the dose consequences to the public for these accident sequences, have been reduced to a level below that considered "intermediate consequences", as that term is defined in (10 CFR 70.61(c)) (CFR, 2003b). See ER Section 4.12.3, Environmental Effects of Accidents.

5.2.13 Waste Management

Mitigation measures will be in place to minimize both the generation and impact of facility wastes. Solid and liquid wastes and liquid and gaseous effluents will be controlled in accordance with regulatory limits. Mitigation measures include:

- System design features are in place to minimize the generation of solid waste, liquid waste, liquid effluents, and gaseous effluent. Liquid and gaseous effluent design features were previously described in ER Section 5.2.12, Public and Occupational Health.
- There will be no onsite disposal of waste at the NEF. Waste will be stored in designated areas of the plant, until an administrative limit is reached. When the administrative limit is reached, the waste will then be shipped offsite to a licensed disposal facility.
- All radioactive and mixed wastes will be disposed of at offsite, licensed facilities.
- Mitigation measures associated with UBC storage are as follows:

- LES will maintain a cylinder management program to monitor storage conditions on the UBC Storage Pad to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs as needed.
- All UBCs filled with depleted uranium hexafluoride (UF_6) will be stored on cradles that do not cause corrosion of the cylinders. These cradles shall be placed on a concrete pad.
- The storage pad areas shall be segregated from the rest of the enrichment facility by barriers (e.g., vehicle guard rails).
- UBCs shall be double stacked on the storage pad. The storage array shall permit easy visual inspection of all cylinders.
- UBCs shall be surveyed for external contamination (wipe tested), prior to being placed on the UBC Storage Pad or transported offsite.
- Provisions are in place to ensure that UBCs do not have the defective valves (identified in NRC Bulletin 2003-03, "Potentially Defective 1-Inch Valves for Uranium Hexafluoride Cylinders") installed.
- All UF_6 cylinders are abrasive blasted and coated with anti-corrosion primer/paint when manufactured (as required by specification). Touch-up application of coating will be performed on UBCs if coating damage is discovered during inspection.
- Only designated vehicles with less than 0.280 m^3 (74 gal) of fuel shall be allowed on the UBC Storage Pad.

UBCs shall be inspected for damage prior to placing a filled cylinder on the storage pad. UBCs shall be re-inspected annually for damage or surface coating defects. These inspections shall verify that:

- Lifting points are free from distortion and cracking.
- Cylinder skirts and stiffener rings are free from distortion and cracking.
- Cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion.
- Cylinder valves are fitted with the correct protector and cap.
- Cylinders are inspected to confirm that the valve is straight and not distorted, two to six threads are visible, and the square head of the valve stem is undamaged.
- Cylinder plugs are undamaged and not leaking.
- If inspection of a UBC reveals significant deterioration or other conditions that may affect the safe use of the cylinder, the contents of the affected cylinder shall be transferred to another good condition cylinder and the defective cylinder shall be discarded. The root cause of any significant deterioration shall be determined, and if necessary, additional inspections of cylinders shall be made.
- Proper documentation on the status of each UBC shall be available onsite, including content and inspection dates.
- The UBC Storage Pad Stormwater Retention Basin is used to capture stormwater runoff from the UBC Storage Pad.

Other waste mitigation measures will include:

- Power usage will be minimized by efficient design of lighting systems, selection of high-efficiency motors, and use of proper insulation materials.

- Processes used to clean up wastes and effluents create their own wastes and effluent as well. Control of these process effluents is accomplished by liquid and solid waste handling systems and techniques as described below.
- Careful applications of basic principles for waste handling are followed in all of the systems and processes.
- Different waste types are collected in separate containers to minimize contamination of one waste type with another. Materials that can cause airborne contamination are carefully packaged, and; ventilation and filtration of the air in the area are provided as necessary. Liquid wastes are confined to piping, tanks, and other containers; curbing, pits, and sumps are used to collect and contain leaks and spills.
- Hazardous wastes are stored in designated areas in carefully labeled containers. Mixed wastes are also contained and stored separately.
- Strong acids and caustics are neutralized before entering an effluent stream.
- Radioactively contaminated wastes, are decontaminated and/or re-used in so far as possible to reduce waste volume.
- PFPE Oil will be recovered and none will be routinely released as waste or effluent.
- Collected waste such as trash, compressible dry waste, scrap metals, and other candidate wastes, will be volume reduced at a centralized waste processing facility.
- Waste management systems will include administrative procedures, and practices that provide for the collection, temporary storage, processing, and disposal of categorized solid waste in accordance with regulatory requirements.
- Handling and treatment process are designed to limit wastes and effluent. Sampling and monitoring is performed to assure plant administrative and regulatory limits, are not exceeded in discharges to the Treated Effluent Evaporative Basin.
- Gaseous effluent is monitored for HF and for radioactive contamination before release.
- Liquid effluent is sampled and/or monitored in liquid waste treatment systems.
- Solid wastes are sampled and/or monitored prior to offsite treatment and disposal.
- Process system samples are returned to their source, where feasible, to minimize input to waste streams.

Currently, the NEF construction plan has not been developed enough to determine how much of the construction debris would be recycled. As such, there is no plan in place at this time to recycle construction materials. A construction phase recycling program will be developed as the construction plan progresses to final design.

The NEF will implement a non-hazardous materials waste recycling plan during operation. The recycling effort will start with the performance of a waste assessment to identify waste reduction opportunities and to determine which materials will be recycled. Once the decision has been made of which waste materials to recycle, brokers and haulers will be contacted to find an end-market for the materials. Employee training on the recycling program will be performed so that employees will know which materials are to be recycled. Recycling bins and containers will be purchased and shall be clearly labeled. Periodically, the recycling program will be evaluated (i.e., waste management expenses and savings, recycling and disposal quantities) and the results reported to the employees.

6.0 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 RADIOLOGICAL MONITORING

6.1.1 Effluent Monitoring Program

The Nuclear Regulatory Commission (NRC) requires, pursuant to 10 CFR 20 (CFR, 2003q) that licensees conduct surveys necessary to demonstrate compliance with these regulations and to demonstrate that the amount of radioactive material present in effluent from the facility has been kept as low as reasonably achievable (ALARA). In addition, the NRC requires pursuant to 10 CFR 70 (CFR, 2003b), that licensees submit semiannual reports, specifying the quantities of the principal radionuclides released to unrestricted areas and other information needed to estimate the annual radiation dose to the public from effluent discharges. The NRC has also issued Regulatory Guide 4.15 – Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment and Regulatory Guide 4.16 – Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluent from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants that reiterate that concentrations of hazardous materials in effluent must be controlled and that licensees must adhere to the ALARA principal such that there is no undue risk to the public health and safety at or beyond the site boundary.

Refer to Figure 6.1-1, Effluent Release Points and Meteorological Tower, and Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Locations. Effluents are sampled as shown in Table 6.1-1, Effluent Sampling Program. For gaseous effluents, continuous air sampler filters are analyzed for gross alpha and beta each week. The filters are composited quarterly and an isotopic analysis is performed. For liquids, a grab sample is taken for isotopic analysis post-treatment prior to discharge to the Treated Effluent Evaporative Basin.

Public exposure to radiation from routine operations at the National Enrichment Facility (NEF) may occur as the result of discharge of liquid and gaseous effluents, including controlled releases from the uranium enrichment process lines during decontamination and maintenance of equipment. In addition, radiation exposure to the public may result from the transportation and storage of uranium hexafluoride (UF_6) feed cylinders, product cylinders, and Uranium Byproduct Cylinders (UBCs). Of these potential pathways, discharge of gaseous effluent has the highest possibility of introducing facility-related uranium into the environment. The plant’s procedures and facilities for solid waste and liquid effluent handling, storage and monitoring result in safe storage and timely disposition of the material. ER Section 1.3, Applicable Regulatory Requirements and Required Consultations, accurately describes all applicable Federal and New Mexico State standards for discharges, as well as required permits issued by local, New Mexico and Federal governments.

Compliance with 10 CFR 20.1301 (CFR, 2003q) is demonstrated using a calculation of the total effective dose equivalent (TEDE) to the individual who is likely to receive the highest dose in accordance with 10 CFR 20.1302(b)(1) (CFR, 2003q). The determination of the TEDE by pathway analysis is supported by appropriate models, codes, and assumptions that accurately represent the facility, site, and the surrounding area. The assumptions are reasonably conservative, input data is accurate, and all applicable pathways are considered. ER Section 4.12, Public and Occupational Health Impacts, presents the details of these determinations.

The computer codes used to calculate dose associated with potential gaseous and liquid effluent from the plant follow the methodology, for pathway modeling, described in Regulatory Guide 1.109, and have undergone validation and verification. The dose conversion factors used are those presented in Federal Guidance Reports Numbers 11 (EPA 520/1-88-020) and 12 (EPA, 1993a).

Administrative action levels are established for effluent samples and monitoring instrumentation as an additional step in the effluent control process. All action levels are sufficiently low so as to permit implementation of corrective actions before regulatory limits are exceeded. Effluent samples that exceed the action level are cause for an investigation into the source of elevated radioactivity. Radiological analyses will be performed more frequently on ventilation air filters if there is a significant increase in gross radioactivity or when a process change or other circumstances cause significant changes in radioactivity concentrations. Additional corrective actions will be implemented based on the level, automatic shutdown programming, and operating procedures to be developed in the detailed alarm design. Under routine operating conditions, radioactive material in effluent discharged from the facility complies with regulatory release criteria.

Compliance is demonstrated through effluent and environmental sampling data. If an accidental release of uranium should occur, then routine operational effluent data and environmental data will be used to assess the extent of the release. Processes are designed to include, when practical, provision for automatic shutdown in the event action levels are exceeded. Appropriate action levels and actions to be taken are specified for liquid effluents and gaseous releases. Data analysis methods and criteria used in evaluating and reporting environmental sample results are appropriate and will indicate when an action level is being approached in time to take corrective actions.

The effluent monitoring program falls under the oversight of the NEF Quality Assurance (QA) program. Therefore, it is subject to periodic audits conducted by the facility QA personnel. Written procedures will be in place to ensure the collection of representative samples, use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples. In addition, the plant's written procedures also ensure that sampling and measuring equipment, including ancillary equipment such as airflow meters, are properly maintained and calibrated at regular intervals. Moreover, the effluent monitoring program procedures include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition. Employees involved in implementation of this program are trained in the program procedures.

The NEF will ensure, when sampling particulate matter within ducts with moving air streams, that sampling conditions within the sample probe are maintained to simulate as closely as possible the conditions in the duct. This will be accomplished by implementing the following criteria: 1) calibrating air sampling equipment so that the sample is representative of the effluent being sampled in the duct; 2) maintaining the axis of the sampling probe head parallel to the air stream flow lines in the ductwork; 3) sampling (if possible) at least ten duct diameters downstream from a bend or obstruction in the duct; and 4) using shrouded-head air sampling probes when they are available in the size appropriate to the air sampling situation. Particle size distributions will be determined from process knowledge or measured to estimate and compensate for sample line losses and momentary conditions not reflective of airflow conditions in the duct.

The NEF will ensure that sampling equipment (pumps, pressure gages and air flow calibrators) are calibrated by qualified individuals. All air flow and pressure drop calibration devices (e.g., rotometers) will be calibrated periodically using primary or secondary air flow calibrators (wet test meters, dry gas meters or displacement bellows). Secondary air flow calibrators will be calibrated annually by the manufacturer(s). Air sampling train flow rates will be verified and/or calibrated each time a filter is replaced or a sampling train component is replaced or modified. Sampling equipment and lines will be inspected for defects, obstructions and cleanliness. Calibration intervals will be developed based on applicable industry standards.

6.1.1.1 Gaseous Effluent Monitoring

As a matter of compliance with regulatory requirements, all potentially radioactive effluent from the facility is discharged only through monitored pathways. See ER Section 4.12.2.1, Routine Gaseous Effluent, for a discussion of pathway assessment. The effluent sampling program for the NEF is designed to determine the quantities and concentrations of radionuclides discharged to the environment. The uranium isotopes ^{238}U, ^{235}U and ^{234}U are expected to be the prominent radionuclides in the gaseous effluent. The annual uranium source term for routine gaseous effluent releases from the plant has been conservatively assumed to be 8.9 MBq (240 μCi) per year, which is equal to twice the source term applied to the 1.5 million SWU plant described in NUREG-1484 (NRC, 1994a). This is a very conservative annual release estimate used for bounding analyses. Additional details regarding source term are provided in ER Section 4.12, Public and Occupational Health Impacts. Representative samples are collected from each release point of the facility. Because uranium in gaseous effluent may exist in a variety of compounds (e.g., depleted hexavalent uranium, triuranium octoxide, and uranyl fluoride), effluent data will be maintained, reviewed, and assessed by the facility's Environmental Compliance Officer, to assure that gaseous effluent discharges comply with regulatory release criteria for uranium. Table 6.1-1, Effluent Sampling Program, presents an overview of the effluent sampling program.

The gaseous effluent monitoring program for the NEF is designed to determine the quantities and concentrations of gaseous discharges to the environment.

Gaseous effluent from the NEF, which has the potential for airborne radioactivity (albeit in very low concentrations) is discharged through the PXGEVS, LXGEVS, CRDB GEVS, or Centrifuge Test and Post Mortem Facilities Exhaust Filtration System. Monitoring for each of these systems is as follows:

- Pumped Extract GEVS: This system discharges to a stack on the SBM-1001 roof. The PXGEVS provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16. The GEVS stack sampling system provides the required samples. The exhaust stack is equipped with monitors for alpha radiation and HF.
- Local Extract GEVS: This system discharges to a stack on the CRDB roof. The LXGEVS provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16. The GEVS stack sampling system provides the required samples. The exhaust stack is equipped with monitors for alpha radiation and HF.

- CRDB GEVS: This system discharges to an exhaust stack on the CRDB roof. The CRDB GEVS provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16. The CRDB GEVS stack sampling system provides the required samples. The exhaust stack contains monitors for alpha radiation and HF.
- The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System: This system discharges through a stack on the Centrifuge Assembly Building (CAB). The Centrifuge Test and Post Mortem Facilities Exhaust Filtration stack sampling system provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16. The exhaust stack is provided with an alpha radiation monitor and an HF monitor.
- CRDB HVAC System (confinement ventilation function portions): This system maintains the room temperature in various areas of the CRDB, including some potentially contaminated areas. For the potentially contaminated areas (Ventilated Room and Decontamination Workshop), the confinement ventilation function of the CRDB HVAC system maintains a negative pressure in these rooms and discharges the gaseous effluent to an exhaust stack on the CRDB roof. The stack sampling system provides for continuous monitoring and periodic sampling of the gaseous effluent from the rooms served by the CRDB HVAC confinement ventilation function in accordance with the guidance in NRC Regulatory Guide 4.16.

The gaseous effluent sampling program supports the determination of quantity and concentration of radionuclides discharged from the facility and supports the collection of other information required in reports to be submitted to the NRC. The MDCs for analyses of gaseous effluent are presented in Table 6.1-2, Required Lower Level of Detection for Effluent Sample Analyses.

6.1.1.2 Liquid Effluent Monitoring

Liquid effluents containing low concentrations of radioactive material, consisting mainly of spent decontamination solutions, floor washings, and evaporator flushes, is expected to be generated by the NEF. Table 6.1-3, Estimated Uranium in Pre-Treated Liquid Waste from Various Sources, provides estimates of the annual volume and radioactive material content in liquid effluent by source prior to processing. Uranium is the only radioactive material expected in these wastes. Potentially contaminated liquid effluent is routed to the Liquid Effluent Collection and Treatment System for treatment. Most of the radioactive material is removed from waste water in the Liquid Effluent Collection and Treatment System through a combination of clean-up processes that includes precipitation, evaporation, and ion exchange. Post-treatment liquid waste water is sampled and undergoes isotopic analysis prior to discharge to assure that the released concentrations are below the concentration limits established in Table 2 of Appendix B to 10 CFR 20 (CFR, 2003q).

After treatment, the effluent is released to the double-lined Treated Effluent Evaporative Basin, which includes leak detection monitoring. Concentrated radioactive solids generated by the liquid treatment processes at the facility are handled and disposed of as low-level radioactive waste.

The design basis uranium source term for routine liquid effluent discharge to the Treated Effluent Evaporative Basin has been conservatively estimated to be 14.4 MBq (390 μCi) per year. There is no offsite release of liquid effluents to unrestricted areas. ER Section 4.12, Public and Occupational Health Impacts, provides additional details regarding effluent source terms.

Representative sampling is required for all batch liquid effluent releases. Liquid samples are collected from each liquid batch and analyzed prior to any transfer. Isotopic analysis is performed prior to discharge. The MDC for analysis of liquid effluent are presented in Table 6.1-2, Required Lower Level of Detection for Effluent Sample Analyses. The liquid effluent sampling program supports the determination of quantities and concentrations of radionuclides discharged to the Treated Effluent Evaporative Basin and supports the collection of other information required in reports submitted to the NRC.

Periodic sampling of liquid effluent is required since these effluents are treated in batches. Representative sampling is assured through the use of tank agitators and recirculation lines. All collection tanks are sampled before the contents are sent through any treatment process. Treated water is collected in Monitor Tanks, which are sampled before discharge to the Treated Effluent Evaporative Basin.

NRC Information Notice 94-07 (NRC, 1994b) describes the method for determining solubility of discharged radioactive materials. Note that liquid effluents at the NEF are treated such that insoluble uranium is removed as part of the treatment process. Releases are in accordance with the ALARA principle.

General site stormwater runoff is routed to the Site Stormwater Detention Basin. The UBC Storage Pad Stormwater Retention Basin collects rainwater from the UBC Storage Pad as well as cooling tower blowdown water. Approximately 174,100 m^3 (46 million gal) of stormwater are expected to be collected each year by the two basins. Both of these basins will be included in the site Radiological Environmental Monitoring Program. See ER Section 6.1.2.

6.1.2 Radiological Environmental Monitoring Program

The Radiological Environmental Monitoring Program (REMP) at the NEF is a major part of the effluent compliance program. It provides a supplementary check of containment and effluent controls, establishes a process for collecting data for assessing radiological impacts on the environs and estimating the potential impacts on the public, and supports the demonstration of compliance with applicable radiation protection standards and guidelines.

The primary objective of the REMP is to provide verification that the operations at the facility do not result in detrimental radiological impacts on the environment. Through its implementation, the REMP provides data to confirm the effectiveness of effluent controls and the effluent monitoring program. In order to meet program objectives, representative samples from various environmental media are collected and analyzed for the presence of plant-related radioactivity. The types and frequency of sampling and analyses are summarized in Table 6.1-4, Radiological Environmental Monitoring Program. Environmental media identified for sampling consist of ambient air, groundwater, soil/sediment, and vegetationEnvironmental samples will be analyzed on site or by a qualified independent laboratory. The MDCs for gross alpha (assumed to be uranium) in various environmental media are shown in Table 6.1-5, Required MDC for Environmental Sample Analyses. Monitoring and sampling activities, laboratory analyses, and reporting of facility-related radioactivity in the environment will be conducted in accordance with industry-accepted and regulatory-approved methodologies and will also comply with the NEF's NMED Groundwater Discharge Permit DP-1481.

The Quality Control (QC) procedures used by the laboratories performing the plant's REMP will be adequate to validate the analytical results and will conform with the guidance in Regulatory Guide 4.15. These QC procedures include the use of established standards such as those provided by the National Institute of Standards and Technology (NIST), as well as standard analytical procedures such as those established by the National Environmental Laboratory Accreditation Conference (NELAC).

Monitoring procedures will employ well-known acceptable analytical methods and instrumentation. The instrument maintenance and calibration program will be appropriate to the given instrumentation, in accordance with manufacturers' recommendations.

The NEF will ensure that the onsite laboratory and any contractor laboratory used to analyze NEF samples participates in third-party laboratory intercomparison programs appropriate to the media and analytes being measured. Examples of these third-party programs are: 1) Mixed Analyte Performance Evaluation Program (MAPEP) and the DOE Quality Assurance Program (DOEQAP) that are administered by the Department of Energy; and 2) Analytics Inc, Environmental Radiochemistry Cross-Check Program. The NEF will require that all radiological and non-radiological laboratory vendors are certified by the National Environmental Laboratory Accreditation Program (NELAP) or an equivalent state laboratory accreditation agency for the analytes being tested.

Reporting procedures will comply with the requirements of 10 CFR 70.59 (CFR, 2003b) and the guidance specified in Regulatory Guide 4.16. Reports of the concentrations of principal radionuclides released to unrestricted areas in effluents will be provided and will include the Minimum Detectable Concentration (MDC) for the analysis and the error for each data point.

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 early initiation of the REMP provides assurance that a sufficient environmental baseline has been established for the plant before the arrival of the first uranium hexafluoride shipment. Radionuclides in environmental media will be identified using technically appropriate, accurate, and sensitive analytical instruments. Data collected during the operational years will be compared to the baseline generated by the pre-operational data. Such comparisons provide a means of assessing the magnitude of potential radiological impacts on members of the public and in demonstrating compliance with applicable radiation protection standards.

During the course of facility operations, revisions to the REMP may be necessary and appropriate to assure reliable sampling and collection of environmental data. The rationale and actions behind such revisions to the program will be documented and reported to the appropriate regulatory agency, as required. REMP sampling focuses on locations within 4.8 km (3 mi) of the facility, but may also include distant locations as control sites. REMP sampling locations have been determined based on NRC guidance found in the document, “Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors” (NRC, 1991), meteorological information, and current land use. The sampling locations may be subject to change as determined from the results of periodic review of land use.

Atmospheric radioactivity monitoring is based on plant design data, demographic and geologic data, meteorological data, and land use data. Because operational releases are anticipated to be very low and subject to rapid dilution via dispersion, distinguishing plant-related uranium from background uranium already present in the site environment is a major challenge of the REMP. The gaseous effluent is released from roof-top discharge points, or resuspension of particles from the Treated Effluent Evaporative Basin, which will result in ground-level releases. A characteristic of ground-level plumes is that plume concentrations decrease continually as the distance from the release point increases. It logically follows that the impact at locations close to the release point is greater than at more distant locations. The concentrations of radioactive material in gaseous effluent from the NEF are expected to be very low concentrations of uranium because of process and effluent controls. Consequently, air samples collected at locations that are close to the plant would provide the best opportunity to detect and identify plant-related radioactivity in the ambient air. Therefore, air-monitoring activities will concentrate on collection of data from locations that are relatively close to the plant, such as the plant perimeter fence or the plant property line. Air monitoring stations will be situated along the site boundary locations of highest predicted atmospheric deposition, and at special interest locations, such as a nearby residential area and business. In addition, an air monitoring station will be located next to the Treated Effluent Evaporative Basin in order to measure for particulate radioactivity that may be being resuspended into the air from sediment layers when the basin is dry.

A control sample location will be established beyond 8 km (5 mi) in an upwind sector (the sector with least prevalent wind direction). Refer to ER Sections 3.6, Meteorology, Climatology and Air Quality and 4.6, Air Quality Impacts, for information on meteorology and atmospheric dispersion. All environmental air samplers operate on a continuous basis with sample retrieval for a gross alpha and beta analysis occurring on a biweekly basis (or as required by dust loads).

Vegetation and soil samples, both from on and offsite locations will be collected on a quarterly basis in at least 8 sectors during the pre-operational REMP. This is to assure the development of a sound baseline. During the operational years, vegetation and soil sampling will be performed semiannually in eight sectors, including three with the highest predicted atmospheric deposition. Vegetation samples may include vegetables and grass, depending on availability. Soil samples will be collected in the same vicinity as the vegetation samples.

Groundwater samples from onsite monitoring well(s) will be collected semiannually for radiological analysis. The locations of the initially proposed groundwater sampling (monitoring) wells are shown on Figure 6.1-2, Modified Site Features with Proposed Sampling Stations and Monitoring Locations. The rationale for the locations is based on the slope of the red bed surface at the base of the shallow sand and gravel layer and the groundwater gradient in the 70 m (230 ft) groundwater zone to the south under the NEF site and proximity to key site structures. Two monitoring wells will be located down-gradient of the site basins, two will be located down-gradient of the UBC Storage Pad and one will be located up-gradient of the UBC Storage Pad and all site facilities.

The background monitoring well, located in the NNW sector of the NEF site, is also shown on Figure 6.1-2. This background monitoring well is located up-gradient of the NEF and cross-gradient from the WCS facility. This location is intended to avoid potential contamination from both facilities, i.e., NEF and/or WCS. Monitoring at this location will occur in both the shallow sand and gravel layer on top of the red bed and in the 70-m (230-ft) groundwater zone. Groundwater in the sand and gravel layer was not encountered at the NEF site during groundwater investigations. Although not an aquifer, it will be monitored since it is the shallowest layer under the NEF site. The 70-m (230 ft) zone contains the first occurrence of groundwater beneath the NEF. Although not strictly meeting the definition of an aquifer, which requires that the unit be able to transit "significant quantities of water under ordinary hydraulic gradients," this layer will also be monitored.

In 2007, one of the three original ground water monitoring wells (MW-3) installed in 2003 was plugged and abandoned because of its location in the footprint of the Storm Water Detention Basin, and fifteen additional ground water monitoring wells were drilled. The rationale for the five initially proposed ground water monitoring locations shown on Figure 6.1-2 is preserved in the expanded coverage of the current complement of active ground water monitoring wells depicted on Figure 6.1-2A.

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.

Other surrounding industrial activities, the Wallach Quarry and the Sundance Services "produced water" lagoons north of the NEF site have some potential to introduce contaminants that could reach the background monitoring well. The contaminants of concern for those facilities should be readily differentiated from potential contaminants from the NEF.

Sediment samples will be collected semiannually from both of the stormwater runoff retention/detention basins onsite to look for any buildup of uranic material being deposited. With respect to the Treated Effluent Evaporative Basin, measurements of the expected accumulation of uranic material into the sediment layer will be evaluated along with nearby air monitoring data to assess any observed resuspension of particles into the air.

Sanitary wastewater will be sent to the City of Eunice Wastewater Treatment Plant via a system of lift stations and 8 inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system. No plant process related effluents will be introduced into the septic or sewage systems. Sewage or septic tank will, however, be periodically sampled (prior to pumping) and analyzed for isotopic Uranium. The septic tanks are upstream of the leach fields. Any Uranium that is in the system that could reach the leach fields would be detected in the septic tanks. Therefore, no sampling will be performed at the leach fields.

Direct radiation in offsite areas from processes inside the facility building is expected to be minimal because the low-energy radiation associated with the uranium will be shielded by the process piping, equipment, and cylinders to be used at the NEF. However, the Uranium Byproduct Cylinders (UBCs) stored on the UBC Storage Pad may have an impact in some offsite locations due to direct and scatter (skyshine) radiation. The offsite impact from the UBC storage has been evaluated and is discussed in ER Section 4.12, Public and Occupational Health Impacts.

The conservative evaluation showed that an annual dose equivalent of < 0.2 mSv (20 mrem) is expected at the highest impacted area at the plant perimeter fence.

Because the offsite dose equivalent rate from stored UBCs is expected to be very low and difficult to distinguish from the variance in normal background radiation beyond the site boundary, demonstration of compliance will rely on a system that combines direct dose equivalent measurements and computer modeling to extrapolate the measurements. Environmental thermoluminescent dosimeters (TLDs) placed at the plant perimeter fence line or other location(s) close to the UBCs will provide quarterly direct dose equivalent information. The direct dose equivalent at offsite locations will be estimated through extrapolation of the quarterly TLD data using the Monte Carlo N-Particle (MCNP) computer program (ORNL, 2000a) or a similar computer program.

Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Stations, indicates the location of REMP sampling locations.

The REMP may be enhanced during the operation of the facility as necessary to maintain the collection and reliability of environmental data based on changes to regulatory requirements or facility operations. The REMP includes administrative action levels (requiring further analysis) and reporting levels for radioactivity in environmental samples.

The REMP falls under the oversight of the facility's Quality Assurance (QA) program. Therefore, written procedures to ensure representative sampling, proper use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples will be a key part of the program. In addition, written procedures ensure that sampling and measuring equipment, including ancillary equipment such as airflow meters, are properly maintained and calibrated at regular intervals. Moreover, the REMP implementing procedures will include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition.

The design status of leak detection (and mitigation procedures) for ponds and tanks has not yet progressed to final design. The NEF will conform with leak detection recommendations required in NUREG-1520.

Within 60 days after January 1 and July 1 of each year, LES shall submit a Semi-Annual Radiological Effluent Release Report (SARERR) addressed to the attention of: **Document Control Desk, Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001**, with a copy to the appropriate NRC Regional Office.

The SARERR shall specify the quantity of each of the principal radionuclides released to unrestricted areas in liquid and gaseous effluents during the previous six months of operation, and such other information as the Commission may require to estimate maximum potential annual radiation doses to the public resulting from effluent releases.

A section of the report shall assess performance relative to 10 CFR 20.1101.d and 10 CFR 20.1301 and 10 CFR 20.1302, as described in Regulatory Guide 4.20; and the report summarizes or references environmental monitoring program changes that are listed in the Environmental Report.

If quantities of radioactive materials released during the reporting periods are significantly above the licensee's design objectives previously reviewed as part of the licensing action, the report must cover this specifically.

6.1.3 Section 6.1 Tables

Table 6.1-1 Effluent Sampling Program

Effluent	Sample Location	Sample Type	Analysis-Frequency
Gaseous	Pumped Extract GEVS Stack Local Extract GEVS Stack CRDB GEVS Stack Centrifuge Test and Post Mortem Facilities Exhaust Filtration System Stack	Continuous Air Particulate Filter	Gross Alpha/Beta-Weekly +/- 25% Isotopic Analysis[a] - Quarterly
	Process Areas	Continuous Air Particulate Filter*	Gross Alpha/Beta – Weekly +/- 25% Isotopic Analysis[a] - Quarterly
	Non-Process Areas	Continuous Air Particulate Filter*	Gross Alpha/Beta-Quarterly
Liquid	Monitor Tank	Representative Grab Sample	Isotopic Analysis[a] Post-Treatment - Prior to Discharge.

[a] Isotopic analysis for ^{234}U ,^{235}U, and ^{238}U.

*As required to complement bioassay program.

Table 6.1-2 Required Lower Level Of Detection For Effluent Sample Analyses

Effluent Type	Nuclide	MDC[a] in Bq/ml (μCi/ml)
Gaseous	^{234}U ^{235}U ^{238}U Gross Alpha	$3.7x10^{-10}$ ($1.0x10^{-14}$) $3.7x10^{-10}$ ($1.0x10^{-14}$) $3.7x10^{-10}$ ($1.0x10^{-14}$) $3.7x10^{-10}$ ($1.0x10^{-14}$)
Liquid	^{234}U ^{235}U ^{238}U	$1.4x10^{-4}$ ($3.0x10^{-9}$) $1.4x10^{-4}$ ($3.0x10^{-9}$) $1.4x10^{-4}$ ($3.0x10^{-9}$)

[a] The gaseous MDCs are 1% of the limits in 10 CFR 20 Appendix B, Table 2 Effluent Concentrations.

