NATIONAL ENRICHMENT FACILITY

ENVIRONMENTAL REPORT

Environmental Report

Revision 3, September 2004
Including Page Removal and Insertion Instructions

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ACRONYMS and ABBREVIATIONS

AC	alternating current
ACI	American Concrete Institute
ADEM	Alabama Department of Environmental Management
AEA	Atomic Energy Act
AEP	American Electric Power
AEGL	Acute Exposure Guideline Level
AHU	air handling unit
AISC	American Institute of Steel Construction
ALARA	as low as reasonably achievable
ALI	Annual Limit on Intake
ANPR	Advance Notice of Proposed Rulemaking
ANS	American Nuclear Society
ANSI	American National Standards Institute
AP	air particulate
APE	area of potential effects
AQB	Air Quality Bureau
ASCE	American Society of Civil Engineers
ASLB	Atomic Safety and Licensing Board
ASME	American Society of Mechanical Engineers
ASNT	American Society of Nondestructive Testing
ASTM	American Society for Testing Materials
ATSDR	Agency for Toxic Substances and Disease Registry
AVLIS	Atomic Vapor Laser Isotope Separation
BDC	baseline design criteria
BEA	Bureau of Economic Analysis
BLM	Bureau of Land Management
BMP	Best Management Practices
BNFL	British Nuclear Fuels
BNFL-EL	British Nuclear Fuels – Enrichment Limited
BOD	biochemical oxygen demand
BS	Bachelor of Science
CA	Controlled Area
CAA	Clean Air Act
CAAS	Criticality Accident Alarm System
CAB	Centrifuge Assembly Building
CAM	Continuous Air Monitor
CAP	Corrective Action Program
CBG	Census Block Group
CEDE	Committed Effective Dose Equivalent
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFO	Chief Financial Officer
CFR	Code of Federal Regulations
CHP	certified health physicist
CIS	Commonwealth of Independent States
CM	configuration management

ACRONYMS and ABBREVIATIONS

COD	chemical oxygen demand
COO	Chief Operating Officer
CRDB	Cylinder Receipt and Dispatch Building
CUB	Central Utilities Building
CVRF	Central Volume Reduction Facility
CWA	Clean Water Act
D&D	decontamination and decommissioning
DAC	derived air concentration
DBA	design basis accident
DBE	design basis earthquake
DCF	dose conversion factor
DE	Dose Equivalent
DEIS	Draft Environmental Impact Statement
DI	deionized
DOC	United States Department of Commerce
DOE	United States Department of Energy
DOI	United States Department of Interior
DOT	United States Department of Transportation
E	east
EDE	Effective Dose Equivalent
EECP	Entry/Exit Control Point
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EJ	Environmental Justice
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPRI	Electric Power Research Institute
eqs.	equations
ER	Environmental Report
ERPG	Emergency Response Planning Guideline
ENE	east north east
ESE	east south east
ETTP	East Tennessee Technology Park
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHA	fire hazards analysis
FNMC	Fundamental Nuclear Material Control
FR	Federal Register
FWPCA	Federal Water Pollution Control Act
GDP	Gaseous Diffusion Plant
GET	General Employee Training
GEVS	Gaseous Effluent Vent System
GPS	Global Positioning System
HEPA	high efficiency particulate air
HEU