The liquid MDCs are less than 2% of the limits in 10 CFR 20 Appendix B, Table 2 Effluent Concentrations

Table 6.1-3Estimated Uranium In Pre-Treated Liquid Waste From Various Sources

Source	Typical Annual Quantities, m^3 (gals)	Typical Annual Uranic Content, kg (lbs)*
Laboratory/floor washings/miscellaneous condensates	23.14 (6112)	16 (35)
Degreaser water	3.71 (980)	18.5 (41)
Citric acid	2.72 (719)	22 (49)
Hand wash & shower water	2100 (554,820)	None
TOTAL	2,130 (562,631)	6.5 (125)

*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.

Table 6.1-4Radiological Environmental Monitoring Program

Sample Type	Minimum Number of Sample Locations	Sampling and Collection Frequency	Type of Analysis
Continuous Airborne Particulate	7	Continuous operation of air sampler with sample collection as required by dust loading but at least biweekly. Quarterly composite samples by location.	Gross beta/gross alpha analysis each filter change. Quarterly isotopic analysis on composite sample.
Vegetation	8	1 to 2-kg (2.2 to 4.4-lb) samples collected semiannually	Isotopic analysis[a]
Groundwater	5	4-L (1.06-gal) samples collected semiannually	Isotopic analysis[a]
Basins	1 from each of 3 basins[b]	4-L (1.06-gal) water sample/1 to 2-kg (2.2 to 4.4-lb) sediment sample collected quarterly	Isotopic analysis[a]
Soil	8	1 to 2-kg (2.2 to 4.4-lb) samples collected semiannually	Isotopic analysis[a]
Septic Tank(s)	1 from each affected tank	1 to 2-kg (2.2 to 4.4-lb) sludge sample from the affected tank(s) prior to pumping	Isotopic analysis[a]
Sewage System	1	500ml sample quarterly	Isotopic analysis[a]
TLD	16	Quarterly	Gamma and neutron dose equivalent

[a] Isotopic analysis for ^{234}U, ^{235}U, and ^{238}U.

[b] Site Stormwater Detention Basin, UBC Storage Pad Stormwater Retention Basin and Treated Effluent Evaporative Basin.

Note:

Physiochemical monitoring parameters are addressed separately in ER Section 6.2, Physiochemical Monitoring.

Table 6.1-5Required MDC For Environmental Sample Analyses

Medium	Analysis	MDC[a] in Bq/ml or g (μCi/ml or g)
Ambient Air	Gross Alpha	9.3×10^{-11} (2.5×10^{-15})
Vegetation	Isotopic U	2.2×10^{-4} (6.0×10^{-9})
Soil/Sediment	Isotopic U	1.1×10^{-2} (3.0×10^{-7})
Groundwater[b]	Isotopic U	1.9×10^{-6} (5.0×10^{-11})

[a] For analyses of groundwater samples, the MDC will be at least 1.9×10^{-6} Bq/ml (5.0×10^{-11} μCi/ml), which represents <0.02% of the concentration limits listed in Table 2 of Appendix B to 10 CFR 20.

6.1.4 Section 6.1 Figures

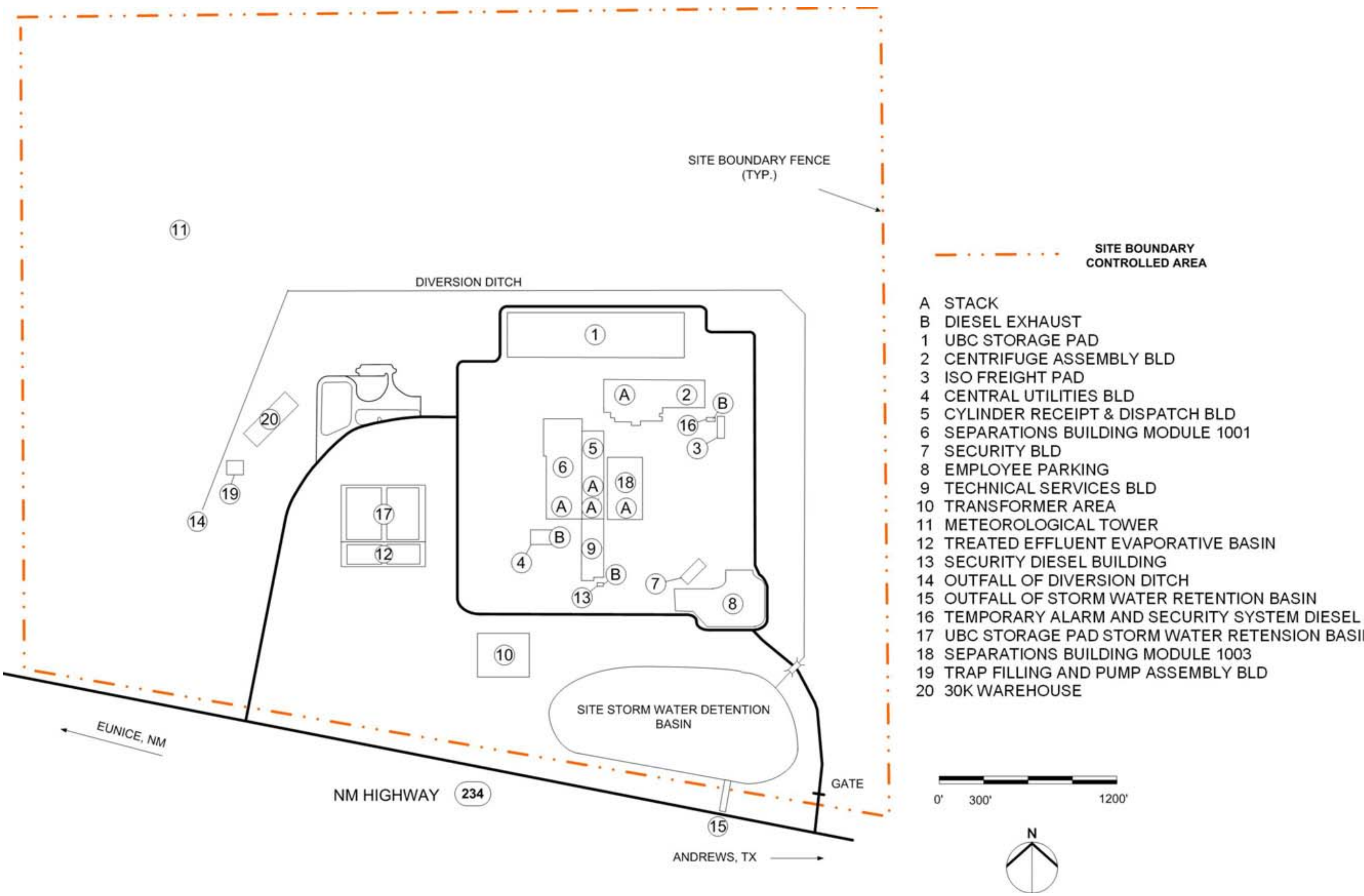


Figure 6.1-1 Effluent Release Points and Meteorological Tower

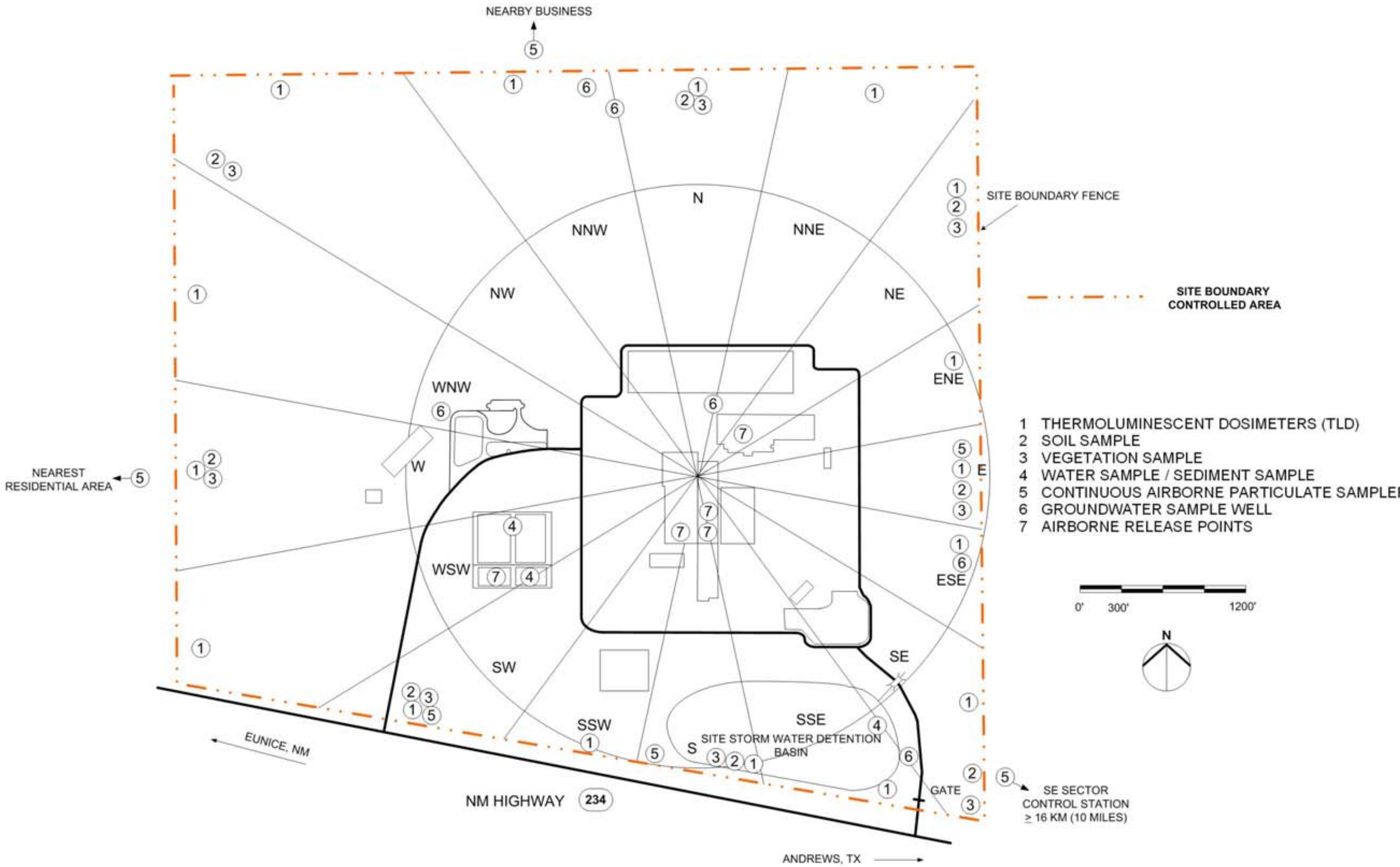
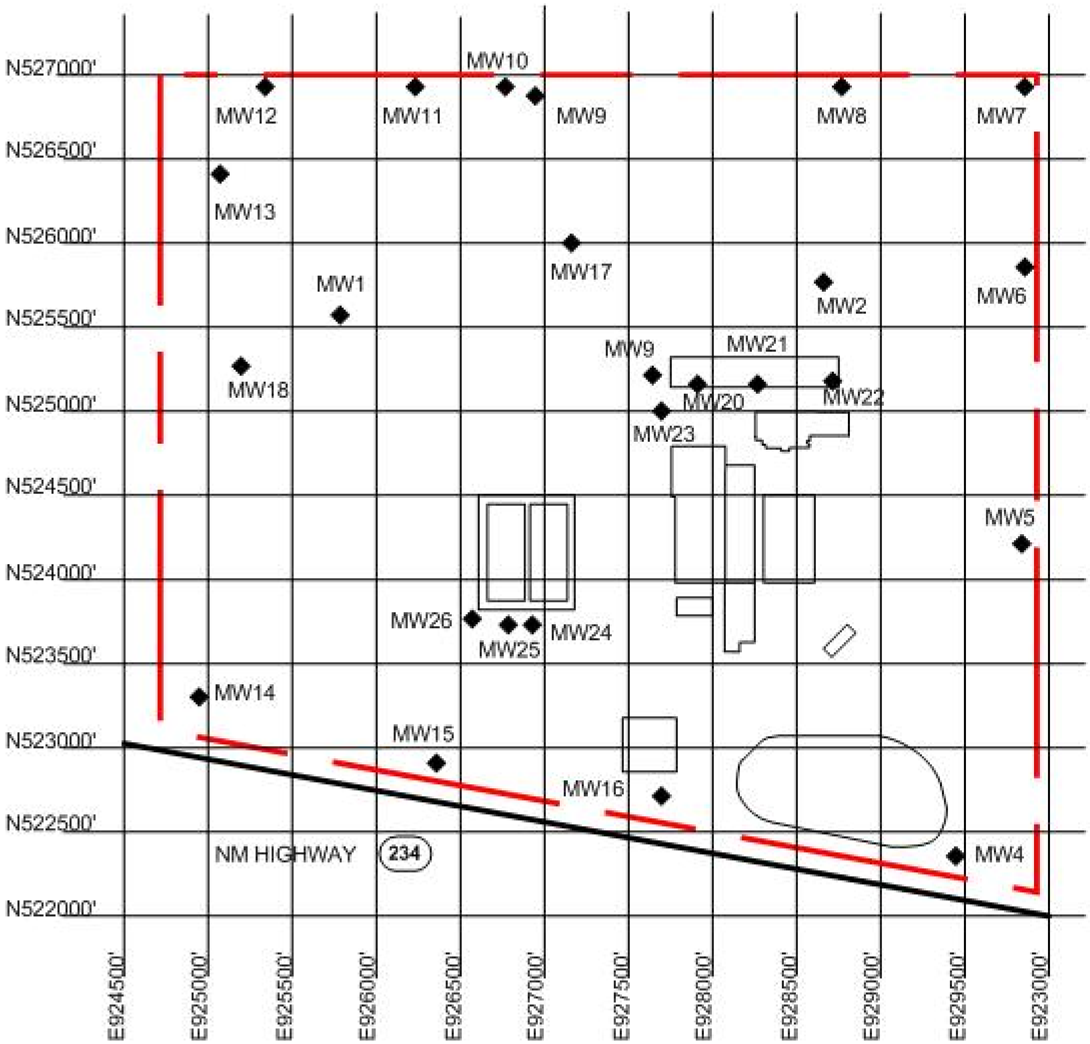


Figure 6.1-2Modified Site Features With Proposed Sampling Stations and Monitoring Locations



MONITORING WELLS		
WELL NO.	NORTHING	EASTING
MW-1	525569.74	925710.07
MW-2	525770.2	928625.73
MW-4	522326.995	929433.808
MW-5	524206.02	929825.78
MW-6	525881.706	929797.959
MW-7	527012.291	929741.526
MW-8	526979.997	928748.078
MW-9	526949.714	926975.341
MW-10	526974.82	926780.668
MW-11	526961.562	926251.803
MW-12	526950.295	925310.473
MW-13	526405.856	925022.698
MW-14	523292.982	924976.896
MW-15	522868.566	926358.939
MW-16	522675.427	927652.874
MW-17	526000.259	927162.85
MW-18	525246.462	925165.989
MW-19	525201.25	927581.17
MW-20	525147.25	927853.25
MW-21	525156.5	928228.42
MW-22	525154.92	928676.5
MW-23	524994.75	927653.83
MW-24	523744.58	926907.75
MW-25	523739.67	926739.67
MW-26	523747.17	926528.42

Figure 6.1-2A Monitoring Wells

6.2 PHYSIOCHEMICAL MONITORING

6.2.1 Introduction

The primary objective of physiochemical monitoring is to provide verification that the operations at the NEF do not result in detrimental chemical impacts on the environment. Effluent controls which are discussed in ER Sections 3.12, Waste Management and 4.13, Waste Management Impacts, are in place to assure that chemical concentrations in gaseous and liquid effluents are maintained as low as reasonably achievable (ALARA). In addition, physiochemical monitoring provides data to confirm the effectiveness of effluent controls.

Administrative action levels will be implemented prior to facility operation to ensure that chemical discharges will remain below the limits specified in the facility discharge permits. The limits are specified in the EPA Region 6 NPDES General Discharge Permits as well as the New Mexico Water Quality Bureau (NMWQB) Groundwater Discharge Permit/Plan.

Specific information regarding the source and characteristics of all non-radiological plant effluents and wastes that will be collected and disposed of offsite, or discharged in various effluent streams is provided in ER Sections 3.12 and 4.13.

In conducting physiochemical monitoring, sampling protocols and emission/effluent monitoring will be performed for routine operations with provisions for additional evaluation in response to potential accidental release.

(See SAR § 12.2.1.2.6) The facility will have an Environmental Monitoring Laboratory, which will be equipped with analytical instruments needed to ensure that the operation of the plant activities complies with federal, state and local environmental regulations and requirements. Compliance will be demonstrated by monitoring/sampling at various plant and process locations, analyzing the samples and reporting the results of these analyses to the appropriate agencies. The sampling/monitoring locations will be determined by the appropriate permit (such as the NMED Groundwater Discharge Permit DP-1481) or requirements for the REMP or SARER program.

The Environmental Monitoring Laboratory is located in the Technical Services Building (TSB) and is used to perform analyses that include the following:

- Hazardous material presence in waste samples
- pH, oil and other contaminants in liquid effluents

The Environmental Monitoring Laboratory will be available to perform analyses on air, water, soil, flora, and fauna samples obtained from designated areas around the plant. In addition to its environmental and radiological capabilities, the Environmental Monitoring Laboratory is also capable of performing bioassay analyses when necessary. Commercial, offsite laboratories may also be contracted to perform bioassay analyses.

Waste liquids, solids and gases from enrichment-related processes and decontamination operations will be analyzed and/or monitored for chemical and radiological contamination to determine safe disposal methods and/or further treatment requirements. A description of the radiological monitoring program at the NEF is provided in ER Section 6.1, Radiological Monitoring.

6.2.2 Evaluation and Analysis of Samples

Samples of liquid effluents, solids and gaseous effluents from plant processes will be analyzed in the Technical Services Building (TSB) Environmental Monitoring Laboratory. Results of process samples analyses are used to verify that process parameters are operating within expected performance ranges. Results of liquid effluent sample analyses will be characterized to determine if treatment is required prior to discharge to the Treated Effluent Evaporative Basin and to determine if corrective action is required in facility process and/or effluent collection and treatment systems.

6.2.3 Effluent Monitoring

Chemical constituents that may be discharged to the environment in facility effluents will be below concentrations that have been established by state and federal regulatory agencies as protective of the public health and the natural environment. Under routine operating conditions, no significant quantities of contaminants will be released from the facility as discussed in ER Sections 3.12 and 4.13. This will be confirmed through monitoring and collection and analysis of environmental data. Routine liquid effluents are listed in Table 3.12-4, Estimated Annual Liquid Effluent. The facility does not directly discharge any industrial effluents to surface waters or grounds offsite. Except for sanitary waste reporting to the City of Eunice Wastewater Treatment plant from the site Sewage System or possibly discharging to leach fields, all liquid effluents are contained on the NEF site via collection tanks and retention basins. See ER Figure 6.1-1, Effluent Release Points and Meteorological Tower, Figure 6.1-2, Modified Site Features with Proposed Sampling Stations and Monitoring Locations, and Section 2.1.2, Proposed Action, for further discussion of the Liquid Effluent Treatment System.

Parameters for continuing environmental performance will be developed from the baseline data in this Environmental Report and additional preoperational sampling as well as those parameters required in Discharge Permit DP-1481. Operational monitoring surveys will also be conducted using sampling sites and at frequencies established from baseline sampling data and as determined based on requirements. Operational monitoring surveys are determined based on requirements contained in EPA Region 6 NPDES General Discharge Permits as well as the NMWQB Groundwater Discharge Permit.

The frequency of some types of samples may be modified depending on baseline data for the parameters of concern. The monitoring program is designed to use the minimum percentage of allowable limits (lower limits of detection) broken down daily, quarterly, and semiannually. As construction and operation of the enrichment plant proceeds, changing conditions (e.g., regulations, site characteristics, and technology) and new knowledge may require that the monitoring program be reviewed and updated. The monitoring program will be enhanced as appropriate to maintain the collection and reliability of environmental data. The specific location of monitoring points will be determined in detailed design.

During implementation of the monitoring program, some samples may be collected in a different manner/method than specified herein. Examples of reasons for these deviations include severe weather events, changes in the length of the growing season, and changes in the number of plantings. Under these circumstances, documentation shall be prepared to describe how the samples were collected and the rationale for any deviations from normal monitoring program methods. If a sampling location has frequent unavailable samples or deviations from the schedule, then another location may be selected or other appropriate actions taken.

LES will submit a summary of the environmental sampling program and associated data to the proper regulatory authorities, as required. This summary will include the types, numbers and frequencies of samples collected.

Physiochemical monitoring will be conducted via sampling of stormwater, soil, sediment, vegetation, and groundwater as defined in Table 6.2-1, Physiochemical Sampling, to confirm that chemical discharges are below regulatory limits. There are no surface waters on the site, therefore no Surface Water Monitoring Program will be implemented; however soil sampling will include outfall areas such as the outfall at the Site Stormwater Detention Basin. In the event of any accidental release from the facility, these sampling protocols will be initiated immediately and on a continuing basis to document the extent/impact of the release until conditions have been abated and mitigated.

The site sewage system will receive only typical sanitary wastes. Sanitary sewage will be sampled as warranted, in accordance with the applicable discharge permit, DP-1481, or treatment facility requirements.

6.2.4 Stormwater Monitoring Program

A stormwater monitoring program will be initiated during construction of the facility. Data collected from the program will be used to evaluate the effectiveness of measures taken to prevent the contamination of stormwater and to retain sediments within property boundaries. A temporary detention basin will be used as a sediment control basin during construction as part of the overall sedimentation erosion control plan.

Stormwater monitoring will continue with the same monitoring frequency upon initiation of facility operation. During plant operation, samples will be collected from the Uranium Byproduct Cylinders (UBC) Storage Pad Stormwater Retention Basin and the Site Stormwater Detention Basin in order to demonstrate that runoff does not contain any contaminants. A list of parameters to be monitored and monitoring frequencies is presented in Table 6.2-1, Physiochemical Sampling. Table 6.2-2, Stormwater Monitoring Program shows the parameters to be monitored with respect to stormwater. This monitoring program will be refined to reflect applicable requirements as determined during the National Pollutant Discharge Elimination System (NPDES) process (see ER Section 4.4, Water Resources Impacts, for the construction and operational permits). Additionally, the Site Stormwater Detention Basin will adhere to the requirements of the Groundwater Discharge Permit/Plan from the NMWQB, as discussed in ER Sections 1.3, Applicable Regulatory Requirements, Permits and Required Consultations and Section 4.4, Water Resources Impacts.

6.2.5 Environmental Monitoring

The purpose of this section is to describe the surveillance-monitoring program, which will be implemented to measure non-radiological chemical impacts upon the natural environment.

The ability to detect and contain any potentially adverse chemical releases from the facility to the environment will depend on chemistry data to be collected as part of the effluent and stormwater monitoring programs described in the preceding sections. Data acquisition from these programs encompasses both onsite and offsite sample collection locations and chemical element/compound analyses. Final constituent analysis requirements will be in accordance with permit mandates.

Sampling locations will be determined based on meteorological information and current land use. The sampling locations may be subject to change as determined from the results of any observed changes in land use.

The range of chemical surveillance incorporated into all the planned effluent monitoring programs for the facility are designed to be sufficient to predict any relevant chemical interactions in the environment related to plant operations.

Vegetation and soil sampling will be conducted. Vegetation samples will include grasses and local vegatation. Soil will be collected in the same vicinity as the vegetation sample. The samples are collected from both onsite and offsite locations in various sectors. Sectors are chosen based on air modeling. Sediment samples will be collected from discharge points to the different collection basins onsite. At this time, groundwater samples will be collected from a series of wells installed around the plant. The locations of the current groundwater sampling (monitoring) wells are as described in Section 6.1.2 and are shown in Figure 6.1-2A.

Stormwater samples collected in the UBC Storage Pad Stormwater Retention Basin will be sampled to ensure no contaminants are present in the UBC Storage Pad runoff.

6.2.6 Meteorological Monitoring

Measurement instrumentation will be located at a height of approximately 10 meters (33 feet) from the finished grade of the nearest building structure and at 40 meters (130 feet) from the finished grade. This data will assist in evaluating the potential locales on and off property that could be influenced by any emissions. The instrument tower will be located at a site approximately the same elevation as the finished facility grade and in an area where facility structures will have little or no influence on the meteorological measurements. An area approximately ten times the obstruction height around the tower towards the prevailing wind direction will be maintained in accordance with established standards for meteorological measurements. This practice will be used to avoid spurious measurements resulting from local building-caused turbulence. The program for instrument maintenance and servicing, combined with redundant data recorders, assures at least 90% data recovery.

The data this equipment provides is recorded in the Control Room and can be used for dispersion calculations. Equipment will also measure temperature and humidity, which will be recorded in the Control Room.

6.2.7 Biota

The monitoring of radiological and physiochemical impacts to biota are detailed in ER Section 6.3, Ecological Monitoring of this report.

6.2.8 Quality Assurance

Quality assurance will be achieved by following a set of formalized and controlled procedures that Louisiana Energy Services (LES) will create, implement and periodically review for sample collection, lab analysis, chain of custody, reporting of results, and corrective actions. Corrective actions will be instituted when an action level is exceeded for any of the measured parameters. Action levels will be divided into three priorities: 1) if the sample parameter is reported at a concentration that exceeds an upper tolerance limit of the normal background level; 2) if the sample parameter is reported at a concentration that exceeds an administrative limit; or 3) if the sample parameter is reported at a concentration that exceeds a regulatory limit or concentration that is protective for public health and the environment. Corrective actions will be implemented to ensure that the cause for the action level exceedance can be identified and immediately corrected, applicable regulatory agencies are notified, if required, communications to address lessons learned are dispersed to appropriate personnel, and applicable procedures are revised accordingly if needed. All action plans will be commensurate to the severity of the exceedance.

The NEF will ensure that the onsite laboratory and any contractor laboratory used to analyze NEF samples participates in third-party laboratory intercomparison programs appropriate to the media and analytes being measured. Examples of these third-party programs are the Mixed Analyte Performance Evaluation Program (MAPEP) and the DOE Quality Assurance Program (DOEQAP) that are administered by the Department of Energy. The NEF will require all radiological and non-radiological laboratory vendors to be certified by the National Environmental Laboratory Accreditation Conference (NELAC) or an equivalent state laboratory accreditation agency for the analytes being tested.

6.2.9 Lower Limits of Detection

Lower limits of detection for the parameters sampled for in the Stormwater Monitoring Program are listed in Table 6.2-2, Stormwater Monitoring Program. Lower limits of detection (LLD) for the nonradiological parameters shown in Table 6.2-1, Physiochemical Sampling, will be based on the results of the baseline surveys and the type of matrix (sample type).

6.2.10 Section 6.2 Tables

Table 6.2-1 Physiochemical Sampling

Sample Type	Sample Location	Frequency	Sampling and Collections[2]
Stormwater	Site Stormwater Detention Basin UBC Storage Pad Stormwater Retention Basin	Quarterly	Analytes as determined by baseline program – see Table 6.2-2
Vegetation	4 minimum[1]	Quarterly (growing seasons)	Fluoride uptake
Soil/Sediment	4 minimum[1]	Quarterly	Metals and fluoride uptake
Groundwater	All selected groundwater wells	Semiannually	Metals

[1] Location identified in site procedures and by applicable permits.

[2] Analyses will meet EPA Lower Limits of Detection (LLD), as applicable, and will be based on the baseline surveys and the type of matrix (sample type).

Table 6.2-2Stormwater Monitoring Program

Stormwater Monitoring Program for Detention and Retention Basins* (See Figure 4.4-1)

Monitored Parameter	Monitoring Frequency	Sample Type	LLD
Oil & Grease	Quarterly, if standing water exists	Grab	0.5 ppm
Total Suspended Solids	Quarterly, if standing water exists	Grab	0.5 ppm
5-Day Biological Oxygen Demand (BOD)	Quarterly, if standing water exists	Grab	2 ppm
Chemical Oxygen Demand (COD)	Quarterly, if standing water exists	Grab	1 ppm
Total Phosphorus	Quarterly, if standing water exists	Grab	0.1 ppm
Total Kjeldahl Nitrogen	Quarterly, if standing water exists	Grab	0.1 ppm
pH	Quarterly, if standing water exists	Grab	0.01 units
Nitrate plus Nitrite Nitrogen	Quarterly, if standing water exists	Grab	0.2 ppm
Metals	Quarterly, if standing water exists	Grab	Varies**

* Site Stormwater Detention Basin, UBC Storage Pad, Stormwater Detention Basin and any temporary basins used during construction.

** Analyses will meet EPA Lower Limits of Detection (LLD), as applicable, and will be based on the baseline surveys and the type of matrix (sample type).

Note:

Radiological monitoring parameters are addressed separately in ER Section 6.1, Radiological Monitoring.

6.3 ECOLOGICAL MONITORING

6.3.1 Maps

See Figure 6.1-2, Modified Site Features with Sampling Stations and Monitoring Locations.

6.3.2 Affected Important Ecological Resources

The existing natural habitats on the NEF site and the region surrounding the site have been impacted by domestic livestock grazing, oil/gas pipeline right-of-ways and access roads. These current and historic land uses have resulted in a dominant habitat type, the Plains Sand Scrub. Hundreds of square kilometers (miles) of this habitat type occur in the area of the NEF. The habitat type at the NEF site does not support any rare, threatened, or endangered animal or plant species. The Plains Sand Scrub vegetation type is characterized by shinnery oak shrub, mesquite shrub, and short to mid-grass prairie with little or no overhead cover.

Based on ecological surveys that have been performed onsite, LES has concluded that there are no important ecological systems onsite that are especially vulnerable to change or that contain important species habitats, such as breeding areas, nursery, feeding, resting, and wintering areas, or other areas of seasonally high concentrations of individuals of important species. The species selected as important (the mule deer and scaled quail) are both highly mobile, generalist species and can be found throughout the site area. Wildlife species on the site typically occur at average population concentrations for the Plains Sand Scrub habitat type.

The nearest suitable habitat for species of concern are several kilometers (miles) from the NEF site. The closest known populations of the Sand Dune Lizard occur approximately 4.8 km (3 mi) north of the site. A population of Lesser Prairie Chickens has been observed approximately 6.4 km (4 mi) north of the NEF site. No Black-Tailed Prairie Dogs are present at the NEF site.

6.3.3 Monitoring Program Elements

Several elements were selected for the initial ecological monitoring program. These elements included vegetation, birds, mammals, and reptiles/amphibians. Currently there is no action or reporting level for each specific element. However, additional consultation with all appropriate agencies (New Mexico Department of Game & Fish, US Fish & Wildlife Service USFWS) will continue. Agency recommendations, based on future consultation and monitoring program data, will be considered when developing action and/or reporting levels for each element. In addition, LES will periodically monitor the NEF site property and basin waters during construction and plant operations to ensure the risk to birds and wildlife is minimized. If needed, measures will be taken to release entrapped wildlife. The monitoring program will assess the effectiveness of the entry barriers and release features to ensure risk to wildlife is minimized.

6.3.4 Observations and Sampling Design

The NEF site observations included preconstruction and construction monitoring programs. The preconstruction monitoring program established the site baseline data. The procedures used to characterize the plant, bird, mammalian, and reptilian/amphibian communities at the NEF site during pre-construction monitoring are considered appropriate and will be used for both the construction monitoring programs. Based on the findings from the pre-construction and construction programs, long term monitoring for bird, mammalian, and reptilian/amphibian communities is not warranted. Additional molnitoring will only be warranted if soil, groundwater, or vegetation samples collected as part of the Radiological Environmental Monitoring Program (REMP) reported in the Semi-Annual Radiological Effluent Release Report (SARERR), or ground water discharge permit DP1481 indicate a site related release that could adversely affect the reptile population.

These surveys were intended to be sufficient to characterize baseline conditions and identify if there are sensitive species that warrant additional continued monitoring. Based on the lack of threatened or endangered species, ongoing monitoring for fauna is not necessary to be completed in addition to the radiological and physiochemical monitoring required by the REMP, SARERR, and Groundwater Discharge Permit DP-1481 requirements. Vegetation sampling will continue as required by the regulation and permits noted above.

Vegetation

Vegetative sampling will be performed as required by permit and /or part of the REMP.Birds

Site-specific avian surveys were conducted in both the wintering and breeding seasons to verify the presence of particular bird species at the NEF site. No endangered bird species were noted. Therefore, no further bird surveys are required. Refer to Section 3.9, Ecological Resourses, of NUREG-1790, the Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, NM.

Mammals

The existing mammalian communities are described in ER Section 3.5.2. General observations were compiled concurrently with other wildlife monitoring data and compared to information listed in Table 3.5 1, Mammals Potentially Using the NEF Site. Surveys were conducted during preconstruction and constructions activities, however because there are no identified threatened or endangered species at the facility, long term mammal studies are not warranted.

Reptiles and Amphibians

There are several groups of reptile and amphibian species (lizards, snakes, amphibians) that provide the biological characteristics (demographics, life history characteristics, site specificity, environmental sensitivity) for an informative environmental monitoring program. Approximately 13 species of lizards, 13 species of snakes and 11 species of amphibians may occur on the site and in the area. Because there are no identified threatened or endangered species at the facility, long term Reptile and Amphibian studies are not warranted.

6.3.5 Statistical Validity of Sampling Program

Any proposed sampling program will include descriptive statistics. These descriptive statistics will include the mean, standard deviation, standard error, and confidence interval for the mean. In each case the sampling size will be clearly indicated. The use of these standard descriptive statistics will be used to show the validity of the sampling program. A significance level of 5% will be used for the studies, which results in a 95% confidence level.

6.3.6 Sampling Equipment

Due to the type of ecological monitoring proposed for the NEF no specific sampling equipment is necessary.

6.3.7 Method of Chemical Analysis

Due to the type of monitoring proposed for the NEF, no chemical analysis is proposed for ecological monitoring.

6.3.8 Data Analysis And Reporting Procedures

LES or its contractor will analyze the ecological data collected on the NEF site. Responsibility for the data analysis resides with the Environmental Compliance Officer.

A summary report will be prepared which will include the types, numbers and frequencies of samples collected.

6.3.9 Agency Consultation

Consultation was initiated with all appropriate federal and state agencies and affected Native American Tribes. Refer to Appendix A, Consultation Documents, for a complete list of consultation documents and comments.

6.3.10 Organizational Unit Responsible for Reviewing the Monitoring Program on an Ongoing Basis

As policy directives are developed, documentation of the environmental monitoring programs will occur. The person or organizational unit responsible for reviewing the program on an ongoing basis will be the Environmental Compliance Officer.

6.3.11 Established Criteria

The ecological monitoring program is conducted in accordance with generally accepted practices and the requirements of the New Mexico Department of Game and Fish. Data will be collected, recorded, stored and analyzed. Actions will be taken as necessary to reconcile anomalous results.

6.3.11.1 Data Recording and Storage

Data relevant to the ecological monitoring program will be recorded in paper and/or electronic forms. These data will be kept on file for the life of the facility.

7.0 COST BENEFIT ANALYSIS

This chapter describes the costs and benefits for the proposed action, quantitatively and qualitatively. Environmental Report (ER) Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, describes the quantitative direct and indirect economic impacts from plant construction and operation. ER Section 7.2 describes the qualitative socioeconomic and environmental impacts from plant construction and operation. ER Section 7.3, No-Action Alternative Cost-Benefit, describes the impacts of the no-action alternative of not building the proposed NEF.

7.1 ECONOMIC COST-BENEFITS, PLANT CONSTRUCTION AND OPERATION

This analysis traces the economic impact of the proposed National Enrichment Facility (NEF) in Lea County, New Mexico, identifying the direct impacts of the plant on revenues of local businesses, on incomes accruing to households, on employment, and on the revenues of state and local government. Further, it explores the indirect impacts of the NEF on local entities using a model showing the interaction of economic sectors in Lea County.

7.1.1 Introduction

The purpose of ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, is to assess the economic impact that the construction and operation of the NEF would have on the surrounding area, including Lea and Eddy Counties in New Mexico. The analysis estimates the economic impact upon a contiguous eight-county region, comprised of the two previously identified New Mexico Counties, as well as six directly affected Texas Counties falling within a 80-km (50-mi) radius of the proposed site. These include Andrews, Ector, Gaines, Loving, Winkler, and Yoakum Counties. (See Figure 7.1-1, Eight-County Economic Impact Area.)

For the purpose of assessing the economic impact of the NEF, the analysis is divided into two distinct phases: Construction and Operations. For each of these two time periods, both the direct and indirect impacts are assessed.

ER Section 7.1.3, Regional Economic Outlook, discusses current economic conditions and existing economic structure of the eight-county region. ER Section 7.1.4, Direct Economic Impact, is a discussion of the direct impacts associated with the NEF, which includes earnings, employment, and tax-related revenues. ER Section 7.1.5, Total Economic Impact Using RIMS II, utilizes the Regional Input-Output Modeling System (RIMS) II framework to assess the total (both direct and indirect) economic impact of the NEF on the regional economy. The origin, general operation, and specific application of the RIMS II framework to the proposed action are discussed below.

7.1.2 The Economic Model

The RMIS II multipliers presented in this report reflect input-output (I-O) data for the 1999 annual I-O table for the nation and 2000 regional data, which shows the input and output structure for approximately 500 industries (BEA, 2003a).

The RIMS II method for estimating regional I-O multipliers can be viewed as a three-step process. In the first step, the producer portion of the national I-O table is made region-specific by using four-digit Standard Industrial Classification (SIC) location quotients (LQ's). The LQ's estimate the extent to which input requirements are supplied by firms within the region. RIMS II uses LQ's based on two types of data: The Bureau of Economic Analysis' (BEA's) personal income data (by place of residence) are used to calculate LQ's in the service industries; and BEA's wage-and-salary data (by place of work) are used to calculate LQ's in the nonservice industries.

In the second step, the household row and the household column from the national I-O table are made region-specific. The household row coefficients, which are derived from the value-added row of the national I-O table, are adjusted to reflect regional earnings leakages resulting from individuals working in the region but residing outside the region. The household column coefficients, which are based on the personal consumption expenditure column of the national I-O table, are adjusted to account for regional consumption leakages stemming from personal taxes and savings.

In the last step, the Leontief inversion approach is used to estimate multipliers. This inversion approach produces output, earnings, and employment multipliers, which can be used to trace the impacts of changes in final demand on directly and indirectly affected industries (BEA 2003b).

7.1.2.1 RIMS II Multipliers

A RIMS II model provides “multipliers” for approximately 500 industries showing the industry outputs stimulated by new activity, the associated household earnings, and the jobs generated.

The RIMS II model of Lea County, New Mexico is based on the National Input-Output table, employment statistics from the Bureau of Labor Statistics, and the Regional Economic Information System (REIS). The National table is regionalized using location quotients, which compare the local proportion of industry employment to total employment to a similar proportion for the Nation. The model is solved to generate a very large table of multipliers for the entire set of industries existing in the county.

Since the 1970s, the Bureau of Economic Analysis (BEA) has provided models designated as RIMS (Regional Industrial Multiplier System). RIMS II is the latest version of this system. The following comments are based on Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II) (BEA, 1997).

RIMS II is based on an accounting framework called an input-output (I-O) table. For each industry, an I-O table shows the distribution of the inputs purchased and the outputs sold. A typical I-O table in RIMS II is derived mainly from two data sources: BEA’s national I-O table, which shows the input and output structure of nearly 500 US Industries, and BEA’s regional economic accounts, which are used to adjust the national I-O table in order to reflect a region’s industrial structure and trading patterns.

The RIMS II model and its multipliers are prepared in three major steps. First, an adjusted national industry-by-industry direct requirements table is prepared. Second, the adjusted national table is used to prepare a regional industry-by-industry direct requirements table. Third, a regional industry-by-industry total requirements table is prepared, and the multipliers are derived from this table.

Unlike the national I-O accounts, RIMS II includes households as both suppliers of labor inputs to regional industries and as purchasers of regional output, because it is customary in regional impact analysis to account for the effects of changes in household earnings and expenditures. Thus, both a household row and a household column are added to the national direct requirements table before the table is regionalized.

The regional industry-by-industry direct requirements table is derived from the adjusted national industry-by-industry direct requirements table. Location quotients (LQ's) are used to "regionalize" the national data. The LQ based on wages and salaries is the ratio of the industry's share of regional wages and salaries to that industry's share of national wages and salaries. The LQ is used as a measure of the extent to which regional supply of an industry's output is sufficient to meet regional demand. If the LQ for a row industry in the regional direct requirements table is greater than, or equal to, one, it is assumed that the region's demand for the output of the row industry is met entirely from regional production. In this instance, all row entries for the industry in the regional direct requirements table are set equal to the corresponding entries in the adjusted national direct requirements table.

Conversely, if the LQ is less than one, it is assumed that the regional supply of the industry's output is not sufficient to meet regional demand, In this instance, all row entries for the industry in the regional direct requirements table are set equal to the product of the corresponding entries in the adjusted national direct requirements table and the LQ for the industry.

The household row and the household column that were added to the national direct requirements table are also adjusted regionally. The household-row entries are adjusted downward, on the basis of commuting data from the Census of Population, in order to account for the purchases made outside the region by commuters working in the region. The household-column entries are adjusted downward, on the basis of tax data from the Internal Revenue Service, in order to account for the dampening effect of State and local taxes on household expenditures.

After the regional direct-requirements table is constructed it is converted into a model using a mathematical process known as "inversion." The resulting model, summarized in a 490-by-490 matrix called the "total requirements" table, now shows the impact of changes in outside sales by each industry on the outputs of every industry in the region. This data can now be manipulated to yield "multipliers."

The output multiplier for an industry measures the total dollar change in output in all industries that results from a $1 change in output delivered to final demand by the industry in question.

The earnings multiplier for an industry measures the total dollar change in earnings of households employed by all industries that results from a $1 change in output delivered to final demand by the industry in question.

7.1.3 Regional Economic Outlook

A socioeconomic profile of the eight-county region surrounding the NEF provides a baseline from which to understand and measure the economic impacts expected to be derived from the NEF. This section includes a discussion of recent regional trends in output and employment, income and other socioeconomic measures and concludes with a brief discussion on the industry structure of the region.

7.1.3.1 Recent Trends in Economic Growth and Employment

The eight-county region has a total current estimated population of 270,000 with 40% of the region's population residents of New Mexico and the remaining 60% residents of Texas.

After rising through the late 1990s, economic growth in New Mexico and Texas slowed in 2001 along with the slowdown in growth of the US economy. Statewide, the Texas economy was hit especially hard from the fallout in the technology sector and weakness in the air transportation sector after the terrorist attacks of September 11, 2001 (Yücek, 2003). The Texas gross state product growth rate declined sharply from 8.8% per annum in 2000 to 3.5% per annum in 2001. Total employment fell 1.4% in 2001 - a greater decline than the 1.1% decrease in employment nationwide - and fell another 0.1% in 2002. The Texas unemployment rate reached an eight-year high of 6.4% in 2002. While the employment situation is beginning to show some signs of recovery (with annual job growth rising 0.8% through May 2003) the recovery is said to be slow and inconsistent across industries (Yücek, 2003). The employment situation for the six Texas Counties included in the analyzed region was worse, with a weighted average unemployment rate of 6.9% in 2002 (that was notably higher than the Texas statewide rate of 6.4%).

In contrast to Texas, New Mexico economic growth slowed during this period, but the annual growth rate in gross state product remained above 5.0% in 2001. According to data published by the BEA, the relative resilience of the New Mexico economy appears to have been related to high government spending and strong manufacturing activity during this unfavorable economic period. Additionally, the unemployment rate in New Mexico rose to 5.5% in 2002, but remained below the national average. In 2002, the two New Mexico Counties analyzed had a 5.5% weighted average unemployment rate, which was consistent with the statewide unemployment rate.

7.1.3.2 Trends in Income

While per capita income in both New Mexico and Texas is below the national average of $22,000, standing at $17,000 and $20,000 respectively, per capita income is notably lower in the eight-county region. For this region as a whole, per capita income was $15,794. This amount is only 73% of the national per capita income. Lea and Eddy Counties in New Mexico had an average per capita income of $15,004, and the six Texas Counties had an average per capita income of $16,058 (DOC, 2002).

While total personal income has increased steadily in the two New Mexico Counties through the 1990s, those counties' total income as a percent of statewide income has declined slightly from 3.2% in 1990, to 2.8% in 2001, reflecting the relatively weak economic performance of the region during the past decade. Additionally, the poverty rate in the eight-county area is significantly higher than the state and national level. Within this region, reported poverty rates range from 16 to 22% of residents, versus the national rate of 12.4%. The Census Bureau defines poverty as those living under specified income thresholds (defined by the Office of Management and Budget) that vary by size of family and composition).

According to LES estimates, the specific jobs created by the NEF will pay wages significantly higher than the regional average income (LES, 2003a). The BEA data reports the 2001 average wage per job in the New Mexico and Texas Counties as $28,013 and $29,799, respectively. In contrast, LES expects to pay an average salary of $39,124 to its construction employees, which is over 1.3 times the average wage per job in the affected Counties. Similarly, LES expects to pay an average salary of $50,000 to its plant operation employees (see Table 7.1-1, Operating Plant Payroll Estimates). (Unless otherwise stated, all fiscal impacts are stated in 2002 real dollars based on the estimated costs and wages/benefits data provided, and are not adjusted for anticipated price or wage inflation over the period analyzed).

7.1.3.3 Regional Industry Analysis

Mining (primarily oil, natural gas, and potash production activities) has been one of the largest and most important industries in the eight-county region throughout the most recent economic history (see Figure 7.1-2, Private Employment in Eight-County Region). According to the BEA, the mining sector directly accounted for 18.6% of total private employment in Lea and Eddy Counties in 2000 and approximately 14% in the eight-county region (BEA, 2003a). More importantly, the dominance of the oil and gas industry in the regional economy is significantly greater when indirect income and employment are considered. (Relying on the RIMS II Multipliers for the eight-county region, the total income and employment generated from the mining sector accounts for nearly 50% of the private sector income and employment). (See Figure 7.1-2, Private Employment in Eight-County Region.)

Unfortunately, mining sector employment in the eight-county region has been declining in recent years, falling 27% from 1990 to 2000 amid increased domestic and foreign competition and consolidation in (primarily) the potash industry. The mining sector was the only major sector in the eight-county region to decline over the past decade. (See Figure 7.1-3, Mining as a Share of Private Employment in Eight-County Region.)

Other important regional industries include agriculture, forestry, and services in education and healthcare. Although accounting for only 2% of employment in the eight-county region, agricultural employment was the fastest growing private sector during 1990s, increasing 43% to 2,233 jobs. While oil and gas continues to have a significant impact, agriculture has underlying influences on the region’s development through an active dairy industry, farming, and ranching (EDCLC, 2000). During the last decade, the construction and service industries were also among the fastest growing employment sectors in the eight-county regional economy, enjoying double-digit growth rates.

Although growth in manufacturing employment became a source of strength for central New Mexico in the mid-1990s, it was one of the slower growing employment sectors in the eight-county region, growing only 5% over the 1990s, and currently making up 6.3% of private employment for the region. Additionally, growth in manufacturing employment was somewhat sporadic in Lea and Eddy Counties, declining in 1998 through 2000, and comprising only 3.3% of private employment in these counties by the end of the century.

In the operations phase, the proposed NEF will produce a 14% increase in manufacturing employment in Lea and Eddy Counties. More importantly, however, the introduction of the NEF should work to diversify and stabilize the regional economy as it reduces the dependence on the mining sectors. The development of non-mining industries in this region is especially important as many of the petroleum producing formations in the Permian Basin have reached secondary and tertiary stages of production, and are in normal production decline associated with mature oil and gas production properties. Importantly, revenue and employment volatility associated with petroleum production increases as the production techniques become more expensive in mature fields.

7.1.4 Direct Economic Impact

7.1.4.1 Introduction

In building and operating the NEF, LES direct expenditures are expected to create a total economic impact calculated to provide a discounted present value benefit of $469 million accruing to local employees, businesses, and the government over the eight-year construction period and anticipated 30-year license period for the facility. (The present value is calculated by discounting the annual construction expenditures over a 8-year period and the annual operation expenditures over a 30-year period (NEF license period) using an 8% discount rate. All figures in this analysis are expressed in 2002 dollars, and are not adjusted for inflation over the referenced time period. It should be noted that expenditures occurring beyond a twenty-year time horizon contribute little to the discounted present value economic benefits, as the discounting of those expenditures provide nominal contributions to the assessed present value). Of this amount, 44%, or approximately $204 million, will go to households in the form of salaries, employment, and benefits. Approximately $261 million, or 56% will go to local business in the form of goods and services purchased and the remaining one percent will be paid to the government in the form of state and local taxes and fees. (See Figure 7.1-4, Total Present Value of Expected LES Expenditures.)

LES has estimated the economic impacts to the local economy during the 8-year construction period and 30-year license period of the NEF. This includes a five and one-half year period when both construction and operation and ongoing simultaneously. The analysis traces the economic impact of the proposed NEF, identifying the direct impacts of the plant on revenues of local businesses, on incomes accruing to households, on employment, and on the revenues of state and local government. The analysis also explores the indirect impacts of the NEF within a 80-km (50-mi) radius of the NEF. Details of the analysis are provided below.

7.1.4.2 Construction Expenditures

LES estimates that it will spend $397 million locally on construction expenditures over an 8-year period. Approximately 31% of the total construction costs will be spent on payroll, totaling $122.2 million. This amount is augmented with the inclusion of the $21.4 million in benefits paid to construction employees. (See Figure 7.1-5, Total Construction Expenditures: $397 Million Over Eight Years.)

LES estimates that the construction phase will create an annual average of 397 new jobs over this period, with peak construction employment estimated at 800 jobs in 2009 (see Table 7.1-2, Annual Impact of Construction Payroll). A majority of these jobs will exist in the first four years of construction, and will be at salary levels ranging between $34,000 and $49,000 annually. Figure 7.1-6, Estimated Construction Jobs by Annual Pay, depicts direct employment during the eight-year construction period, grouping jobs by salary range.

The regional construction work force appears to be large enough to support the employment needs for the construction of the NEF. According to 2000 data published by the Bureau of the Census, the construction labor force in Lea County is made up of about 1,200 workers. The construction labor force in the New Mexico Counties (Lea and Eddy Counties) totals more than 3,000 employees, and totals approximately 9,000 construction sector employees for the entire 8-county region. The estimated 397 new construction jobs would represent employment of 13% of the existing construction labor force in the two-New Mexico County region, and 4.5% of the existing eight-county region construction labor force. LES estimates that most construction employees will come from the local labor pool, however, a few positions that require specialized skills may be filled by non-local residents.

The remainder of the construction expenditures will be spent locally on construction goods and services, benefiting local businesses. (See Table 7.1-3, Total Impact of Local Spending for Construction Goods and Services, for additional details of local construction expenditures.)

7.1.4.3 Operation Expenditures

During the operation period, LES estimates that it will spend $10.5 million on operating payroll annually and an additional $3.2 million in benefits. The operation of the plant is expected to generate approximately 210 permanent, full-time jobs. LES will pay a weighted average annual salary of $50,000, which is 1.7 times greater than the average wage per job for the eight-county region. Additionally, as shown in Table 7.1-1, Operating Plant Payroll Estimates, 90% of the jobs will have an annual pay of $42,000 or higher. According to LES, employment opportunities will range from plant operations, maintenance and health physics positions to clerical and security-related jobs. LES plans to provide extensive training for employees, and approximately 20% of employment opportunities will involve an advanced understanding of the NEF. (See Table 7.1-4 for information on the annual impact of operations payroll.)

The local labor force appears to be well positioned for these types of jobs. The total Lea County labor force stands at approximately 25,604 and the Eddy County labor force is an additional 23,957. The total eight-county labor force totals approximately 129,000. Within the eight-county region, between 6% and 14% of the individual county residents have at least a bachelors degree and between 56% and 86% of the individual county residents have graduated from high school (DOC, 2002).

Approximately $9.6 million per year will be spent locally on goods and services, benefiting local businesses. (See Table 7.1-5, Annual Impact of NEF Purchases, below for additional details of local NEF purchases.)

7.1.4.4 Other Expenditures

LES anticipates annual payroll to be $10.5 million with additional $3.2 million expenditure in employee benefits once the plant is operational. Approximately $9.6 million will be spent annually on local goods and services required for operation of the NEF.

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

Using the New Mexico and Lea County income tax rates and the estimated household income generated (directly and indirectly) from the NEF, it is estimated that income taxes could total as much as $4 million each year during the 8-year construction period and $2 million each year during the anticipated 30-year license period. Additionally, using the estimated total (direct and indirect) new business activity associated with the NEF, gross receipts taxes from local business could total as much as $3 million per year during the 8-year construction period and $928,000 per year during the anticipated 20-year operation period.

Of course, not all of the economic benefits from construction and operations of the NEF can be quantified. For example, due to the relatively small size of the manufacturing sector in this eight-county region, the opening of the NEF should have positive spillover effects throughout the region, such as increasing the skill level of the local labor force and potentially attracting other manufacturing firms. In addition to increasing the role of the manufacturing sector within the region, the NEF will help to diversify the regional economy and provide some additional insulation from the volatility of the oil and gas dependent economy of the region. Additionally, housing values have the potential to increase from current levels as income and relatively high-paying job opportunities in the area grow, potentially attracting new residents. In 2000, the median housing value in the eight-county region was $40,313, which is less than half of New Mexico, Texas, and U.S. levels (DOC, 2002).

7.1.5 Total Economic Impact Using RIMS II

7.1.5.1 Introduction

The RIMS II Methodology, first created by the BEA in the 1970s, is based on an accounting framework called an Input-Output (I-O) table. For each industry, an I-O table shows the distribution of the inputs purchased and the outputs sold among individual sectors of a national or regional economy. Using RIMS II for impact analysis has several advantages. RIMS II multipliers can be estimated for any region composed of one or more counties and for any industry or group of industries characterized in the national I-O table. According to empirical tests, the estimates based on RIMS II are similar in magnitude to the estimates based on relatively expensive surveys. This analysis utilized the RIMS II regional I-O Multipliers for the eight-county, Hobbs-Odessa-Midland, New Mexico-Texas Region based on data obtained from the BEA (BEA 2003a).

7.1.5.2 Construction Impacts

LES estimates that it will spend $122.2 million on payroll over the 8-year construction period. It is possible to compute the total annual impact by converting this amount into an average annual number and using RIMS II Multipliers. An annual payroll of approximately $15 million is expected to generate a total impact on earnings equal to $24 million (i.e., $15 million direct impact, and $8 million indirect impacts) within the 8-county region. The initial annual average 397 direct jobs created during the 8-year construction period are expected to produce a total employment increase of 650 jobs through the construction period. This total direct and indirect economic impact would result in a 1.0% and 0.7% increase (respectively) in total non-mining, private sector personal income and employment, respectively, for the eight-county region.

LES estimates that it will spend between $265 and $462 million on goods and services in the local economy over the 8-year construction period. Using the minimum amount of expected purchases and RIMS II Final Demand Multipliers, these expenditures are expected to generate a total annual output amounting to $53 million and total annual earnings of $15 million. Additionally, these expenditures are expected to produce a total of 452 new jobs per year.

To summarize, the construction phase of the project is expected to generate a total impact of $53 million in output for local businesses, $38 million in household earnings, and 1,102 new jobs. The total impact figures from the construction period are derived from adding the total impacts from construction payroll and employment and local construction expenditures. The output figure comes directly from Table 7.1-3, Total Impact of Local Spending for Construction Goods and Services, and the household earnings figures come from adding the total annual impact on earnings from Table 7.1-2, Annual Impact of Construction Payroll and Table 7.1-3, Total Impact of Local Spending for Construction Goods and Services, as does the total new jobs figure. (See Figure 7.1-7, Annual Flow of Direct and Indirect Economic Benefits Associated with NEF Construction below for the annual flow of benefits associated with the NEF construction period.)

7.1.5.3 Operations Impact

Upon completion of the NEF's construction, LES estimates that it will spend $10.5 million on plant operations payroll and an additional $3.2 million in benefits annually. Using the RIMS II Multipliers, total additional earnings of $20 million will be produced, which would result in a 0.8% increase in total non-mining, private sector income in the eight-county region. Additionally, a total employment impact is estimated at 694 additional jobs, which would result in a 0.7% increase in the 8-county region non-mining, private sector employment.

Lastly, the estimated $9.6 million in annual purchases by LES of goods and services associated with the plant operation are expected to have a total annual impact on local business revenues equal to $14.6 million, $3.3 million for household income, and an increase in employment of 88 jobs.

To summarize, the operations phase of this project is expected to generate a total annual impact of $14.6 million in output for local businesses, $23 million in household earnings, and 782 new jobs. The total impact figures from the operations period are derived from adding the total impacts from operations payroll and local expenditures. The output figure comes directly from Table 7.1-5, Annual Impact of NEF Purchases, the household earnings figure comes from adding the total annual impact on earnings from Table 7.1-4, Annual Impact of Operations Payroll and Table 7.1-5, Annual Impact of NEF Purchases as does the total new jobs figure. (See Figure 7.1-8, Annual Flow of Direct and Indirect Economic Benefits Associated with NEF Operations for annual flows of economic benefits associated with the NEF operation period.)

7.1.6 Section 7.1 Tables

Table 7.1-1 Operating Plant Payroll Estimates

Level	Proportion	Jobs #	Average Pay	Total Payroll
Management	10%	21	$95,000	$1,995,000
Professional	20%	42	$62,000	$2,604,000
Skilled	60%	126	$42,000	$5,292,000
Administrative	10%	21	$30,000	$ 630,000
Total	**100%**	**210**		**$10,521,000**

Table 7.1-2 Annual Impact of Construction Payroll

	RIMS II Direct Effect Multipliers	**Impact**	**Regional Increase in Non-Mining Sector**
Direct Impact on:			
Earnings by Households		$15,273,750	
Indirect Impact on:			
Earnings by Households	0.5491	$8,386,816	
Total Impact on:			
Earnings by Households	1.5491	$23,660,566	1.0%
Direct Impact on:			
Employment (jobs)		397	
Indirect Impact on:			
Employment (jobs)	0.6385	253	
Total Impact on:			
Employment (jobs)	1.6385	650	0.7%

Table 7.1-3Total Impact of Local Spending for Construction Goods and Services

Industry	Local Purchases	Final Demand Multiplies			Total Impact			
		Output	Earnings	Employment*	Output	Earnings	Job-years	Jobs/year
Concrete	$5,000,000	1.7112	0.5087	16.4093	$8,556,000	$2,543,500	82	10
Reinforcing Steel	$500,000	1	0	0	$500,000	$0	0	0
Structural Steel	$2,000,000	1	0	0	$2,000,000	$0	0	0
Lumber	$250,000	1	0	0	$250,000	$0	0	0
Site Preparation – Total	$20,000,00	1.6002	0.4459	13.7205	$32,004,000	$8,918,000	274	34
Transportation (freight on all materials)	$2,000,000	1.7782	0.5066	17.6983	$3,556,400	$1,013,200	35	4
Subcontracts by type of service								
Precast Concrete	$20,000,000	1.6002	0.4459	13.7205	$32,004,000	$8,918,000	274	34
Multiple Arch/Bldg. Packages	$40,000,000	1.6002	0.4459	13.7205	$64,008,000	$17,836,000	549	69
Equipment Installation Packages	$25,000,000	1.6002	0.4459	13.7205	$40,005,000	$11,147,500	323	43
Mechanical/Piping/HVAC Packages	$75,000,000	1.6002	0.4459	13.7205	$120,015,000	$33,442,500	1029	129
Electrical/Controls Packages	$75,000,000	1.6002	0.4459	13.7205	$120,015,000	$33,442,500	1029	129
Total	$264,750,000				**$422,913,400**	**$117,261,200**	**3616**	
Per Year (over 8-year period)	$33,093,750	*The employment multiplier is measured on the basis of $1 million change in output delivered to final demand			**$52,864,175**	**$14,657,650**		**452**
		Indirect Impact			**$19,770,425**			

Table 7.1-4Annual Impact of Operations Payroll

	RIMS II Direct Effect Multipliers	Impact	Regional Increase in Non-Mining Sector
Direct Impact on:			
Earnings by Households		$10,521,000	
Indirect Impact on:			
Earnings by Households	0.8969	$9,436,285	
Total Impact on:			
Earnings by Households	1.8969	$19,957,285	0.8%
Direct Impact on:			
Employment (jobs)		210	
Indirect Impact on:			
Employment (jobs)	2.3039	484	
Total Impact on:			
Employment (jobs)	3.3039	694	0.7%

Table 7.1-5Annual Impact of NEF Purchases

Item	Local Purchases	Final Demand Multipliers			Total Impact on 8-County Region		
	(Direct Impact)	Output	Earnings	Employment*	Output	Earnings	Employment
Landscaping	$75,000	1.6154	0.7509	38.1785	$121,155	$56,318	3
Protective Clothing	$30,000	1.4698	0.3211	13.4385	$44,094	$9,633	0
Laboratory Chemicals	$50,000	1.7137	0.3411	6.4671	$85,685	$17,055	0
Plant Spare Equipment	$170,000	1.4774	0.3783	10.722	$251,158	$64,311	2
Office Equipment	$160,000	1	0	0	$160,000	$0	0
Engineered Parts	$150,000	1.6005	0.5761	16.6379	$240,075	$86,415	2
Electrical/Electronic Parts	$220,000	1.5052	0.4576	14.8929	$331,144	$100,672	3
Electricity	$7,076,000	1.5129	0.2892	5.4635	$10,705,280	$2,046,379	39
Waste Water	$93,000	1.7537	0.4507	11.9573	$163,094	$41,915	1
Solid Waste Disposal	$3,000	1.7537	0.4507	11.9573	$5,261	$1,352	0
Insurance	$0	1.5546	0.5486	17.6514	$0	$0	0
Catering	$50,000	1.5453	0.4801	30.1599	$77,265	$24,005	2
Building Maintenance	$370,000	1.5772	0.4727	14.819	$583,564	$174,899	5
Custodial Services	$250,000	1.7909	0.7261	41.7122	$447,725	$181,525	10
Professional Services	$180,000	1.6377	0.6922	18.8168	$294,786	$124,596	3
Security Services	$500,000	1.4976	0.6315	28.894	$784,800	$315,750	14
Mail, Document Services	$100,000	1.637	0.7074	19.4951	$163,700	$70,740	2
Office Supplies	$140,000	1	0	0	$140,000	$0	0
Total	$9,617,000	*The employment multiplier is measured on the basis of $1 million change in output delivered to final demand.			**$14,598,986**	**$3,315,565**	**89**
		Indirect Impact			**$5,009,202**		

7.1.7 Section 7.1 Figures

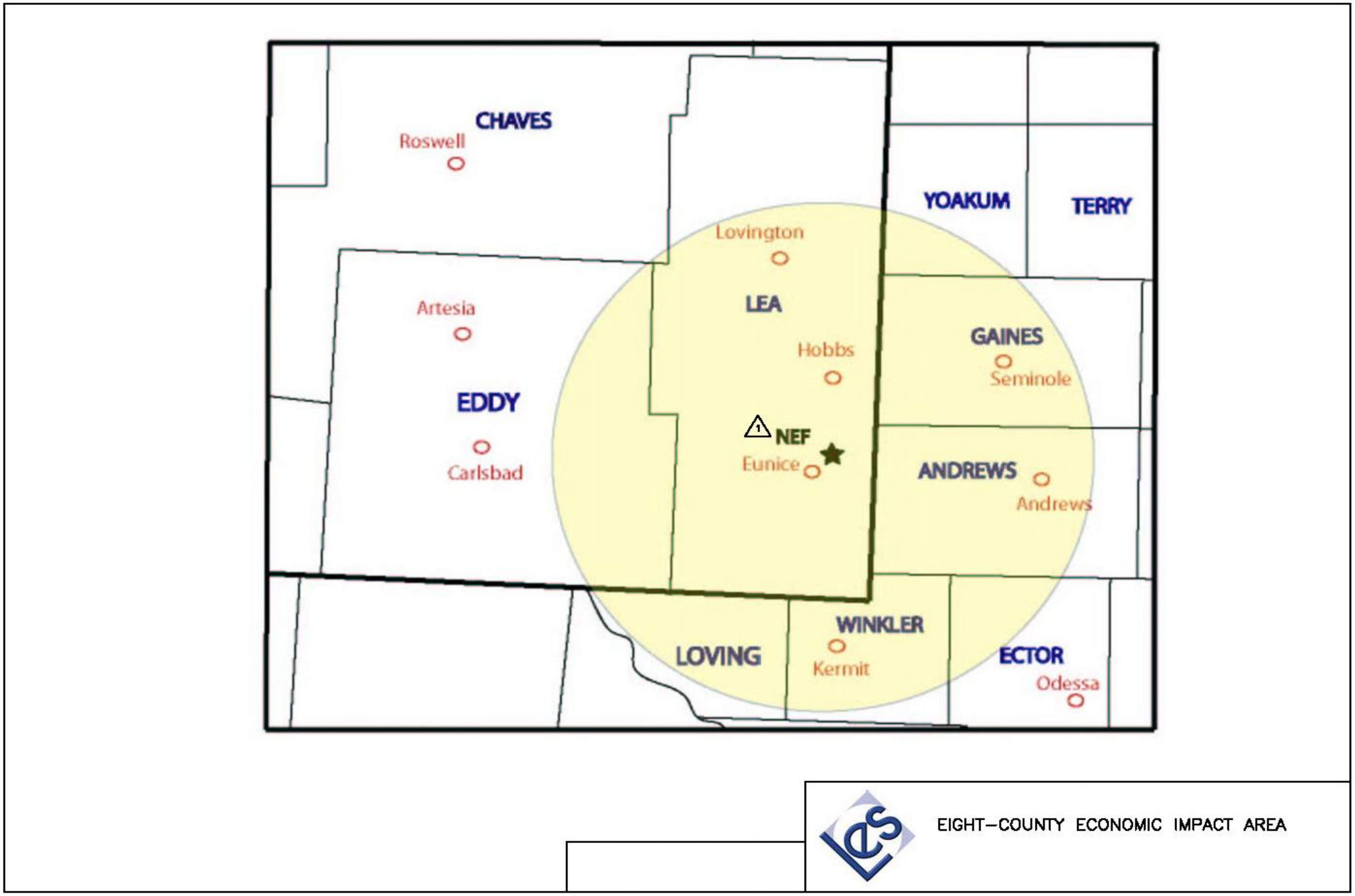


Figure 7.1-1 Eight-County Economic Impact Area

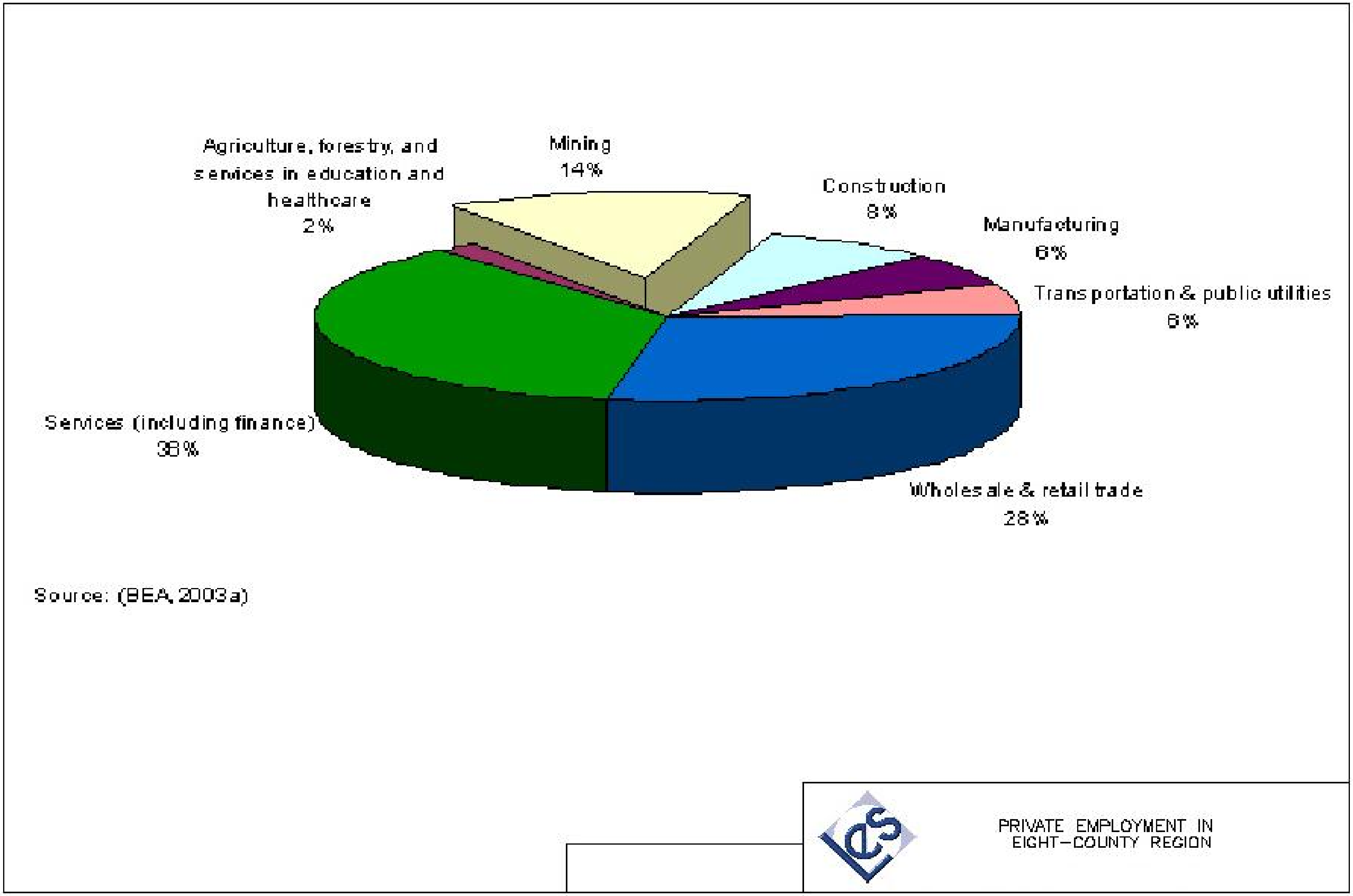


Figure 7.1-2Private Employment in Eight-County Region

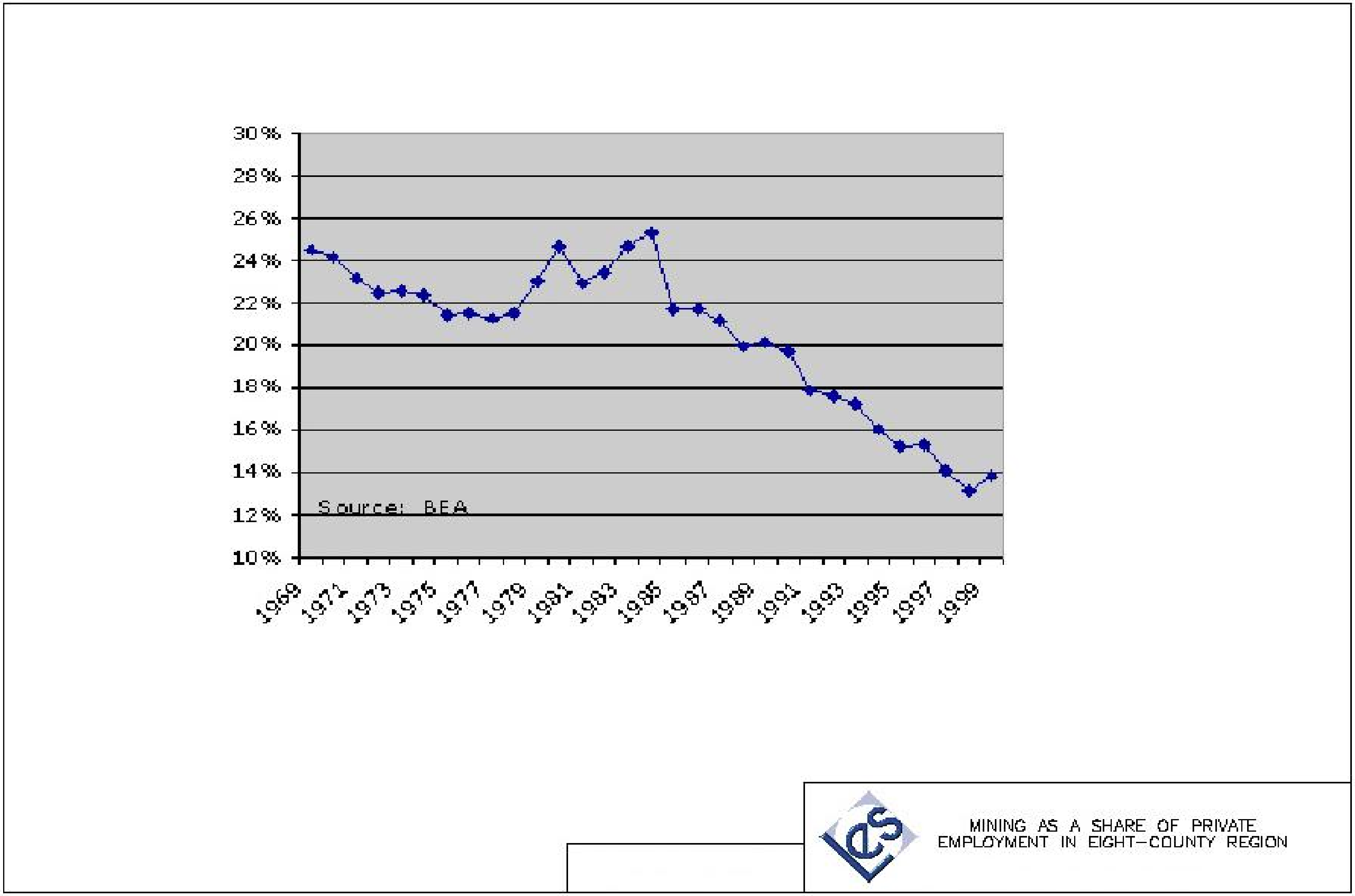


Figure 7.1-3Mining as a Share of Private Employment in Eight-County Region

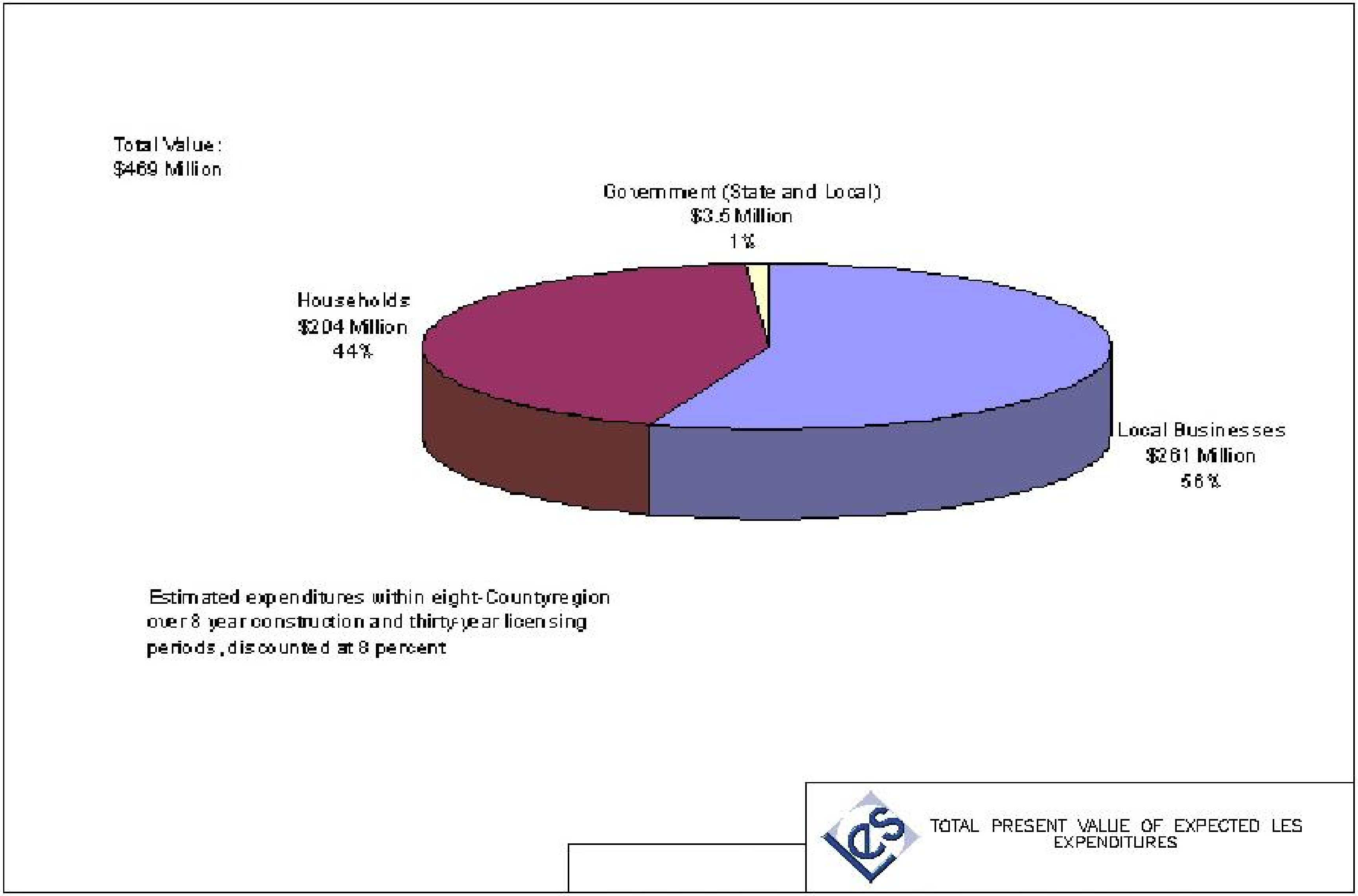


Figure 7.1-4Total Present Value of Expected LES Expenditures

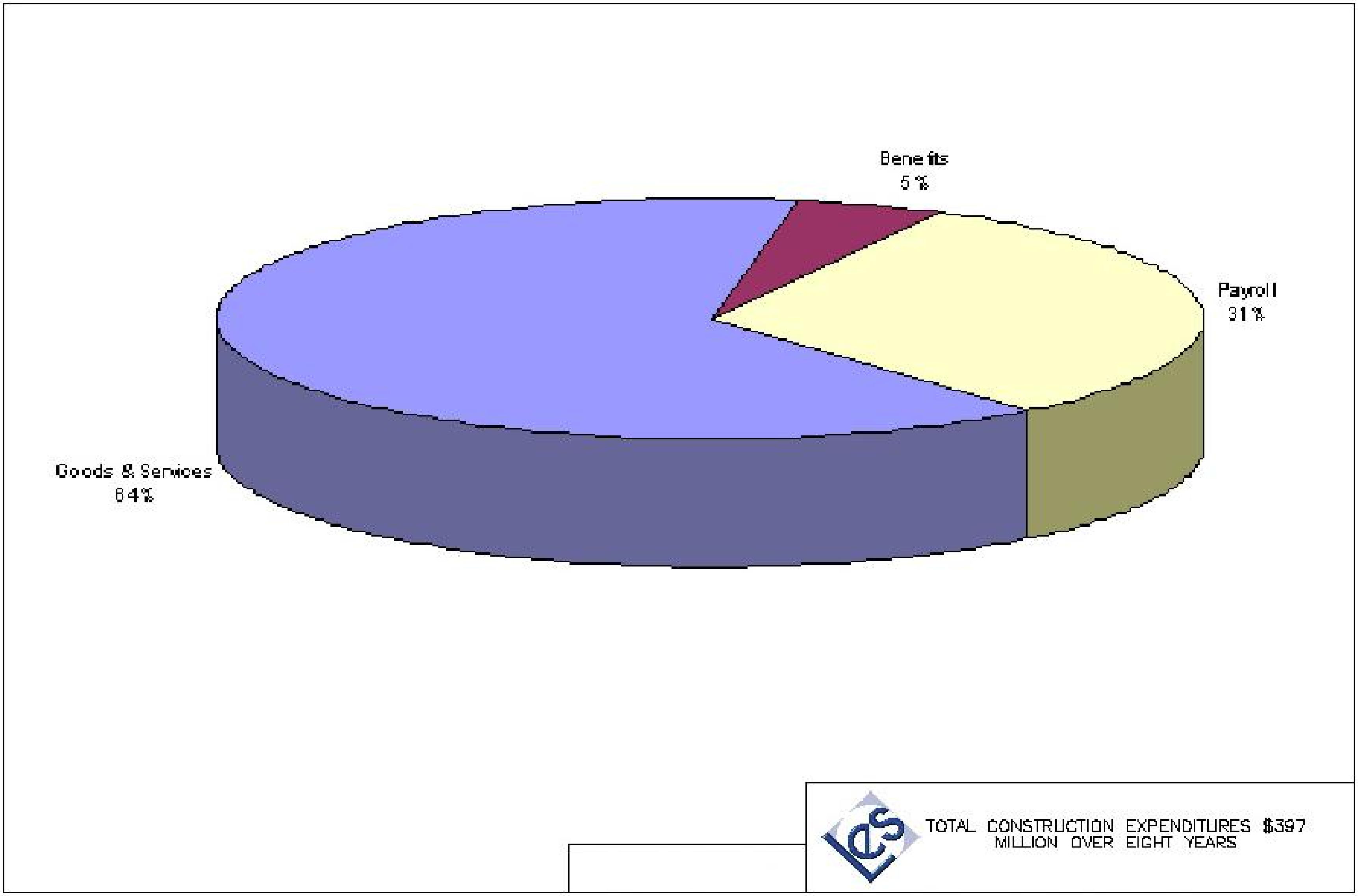


Figure 7.1-5Total Construction Expenditures: $397 Million Over Eight Years

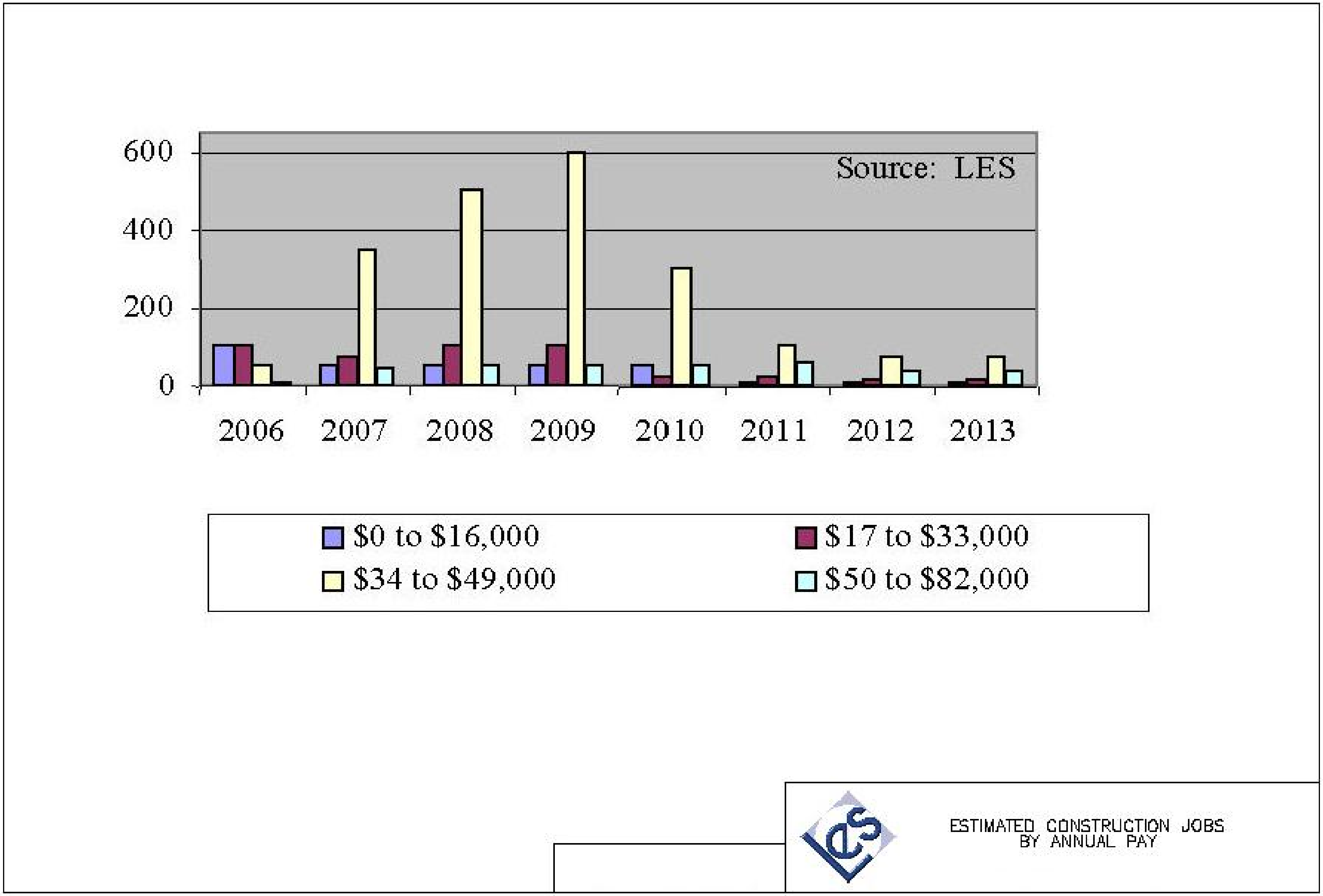


Figure 7.1-6Estimated Construction Jobs by Annual Pay

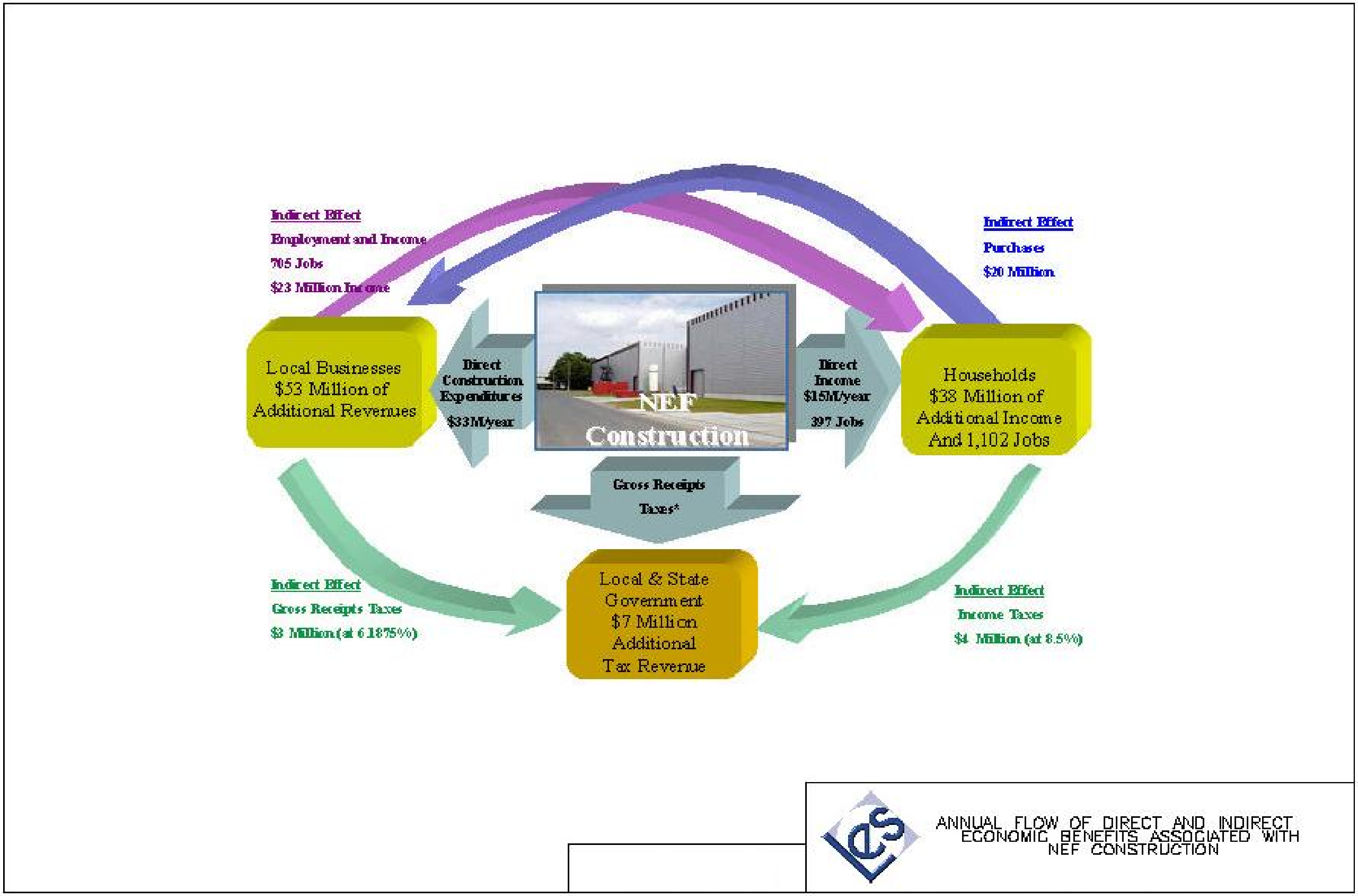


Figure 7.1-7Annual Flow of Direct and Indirect Economic Benefits Associated with NEF Construction

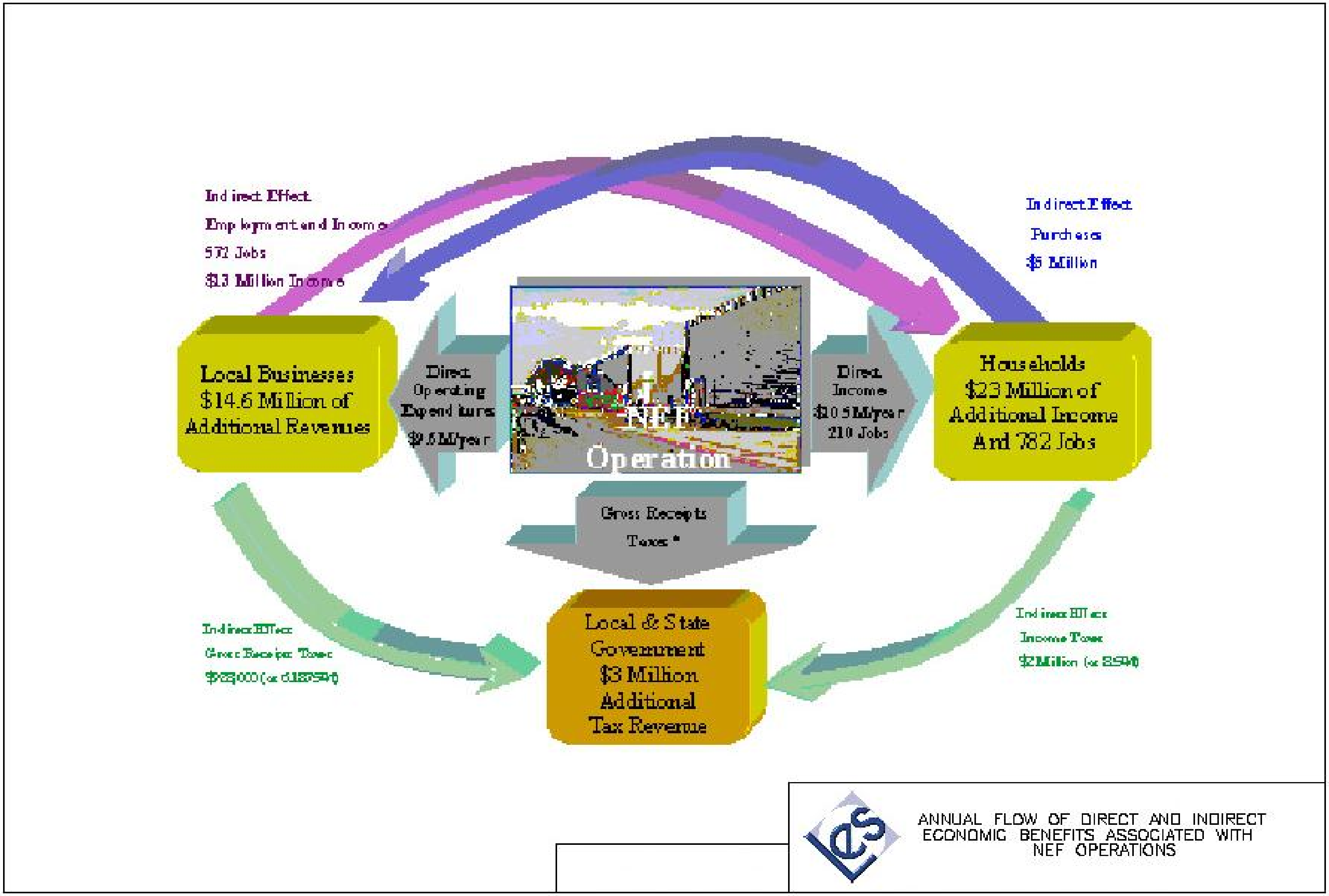


Figure 7.1-8Annual Flow of Direct and Indirect Economic Benefits Associated with NEF Operations

7.2 ENVIRONMENTAL COST- BENEFIT, PLANT CONSTRUCTION AND OPERATION

This section describes qualitatively the environmental costs and benefits of the proposed NEF in Lea County, New Mexico. It identifies the impacts of the plant construction and operation on the site and adjacent environment. Table 7.2-1, Qualitative Environmental Costs/Benefits of NEF During Construction and Operation, summarizes the results.

7.2.1 Site Preparation and Plant Construction

7.2.1.1 Existing Site

There will be minimal disturbance to the existing site features at the project site associated with construction activities. Potentially, 220 ha (543-acres) could be subjected to clearing and earthmoving activities. Site property outside the primary plant area will generally be left in its preconstruction condition or improved through stabilization as needed.

7.2.1.2 Land Conservation and Erosion Control Measures

Louisiana Energy Services (LES) anticipates there will be some short-term increases in soil erosion at the site due to construction activities. Erosion impacts due to site clearing, excavation, if required, and grading will be mitigated by utilization of proper construction and erosion best management practices (BMPs). These practices include minimizing the construction footprint to the extent possible, mitigating discharge including stormwater runoff (i.e., the use of detention and retention ponds), the protection of all unused naturalized areas, and site stabilization practices to reduce the potential for erosion. Only about one-quarter of the site will be involved in construction activities at any one time. Cleared areas will be seeded as soon as practicable and watering will be used to control fugitive dust. Water conservation will be considered when deciding how often dust suppression sprays will be applied.

7.2.1.3 Aesthetic Changes

Visual and noise impacts due to site preparation and plant construction activities are anticipated to be minimal, due to the remote location of the site and the buffer zone along the outer perimeter of the property boundary. Some elevated and intermittent noise levels during construction may be discernable offsite but should not constitute an annoyance to nearby residences since the nearest resident is 4.3 km (2.63 mi) away. The visual intrusion of the NEF upon an otherwise relatively denuded landscape that constitutes the plant site property should not be objectionable given the vegetative buffer around the site and its remote location.

7.2.1.4 Ecological Resources

Pre-construction and construction activities at the site are not expected to have any significant adverse impact on vegetation and wildlife. LES anticipates that construction activities within the existing clear-cut area will remove some shrub vegetation and cause some small animal life to relocate on the site. No proposed activities will impact communities or habitats defined as rare or unique, or that support threatened and endangered species, since no such communities or habitats have been identified anywhere within the site.

7.2.1.5 Access Roads and Local Traffic

All traffic into and out of the site will be along New Mexico Highway 234 because Highway 234 is dedicated to heavy-duty use and built to industrial standards, it would be able to handle increased heavy-duty traffic adequately. Additionally, due to the already substantial truck traffic using these roads to access Andrews County, Texas there would be little additional effect on other road users.

7.2.1.6 Water Resources

Water quality impacts will be controlled during construction by compliance with the State of New Mexico's water quality regulations and the use of BMPs as detailed in the site Stormwater Pollution Prevention Plan (SWPPP). NEF is exempt from the SPCC plan, however, BMPs will be implemented to minimize the possibility of spills of hazardous substances, minimize the environmental impact of any spills. Site procedures will be in place to ensure prompt and appropriate remediation, as warranted. Site procedures will also identify individuals and their responsibilities for implementation of the corrective actions and provide for prompt notifications of state and local authorities as needed.

7.2.1.7 Noise and Dust Control Measures

Objectionable construction noises are to be reduced to acceptable levels by use of noise control equipment on all powered equipment. Shrub and vegetation buffer areas, which will be left around the plant property, will combine to reduce noise. Since substantial truck traffic already exists along New Mexico State Highway 234, the temporarily increased noise levels along Highway 234 due to construction activities are not expected to adversely affect nearby residents.

Traffic areas during construction will be watered as necessary to prevent dust. Water conservation will be considered when deciding how often dust suppression sprays will be applied. All potential air pollution and dust emission conditions will be monitored to assure compliance with applicable health, safety, and environmental regulations.

7.2.1.8 Socioeconomic

Construction of the NEF is expected to have positive socioeconomic impacts on the region. The Regional Input-Output Modeling System (RIMS II) allows estimation of various indirect impacts associated with each of the expenditures associated with the NEF. According to the RIMS II analysis, the region's residents can anticipate an annual impact of $53 million in increased economic activity for local businesses, $38 million in increased earnings by households, and an annual average of 1,102 new jobs during the 8-year construction period. The temporary influx of labor is not expected to overload local services and facilities within the Hobbs-Eunice, New Mexico area.

7.2.1.8.1 Yearly Purchases of Steel, Concrete and Related Construction Materials

The initial construction period for NEF is approximately three years. This period will encompass site preparation and construction of most site structures. Due to the phased installation of centrifuge equipment, production will commence prior to completion of the initial three-year construction period. The manpower and materials used during this phase of the project will vary depending on the construction plan. Table 7.2-2, Estimated Construction Material Yearly Purchases, provides the estimated total quantities of purchased construction materials and Table 7.2-3, Estimated Yearly Labor Costs for Construction, provides the estimated labor that will be required to install these materials. The scheduling of materials and labor expenditures is subject to the provisions of the project construction execution plan, which has not yet been developed.

Approximately 60 to 80% of the construction materials will be purchased from the local NEF site area. According to the labor survey conducted as part of the conceptual estimate, the major portion of the required craft labor forces will come from the five or six counties around the project area, including the nearby Texas counties.

7.2.2 Plant Operation

7.2.2.1 Surface and Groundwater Quality

Liquid effluents at the NEF will include stormwater runoff, sanitary and industrial wastewater, and treated radiologically contaminated wastewater. Radiologically contaminated process water will be treated to 10 CFR 20, Appendix B limits (CFR, 2003q) and discharged to the Treated Effluent Evaporative Basin, which is a double-lined treated effluent evaporative basin with leak detection. Site stormwater runoff from the Uranium Byproduct Cylinder (UBC) Storage Pad is routed to the UBC Storage Pad Stormwater Retention Basin. The general site runoff is routed to the Site Stormwater Detention Basin. Stormwater discharges will be regulated by the National Pollutant Discharge Elimination System (NPDES) during operation. Approximately 174,100 m^3 (46 million gal) of stormwater from the plant site is expected to be released annually to the two stormwater basins.

7.2.2.2 Terrestrial and Aquatic Environments

No communities or habitats defined as rare or unique or that support threatened and endangered species, have been identified anywhere on the NEF site. Thus, no operation activities are expected to impact such communities or habitats.

7.2.2.3 Air Quality

No adverse air quality impacts to the environment, either on or offsite, are anticipated to occur. Air emissions from the facility during normal facility operations will be limited to the plant ventilation air and gaseous effluent systems. All plant process/gaseous air effluents are to be filtered and monitored on a continuous basis for chemical and radiological contaminants, which could be derived from the UF_6 process system. Two standby diesel generators and a security diesel generator supply standby electrical power. These generators operate only in the event of power interruptions and for routine testing and will have negligible health and environmental impacts.

7.2.2.4 Visual/Scenic

No impairments to local visual or scenic values will result due to the operation of the NEF. The facility and associated structures will be relatively compact, located in a rural location. No offensive noises or odors will be produced as a result of plant operations.

7.2.2.5 Socioeconomic

The Regional Input-Output Modeling System (RIMS) II allows estimation of various indirect impacts associated with each of the expenditures associated with the NEF. Over the anticipated thirty-year license period of the NEF, residents can anticipate an annual total of $15 million in increased economic activity, $23 million in increased earnings by households and an annual average of 782 jobs directly or indirectly relating to the NEF.

In general, no significant impacts are expected to occur for any local area infrastructure (e.g., schools, housing, water, and sewer). Costs of operation should be diffused sufficiently throughout the Hobbs-Eunice, New Mexico area to be indistinguishable from normal economic growth.

7.2.2.6 Radiological Impacts

Potential radiological impacts from operation of the NEF would result from controlled releases of small quantities of UF_6 during normal operations and releases of UF_6 under hypothetical accident conditions. Normal operational release rates to the atmosphere and to the onsite Treated Effluent Evaporative Basin are expected to be less than 8.9 MBq/yr (240 µCi/yr) and 2.1 MBq/yr (56µCi/yr), respectively.

The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from gaseous effluent to an adult located at the plant site south boundary are 1.7×10^{-4} mSv (1.7×10^{-2} mrem) and 1.4×10^{-3} mSv (1.4×10^{-1} mrem), respectively. The maximum effective dose equivalent and maximum annual organ (lung) dose equivalent from discharged gaseous effluent to the nearest resident (teenager) located 4.3 km (2.63 mi) in the west sector are expected to be less than 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.2×10^{-4} mSv (1.2×10^{-2} mrem), respectively.

The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from liquid effluent to an adult at the south site boundary are 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.5×10^{-4} mSv (1.5×10^{-2} mrem), respectively. The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from liquid effluent to an individual (teenager) at the nearest residence are 1.7×10^{-6} mSv (1.7×10^{-4} mrem) and 1.3×10^{-5} mSv (1.3×10^{-3} mrem), respectively.

The maximum annual dose equivalent due to external radiation from the UBC Storage Pad and all other feed, product and byproduct cylinders on the NEF property (skyshine and direct) is estimated to be less than 2.0×10^{-1} mSv (20 mrem) to the maximally exposed person at the nearest point on the site boundary (2,000 hrs/yr) and 8×10^{-12} mSv/yr (8×10^{-10} mrem/yr) to the maximally exposed resident (8,760 hrs/yr) located at 4.3 km (2.63 mi) west of the NEF. Given the conservative assumptions used in estimating these values, these concentrations and resulting dose equivalents are insignificant and their potential impacts on the environment and health are inconsequential.

These dose equivalents due to normal operations are small fractions of the normal background radiation range of 2.0 to 3.0 mSv (200 to 300 mrem) dose equivalent that an average individual receives in the US, and within regulatory limits. .

7.2.2.7 Other Impacts of Plant Operation

NEF water will be obtained from the Eunice, New Mexico municipal water system, and routine liquid effluent will be treated and discharged to evaporative pond(s), whereas sanitary wastes will be sent to the City of Eunice Wastewater Treatment Plant via a system of lift stations and 8 inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the the sanitary waste system. Facility water requirements are relatively low and well within the capacity of the Eunice water utility. The current capacity for the Eunice Potable water supply system is 16,350 m^3/day (4.3 million gpd), and current usage is 5,600 m^3/day (1.48 million gal/d). Requirements for operation of the NEF are expected to be 240 m^3/day (63,423 gal/d), a volume well within the capacity of the supply system. Non-hazardous and non-radioactive solid waste is expected to be approximately 172,500 kg (380,400 lbs) annually. It will be shipped offsite to a licensed landfill. The local Lea County landfill capacity is more than adequate to accept the non-hazardous waste.

7.2.2.8 Decommissioning

The plan for decommissioning is to decontaminate or remove all materials promptly from the site that prevent release of the facility for unrestricted use. This approach avoids the need for long-term storage and monitoring of wastes on site. Only building shells and the site infrastructure will remain. All remaining facilities, including site basins, will be decontaminated where needed to acceptable levels for unrestricted use. Excavations and berms will be leveled to restore the land to a natural contour.

Depleted UF_6 , if not already sold or otherwise disposed of prior to decommissioning, will be disposed of in accordance with regulatory requirements. Radioactive wastes will be disposed of in licensed low-level radioactive waste disposal sites. Hazardous wastes will be treated or disposed of in licensed hazardous waste facilities. Neither conversion (if done), nor disposal of radioactive or hazardous material will occur at the plant site, but at licensed facilities located elsewhere.

Following decommissioning, all parts of the plant and site will be unrestricted to any specific type of use.

7.2.3 Section 7.2 Tables

Table 7.2-1 Qualitative Environmental Costs/Benefits of NEF During Construction And Operation

Qualitative Costs	Determination/Evaluation
Change in real estate values in areas/communities adjacent to the facility (e.g., land, homes, rental property etc.)	Potentially inflationary
Traffic changes along local streets and highways	Some increases during shift changes
Demand on local services, public utilities, schools, etc.	Some increased utilization expected, but within services capacity
Impact to natural environmental components (e.g., ecology, water quality, air quality, etc.)	Minimal impacts
Alteration of aesthetic, scenic, historic, or archaeological areas or values	No measurable impact
Change in local recreational potential	Not significant
Qualitative Benefits	
Site soil stabilization and erosion reduction	Beneficial
Incentive for development of other ancillary/support business development resulting from presence of LES facility	Beneficial
Change in real estate values in areas/communities adjacent to the facility (e.g., land, homes, rental property etc.)	Potentially beneficial
Increase in local employment opportunities	Beneficial
Impacts to local retail trade and services	Beneficial
Development of local workforce capabilities	Beneficial

Table 7.2-2 Estimated Construction Material Yearly Purchases

Commodity	Quantity	Total Value (Material Cost)	Yearly Purchases
Concrete/Forms/Rebar	59,196 m^3 (77,425 yd^3)	$9,441,000	$9,441,000
Pre-Cast Concrete	120,774 m^2 (1,300,000 ft^2)	$25,232,000	$8,410,667
Structural Steel	1,865 t (2,056 tons)	$5,524,000	$5,524,000
Architectural Items	1 Lot	$26,995,000 Finishes, etc.	$26,995,000
HVAC Systems	109 Each	$27,098,000 Systems Mat'ls.	$27,098,000
Utility Piping	55,656 m (182,597 linear ft)	$20,777,000	$20,777,000
Electrical Conduit & Wire	361,898 m (1,187,328 linear ft)	$14,174,000	$7,087,000

Table 7.2-3 Estimated Yearly Labor Costs for Construction

Type of Work	Number Of Craft-Hours	Approx. No. People	Total Value	Yearly Purchases
Civil & Site Work	163,000	65 people for 1 year	$5,264,900	$5,264,900
Concrete Work	541,000	70 people for 3 years	$17,420,200	$5,806,733
Structural Steel	54,000	25 people for 1 year	$1,852,200	$1,852,200
Pre-cast Concrete	166,000	66 people for 1 year	$5,345,200	$5,345,200
Architectural Finishes	284,000	150 people for 1 year	$9,088,000	$9,088,000
Utility Equipment	23,000	15 people for 1 year	$969,450	$969,450
HVAC Sys. & Ductwork	186,000	40 people for 1 year	$6,175,200	$6,175,200
Electrical Conduit & Wire	280,000	70 people for 2 years	$10,556,000	$5,278,000

7.3 NO-ACTION ALTERNATIVE COST-BENEFIT

The no-action alternative would be to not build the proposed NEF. Under the no-action alternative, the NRC would deny the license application for the plant, in which case the proposed site is assumed to continue its current use and the potential impacts of constructing and operating the proposed NEF would not occur. Although the no-action alternative would avoid impacts to the NEF area, it could lead to impacts at other locations.

Under the no-action alternative, for example, reactor licensees would still need uranium enrichment services. LES estimates that the proposed NEF production (3 million SWU/Yr) represents about 25% of the estimated U.S. requirement for enrichment services in the year 2002. During the period 2003 through 2010, these US requirements are forecast to average 11.1 million SWU and during the 10-year period 2011 through 2020 they are forecast to average between 10.1 and 10.2 million SWU. Indigenous supply from the single, aging, high cost, and electric power intensive Paducah GDP, which is operated by USEC, could theoretically supply up to 6.5 million SWU of these requirements (55%). However, USEC has obligated much of the ongoing production from the Paducah GDP to meet the contractual requirements of some of its Far East customers. As a result, a significant amount of USEC's obligations to US customers are being met with a foreign source (Russian HEU-derived SWU) that USEC purchases under its contract as executive agent for the US government

Many US operators of nuclear power plants in the US, who are also the end users of uranium enrichment services in the US, view the present supply situation with concern. They see a world supply and requirements situation for economical uranium enrichment services that is presently in balance, exhibiting a potential for significant shortfall if plans that have been announced by two of the primary enrichers are not executed.

These US purchasers find that as a result of recent trade actions and substantial duties imposed on Eurodif, that one source of competitive enrichment services for US consumption has been significantly reduced for the foreseeable future. They view themselves as being largely dependent on a single enricher, USEC, whose only operating enrichment plant is the Paducah GDP. These purchasers are concerned that the primary source of enrichment services that USEC delivers for use in their nuclear power plants is obtained from Russia and could be vulnerable to either internal or international political unrest in the future. Also, they are concerned that neither the performance nor economics of the updated version of the DOE centrifuge technology that USEC is planning to use have been successfully demonstrated.

Not building the NEF, therefore, could have the following consequences:

- The inability to meet important considerations of energy and national security policy, namely the need for the development of additional, secure, reliable, and economical domestic enrichment capacity.
- Continued reliance on the high-cost, power-intensive, and inefficient technology now in use at the aging Paducah gaseous diffusion plant, or, alternatively, reliance on the proposed USEC gas centrifuge technology that, at present, is still under development and has yet to be deployed on a commercial scale.
- Continued extensive reliance on uranium enriched in foreign countries.
- The inability to ensure both security of supply and diverse domestic suppliers for U.S. purchasers of enrichment services.

- A possible uranium enrichment supply deficit with respect to the uranium enrichment requirements forecasts set forth in ER Section 1.1.2, Market Analysis of Enriched Uranium Supply and Requirements.

ER Section 2.4, Comparison of the Predictive Environmental Impacts, describes the environmental impacts of the no-action alternatives and compares them to the proposed action. Table 2.4-1, Comparison of Potential Impacts for the Proposed Action and the No-Action Alternatives and 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternatives, summarize that comparison in tabular form for the 13 environmental categories, described in detail in ER Chapter 4, Environmental Impacts. In sum, LES anticipates the affects to the environment of all no-action alternatives to be at least equal to or greater than the proposed action in the near term. There are potentially lesser impacts in the long term, but this is based on USEC's unproven commercially demonstrated technology or the availability of the speculative DOE HEU-derived supply source. In addition, under the no-action alternative, attainment of both important national policy and commercial objectives would be, at best, delayed.

The following types of impacts would be avoided in the Lea County area by the no-action alternative (see Table 2.1-1, Chemicals and Their Properties and Table 7.2-1, Qualitative Environmental Costs/Benefits of NEF During Construction and Operation). During construction, the potential, short-term impacts of soil erosion and fugitive emissions from dust and construction equipment; disruption to ecological habitats; noise from equipment; and traffic from worker transportation and supply deliveries. These impacts, as discussed in Chapter 4, are temporary and limited in scope due to construction BMPs. During operation, the no-action alternative would avoid increased traffic due to feed/product deliveries and shipments and worker transportation; increased demand on utility and waste services; and public and occupational exposure from effluent releases. These impacts, however, will be minimal because the area already has traffic from a nearby city and general trucking commerce; there is sufficient capacity of utility and waste services in the region; and effluent releases will be strictly controlled, maintained onsite, monitored, and maintained below regulatory limits.

While the no-action alternative would have no impact on the socioeconomic structure of the Lea County area, the proposed action would have moderate to significant beneficial effects (see Tables 7.1-1 through 7.1-5). The results of the economic analysis show that the greatest fiscal impacts (i.e., 63% of total present value impacts) will derive from the 8-year construction period associated with the proposed facility. The largest impact on local business revenues stems from local construction expenditures, while the most significant impact on household earnings and jobs is associated with construction payroll and employment projected during the 8-year construction period. Operation of the facility will also have a net positive impact on the eight-county area and will help diversify the regional economy and provide some additional insulation from the volatility of the oil and gas dependent economy of the region.

LES estimates that construction payroll will total $122.2 million with an additional $21 million expended for employment benefits over the 8-year construction period. Construction services purchased from third party firms within the region will add $265 million in direct benefits to the local economy during the NEF's construction.

LES anticipates annual payroll to be $10.5 million with an additional $3.2 million expenditure in employee benefits once the plant is operational. Approximately $9.6 million will be spent annually on local goods and services required for operation of the NEF.

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

The Regional Input-Output Modeling System (RIMS) II allows estimation of various indirect impacts associated with each of the expenditures associated with the operation of NEF. According to the RIMS II analysis, the region's residents can anticipate an annual total of $53 million in increased economic activity, $38 million in increased earnings by households, and an annual average of 1,102 new jobs during the eight-year construction period. Over the anticipated 30-year license period of the NEF, residents can anticipate an annual total of $15 million in increased economic activity, $23 million in increased earnings by households and an annual average of 782 new jobs directly or indirectly relating to the NEF. In general, no significant impacts are expected to occur for any local infrastructure areas (e.g., schools, housing, water, and emergency responders). Costs of operation should be diffused sufficiently to be indistinguishable from normal economic growth. Based on the above information, cost-benefit analyses in Section 7.1, Economic Cost-Benefits, Plant Construction and Operation and Section 7.2, Environmental Cost-Benefit, Plant Construction and Operation, and the minimal impacts to the affected environment demonstrated in Chapter 4, LES has concluded that the preferred alternative is the proposed action, construction and operation of the NEF.

8.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

8.1 INTRODUCTION

This Environmental Report (ER) was prepared by Louisiana Energy Services (LES) to assess the potential environmental impacts of licensing the construction and operation of a uranium enrichment facility to be located in Lea County, near the city of Eunice, New Mexico (the proposed action). The proposed facility will use the centrifuge enrichment process, which is an energy-efficient, proven advanced technology. The National Enrichment Facility (NEF) will be owned and operated by LES, as described in Safety Analysis Report (SAR) Chapter 1, General Information, which is a Delaware limited liability company. LES prepared this ER in accordance with 10 CFR 51 (CFR, 2003a), which implements the requirements of the National Environmental Policy Act of 1969 (NEPA), as amended (USC, 2003a). This ER also reflects the applicable elements of the Nuclear Regulatory Commission (NRC) guidance, including format, in NUREG-1748, “Environmental Review Guidelines for Licensing Actions Associated with NMSS Programs,”. This ER analyzes the potential environmental impacts of the proposed action and eventual Decontamination and Decommissioning (D&D) of the facility, and discusses the effluent and environmental monitoring programs proposed to assess the potential environmental impacts of facility construction and operation. The ER also considers a no-action alternative.

8.2 PROPOSED ACTION

The proposed action is to license the construction and operation of the NEF uranium enrichment facility in Lea County, near the city of Eunice, New Mexico. The NEF will use the gas centrifuge enrichment process to separate natural uranium hexafluoride UF_6 feed material containing 0.711 $^{w}/_{o}$ ^{235}U into a product stream enriched up to the LES license limit in isotope ^{235}U and a depleted stream containing approximately 0.10 to 0.5 $^{w}/_{o}$ ^{235}U. Production capacity at design throughput is up to 3.0 million separative work units (SWU) per year. Facility construction is expected to require eight years. Construction would be conducted in six phases. Operation would commence after the completion of the first cascade in the first phase. The facility is licensed for 30 years. Decontamination and Decommissioning (D&D) is projected to take approximately nine years. LES estimates the cost of the plant to be approximately $1.2 billion (in 2002 dollars) excluding escalation, contingency, interest, tails disposition, decommissioning, and any replacement equipment required during the operational life of the facility.

8.3 NEED FOR THE PROPOSED ACTION

The proposed action will serve the clear and well-substantiated need for additional reliable and economical uranium enrichment capacity in the United States. This underlying need for the proposed NEF stems directly from important US energy and national security concerns and the continuing demand for reliable and economical uranium enrichment services. As the Department of Energy (DOE) has noted (DOE, 2002a), these energy and national security concerns "…are due, in large part, to the lack of available replacement for the inefficient and non-competitive gaseous diffusion enrichment plants. These concerns highlight the importance of identifying and deploying an economically competitive replacement domestic enrichment capacity in the near term." By providing this needed additional domestic enrichment capacity, the NEF would also serve important commercial objectives related to the security of supply of enriched uranium in the US. At present, the enrichment services needs of US utilities are susceptible to "a supply disruption from either the Paducah plant production or the highly-enriched uranium (HEU) Agreement deliveries."

8.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the NRC would not approve the license application to construct and operate the proposed National Enrichment Facility (NEF). As a result, the additional domestic source and supply of enrichment services that would result from the issuance of the license to LES would not become available to utility customers. These potential LES utility customers would be required to fill their enrichment needs through existing suppliers, with USEC's Paducah plant being the only domestic facility available to serve this purpose. Thus, under the no-action alternative, a decision not to approve the license application would result in only one domestic source of enrichment services, a source that employs a high-cost, inefficient technology – a situation that the DOE has indicated could lead to "serious domestic energy consequences." (DOE, 2002a). ER Section 2.4, Comparison of the Predicted Environmental Impacts, describes the environmental impacts of the no-action alternative scenarios and compares them to the proposed action. Table 2.4-1, Comparison of Potential Impacts for the Proposed Action and the No-Action Alternative Scenarios and Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios, which summarizes that comparison in tabular form for thirteen environmental categories, are described in detail in Chapter 4, Environmental Impacts. In summary, LES anticipates that the effects to the environment of all no-action alternative scenarios to be greater than the proposed action in both the short and long term. There are potentially lesser impacts in some environmental categories, but this is based on an unproven commercially demonstrated technology. In addition, the important objective of security of supply is delayed.

The following types of impacts would be avoided in Lea County, New Mexico and the surrounding area by the no-action alternative (see ER Table 2.4-2). During construction, the potential, short-term impacts are soil erosion and fugitive emissions from dust and construction equipment; minor disruption to ecological habitats and cultural resources, noise from equipment; and traffic from worker transportation and supply deliveries. These impacts, as discussed in Chapter 4, are temporary and limited in scope due to construction best management practices (BMPs). During operation, the no-action alternative would avoid increased traffic due to feed/product deliveries and shipments, and worker transportation; increased demand on utility and waste services; and public and occupational exposure from effluent releases. These impacts, however, will be minimal because the local roadway (New Mexico Highway 234) already has significant traffic of similar nature; there is sufficient capacity of utility and waste services in the region; and effluent releases will be strictly controlled, monitored, and maintained below regulatory limits (CFR, 2003q; CFR, 2003w; CFR, 2003o; NMAC 20.2.78).

While the no-action alternative would have no impact on the socioeconomic structure of the Lea County, New Mexico area, the proposed action would have moderate to significant beneficial effects (see Table 7.1-2, Annual Impact of Construction Payroll, Table 7.1-3, Total Impact of Local Spending for Construction Goods and Services, Table 7.1-4, Annual Impact of Operations Payroll, and Table 7.1-5, Annual Impact of NEF Purchases). The results of the economic analysis show that the greatest fiscal impacts (i.e., 63% of total present value impacts) will derive from the eight-year construction period associated with the proposed facility. The largest impact on local business revenues stems from local construction expenditures, while the most significant impact on household earnings and jobs is associated with construction payroll and employment projected during the eight-year construction period. Operation of the facility will also have a net positive impact on the eight-county area and will help diversify the regional economy and provide some additional insulation from the volatility of the oil and gas dependent economy of the region.

LES has estimated the economic impacts to the local economy during the 8-year construction period and 30-year license period of the NEF. This includes a five and one-half year period when both construction and operation and ongoing simultaneously. The analysis traces the economic impact of the proposed NEF, identifying the direct impacts of the plant on revenues of local businesses, on incomes accruing to households, on employment, and on the revenues of state and local government. The analysis also explores the indirect impacts of the NEF within a 80-km (50-mi) radius of the NEF. Details of the analysis are provided in ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, and are summarized below.

LES estimates that construction payroll will total $122.2 million with an additional $21 million expended for employment benefits over the eight-year construction period. Construction services purchased from third party firms within the region will add $265 million in direct benefits to the local economy during the NEF’s construction.

LES anticipates annual payroll to be $10.5 million with additional $3.2 million expenditure in employee benefits once the plant is operational. Approximately $9.5 million will be spent annually on local goods and services required for operation of the NEF.

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

Based on the cost-benefit analyses in ER Sections 7.1 and 7.2, and the minimal impacts to the affected environment demonstrated in Chapter 4, LES has concluded that the preferred alternative is the proposed action, construction and operation of the NEF.

8.5 ENVIRONMENTAL IMPACTS OF CONSTRUCTION

The construction of the NEF involves the potential clearing of the previously undisturbed 220-ha (543-acre) site. Most of the core buildings area will be graded and will form the Controlled Area that includes all support buildings and the 8.5-ha (21-acre) uranium byproduct cylinder (UBC) Storage Pad. Numerous environmental protection measures will be taken to mitigate potential construction impacts. The measures will include controls for noise, oil and hazardous material spills, and dust. Potential impacts associated with the construction phase of the NEF are primarily limited to increased dust (degraded air quality) and noise from vehicular traffic, and potential soil erosion during excavations. It is unlikely that NEF construction activities will impact water resources since the site does not have any surface water and only limited groundwater. Groundwater resources will not be used during construction or at any time during the operational life of the plant.

During the construction phase of the NEF, standard clearing methods (i.e., the use of heavy equipment) in combination with excavation will be used. Potentially, the total site area will be disturbed, affording the biota of the site an opportunity to move to undisturbed areas of suitable habitat bordering the NEF site. Trenching associated with plant construction and relocation of the existing CO2 line will be in accordance with all applicable regulations so as to minimize any direct or indirect impacts on the environment.

The anticipated effects on the soil during construction activities are limited to a potential short-term increase in soil erosion. However, this will be mitigated by proper construction best management practices (BMPs). These practices include minimizing the construction footprint to the extent possible, avoiding all direct discharges by the use of detention ponds, the protection of all unused naturalized areas, and site stabilization practices to reduce the potential for erosion and sedimentation. Other temporary stormwater detention basins will be constructed and used as sedimentation collection basins during construction and stabilized afterwards. After construction is complete, the site will be stabilized with natural, low-water consumption landscaping, pavement, and crushed stone to control erosion.

Water quality impacts will be controlled during construction by compliance with the requirements of a National Pollutant Discharge Elimination System (NPDES) Construction General Permit and BMPs detailed in the site Stormwater Pollution Prevention Plan (SWPPP). In addition, BMPs will be implemented to minimize the possibility of spills of hazardous substances, minimize environmental impact of any spills. Site procedures will ensure prompt and appropriate notification and will initiate remediation, if warranted. The procedures will also identify individuals and their responsibilities for implementation of corrective action, if warranted, and provide for prompt notifications of state and local authorities.

The construction phase impacts on air quality, land use, transportation, and socioeconomics are localized, temporary, and small. The temporary influx of labor is not expected to overload community services and facilities.

Dust will be generated to some degree during the various stages of construction activity. The amount of dust emissions will vary according to the types of activity. The first 5 months of earthwork will likely be the period of highest emissions with the greatest number of construction vehicles operating on an unprepared surface. However, no more than approximately 18 ha (45 acres), will be involved in this type of work at any one time. Airborne dust will be controlled through the use of BMPs such as surface water sprays (when required), by ensuring trucks' loads and soil piles are covered, and by promptly removing construction wastes from the site. The application of water sprays for dust suppression will be applied only when required so that water resources can be conserved to the maximum extent possible.

Construction of the NEF is expected to have generally positive socioeconomic impacts on the region. No radioactive releases (other than natural radioactive materials, for example, in soil) will result from site development and facility construction activities.

8.6 ENVIRONMENTAL IMPACTS OF OPERATIONS

Operation of the National Enrichment Facility (NEF) would result in the production of gaseous effluent, liquid effluent, and solid waste streams. Each stream could contain small amounts of hazardous and radioactive compounds, either alone or in a mixed form. Based on the experience gained from operation of the Urenco European plants, the aggregate routine airborne uranium gaseous releases to the atmosphere are estimated to be less than 10 g (0.35 ounces) annually. However, based on recent environmental monitoring at the Urenco plants, the annual release is closer to 0.1 MBq (2.8 μCi) which is equivalent to 3.9 g of natural uranium. Extremely minute amounts of uranium and HF (all well below regulatory limits) could potentially be released at the roof-top through the gaseous effluent stacks. The PXGEVS discharge stack is located on the SBM-1001 roof. The LXGEVS and CRDB GEVS discharge stacks are both located on the CRDB roof. The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System exhaust stack is located on the Centrifuge Assembly Building (CAB) roof. Gaseous effluent discharges from each of the four stacks are filtered for particulates and HF, and are continuously monitored prior to release.

Liquid effluents include stormwater runoff, sanitary waste water, cooling tower blowdown water, and treated contaminated process water. All liquid effluents, with the exception of sanitary waste water, are discharged to one of three onsite basins.

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin. During a rainfall event larger than the design basis, the potential exists to overflow the basin if the outfall capacity is insufficient to pass beyond design basis inflows to the basin. Overflow of the basin is an unlikely event. The additional impact to the surrounding land over that would occur during such a flood is assumed to be small. Therefore, potential overflow of the Site Stormwater Detention Basin during an event beyond its design basis is expected to have a minimal impact to surrounding land.

The UBC Storage Pad Stormwater Retention Basin, which exclusively serves the UBC Storage Pad, and cooling tower blowdown water discharges, is lined to prevent infiltration. It is designed to retain a volume slightly more than twice that for the 24-hour, 100-year frequency storm and an allowance for cooling tower blowdown. This lined basin has no flow outlet and all effluents are dispositioned through evaporation.

Discharge of operations-generated potentially contaminated liquid effluent is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on NRC standards in 10 CFR 20 (CFR, 2003q) are discharged to this basin. The basin is double-lined with leak detection and open to allow evaporation.

Sanitary waste water will be sent to the City of Eunice Wastewater Treatment Plant via a system of lift stations and 8 inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system.

Since the NEF will not obtain any water from or discharge process effluents from the site, there are no anticipated impacts on natural water systems quality due to facility water use. Control of surface water runoff will be required for NEF activities, covered by the NPDES General Permit and a New Mexico Water Quality Bureau Groundwater Discharge Plan/Permit. As a result, no significant impacts are expected for either surface water bodies or groundwater.

Solid waste that would be generated at NEF is grouped into nonhazardous, radioactive, hazardous, and mixed waste categories. All these wastes will be collected and transferred to authorized offsite treatment or disposal facilities. All solid radioactive waste generated will be Class A low-level waste as defined in 10 CFR 61 (CFR, 2003r). This waste consists of industrial waste, filters and filter material, resins, gloves, shoe covers, and laboratory waste. Approximately 86,950 kg (191,800 lbs) of low-level waste would be generated annually. In addition, annual hazardous and mixed wastes generated at NEF are expected to be about 1,770 kg (3,930 lbs) and 50 kg (110 lbs), respectively. These wastes will be collected, inspected, volume-reduced, and transferred to treatment facilities or disposed of at authorized waste disposal facilities. Nonhazardous waste, including miscellaneous trash, filters, resins, and paper will be shipped offsite for compaction and then sent to a licensed landfill. The NEF is expected to produce approximately 172,500 kg (380,400 lbs) of this waste annually. Local landfill capacity is more than adequate to accept this mass of nonhazardous waste.

Operation of the NEF would also result in the annual nominal production of approximately 7,800 metric tons (8,600 tons) of depleted UF_6. The depleted UF_6 would be stored onsite in cylinders (UBCs) that will have little or no impact while in storage. The removal and disposition of the depleted UF_6 will most likely involve its conversion offsite to triuranium octoxide (U_3O_8).

8.7 RADIOLOGICAL IMPACTS

The assessment of potential impacts considers the entire population surrounding the proposed NEF within a distance of 80 km (50 mi).

Radiological impacts are regulated under 10 CFR 20 (CFR, 2003q), which specifies a total effective dose equivalent (TEDE) limit for members of the public of 1 mSv/yr (100 mrem/yr) from all sources and pathways from the NEF, excluding natural background sources. In addition, 10 CFR 20.1101(d) (CFR, 2003bb) requires that constraints on atmospheric releases be established for the NEF such that no member of the public would be expected to receive a total effective dose equivalent in excess of 0.1 mSv/yr (10 mrem/yr) from these releases. Further, the NEF would be subject to the Environmental Protection Agency's (EPA) standards, including: standards contained in 40 CFR 190 (CFR, 2003f) that require that dose equivalents under routine operations not exceed 0.25 mSv (25 mrem) to the whole body, 0.75 mSv (75 mrem) to the thyroid, and 0.25 mSv (25 mrem) to any other organ from all pathways.

The general public and the environment may be impacted by radiation and radioactive material from the NEF as the result of discharges of gaseous and liquid effluent discharges, including controlled releases from the uranium enrichment process lines during decontamination and maintenance of equipment. In addition, radiation exposure to the public may result from the transportation and storage of uranium hexafluoride (UF_6) feed cylinders, UF_6 product cylinders, low-level radioactive waste, and depleted UF_6 cylinders.

Potential radiological impacts from operation of the NEF would result from controlled releases of small quantities of UF_6 during normal operations and releases of UF_6 under hypothetical accident conditions. Normal operational release rates to the atmosphere and to the onsite Treated Effluent Evaporative Basin are expected to be less than 8.9 MBq/yr (240 µCi/yr) and 2.1 MBq/yr (56 µCi/yr), respectively. The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from discharged gaseous effluent to an adult located at the plant site south boundary are 1.7×10^{-4} mSv (1.7×10^{-2} mrem) and 1.4×10^{-3} mSv (1.4×10^{-1} mrem), respectively. The maximum effective dose equivalent and maximum annual organ (lung) dose equivalent from gaseous effluent to the nearest resident (teenager) located 4.3 km (2.63 mi) in the west sector are expected to be less than 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.2×10^{-4} mSv (1.2×10^{-2} mrem), respectively.

The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from liquid effluent to an adult at the south site boundary are 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.5×10^{-4} mSv (1.5×10^{-2} mrem), respectively, assuming the Treated Effluent Evaporative Basin is dry only 10% of the year (i.e., resuspension of dust when dry). The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from discharged liquid effluent to an individual (teenager) at the nearest residence are 1.7×10^{-6} mSv (1.7×10^{-4} mrem) and 1.3×10^{-5} mSv (1.3×10^{-3} mrem), respectively, for the same release assumptions.

The maximum annual dose equivalent due to external radiation from the UBC Storage Pad and all other feed, product and byproduct cylinders on NEF property (skyshine and direct) is estimated to be less than 2.0×10^{-1} mSv (< 20 mrem) to the maximally exposed person at the nearest point on the site boundary (2,000 hrs/yr) and 8×10^{-12} mSv (8×10^{-10} mrem) to the maximally exposed resident (8,760 hrs/yr) located 4.3 km (2.63 mi) west of NEF.

With respect to the impact from the transportation of UF_6 as feed, product or depleted material and solid low level waste, the cumulative dose impact has been found to be small. The cumulative dose equivalent to the general public from the “worst-case” combination of all transport categories combined equaled 2.33 x 10^{-6} person-Sv/year (2.33 x 10^{-4} person-rem/year). Similarly, the dose equivalent to the onlooker, drivers and workers totaled 1.05 x 10^{-3}, 9.49 x 10^{-2}, 6.98 x 10^{-4} person-Sv/year (1.05 x 10^{-1}, 9.49 x 10^{-2}, and 6.98 x 10^{-2} person-rem/year), respectively.

The dose equivalents due to normal operations are small fractions of the normal background range of 2.0 to 3.0 mSv (200 to 300 mrem) that an average individual receives in the US, and well within regulatory limits. Given the conservative assumptions used in estimating these values, these concentrations and resulting dose equivalents are insignificant, and their potential impacts on the environment and health are inconsequential.

Since the NEF will operate with only natural and low enriched (i.e., not reprocessed) uranium in the form of uranium hexafluoride (UF_6), it is unlikely that an accident could result in any significant offsite radiation doses. The only chemical exposures that could impact safety are those associated with the potential release of HF to the atmosphere. The possibility of a nuclear criticality occurring at the NEF is highly unlikely. The facility has been designed with operational safeguards common to the most up-to-date chemical plants. All systems are highly instrumented and abnormal operations are alarmed in the facility Control Room.

Postulated accidents are those accidents described in the Integrated Safety Analysis (ISA) that have, for the uncontrolled case, been categorized as having the potential to exceed the performance criteria specified in 10 CFR 70.61(b) (CFR, 2003b). No significant exposure to offsite individuals is expected from any of the accidents, since many barriers are in place to prevent or mitigate such events.

Evaluation of potential accidents at the NEF included identification and selection of a set of candidate accidents and analysis of impacts for the selected accidents. The ISA team identified UF_6 as the primary hazard at the facility. An example of an uncontrolled accident sequence is a seismic event which produces loads on the UF_6 piping and components beyond their capacity. This accident is assumed to lead to release of gaseous UF_6, with additional sublimation of solid UF_6 to gas. The UF_6 gas, when in contact with moisture in the air, will produce HF gas.

For the controlled accident sequence, the mitigating measures are (1) seismically designed buildings (SBMs and CRDB) designed to withstand a 0.15 g peak ground acceleration; (2) seismically designed portions of the UF_6 process systems and components. These sections of piping and components are deigned to contain the portions of the gaseous UF_6 and HF within the process system and attenuate the release of effluent to the building and the environment, and (3) seismically designed autoclaves. This will reduce the consequences of a seismic event to acceptable levels, even if all non-seismically designed portions of the UF_6 process systems fail.

Exposures to workers would most likely be higher than those to offsite individuals and highly dependent on the workers proximity to the incident location. All workers at the NEF are trained in the physical characteristics and potential hazards associated with facility processes and materials. Therefore, facility workers know and understand how to lessen their exposures to chemical and radiological substances in the event of an incident at the facility.

Liquefied UF_6 is present only in the Product Liquid Sampling System, where safety process control systems are backed up by redundant safety protection circuits to preclude the occurrence of cylinder overheating. Fire protection systems, administrative controls, and limits on cylinder transporter fuel inventory limit the likelihood of cylinder-overheating in a fire. Thus, this accident scenario is highly unlikely. LES concludes that through the combined result of plant and process design, protective controls, and administrative controls, operation of the NEF does not pose a significant threat to public health and safety.

8.8 NONRADIOLOGICAL IMPACTS

Numerous design features and administrative procedures are employed to minimize gaseous and liquid effluent releases and keep them within regulatory limits. Potential nonradiological impacts of operation of the NEF include releases of inorganic and organic chemicals to the atmosphere and surface water impoundments during normal operations Other potential impacts involve land use, transportation, soils, water resources, ecological resources, air quality, historic and cultural resources, socioeconomic and public health. Impacts from hazardous, radiological and mixed wastes and radiological effluents have been discussed earlier.

The other potential nonradiological impacts from the construction and operation of NEF are discussed below:

Land-Use Impacts:

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

BMPS will be implemented during construction to minimize environmental impacts from potential. Site procedures will identify individuals and their responsibilities for prompt notification of state and local authorities, as required.

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

The NEF facility will require the installation of water and electrical utility lines. Sanitary waste water will be sent to the City of Eunice Wastewater Treatment Plant via a system of lift stations and 8 inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system.

A new potable water supply line will be extended from the city of Eunice to the NEF site. The line from Eunice will be about 8 km (5 mi) in length. Placement of the new water supply lines along New Mexico Highway 234 would minimize impacts to vegetation and wildlife. Since there are no bodies of water between the site and the city of Eunice, no waterways will be disturbed.

Two new electrical transmission lines on a large loop system are proposed for providing electrical service to the NEF. These lines would tie into a trunk line about 13 km (8 mi) to the west. Similar to the new water supply lines, land use impacts would be minimized by placing associated support structures along New Mexico Highway 234. An application for highway easement modification will be submitted to the state. There are currently several power poles along the highway in front of the adjacent, vacant parcel east of the site. In conjunction with the new electrical lines serving the site, two onsite transformers ensure redundant service.

Sanitary waste water will be sent to the City of Eunice Wastewater Treatment Plant via a system of lift stations and 8 inch sewage lines. Six septic tanks, each with one or more leach fields, may be installed as a backup to the sanitary waste system. The combined leach fields will require about 975 m (3,200 ft) of percolation drain field. The drain field will either be placed below grade or buried in a mound consisting of sand, aggregate and soil.

Overall land use impacts to the site and vicinity will be minimal considering that the majority of the site will remain undeveloped, the current industrial activity on neighboring properties, the nearby, expansive oil and gas well fields, and the placement of most utility installations along highway easements.

Transportation Impacts:

Impacts from construction and operation on transportation will include the generation of fugitive dust, changes in scenic quality, added environmental noise and small radiation dose to the public from the transport of UF_6 feed and product cylinders, as well as low-level radioactive waste.

Dust will be generated to some degree during the various stages of construction activity. The amount of dust emissions will vary according to the types of activity. LES estimated that fugitive dust are expected to be well below the National Ambient Air Quality Standards (CFR, 2003w).

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

The temporary increase in noise levels along New Mexico Highways 18 and 234 and Texas Highway 176 due to construction vehicles are not expected to impact nearby receptors significantly, due to substantial truck traffic currently using these roadways, and the large distance between the nearest receptors and the site, i.e., 4.3 km (2.63 mi). See the environmental noise discussion below concerning noise levels due to traffic during operations.

Water Resources:

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

Liquid effluents include stormwater runoff, sanitary waste water, cooling tower blowdown water, and treated contaminated process water. All liquid effluents, with the exception of sanitary waste water, are discharged to one of three onsite basins.

Stormwater from the site will be diverted and collected in the Site Stormwater Detention Basin. This basin collects runoff from various developed parts of the site. It is unlined and will have an outlet structure to control discharges above the design level. The normal discharge will be through evaporation and infiltration into the ground. The basin is designed to contain runoff for a volume equal to that for the 24-hour, 100-year return frequency storm, a 15.2-cm (6.0-in) rainfall. It will have approximately 123,350 m^3 (100-acre-ft) of storage capacity. In addition, the basin has 0.6 m (2 ft) of free-board beyond the design capacity. It will also be designed to discharge post-construction peak flow runoff rates from the outfall that are equal to or less than the pre-construction runoff rates from the area.

Cooling tower blowdown water and stormwater runoff from the UBC Storage Pad are discharged to the UBC Storage Pad Stormwater Retention Basin. The ultimate disposition of this water will be through evaporation along with permanent impoundment of the residual dry solids byproduct of evaporation. It is designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency storm, a 15.2-cm (6.0-in) rainfall and an allowance for cooling tower blowdown water. The UBC Storage Pad Stormwater Retention Basin is designed to contain a volume of approximately 77,700 m^3 (63 acre-ft). This basin is designed with a synthetic membrane lining to minimize any infiltration into the ground.

Discharge of treated contaminated plant process water will be to the onsite Treated Effluent Evaporative Basin. The Treated Effluent Evaporative Basin is utilized for the collection and containment of liquid effluent from the Liquid Effluent Collection and Treatment System. The ultimate disposal the liquid effluent will be through evaporation of water and permanent impoundment of the residual dry solids. Total annual discharge to that basin will be approximately 2,130 m^3/yr (562,631 gal/yr). The basin will be designed for double that volume. Evaporation will provide the only means of liquid disposal from this basin. The basin will include a double-layer membrane liner with a leak detection system to prevent infiltration of basin water into the ground.

Ecological Resources:

No communities or habitats that have been defined as rare or unique or that support threatened and endangered species have been identified as occurring on the 220-ha (543-acre) NEF site. Thus, no proposed activities are expected to impact communities or habitats defined as rare or unique or that support threatened and endangered species within the site area. Field surveys that were performed in September and October 2003, and April 2004, for the lesser prairie chicken, the sand dune lizard, and the black-tailed prairie dog determined that these species were not present at the NEF site. Another survey for the sand dune lizard was conducted in June 2004 and confirmed there were no sand dune lizards at the NEF site.

Several practices and procedures have been designed to minimize adverse impacts to the ecological resources of the NEF site. These practices and procedures include the use of BMPs, i.e., minimizing the construction footprint to the extent possible, channeling site stormwater to temporary detention basins during construction, the protection of all unused naturalized areas, and site stabilization practices to reduce the potential for erosion and sedimentation.

Historic and Cultural Resources:

A pedestrian cultural resource survey of the 220-ha (543-acre) NEF site identified seven prehistoric archaeological sites; three of these sites are located in the Area of Potential Effect (APE). Based on its survey findings and consultations with the New Mexico State Historic Preservation Officer (SHPO), LES is developing a treatment/mitigation plan to recover any significant information from the identified archaeological sites.

Given the small number of potential archaeological sites and isolated occurrences located on the site, and LES's ability to avoid or mitigate impacts to those sites, the NEF project will not have a significant impact on historic and cultural resources. (See ER Section 4.8.6, Minimizing Adverse Impacts.)

Environmental Noise:

Noise generated by the operation of NEF will be primarily limited to truck movements on the road. Potential impacts to local schools, churches, hospitals, and residences are expected to be insignificant because of the large distance to the nearest sensitive receptors. The nearest home is located west of the site at a distance of approximately 4.3 km (2.63 mi) and is not expected to perceive operational noise levels from the plant. The nearest school, hospital, church and other sensitive noise receptors are beyond this distance, thus the noise will be dissipated and attenuated, helping decrease the sound levels even further. Homes located near the construction traffic at the intersection of New Mexico Highway 234 and New Mexico Highway 18 will be affected by the vehicle noise, but due to existing heavy tractor trailer vehicle traffic, the change should be minimal. No schools, hospitals, or any other sensitive receptors are located at this intersection. Expected noise levels will mostly affect a 1.6-km (1-mi) radius and due to the large size of the site, sound levels resulting from the cumulative noise of all site activities will not have a significant impact on even those receptors closest to the site boundary.

Socioeconomics:

LES has estimated the economic impacts to the local economy during the 8-year construction period and 30-year license period of the NEF. This includes a five and one-half year period when both construction and operation are ongoing simultaneously. The analysis traces the economic impact of the proposed NEF, identifying the direct impacts of the plant on revenues of local businesses on incomes accruing to households, on employment, and on the revenues of the state and local government. The analysis also explores the indirect impacts of the NEF within a 80-km (50-mi) radius of the NEF. Details of the analysis are provided in ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, and are summarized below.

LES estimates that construction payroll will total $122.2 million with an additional $21 million expended for employment benefits over the eight-year construction period. Construction services purchased from third party firms within the region will add $265 million in direct benefits to the local economy during NEF's construction. See ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation.

LES anticipates annual payroll to be $10.5 million with an additional $3.2 million expenditure in employee benefits once the plant is operational. Approximately $9.5 million will be spent annually on local goods and services required for operation of the NEF.

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

The Regional Input-Output Modeling System (RIMS) II allows estimation of various indirect impacts associated with each of the expenditures listed above. According to the RIMS II analysis, the region's residents can anticipate an annual total of $53 million in increased economic activity, $38 million in increased earnings by households, and an annual average of 1,102 new jobs during the eight-year construction period. Over the anticipated thirty-year license period of the NEF, residents can anticipate an annual total of $15 million in increased economic activity, $23 million in increased earnings by households and an annual average of 782 new jobs directly or indirectly relating to the NEF. Table 8.8-1, Estimated Annual Economic Impacts from the National Enrichment Facility, summarizes the impact economic by the facility on Lea County and the surrounding area. A more detailed discussion of the RIMS II methodology and results is found in ER Section 7.1.

The major impact of facility construction on human activities is expected to be a result of the influx of labor into the area on a daily or semi-permanent basis. LES estimates that approximately 15% of the construction work force (120 workers) is expected to move into the vicinity as new residents. Previous experience regarding construction for the nuclear industry projects suggests that of those who move, approximately 65% will bring their families, which on average consist of the worker, a spouse, and one school-aged child. The likely increase in area population during peak construction, therefore, will total 360. This is less than 1% of the total Lea, New Mexico-Andrews, Texas Counties' 2000 population. For additional information, refer to ER Section 4.10.

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

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

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

Public Health Impacts:

Trace quantities of HF are released to the atmosphere during normal separation operations. The annual HF release rate is estimated as less than 1 kg (< 2.2 lb). The HF emissions from the plant will not exceed the strictest of regulatory limits at the point of release. Standard dispersion modeling techniques estimated the HF concentration at the nearest fence boundary to be 3.2×10^{-4} µg/m^3 and the concentration at the nearest residence located west of the site at a distance of 4.3 km (2.63 mi) as 6.4×10^{-6} µg/m^3. Both of these concentrations are several orders of magnitude below the strictest HF exposure standards in use today (see ER Section 4.12.1.1, Routine Gaseous Effluent).

Radiological public health impacts were summarized previously in ER Section 8.7, Radiological Impacts.

Methylene chloride is used in small bench-top quantities to clean certain components. All chemicals at NEF will be used in accordance with the manufacturer's recommendations. All chemicals are used in quantities that are considered deminimus with respect to air emissions outside the NEF. Its use and the resulting emissions have been evaluated and determined to pose minimal or no public risk. All regulated gaseous effluents will be below regulatory limits as specified in permits issued by the New Mexico Air Quality Bureau (NMAC 20.2.78). LES has concluded that the public health impacts from radiological and nonradiological constituents used within NEF are minimal and well below regulatory limits at the point of discharge. All hazardous materials and waste streams will be managed and disposed of in accordance with the permit requirements issued by the EPA Region 6 and the New Mexico Environment Department.

8.9 DECONTAMINATION AND DECOMMISSIONING

Decontamination and decommissioning of the facility will be staged during facility operations and is projected to take approximately nine years. Potential adverse environmental impacts would primarily be the release of small quantities of uranium to the Treated Effluent Evaporative Basin as a consequence of decontamination operations. Releases will be maintained such that associated impacts are the same order of magnitude or less than normal operational impacts. Decommissioning would also result in release of the facilities and land for unrestricted use, discontinuation of water and electrical power usage, and reduction in vehicular traffic.

As Urenco plant experience in Europe has demonstrated, conventional decontamination techniques are entirely effective for all plant items. All recoverable items will be decontaminated except for a relatively small amount of intractably contaminated material. The majority of materials requiring disposal will include centrifuge rotor fragments, trash, and residue from the effluent treatment systems. No problems are anticipated which will prevent the site from being released for unrestricted use. Additional details concerning decommissioning are provided in SAR Chapter 10, Decommissioning.

8.10 DEPLETED URANIUM DISPOSITION

Enrichment operations at the NEF will generate an average 7,800 metric tons (8,600 tons) of depleted UF_6 per year. After temporary storage onsite, the depleted UF_6 in Uranium Byproduct Cylinders (UBCs) would then be shipped offsite in preparation for appropriate deconversion to a more chemically stable form. Currently, there are no deconversion facilities in the US for large quantities of depleted UF_6, although DOE has awarded a commercial contract that provides for two deconversion facilities to be operational within approximately three to five years. Nevertheless, LES is pursuing commercially available deconversion services in lieu of counting on the availability of the DOE facilities as described below. Therefore, LES evaluated expected environmental impacts based on plausible strategies for offsite deconversion and disposal. LES projects that the depleted UF_6 will be deconverted from fluoride to the more stable oxide form, and disposed of in a deep geological facility or placed in long-term storage. LES estimates that the environmental impacts associated with such a strategy will be small.

LES has committed to the Governor of New Mexico (LES, 2003b) that: (1) there will be no long-term disposal or long-term storage (beyond the life of the plant) of UBCs in the State of New Mexico; (2) a disposal path outside the State of New Mexico is utilized as soon as possible; (3) LES will aggressively pursue economically viable paths for UBCs as soon as they become available; (4) LES will work with qualified vendors pursuing construction of private deconversion facilities by entering in good faith discussions to provide such vendor long-term UBC contracts to assist them in their financing efforts; and (5) LES will put in place as part of the NRC license a financial surety bonding mechanism that assures funding will be available in the event of any default by LES.

8.11 ENVIRONMENTAL JUSTICE

An analysis of census block groups (CGBs) within a 6.4-km (4-mi) radius of the site was conducted in accordance with NRC guidance in NUREG-1748 to assess whether any disproportionately large minority or low-income populations were present that warranted further analysis of the potential for disproportionately high and adverse environmental impacts upon those populations.

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

In addition, the LES analysis demonstrates that no individual CBG is comprised of more than 50% of low-income households. The percentages are as follows: Tract 8, CBG 2 –3.6%; Tract 9501, CBG 4- 9.9%. Neither of these percentages exceeds 50 percent; moreover, neither of these populations significantly exceeds the percentage of low-income households in the applicable State or County.

Based on this analysis, LES has concluded that no disproportionately high minority or low-income populations exist that would warrant further examination of disproportionately high and adverse environmental impacts upon such populations.

8.12 CONCLUSION

In conclusion, analysis of the potential environmental impacts associated with construction and operation of NEF indicates that adverse impacts are small and are outweighed by the substantial socioeconomic benefits associated with plant construction and operation. Additionally, the NEF will meet the underlying need for additional reliable and economical uranium enrichment capacity in the United States, thereby serving important energy and national security policy objectives. Accordingly, because the impacts of the proposed NEF are minimal and acceptable, and the benefits are desirable, the no-action alternative may be rejected in favor of the proposed action. Significantly, LES has also completed a safety analysis of the proposed facility, in which demonstrates that NEF operation will be conducted in a safe and acceptable manner.

8.12.1 Section 8 Tables

Table 8.8-1 Estimated Annual Economic Impacts From the National Enrichment Facility (Lea County and Nearby)

Impact	Construction	Operations
Local Businesses Additional Revenues	$53 Million	$14.6 Million
Household Additional Income	$38 Million	$23 Million
State & Local Government Additional Tax Revenue	$7.0 Million	$3 Million
Employment	1,102 Jobs	782 Jobs

9.0 LIST OF REFERENCES

Edition of Codes, Standards, NRC Documents, etc that are not listed below are given in ISAS Table 3.0-1.

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10.0 LIST OF PREPARERS

The organizations and individuals listed below are the principal contributors to the preparation of this Environmental Report (ER). Table 10-1 summarizes the specific chapters to which each principal contributor provided input.

Devine Tarbell & Associates, Inc. (Consultant)

Peter M. Browne
Environmental Scientist

Energy Economics & Environmental Consultants (E3c) Inc. (Consultant)

John C. Tysseling, Ph.D.
President

Olivia E. Padilla-Jackson
Senior Economic Analyst

Energy Resources International, Inc. (Consultant)

Julian J. Steyn, Ph.D.
Principal

Michael Schwartz
Principal

Entech Engineering (Consultant)

John N. Hamawi, Ph.D.
Consulting Radiological Engineer

EXCEL Services Corporation (Consultant)

Daniel G. Green
Licensing Consultant

GL Environmental, Inc. (Consultant)

V. Denise Gallegos
Principal

Tim J. Leftwich
Principal

Georgia Institute of Technology (Consultant)

William A. Schaffer, Ph.D.
Economist

Lockwood Greene

Rebecca Punch
Draftsman

John Shaw, P.E.
Project Director

Carroll Walker, P.E.
Assistant Manager

Marsha Wood
Administrative Assistant

Louisiana Energy Services

Rod M. Krich
Vice President, Licensing, Safety & Nuclear Engineering

Weston Geophysical Engineers, Inc. (Consultant)

George C. Klimkiewicz
President

Winston & Strawn

James R. Curtiss
Attorney at Law

Martin J.O'Neill
Attorney at Law

Brooke D. Poole
Attorney at Law

Urenco

Allan J. Brown
Project Manager

Philip Hale
Lead Engineer, Mechanical & Process

Michael Lynch
Project Manager

Framatome ANP

Francis X. Bellini
Senior Geologist, Environmental Health & Safety

Matthew D. Fuller
Health & Safety Technologist, Environmental Health & Safety

George A. Harper, P.E.
Manager, Regulatory Compliance Programs

Andrew D. Hodgdon, CHP
Health Physicist, Radiological Engineering

Michael F. Kennedy, Ph.D.
Manager, Integrated Safety Analysis

Robert G. Knowlton, Ph.D., P.E.
Manager, Performance Assessment

Linda L. Laws
Senior Project Administrator, Regulatory Compliance Programs

Maureen L. Lyons
Senior Project Administrator

Edward F. Maher, Sc.D., CHP
Environmental Report Manager

David G. Marcelli, P.E.
Project Manager

Theodore A. Messier
Senior Technical Specialist, Radiological Engineering

Tina L. Niedzialkoski
Senior Project Administrator, Nuclear Analysis

Nicholas M. Panzarino, CHP
Technical Services Manager II, Environmental Laboratory

Jo-Ann Pelczar
Health Physicist/Scientist, Radiological Engineering

David M. Pepe
Engineer, Safety Analysis

Glen D. Seeburger
Senior Engineer, Nuclear Analysis

John H. Snooks
Senior Environmental Consultant, Environmental Health & Safety

Mark S. Strum
Technical Systems Manager II, Radiological Engineering

Stacy T. Thomson, P.E.
Senior Engineer, Plant Life Extension Programs

Table 11-1Principal Contributors to the ER												
Principal Contributor	**Chapters**										**Appendices**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**A**	**B**
Devine Tarbell & Associates, Inc.												
Peter M. Browne Environmental Scientist			C	C					C			
Energy Economics & Environmental Consultants (E3c) Inc.												
John C.Tysseling, Ph.D. President							R		C			
Olivia E. Padilla-Jackson Senior Economic Analyst							L		C			
Energy Resources International, Inc.												
Julian J. Steyn, Ph.D. Principal	C	C							C			
Michael Schwartz Principal	C	C							C			
Entech Engineering												
John N. Hamawi, Ph.D. Consulting Radiological Engineer			C	C					C			
EXCEL Services Corporation												
Daniel G. Green Licensing Consultant	R	R	R	R	R	R	R	R	R	R	R	R
GL Environmental, Inc.												
V. Denise Gallegos Principal			C	C		C			C			
Tim J. Leftwich Principal			C	C		C			C			
Georgia Institute of Technology												
William A. Schaffer, Ph.D. Economist		C					C		C			
Lockwood Greene												
Rebecca Punch Draftsman	C	C	C	C		C	C					
John L. Shaw, P.E. Project Director	R	R	R	R	R	R	R	R	R	R		
Carroll Walker, P.E. Assistant Manager	C	C	C	C		C	C					
Marsha Wood Administrative Assistant							A		A	A	A	
Louisiana Energy Services												
Rod M. Krich, Vice President Licensing, Safety & Nuclear Engineering	R	R	R	R	R	R	R	R	R	R	R	R
Weston Geophysical Engineers, Inc.			C						C			
George C. Klimkiewicz President			C						C			
Winston & Strawn												
James R. Curtiss Attorney at Law	R	R	R	R	R	R	R	R	R	R	R	R
Martin J. O'Neill Attorney at Law	R	R	R	R	R	R	R	R	R	R	R	R
Brooke D. Poole Attorney at Law		R	R	R	R	R		R	R	R	R	R
Urenco												

Table 11-1Principal Contributors to the ER

Principal Contributor	Chapters										Appendices	
	1	2	3	4	5	6	7	8	9	10	A	B
Allan J. Brown Project Manager	R	R	R	R		R						R
Philip Hale Lead Engineer, Mechanical & Process			R	R			R					
Michael Lynch Project Manager	R	R	R	R	R	R	R	R	R	R	R	R
Framatome ANP												
Francis X. Bellini Senior Geologist			C	C					C			
Matthew D. Fuller Health & Safety Technologist			C	C		C			C			
George A. Harper, P.E. Manager, Regulatory Compliance Programs	R	R	C	C	R	R	R	R	R		R	R
Andrew D. Hodgdon, CHP Health Physicist				C					C			
Michael F. Kennedy, Ph.D. Manager, Integrated Safety Analysis		C		C								
Robert G. Knowlton, Ph.D., P.E. Manager, Performance Assessment			C	C					C			
Linda L. Laws Senior Project Administrator									A	A		
Maureen L. Lyons Senior Project Administrator	A	A	A	A	A	A	A	A	A	A	A	A
Edward F. Maher, Sc.D., CHP Environmental Report Manager	L	L	L	L R	R	R	R	L	L	L	R	R
David G. Marcelli Project Manager	R	R	R	R	R	R	R	R	R	R	R	R
Theodore A. Messier Senior Technical Specialist			C	C					C			L
Tina L. Niedzialkoski Senior Project Administrator	A	A	A	A	A	A	A	A	A	A	A	A
Nicholas M. Panzarino, CHP Technical Services Manager II			C	C	L	R						
Jo-Ann Pelczar Health Physicist/Scientist			C	C					C			
David M. Pepe Engineer	R	R	R	R	R		R	R				
Glen D. Seeburger Senior Engineer				C					C			
John H. Snooks Senior Environmental Consultant				C					C			
Mark S. Strum, CHP Technical Systems Manager II			C	C		L			C			
Stacy T. Thomson, P.E. Senior Engineer		C	C	C								

L = Lead Author C = Contributing Author A = Admin R = Reviewer

11.0 APPENDIX A CONSULTATION DOCUMENTS

American Indian Consultation List of Addressees

Apache of Oklahoma

Alonso Chalepah
Apache Tribe of Oklahoma
PO Box 1220
Anadarko, OK 73005

Cc:
Mr. Gene Maroquin, Chairman
Apache Tribe of Oklahoma
PO Box 1220
Anadarko, OK 73005

Comanche of Oklahoma

Jimmy Arterberry, NAGPRA Director
Comanche of Oklahoma
PO Box 908
Lawton, OK 73502

Cc:
Johnny Wauqua, Chairman
Comanche of Oklahoma
PO Box 908
Lawton, OK 73502

Fort Sill Apache Tribe

Michael Darrow, Historian
FORT SILL APACHE TRIBE
Route 1 Box 445
Ft. Cobb, Oklahoma 73038

Cc:
Mrs. Ruey Darrow, Chairperson
Fort Sill Apache Business Committee
Route 2, Box 121
Apache, Oklahoma 73006

Kiowa Tribe of Oklahoma

George Daingkau, NAGPRA Representative
Kiowa Tribe of Oklahoma
118 North Stephans
Hobart, OK 73657

Cc:
Clifford A. McKenzie, Chairman
Kiowa Tribe of Oklahoma
PO Box 369
Carnegie, OK 73015

Mescalero Apache Tribe

Ms. Naida Natchez
Assistant Tribal Historic Preservation Officer
Mescalero Apache Tribe
P.O. Box 227
Mescalero, New Mexico 88340

Cc:
Sara Misquez, President
Mescalero Apache Tribe
P.O. Box 227
Mescalero, New Mexico 88340

Tonto Apache Tribe

Vivian Burdette, Chairperson
TONTO APACHE TRIBE
Reservation #30
Payson, AZ 85541

Cc:
Vincent Randall, Tribal Historian and Chairperson,
YAVAPAI-APACHE NATION
[Official] 3435 Shaw Ave.
P.O. Box 1188
Camp Verde, AZ 86322

Dear xxxxx,

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

Framatome ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments concerning the proposed facilities as they relate to archeological, cultural and historical sites important to Native American groups. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or edward.maher@framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

Mr. Ed Roberson
Roswell Field Office Manager
Bureau Of Land Management
2909 W. Second
Roswell, NM 88201

Dear Mr. Roberson:

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

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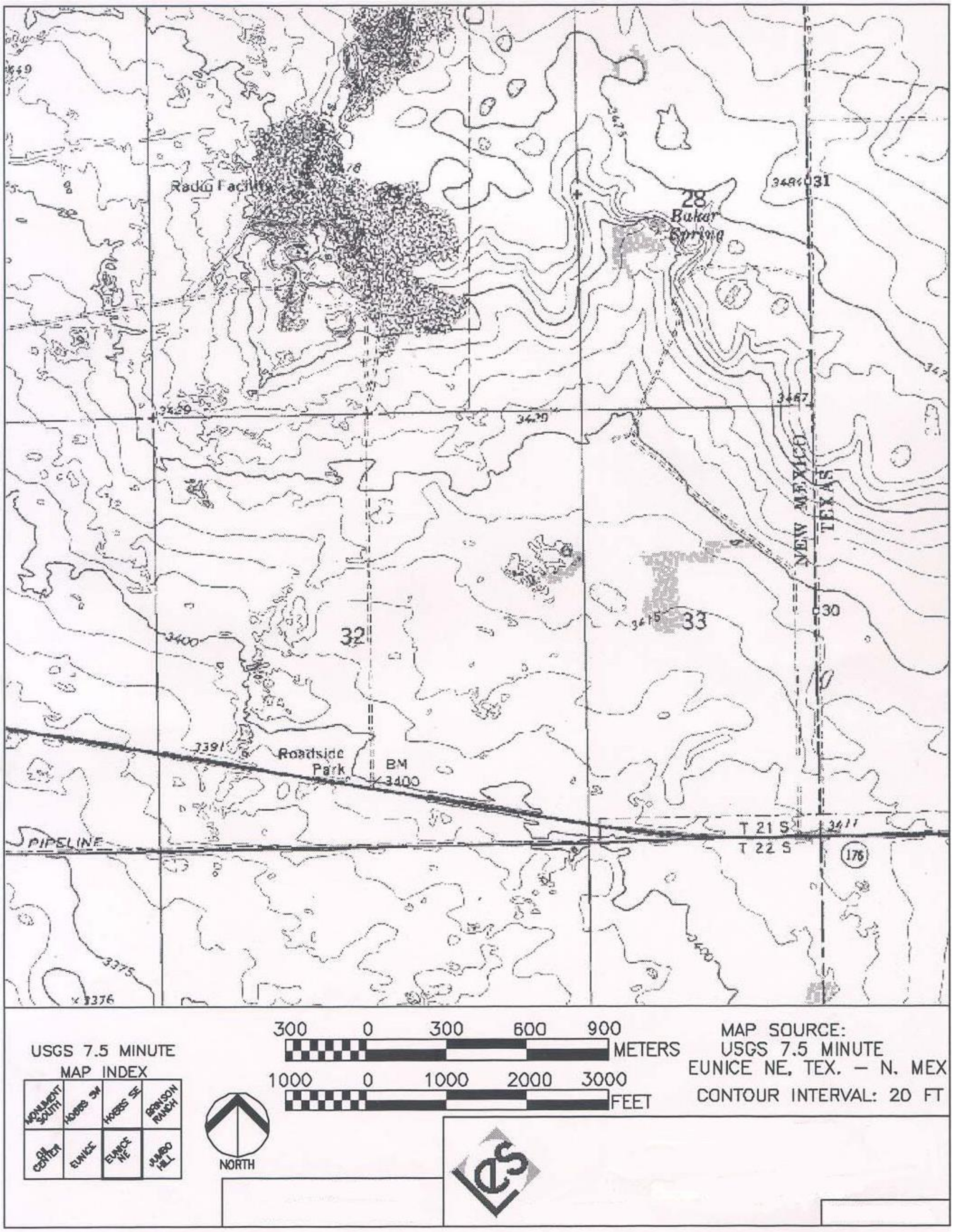
Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map


Radio Facility
28
Baker Spring
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NEW MEXICO
TEXAS
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Roadside Park
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BRINSON RANCH
OIL CENTER
EUNICE
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JUMBO HILL
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FEET
MAP SOURCE:
USGS 7.5 MINUTE
EUNICE NE, TEX. — N. MEX
CONTOUR INTERVAL: 20 FT

Mr. Bruce Thompson
New Mexico Department of Game & Fish
1 Wildlife Way
P.O. Box 25112
Santa Fe, NM 87504

Dear Mr. Thompson:

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project, will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

Framatome ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments and information concerning the proposed facilities as they relate to threatened and endangered species, critical habitats, other wildlife, wetlands, and any other natural resource concerns. Based on an initial environmental analysis, this project is not expected to result in significant negative effects on the local environment. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or Edward.maher@framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

Ms. Katherine Slick, Director
NM Historic Preservation Division
228 E. Palace Ave., Room 320
Santa Fe, NM 87501

Dear Ms. Slick:

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543 acre site. Approximately 350 acres will be directly impacted by construction of the facility. A complete cultural resources survey will be conducted on the project area by WCRM, Inc.

Framatome-ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments concerning the proposed facilities as they relate to archeological, cultural and historical sites. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or Edward.maher@framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

Ms. Joy Nicholopoulous
U.S. Fish & Wildlife Service
New Mexico Field Office
2105 Osuna Road NE
Albuquerque, NM 87113-1001

Dear Ms. Joy Nicholopoulous:

Louisiana Energy Services (LES) is proposing to construct a Uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Sections 32 and 33 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

Framatome-ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. In addition to informing your agency of LES's plans, we are asking for comments and information concerning the proposed facilities as they relate to threatened and endangered species, critical habitats, other wildlife, wetlands, and any other natural resource concerns. Based on an initial environmental analysis, this project is not expected to result in significant negative effects on the local environment. To facilitate your review, a site map of the project area has been included. Your comments will be included in the ER that will be submitted to the Nuclear Regulatory Commission (NRC) for review.

We would appreciate receiving your comments within 30 days. Should you have any questions or need additional information please contact Dr. Edward F. Maher at (978) 568-2785 or edward.maher@framatome-anp.com.

Sincerely,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

STATE OF NEW MEXICO
DEPARTMENT OF CULTURAL AFFAIRS
HISTORIC PRESERVATION DIVISION

228 EAST PALACE AVENUE
SANTA FE, NEW MEXICO 87501
(505) 827-6320

BILL RICHARDSON
Governor

October 8, 2003

Dr. Edward F. Maher
Framatome ANP
400 Donald Lynch Blvd.
Marlborough, MA 01752

Re: National Enrichment Facility Near Eunice, Lea County, New Mexico

Dear Dr. Maher:

I am writing in response to the letter the Historic Preservation Division (HPD) received September 18, 2003 from R.M. Krich, Vice President of Louisiana Energy Services. As you are probably aware, involvement of the U.S. Nuclear Regulatory Commission brings this project under the purview of Section 106 of the National Historic Preservation Act (NHPA). Under Section 106, the effects on cultural resources must be evaluated.

Our records show that Western Cultural Resource Management (WCRM) has been retained to conduct a pedestrian archaeological survey of the proposed project area. That survey resulted in the identification of seven archaeological sites. WCRM will (if they have not already) prepare a report of their findings and submit it to your office for review. Please forward the report to HPD for review so that we can issue a determination of effect for this project.

In addition, if tribal consultation has not already been conducted, now is a good time to initiate it. I have enclosed a listing of tribes that have indicated they wish to be contacted for projects occurring in Lea County. This list is provided as guidance only and you may wish to contact other tribes as well. Please forward us a copy of a letter that is sent to the tribes and indicate which tribes were contacted. Please also send us copies of any responses you may receive.

We look forward to reviewing the archaeological survey report. If you have any questions, please do not hesitate to contact me. I can be reached by telephone at (505) 827-4064 or by email at mensey@oca.state.nm.us.

Sincerely,

Michelle M. Ensey
Staff Archaeologist

Log: 68950
Enc.

OTHER TRIBAL OFFICIALS

Chairman Frederick Vigil
All Indian Pueblo Council
123 4th Street S.W.
P.O. Box 400
Albuquerque, NM 87103
Phone: (505) 881-1992
Fax: (505) 883-7682

Roger Madalena, Director
Five Sandoval Indian Pueblo, Inc.
1043 Highway 313
Bernalillo, NM 87004
Phone: (505) 867-3351
Fax: (505) 867-3514

Bernie Teba, Director
Eight Northern Indian Pueblo Council
P.O. Box 969
San Juan Pueblo, NM 87566
Phone: (505) 852-4265
Fax: (505) 852-4835

OTHER TRIBES HAVING TRADITIONAL USE AREAS IN NEW MEXICO

Arizona

Wayne Taylor, Jr., Chairman
Hopi Tribal Council
P.O. Box 123
Kykotsmovi, AZ 86039
Phone: (928) 734-2441
Fax: (928) 734-6665
Attn: Leigh Kuwanwisiwma
Director, Cultural Preserv. Office
(928) 734-3751

Dallas Massey, Sr., Chairman
White Mountain Apache
Tribal Council
P.O. Box 700
Whiteriver, AZ 85941
Phone: (928) 338-4346
Fax: (928) 338-4778
Historic Preservation: John Welch
(928) 338-3033

Raymond Stanley, Jr., Chairman
San Carlos Tribal Council
P.O. Box 0
San Carlos, AZ 85550
Phone: (520) 475-2361
Fax: (520) 475-2567

Colorado

Howard Richards, Sr., Chairman
Southern Ute Tribe
P.O. Box 737
Ignacio, CO 81137
Phone: (970) 563-0100
Fax: (970) 563-0396

Ernest House, Chairman
Ute Mountain Ute Tribe
General Delivery
Towaoc, CO 81334
Phone: (970) 565-3751
Fax: (970) 565-7412

Oklahoma

Alonzo Chalepah, Chairman
Apache Tribe of Oklahoma
P.O. Box 1220
Anadarko, OK 73005
Phone: (405) 247-9493
Fax: (405) 247-3153

Wallace Coffey, Chairman
Comanche Indian Tribe
P.O. Box 908
Lawton, OK 73502
Phone: (580) 492-4988
Fax: (580) 492-3796
THPO: Jimmy Arterberry (580) 492-3754

Jeff Houser, Chairman
Fort Sill Apache Tribe of Oklahoma
Rt. 2, Box 121
Apache, OK 73006
Phone: (580) 588-2298
Fax: (580) 588-3133

Earl Yeahquo, Chairman
Kiowa Tribe of Oklahoma
P.O. Box 369
Carnegie, OK 73015
Phone: (580) 654-2300
Fax: (580) 654-2188
Historic Preservation: R.H. Hess Bointy

Robert Chapman, President
Pawnee Tribal Business Council
P.O. Box 470
Pawnee, OK 74058
Phone: (918) 762-3621
Fax: (918) 762-6446
THPO: Alice Alexander

Gary McAdams, President
Wichita and Affiliated Tribes
P.O. Box 729
Anadarko, OK 73005
Phone: (405) 247-2425
Fax: (405) 247-2430

Texas

Albert Alvidrez, Governor
Ysleta del Sur Pueblo
P.O. Box 17579 – Ysleta Station
El Paso, TX 79917
Phone: (915) 859-7913
Fax: (915) 859-2988

rev. 07/02/2003

Native American Consultations
New Mexico Historic Preservation Division (HPD)

(NOTE: This is a county-by-county working list for determining which Native American Indian tribes want to be consulted for proposed projects in various geographic parts of New Mexico. It has been generated from a HPD ethnographic study, the National Park Service's Native American Consultation Database, and tribes telling us they wish to be consulted for at least "certain projects" in that specific county. We are always in the process of updating and refining consultative efforts. It is NOT a definitive list, and may change depending on the type and location of the proposed project. We have been working with agencies, Native American Indian tribes, and The Advisory Council on Historic Preservation to develop a GIS based map resource system. Tribes wishing to amend or change their areas of geographic interest should contact the HPD at 228 E. Palace Ave., Room 320, Santa Fe, NM 87501; 505-827-6320; fax 505-827-6338)

BERNALILLO
Hopi Tribe
Isleta Pueblo
Laguna Pueblo
Navajo Nation
Sandia Pueblo
White Mountain Apache Tribe
Ysleta del Sur

CATRON
Acoma Pueblo
Fort Sill Apache Tribe
Hopi Tribe
Isleta Pueblo
Laguna Pueblo
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

CHAVES
Apache Tribe of Oklahoma
Comanche Indian Tribe
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

CIBOLA
Acoma Pueblo
Hopi Tribe
Isleta Pueblo
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe
Zuni Pueblo

COLFAX
Comanche Indian Tribe
Kiowa Tribe
Jicarilla Apache Nation
Taos Pueblo

CURRY
Apache Tribe of Oklahoma
Comanche Indian Tribe
Kiowa Tribe

De BACA
Comanche Indian Tribe
Isleta Pueblo
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation

DONA ANA
Comanche Indian Tribe
Fort Sill Apache Tribe
Isleta Pueblo
Kiowa Tribe (east half of county)
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe
Ysleta del Sur Pueblo

EDDY
Comanche Indian Tribe
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

GRANT
Fort Sill Apache Tribe
Hopi Tribe
Isleta Pueblo
Mescalero Apache Tribe
Navajo Nation
White Mountain Apache Tribe

GUADALUPE
Comanche Indian Tribe
Isleta Pueblo
Jicarilla Apache Nation
Kiowa Tribe
Mescalero Apache Tribe
Navajo Nation

HARDING
Comanche Indian Tribe
Jicarilla Apache Nation
Kiowa Tribe

HIDALGO
Fort Sill Apache Tribe
Hopi Tribe
Mescalero Apache Tribe
White Mountain Apache Tribe

LEA
Apache Tribe of Oklahoma
Comanche Indian Tribe
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

LINCOLN
Comanche Indian Tribe
Isleta Pueblo
Kiowa Tribc
Mescalero Apache Tribe
Ysleta del Sur Pueblo

LOS ALAMOS
Cochiti Pueblo
Comanche Indian Tribe
Hopi Tribe
Jemez Pueblo
Navajo Nation
Santa Clara Pueblo
San Ildefonso Pueblo

LUNA
Fort Sill Apache Tribe
Hopi Tribe
Mescalero Apache Tribe
White Mountain Apache Tribe
Ysleta del Sur Pueblo

McKINLEY
Acoma Pueblo
Comanche Indian Tribe
Hopi Tribe
Isleta Pueblo
Laguna Pueblo
Navajo Nation
San Ildefonso Pueblo
White Mountain Apache Tribe
Zuni Pueblo

MORA
Comanche Indian Tribe
Hopi Tribe
Jicarilla Apache Nation
Kiowa Tribe
Navajo Nation
Taos Pueblo

OTERO
Comanche Indian Tribe
Isleta Pueblo
Kiowa Tribe
Mescalero Apache Tribe
Ysleta del Sur Pueblo

QUAY
Apache Tribe of Oklahoma
Comanche Indian Tribe
Isleta Pueblo
Jicarilla Apache Nation
Kiowa Tribe
Pawnee Tribe

PUEBLO GOVERNORS/TRIBAL OFFICIALS

SOUTHERN PUEBLOS

Governor Fred S. Vallo
Pueblo of Acoma
P.O. Box 309
Acoma, NM 87034
Phone: (505) 552-6604/6605
Fax: (505) 552-7204
1st Lt. Gov. Marcus J. Aragon Jr.
2nd Lt. Gov. Jason Johnson
Historic Preservation: Damian Garcia

Governor Simon Suina
Pueblo of Cochiti
P.O. Box 70
Cochiti Pueblo, NM 87072
Phone: (505) 465-2244
Fax: (505) 465-1135
Lt. Gov. Vernon Garcia
DNR&C: Jacob Pecos (505) 465-0617

Governor Alvino Lucero
Pueblo of Isleta
P.O. Box 1270
Isleta Pueblo, NM 87022
Phone: (505) 869-3111/6333
Fax: (505) 869-4236
1st Lt. Gov. Lawrence R. Lucero
2nd Lt. Gov. Emil Jojola
Historic Preservation: Ben Lucero (505) 869-3379

Governor Raymond Loretto
Pueblo of Jemez
P.O. Box 100
Jemez Pueblo, NM 87024
Phone: (505) 834-7359/7525
Fax: (505) 834-7331
1st Lt. Gov. Augustine Fragua Jr.
2nd Lt. Gov. George Shendo
DRP: David Duffy (505) 834-7696

Governor Anthony Ortiz
Pueblo of San Felipe
P.O. Box 4339
San Felipe Pueblo, NM 87001
Phone: (505) 867-3381/3382
Fax: (505) 867-3383
Lt. Gov. Timothy Sandoval
Administrator: Bruce Garcia

Governor Myron Armijo
Pueblo of Santa Ana
2 Dove Road
Bernalillo, NM 87004
Phone: (505) 867-3301/3302
Fax: (505) 867-3395
Lt. Gov. Glenn Tenorio
NAGPRA: Ben Robbins

Governor Everett Chaves
Pueblo of Santo Domingo
P.O. Box 99
Santo Domingo Pueblo, NM 87052
Phone: (505) 465-2214/2215
Fax: (505) 465-2688
Lt. Gov. John Nieto
Administrator: Boyd Nystedt (505)465-0055

Governor Gilbert Lucero
Pueblo of Zia
135 Capitol Square Dr.
Zia Pueblo, NM 87053-6013
Phone: (505) 867-3304/3305
Fax: (505) 867-3308
Lt. Gov. Alfredo Medina
Environmental: Harold Reid

Governor Roland E. Johnson
Pueblo of Laguna
P.O. Box 194
Laguna Pueblo, NM 87026
Phone: (505) 552-6654/6655
Fax: (505) 552-6941
1st Lt. Gov. Clarence Marie
2nd Lt. Gov. Harry Cheromiah
Environ: Barbara Bernacik (505) 552-7534

Governor Arlen P. Quetawki Sr.
Pueblo of Zuni
P.O. Box 339
Zuni, NM 87327
Phone: (505) 782-4481
Fax: (505) 782-2700
Lt. Gov. Carmelita Sanchez
THPO Jonathan Damp (505) 782-4814

Governor Stuwart Paisano
Pueblo of Sandia
Box 6008
Bernalillo, NM 87004
Phone: (505) 867-3317
Fax: (505) 867-9235
Lt. Gov. Felix Chaves
Cultural Preservation: Sam Montoya (505) 771-5080

NORTHERN PUEBLOS

Governor Tom F. Talache Jr.
Pueblo of Nambe
Route 1, Box 117-BB
Santa Fe, NM 87501
Phone: (505) 455-2036
Fax: (505) 455-2038
Lt. Gov. Shannon McKenna
Historic Preservation: Ernest Mirabal Sr. (505) 455-2979

Governor Earl Salazar
Pueblo of San Juan
P.O. Box 1099
San Juan Pueblo, NM 87566
Phone: (505) 852-4400/4210
Fax: (505) 852-4820
1st Lt. Gov. Eugene Cruz
2nd Lt. Gov. Louis Cata
Environ: Charles Lujan (505) 852-4212

Governor Gerald Nailor
Pueblo of Picuris
P.O. Box 127
Penasco, NM 87553
Phone: (505) 587-2519
Fax: (505) 587-1071
Lt. Gov. Manuel Archuleta
Historic Preservation: Richard Meremejo (505) 827-2519

Governor Denny Gutierrez
Pueblo of Santa Clara
P.O. Box 580
Espanola, NM 87532
Phone: (505) 753-7330/7326
Fax: (505) 753-8988
Lt. Gov. Edwin Tafoya
Historic Preservation: Paul Baca x 238

Governor Jacob Viarrial
Pueblo of Pojoaque
No. 39 Camino Del Rincon, Tribal Admin. Suite 6
Santa Fe, NM 87501
Phone: (505) 455-2278/2279
Fax: (505) 455-3363
Lt. Gov. George Rivera
Historic Preservation: Charles Tapia (505) 455-2916

Governor Allen R. Martinez
Pueblo of Taos
P.O. Box 1846
Taos, NM 87571
Phone: (505) 758-9593
Fax: (505) 758-4604
Lt. Gov. Trini Romero
War Chief's Office: 758-3883

Governor John Gonzales
Pueblo of San Ildefonso
Route 5, Box 315-A
Santa Fe, NM 87501
Phone: (505) 455-2273/2274
Fax: (505) 455-7351
1st Lt. Gov. Timothy Martinez
2nd Lt. Gov. Martin Aguilar
Cultural Preservation: Neil Weber (505) 455-2273
Historic Preservation: Myron J. Gonzales x 313

Governor Marvin Herrera
Pueblo of Tesuque
Route 5, Box 360-T
Santa Fe, NM 87501
Phone: (505) 983-2667
Fax: (505) 982-2331
Lt. Gov. Clarence Coriz
Environ: Anthony Dorame

RESERVATION OFFICIALS

President Joe Shirley Jr.
Navajo Nation
Post Office Box 9000
Window Rock, Arizona 86515
Phone: (928) 871-6352 thru 6357
Fax: (928) 871-4025
Vice Pres. Frank Dayish Jr.
THPO: Dr. Alan Downer (928) 871-6437
P.O. Box 4950

Lawrence Morgan
Navajo Nation Council
Office of the Speaker
P.O. Box 3390
Window Rock, Arizona 86515
Phone: (928) 871-7160
Fax: (928) 871-7255

Leo L. Pino, President
Ramah Navajo Chapter
Route 2, Box 13
Ramah, NM 87321
Phone: (505) 775-7130
Fax: (505) 775 3538
NNHPD: Ron Maldonado (602) 871-6000

George Apachito, President
Alamo Navajo Tribe
P.O. Box 827
Magdalena, NM 87825
Phone: (505) 854-2686

Tony Secatero
Canoncito Navajo Chapter
P.O. Box 3396
Canoncito, NM 87026
Phone: (505) 833-0731

President Sara Misquez
Mescalero Apache Tribe
P.O. Box 227
Mescalero, NM 88340
Phone: (505) 464-4494 x 279
Fax: (505) 464-9191
Vice Pres. Ferris Palmer
THPO: Donna Stern-McFadden (505) 464-9279

President Claudia J. Vigil-Muniz
Jicarilla Apache Nation
P.O. Box 507
Dulce, NM 87528
Phone: (505) 759-3242
Fax: (505) 759-3005
Heritage Preservation Office
~~Adelaide Paiz~~ (505) 759-3613
Lorene Willis

GOVERNOR
Bill Richardson

STATE OF NEW MEXICO
DEPARTMENT OF GAME & FISH
One Wildlife Way
PO Box 25112
Santa Fe, NM 87504

STATE GAME COMMISSION
Tom Arvas, Chairman
Albuquerque, NM

Alfredo Montoya, Vice-Chairman
Alcalde, NM

David Henderson
Santa Fe, NM

Jennifer Atchley Montoya
Las Cruces, NM

Peter Pino
Zia Pueblo, NM

Guy Riordan
Albuquerque, NM

Leo Sims
Hobbs, NM

DIRECTOR AND SECRETARY
TO THE COMMISSION
Bruce C. Thompson

Visit our website at www.gmfsh.state.nm.us
For basic information or to order free publications: 1-800-862-9310.

September 30, 2003

Dr. Edward F. Maher
Framatome ANP
4000 Donald Lynch Blvd.
Marlborough MA 01752

Re: Louisiana Energy Services National Enrichment Facility, Lea County, New Mexico
NMGF Project No.: 8926

Dear Dr. Maher:

This letter was prepared in response to a September 15, 2003, letter from R.M. Krich of Louisiana Energy Services, requesting written comment from the NM Department of Game and Fish (Department) on the above referenced project. A project scoping meeting for state regulatory agencies, held in Santa Fe on September 17, 2003, was attended by Rachel Jankowitz of my staff.

The proposed project is a gas centrifuge uranium enrichment facility, located on Section 32 and 33, Township 21S, Range 38E. The size of the site is 543 acres, of which approximately 350 acres will be directly impacted by construction. Facilities will include process and administrative structures, access roads and a depleted uranium storage pad. Framatome ANP is in process of generating an Environmental Report which will be used by the U.S. Nuclear Regulatory Commission to prepare an Environmental Impact Statement for the facility, as required under the National Environmental Policy Act (NEPA).

The project location is within the range of a state listed threatened species, *Sceloporus arenicolus*, the sand dune lizard. Ms Denise Gallegos of GL Environmental, a subcontractor for Framatome ANP, has identified potential suitable habitat for the sand dune lizard on the project site. She stated that occupancy surveys had not yet been completed, and also that GL Environmental had been in contact with the Department herpetologist, Mr. Charlie Painter.

The sand dune lizard occurs only in a limited range comprising a narrow band of shinnery oak sand dunes in southeast New Mexico and adjacent Texas. The Department species management plan identifies the range east of Highway 18 to the Texas border as a one mile wide band of primary habitat, with up to three miles wide marginal habitat. "Future disruptions in this restricted habitat can sever the TX-NM habitat corridor of *S. arenicolus* populations and increase the risk of local extinction." It is considered prudent to conserve even unoccupied suitable habitat because of the dynamic nature of the sand dune system, and uncertainties regarding the life history and metapopulation characteristics of the lizard. Oil and gas development has been identified as a threat to the species. NEPA analysis of the project's impact on sand dune lizard should include a discussion of the cumulative impacts in the region.

For the purpose of minimizing adverse impact to sand dune lizards and their habitat, facilities (including parking lots, drainage ponds, storage sheds, etc) should be located as far as feasible from occupied or suitable dune blowouts and associated stands of shinnery oak. Suitable habitat should be clearly identified and protected from traffic or other damage during construction and operation. It should be noted that while the lizards may be active until mid-September, the management plan survey methodology recommends that, in order to increase the probability of finding sand dune lizards if they occur, presence/absence surveys should be conducted during May and June between 0800 and 1300 h. If occupancy of the project site is documented, or for any further information, please contact Mr. Painter at (505) 476-8106.

Approximately one mile of carbon dioxide transmission pipeline will be relocated off the proposed project site to the Highway 176 corridor. Any impact associated with the pipeline relocation should be included in NEPA analysis as an indirect impact of the enrichment facility project. A copy of the Department trenching guidelines is enclosed with this letter.

The site design includes three ponds which will hold runoff and cooling water. The NM Water Quality Control Commission has established surface water quality standards for wildlife usage. If the ponds will not meet those standards, compliance with the federal Migratory Bird Treaty Act requires that they be protected from avian wildlife. This is usually accomplished by the use of netting or floating plastic balls. It was indicated at the scoping meeting that floating balls will be used to exclude birds. Advantages of floating balls over netting include disguising of the water surface so birds don't try to land, and lower maintenance needs. Disadvantages include higher initial cost and susceptibility to high winds. The bird exclusion balls also reduce evaporation, which may be an advantage or disadvantage depending on the design purpose of the pond.

Thank you for the opportunity to review and comment on your project. If you have any questions, please contact Rachel Jankowitz of my staff at 505-476-8159 or rjankowitz@state.nm.us.

Sincerely,

Lisa Kirkpatrick, Chief
Conservation Services Division

LK/rjj

(encl)

CC: Joy Nicholopoulos, Ecological Services Field Supervisor, USFWS
Roy Hayes, SE Area Operations Chief, NMGF
Alexa Sandoval, SE Area Habitat Specialist, NMGF
Rachel Jankowitz , Habitat Specialist, NMGF

TRENCHING GUIDELINES

NEW MEXICO DEPARTMENT OF GAME AND FISH

November 1994

Open trenches and ditches can trap small mammals, amphibians and reptiles and can cause injury to large mammals. Periods of highest activity for many of these species include night time, summer months and wet weather. Loss of wildlife can be minimized by implementing the following recommendations.

- To minimize the amount of open trenches at any given time, keep trenching and back-filling crews close together.

- Trench during the cooler months (October – March). However, there may be exceptions (e.g., critical wintering areas) which need to be assessed on a site-specific basis.

- Avoid leaving trenches open overnight. Where trenches cannot be back-filled immediately, escape ramps should be constructed at least every 90 meters. Escape ramps can be short lateral trenches sloping to the surface or wooden planks extending to the surface. The slope should be less than 45 degrees (100%). Trenches that have been left open overnight, especially where endangered species occur, should be inspected and animals removed prior to back-filling.

State wide there are 41 threatened, endangered or sensitive species potentially at risk by trenching operations, (Source: 11/01/94 query of Biota Information System of New Mexico, version 2.5). Risk to these species depends upon a wide variety of conditons at the trenching site, such as trench depth, side slope, soil characteristics, season, and precipitation events.

COMANCHE TRIBE
NAGPRA

October 8, 2003

Greetings,

The Comanche Nation is in receipt of your request for consultation in compliance with the revised 36 CFR 800 Guidelines issued by the Advisory Council for Historic Preservation.

We are unable to confirm the determination of ***"no effect"*** on our Traditional Ancestral lands. However, in the scope of work, if archaeological materials are exposed, such as bone, organic/inorganic materials, glass, metal, pottery, chipped stone tools, or historic crockery, we respectfully request that all activities are halted and the Comanche Nation notified immediately.

If you have any questions or concerns, please feel free to contact me at (580) 492-3754.

Sincerely,

Donnita F. Sovo
Administrative Assistant
Comanche Nation Environmental Program`

P.O. Box 908 • Lawton, Oklahoma 73502 • (580) 492-3754 • (580) 492-3733 FAX

1133 Connecticut Ave. NW Suite 200 Washington D.C. 20036
(Voice) 202.659.4344 (Fax) 202.659.0791

September 15, 2003

Vivian Burdette, Chairperson
TONTO APACHE TRIBE
Reservation #30
Payson, AZ 85541

Dear Ms. Burdette:

Louisiana Energy Services (LES) is proposing to construct a gas centrifuge uranium enrichment plant called the National Enrichment Facility (NEF) near the town of Eunice, Lea County, New Mexico. The proposed facility will be constructed on Section 32 of Township 21S, Range 38E.

The NEF project will involve the construction of multiple buildings and the expansion of access roads existing on the 543-acre site. Approximately 350 acres will be directly impacted by construction of the facility.

Framatome ANP has been contracted to assist LES in preparing an Environmental Report (ER) for this project. This document, along with other environmental information, will be used by the U.S. Nuclear Regulatory Commission (NRC) to prepare an Environmental Impact Statement for the facility. In addition to informing your agency of LES's plans, we are asking for comments and information concerning the proposed facility as it relates to threatened and endangered species, critical habitats, other wildlife, wetlands, and any other natural resource concerns. Based on an initial environmental analysis, this project is not expected to result in significant negative effects on the local environment. To facilitate your review, a site map of the project area has been enclosed. Your comments will be included in the ER that will be submitted to the NRC.

We would appreciate receiving your comments within 30 days from receipt of this letter; please return them to Dr. Edward F. Maher, Framatome ANP, 400 Donald Lynch Blvd, Marlborough, MA 01752. Should you have any questions or need additional information please contact Dr. Maher at (978) 568-2785 or edward.maher@framatome-anp.com.

Respectfully,

R.M. Krich
Vice President
Licensing, Safety and Nuclear Engineering

Enclosure: Map

MESCALERO APACHE TRIBAL HISTORIC PRESERVATION OFFICE
P.O. Box 227
Mescalero, New Mexico 88340
Phone: 505/464-4711
Fax: 505/464-4637

September 24, 2003

R. M. Kirch
Louisiana Energy Services
1133 Connecticut Ave. NW Suite 200
Washington D.C 20036

Dear Mr. Kirch:

Thank you for providing the Mescalero Apache Tribe the opportunity to comment on the National Enrichment Facility near the town of Eunice, Lea County, New Mexico. This project is located within the Mescalero Apache Tribe's traditional homelands and thus we are interested in this project.

There is no knowledge of any Traditional Cultural Places in this area, but we would like to request that a cultural resources survey be undertaken for this project. The survey would aid in our assurance that no cultural or archeological sites that are affiliated to the Apache are located in this area that could be impacted by this project. Please send us a copy of the survey report when it is completed for our review.

Feel free to contact me if you have any questions or if our concerns cannot be met.

Sincerely,

Holly B.E. Houghten
Tribal Historic Preservation Officer

CC: Sara Misquez, Tribal President

12.0 APPENDIX B AIR QUALITY IMPACTS OF CONSTRUCTION SITE PREPARATION ACTIVITIES

Introduction

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

Emission Rate Estimates

Sources of Criteria Pollutants during construction site preparation will include combustion sources and fugitive dust. Of the combustion sources, vehicle exhaust will be the dominant source. Fugitive volatile emissions will also occur because vehicles will be refueled on-site. Fugitive dust will originate predominantly from vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing, and to a lesser extent from wind erosion. Emission rates from vehicle exhaust and fugitive dust for air modeling purposes were estimated for a 10-hour workday assuming peak construction activity levels were maintained throughout the year. This will lead to a conservative estimate of the annual average air concentrations because the peak construction activity levels will occur for only a portion of the year. Emission factors and assumptions specific to each of these two sources are discussed separately in the following paragraphs:

Vehicle Exhaust

Vehicles that will be operating on the site during construction consist of two types: support vehicles and construction equipment. The types and quantities of support vehicles used for modeling purposes included twenty pickup trucks, ten gators (gas-powered carts), five fuel trucks, three stakebody trucks, five mechanic's trucks and five boom trucks. Emission factors in AP-42 for "highway mobile sources" were used to estimate emissions of criteria pollutants and non-methane hydrocarbons for these vehicles. Use of AP-42 requires that highway mobile sources be categorized by vehicle size: the gators were assumed to be Light Duty Vehicles, the pickup trucks and the mechanic's trucks were assumed to be Category I Light Duty Trucks; the boom trucks and stakebody trucks were assumed to be Category II Light Duty Trucks; and the fuel trucks were assumed to be Heavy Duty Trucks. Baseline emission factors for each of the vehicle categories are provided in AP-42 as a function of the model year of the vehicle and the year of emissions, and increase with the age of the vehicle. Emission factors were used for emissions occurring from model year 2001 vehicles on January 1, 2003. An assumption of three-year old vehicles is conservative yet realistic, given the typical operating life of construction vehicles. The baseline emissions from AP-42 can be adjusted based on operating conditions that vary from those under which the emissions in the baseline tables were measured (e.g., average speed, percentage of cold starts, ambient temperature, mileage accumulation, etc.). However, in the absence of any detailed knowledge of the likely operating conditions of the support vehicles, the baseline emission factors were used and are considered adequate for a screening-level analysis of the air quality impacts from the site preparation activities. It should be noted that the emission factor for non-methane hydrocarbons includes refueling emissions, and therefore, no separate emission estimates are needed to account for onsite refueling. It was assumed that each of the support vehicles would be in use each workday and would travel an average of 16.1 km (10 mi) around the construction site. Average emission rates (in g/s) for the entire workday for each vehicle for air modeling purposes were estimated by multiplying the AP-42 emission factor (in g/mi) by 16.1 km (10 mi) and dividing by the number of seconds in the workday (36,000). Table B-1, Support Vehicle Emissions, lists the emission factors used and the resulting emission rates for the support vehicles.

The types and quantities of construction equipment used for modeling purposes that would be operating on the site during peak construction consisted of five bulldozers, three graders, three pans, six dump trucks, three backhoes, four loaders, four rollers, three water trucks and two tractors. Emission factors, in units of grams per hour of operation, provided in AP-42 for diesel-powered construction equipment, were compiled. The emission factors used are listed in Table B-2, Construction Equipment Inventory and Emission Factors, along with a count of the number of pieces of equipment which fall into each of the construction equipment types for which emission factors are provided in AP-42. The EPA does not include refueling emissions in the diesel emission factors for non-methane hydrocarbons because the low-volatility of diesel fuel results in these emissions being relatively insignificant. In calculating emissions, it was conservatively assumed that all the equipment listed in Table B-2 would be in continuous operation throughout the 10-hour workday. Table B-3, Emission Rates for All Construction Vehicles, contains the emission estimates for all the equipment operating simultaneously. These emissions were treated as workday average emission rates in the air dispersion modeling, even though they are more representative of peak emissions.

Fugitive Dust

A fugitive dust emission factor of 2.7 MT per ha (1.2 tons per acre) per month of construction activity is provided in AP-42 for heavy construction activities. This factor is based on downwind measurements of construction sites and therefore includes background and all site-related sources of particulates. The value is most applicable to construction sites with: (1) medium activity level, (2) moderate silt content (~30%), and (3) a semi-arid climate. Note that this factor is referenced to total suspended particulates (TSP), and use of it to estimate particulate matter no greater than 10 μm in diameter (PM10) will result in conservatively high estimates. Also, because derivation of this factor assumes that construction activity occurs 30 days per month, the factor itself is conservatively high for TSP.

The AP-42 emission factor applies to particles 30 μm or less in size, whereas the NAAQS for particulates applies to PM10 (i.e., particles 10 μm or less in size). Based on particle size multipliers presented in AP-42 for other fugitive dust sources, PM10 typically is generated in about a 1:2 ratio with total particulates 30 μm or less in size. Therefore, a correction factor of 0.5 was applied to the construction emission factor in order to adjust it to PM10.

For air modeling purposes, since the derivation of the AP-42 emission factor assumed construction activity on 30 days per month, a second correction factor to account for actual number of workdays was applied. The average number of workdays per month was assumed to be 21.4 (4 major holidays were excluded). The second correction factor was therefore 21.4/30 or 0.71.

The AP-42 emission factor also assumes uncontrolled emissions, whereas the NEF construction site will undergo watering for dust suppression. Water conservation will be considered when deciding how often dust suppression sprays will be applied. The EPA suggests in AP-42 that a twice-daily watering program will reduce dust emissions by up to 50%. Other EPA research suggests that watering can achieve emission reductions upwards of 90%. Therefore, a third correction factor of 0.1 was applied to the AP-42 emission factor to account for fugitive dust controls.

The resulting emission factor after application of the three correction factors is 1.2 x 0.5 x 0.71 x 0.1 = 0.04 tons of dust/acre/month (0.09 MT of dust/ha/month). To this point, an assumption was made that the fugitive dust emissions will occur from the entire site. This assumption is representative of peak emissions rather than average emissions over the construction period. To account for this, the workday average emission rate (in g/s) was calculated assuming that 18 ha (45 acres) of the entire 73-ha (180-acre) site would be under construction at any given time over the period of construction and that emissions occur entirely within a 10-hour workday. This assumption is still conservative considering there are only 33 construction vehicles to be onsite during peak activity. This average workday emission rate was assumed to occur 5 days per week for 50 weeks per year.

The resulting estimate of the workday average emission rate of PM10 was 2.4 g/s (19.1 lbs/hr). Because this emission rate is based on an assumption of emissions occurring from 18 ha (45 acres) of the entire site, it is more representative of peak emissions than of the average over the entire construction period.

Air Dispersion Modeling

The ISCST3 air dispersion model was used to estimate maximum short-term and annual average air concentrations of criteria pollutants and non-methane hydrocarbons released by construction site preparation activities. Averaging periods used for short-term air concentrations included all those for which a NAAQS exists (i.e., 1-hour, 3-hour, 8-hour and 24-hour averages). Maximum ground-level air concentrations were determined along the facility property boundary that was assumed to be 150 m (492 ft) from the construction area.

Because vehicles will be moving and working at varying points within the construction site, both vehicle emissions and fugitive dust were modeled as if emitted uniformly over the entire 73-ha (180-acre) construction site. Emissions were thus represented in the ISCST3 model as an area source 853 m (2,798 ft) on each side centered over the construction site. A unit emission rate of 1 g/s (7.9 lbs/hr) was assumed for the 18-ha (45-acre) source. Because predicted air concentrations are directly proportional to the emission rate, pollutant-specific air concentrations were obtained by multiplying the air concentrations output by ISCST3 using a unit emission rate by the actual pollutant emission rates.

An important aspect of refined air dispersion modeling is use of appropriate meteorological data into the model. ISCST3 requires hourly observations of wind speed and direction, mixing height, air temperature and atmospheric stability. This requires both surface and upper-air meteorological data. Surface meteorological data from the Midland-Odessa, Texas, National Weather Service (NWS) station were combined with concurrent mixing height data from Midland-Odessa for use in the ISCST3 model. According to air modeling guidance, a five-year record of meteorological data should be used. Five years of data (1987 to 1991) were used in the modeling so that expected worst-case meteorological conditions for the area would be included. This 5-year data set is the most recent set of verified data available from the EPA for Midland-Odessa. In order to account for the fact that emissions will occur primarily during the workday, air concentrations were calculated for 7 a.m. to 5 p.m. for 5-day intervals separated by 2-day gaps to account for weekends. This was done for 50 weeks per year.

For each of the five years in the meteorological record, the maximum 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at the site property boundary were determined. In addition, because the NAAQS for PM10 allows for one exceedance of the 24-hour standard per year, the second highest 24-hour averages were also determined. Air concentrations at the property boundary were located using a discrete receptor grid with a distance of 150 m (492 ft) to the boundary. Table B-4, Maximum Predicted Site-Boundary Air Concentrations Based on a 1.0 g/s Emission Rate, lists the maximum site-boundary air concentrations (based on a unit emission rate) for each of the averaging times and the direction from the construction site of the receptor grid point at which it occurred.

<u>Pollutant-Specific Air Concentrations and Comparison to NAAQS</u>

The air concentrations in Table B-4 were multiplied by the emission rates in Tables B-1 and B-3 to obtain pollutant-specific air concentrations. These concentrations were then compared to the appropriate NAAQS. The predicted maximum air concentrations and NAAQS are shown in Table B-5, Predicted Property-Boundary Air Concentrations and Applicable NAAQS (μg/m3). No NAAQS has been set for hydrocarbons; however, the total annual emissions of hydrocarbons predicted from the site (approximately 4.08 MT (4.5 tons)) are well below the level 36.3 MT (40 tons) that defines a significant source of volatile organic compounds (40 CFR 50.21) (CFR, 2003w). Air concentrations of the Criteria Pollutants predicted for vehicle emissions were all at least an order of magnitude below the NAAQS. PM10 emissions from fugitive dust were also below the NAAQS. The maximum annual average concentration was lower by a factor of 4 and the second highest 24-hour average was lower by about a factor of 2. The results of the fugitive dust estimates should be viewed in light of the fact that the peak anticipated fugitive emissions were assumed to occur throughout the year, and that one quarter of the entire construction site was assumed to be under construction at any given time during the construction process. These conservative assumptions will result in predicted air concentrations that tend to overestimate the potential impacts.

Updated Evaluation of Fugitive Dust Emissions During Construction

A report, "Evaluation of Potential Particulate Matter Air Emissions During Construction of the National Enrichment Facility," was completed to updated the original fugitive dust emissions calculations. The report (Penn, 2008) evaluated and quantified potential emissions from discrete construction act ivities with the objective of refining anticipated estimates. These emissions are generated from the handling and spreading of the soil and from travel on paved and unpaved roads. Base case assumptions included the following heavy equipment operating onsite during peak construction: eight concrete trucks, eight dump trucks, 6 water trucks, 4 track-type crawler loaders, 4 scrapers, and 4 bulldozers. Soil compacting was anticipated to occur 6 hours per day, 365 days per year, but it was noted that compaction could be increased to 24 hours per day with very little effect on the final total dust emissions.

Particulate matter emissions estimates resulted in 7.2 lbs./hr and 17.7 tons/year (fine particulate matter (PM10) emissions estimates resulted in 4.52 tons/year). These estimates are beneath the regulatory thresholds of 10 lbs/hr and/or 25 tons/year and a Notice of Construction is not required to be filed under the New Mexico Administrative Code. However, the report also demonstrates that regardless of the number of acres being disturbed, the number of vehicles in use, or the number of hours being worked, the quantity of dust generated will remain below the regulatory limits if the combination of vehicles in use, the miles traveled , and soil acreage disturbed or compacted remain within the footprint of these derivations. These results enable construction activities to be managed in such a manner as to ensure that the PM emissions remain within regulatory limits.

Table B-1Support Vehicle Emissions

Vehicle	Emission Factor g/km (g/mi)	Number	Daily Mileage km (mi)	Daily Emissions g (lb)		Work-day (10-hr) Average Emission Rate g/s (lb/hr)	
NONMETHANE HYDROCARBONS:							
Light Duty Vehicles	0.75 (1.2)	10	16.1 (10)	120	(0.26)	0.00333	(0.0264)
Light Duty Truck I	0.81 (1.3)	25	16.1 (10)	325	(0.72)	0.00903	(0.0717)
Light Duty Truck II	0.87 (1.4)	8	16.1 (10)	112	(0.25)	0.00311	(0.2247)
Heavy Duty Truck	1.55 (2.5)	5	16.1 (10)	125	(0.28)	0.00347	(0.0275)
Total				682	(1.50)	0.01894	(0.1503)
CARBON MONOXIDE:							
Light Duty Vehicles	2.86 (4.6)	10	16.1 (10)	460	(1.01)	0.01278	(0.1014)
Light Duty Truck I	4.41 (7.1)	30	16.1 (10)	2130	(4.69)	0.05917	(0.4696)
Light Duty Truck II	4.47 (7.2)	8	16.1 (10)	576	(1.27)	0.01600	(0.1269)
Heavy Duty Truck	7.89 (12.7)	5	16.1 (10)	635	(1.40)	0.01764	(0.1400)
Total				3801	(8.37)	0.10559	(0.8380)
NITROGEN OXIDES:							
Light Duty Vehicles	0.43 (0.7)	10	16.1 (10)	70	(0.15)	0.00194	(0.0154)
Light Duty Truck I	0.56 (0.9)	30	16.1 (10)	270	(0.59)	0.00750	(0.0595)
Light Duty Truck II	0.56 (0.9)	8	16.1 (10)	72	(0.16)	0.00200	(0.0159)
Heavy Duty Truck	2.24 (3.6)	5	16.1 (10)	180	(0.40)	0.00500	(0.0397)
Total				592	(1.30)	0.01644	(0.1305)

Table B-2Construction Equipment Inventory And Emission Factors

		Emission Factors Per Vehicle, g/s (lb/hr)				
Equipment	Numbers	Exhaust Hydrocarbons	Carbon Monoxide	Nitrogen Oxides	Sulfur Oxides	Particulates
Wheeled Tractor	2	85.26 (676.7)	1622.77 (12879.4)	575.84 (4570.2)	40.9 (325)	61.5 (488)
Grader	3	18.07 (143.4)	68.46 (543.3)	324.43 (2574.9)	39.0 (310)	27.7 (220)
Pans	3	18.07 (143.4)	68.46 (543.3)	324.43 (2574.9)	39.9 (317)	27.7 (220)
Wheeled Loader	4	113.17 (898.19)	259.58 (2060.2)	858.19 (6811.2)	82.5 (655)	77.9 (618)
Track-type Loader	5	44.55 (353.6)	91.15 (723.4)	375.22 (2978.0)	34.4 (273)	26.4 (210)
Off-Road Truck	7	86.84 (689.2)	816.81 (6482.7)	1889.16 (14,993.6)	206.6 (1640)	116.0 (921)
Roller	4	30.58 (242.7)	137.97 (1095.0)	392.9 (3118)	30.5 (242)	22.7 (180)
Miscellaneous	5	69.35 (550.4)	306.37 (2431.6)	767.3 (6090)	64.7 (514)	63.2 (502)

Table B-3Emission Rates For All Construction Vehicles

	Work-Day Average Emissions Rates g/s (lb/hr)				
Equipment	Exhaust Hydrocarbons	Carbon Monoxide	Nitrogen Oxides	Sulfur Oxides	Particulates
Wheeled Tractor	0.047 (0.37)	0.902 (0.716)	0.320 (2.5)	0.023 (0.18)	0.034 (0.27)
Grader	0.015 (0.12)	0.057 (0.45)	0.270 (2.1)	0.033 (0.26)	0.023 (0.18)
Pans	0.015 (0.12)	0.057 (0.45)	0.270 (2.1)	0.033 (0.26)	0.023 (0.18)
Wheeled Loader	0.126 (1.00)	0.288 (2.29)	0.954 (7.57)	0.092 (0.73)	0.087 (0.69)
Track-Type Loader	0.062 (0.49)	0.127 (1.01)	0.521 (4.13)	0.048 (0.38)	0.037 (0.29)
Off-Road Truck	0.169 (1.34)	1.588 (12.60)	3.673 (29.15)	0.402 (3.19)	0.226 (1.79)
Roller	0.034 (0.27)	0.153 (1.21)	0.437 (3.47)	0.034 (0.27)	0.025 (0.20)
Miscellaneous	0.096 (0.076)	0.426 (3.38)	1.066 (8,460)	0.090 (0.71)	0.088 (0.70)
Total	0.564 (4.48)	3.598 (28.56)	7.511 (59.61)	0.755 (5.99)	0.543 (4.31)

Table B-4Maximum Predicted Site-Boundary Air Concentrations Based On A 1.0 g/s Emission Rate

Averaging Time	Maximum Air Concentration ($\mu g/m^3$)	Direction From Site
1-Hour	1089.9	North-Northeast
3-Hour	409.9	North
8-Hour	145	North-Northeast
Highest 24-Hour	63.3	North
2nd Highest 24-Hour	32.3	North
1-Year	5	North

Table B-5Predicted Property-Boundary Air Concentrations and Applicable NAAQS

	Maximum 1-Hr Average (µg/m^3)		Maximum 3-Hr Average (µg/m^3)		Maximum 8-Hr Average (µg/m^3)		Maximum 24-Hr Average (µg/m^3)		2nd Highest 24-Hr Average (µg/m^3)		Maximum Annual Average (µg/m^3)	
Pollutant	Predicted	NAAQS	Predicted	NAAQS	Predicted	NAAQS	Predicted	NAAQS	Predicted	NAAQS	Predicted	NAAQS
VEHICLE EMISSIONS												
Hydrocarbons	635.3	NA	238.9	NA	84.5	NA	36.9	NA	18.8	NA	2.9	NA
Carbon Monoxide	4,036.5	40,000	1,518.1	NA	537.0	10,000	234.4	NA	119.6	NA	18.5	NA
Nitrogen Oxides	8,204.2	NA	3,085.5	NA	1,091.5	NA	476.5	NA	243.1	NA	37.6	100
Sulfur Oxides	822.9	NA	309.5	1310(a)	109.5	NA	47.8	365	24.4	NA	3.8	80
Particulates	591.8	NA	222.6	NA	78.7	NA	34.4	NA	17.5	150	2.7	50
FUGITIVE DUST												
Particulates	2,615.8	NA	983.8	NA	348.0	NA	151.9	NA	77.5	150	12.0	50

(a) Secondary standard

NANot applicable

Addendum 1 to the Environmental Report

This Addendum was created to support implementation of LAR-11-02 to replace IROFS41 with IROFSC23, along with the other NRC approved changes included in the LAR.

The following markup changes to this License Basis Document were approved by the NRC in a Safety Evaluation Report contained in Letter Number IN-12-0001-NRC[2] and apply to the UUSA Facility as shown, except for the following:

> Centrifuge cascades 1-1 through 1-7 in SBM-1001, which shall retain IROFS41 until the NRC approves full implementation of IROFSC23.

Upon approval of IROFSC23 in centrifuge cascades 1-1 through 1-7, the appropriate pages in the main body of the Environmental Report will be updated to incorporate the information in the Addendum and the Addendum will be deleted.

[2] NRC Letter Number IN-12-0001-NRC, License Amendment Request (LAR 11-02) for the National Enrichment Facility for Replacement of IROFS41 and IROFS27e (TAC No. L33180) and Amendment 50 to License SNM-2010, November 30, 2011.

ENVIRONMENTAL REPORT

REVISION 19c

Markups for LAR-11-02

LES, PO Box 1789, Eunice, New Mexico 88231, USA T: +1 575 394 4646 F: +1 575 394 4545 W: www.urenco.com

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

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

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

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

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

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

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

4.12.3.2 Accident Mitigation Measures

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

4.12.3.3 Non-Radiological Accidents

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

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

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

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

5.2.12.2 Radiological – Normal Operations

Mitigation measures to minimize the impact of radiological gaseous and liquid effluents are the same as those listed in ER Section 5.2.12.1, Nonradiological – Normal Operations. Additional measures to minimize radiological exposure and release are listed below.

Radiological practices and procedures are in place to ensure compliance with the NEFs' Radiation Protection Program. This program is designed to achieve and maintain radiological exposure to levels that are "As Low as Reasonably Achievable" (ALARA). These measures include:

- Routine plant radiation and radiological surveys to characterize and minimize potential radiological dose/exposure.
- Monitoring of all radiation workers via the use of dosimeters and area air sampling to ensure that radiological doses remain within regulatory limits and are ALARA.
- Radiation monitors are provided in the gaseous effluent stacks to detect and alarm, and affect the automatic safe shutdown of process equipment in the event contaminants are detected in the system exhaust. Systems will either automatically shut down, switch trains or rely on operator actions to mitigate the potential release.

5.2.12.3 Accidental Releases

Mitigation measures will be in place to minimize the impact of a potential accidental release of radiological and/or nonradiological effluents. For example, several accident sequences involving UF_6 releases to the environment due to seismic or fire events were mitigated using design features to delay and reduce the UF_6 releases from reaching the outside environment. The mitigative measures for seismic secenarios are: seismically designed buildings, seismically designed autoclaves~~, and portions of the UF_6 process piping and UF_6 process components~~, and certain features of centrifuges. Fire events are mitigated though measures such as~~that include~~ the automatic shutoff of building heating, ventilation and air conditioning (HVAC) systems.

With mitigation, the dose consequences to the public for these accident sequences, have been reduced to a level below that considered "intermediate consequences", as that term is defined in (10 CFR 70.61(c)) (CFR, 2003b). See ER Section 4.12.3, Environmental Effects of Accidents.

5.2.13 Waste Management

Mitigation measures will be in place to minimize both the generation and impact of facility wastes. Solid and liquid wastes and liquid and gaseous effluents will be controlled in accordance with regulatory limits. Mitigation measures include:

- System design features are in place to minimize the generation of solid waste, liquid waste, liquid effluents, and gaseous effluent. Liquid and gaseous effluent design features were previously described in ER Section 5.2.12, Public and Occupational Health.
- There will be no onsite disposal of waste at the NEF. Waste will be stored in designated areas of the plant, until an administrative limit is reached. When the administrative limit is reached, the waste will then be shipped offsite to a licensed disposal facility.
- All radioactive and mixed wastes will be disposed of at offsite, licensed facilities.
- Mitigation measures associated with UBC storage are as follows:

With respect to the impact from the transportation of UF_6 as feed, product or depleted material and solid low level waste, the cumulative dose impact has been found to be small. The cumulative dose equivalent to the general public from the "worst-case" combination of all transport categories combined equaled 2.33×10^{-6} person-Sv/year (2.33×10^{-4} person-rem/year). Similarly, the dose equivalent to the onlooker, drivers and workers totaled 1.05×10^{-3}, 9.49×10^{-2}, 6.98×10^{-4} person-Sv/year (1.05×10^{-1}, 9.49×10^{-2}, and 6.98×10^{-2} person-rem/year), respectively.

The dose equivalents due to normal operations are small fractions of the normal background range of 2.0 to 3.0 mSv (200 to 300 mrem) that an average individual receives in the US, and well within regulatory limits. Given the conservative assumptions used in estimating these values, these concentrations and resulting dose equivalents are insignificant, and their potential impacts on the environment and health are inconsequential.

Since the NEF will operate with only natural and low enriched (i.e., not reprocessed) uranium in the form of uranium hexafluoride (UF_6), it is unlikely that an accident could result in any significant offsite radiation doses. The only chemical exposures that could impact safety are those associated with the potential release of HF to the atmosphere. The possibility of a nuclear criticality occurring at the NEF is highly unlikely. The facility has been designed with operational safeguards common to the most up-to-date chemical plants. All systems are highly instrumented and abnormal operations are alarmed in the facility Control Room.

Postulated accidents are those accidents described in the Integrated Safety Analysis (ISA) that have, for the uncontrolled case, been categorized as having the potential to exceed the performance criteria specified in 10 CFR 70.61(b) (CFR, 2003b). No significant exposure to offsite individuals is expected from any of the accidents, since many barriers are in place to prevent or mitigate such events.

Evaluation of potential accidents at the NEF included identification and selection of a set of candidate accidents and analysis of impacts for the selected accidents. The ISA team identified UF_6 as the primary hazard at the facility. An example of an uncontrolled accident sequence is a seismic event which produces loads on the UF_6 piping and components beyond their capacity. This accident is assumed to lead to release of gaseous UF_6, with additional sublimation of solid UF_6 to gas. The UF_6 gas, when in contact with moisture in the air, will produce HF gas.

For the controlled accident sequence, the mitigating measures are (1) seismically designed buildings (SBM-1001, SBM-1003, UF_6 Handling Areas in SBMs beyond SBM-1003,s and the CRDB) designed to withstand a 0.15 g peak ground acceleration; (2) seismically designed portions of the UF_6 process systems and components. These sections of piping and componets are deigned to contain the portions of the gaseous UF_6 and HF within the process system and attenuate the release of effluent to the building and the environment, and (3) seismically designed autoclaves; and (3) certain features of the centrifuges. This will reduce the consequences of a seismic event to acceptable levels, even if all non-seismically designed portions of the UF_6 process systems fail.

Exposures to workers would most likely be higher than those to offsite individuals and highly dependent on the workers proximity to the incident location. All workers at the NEF are trained in the physical characteristics and potential hazards associated with facility processes and materials. Therefore, facility workers know and understand how to lessen their exposures to chemical and radiological substances in the event of an incident at the facility.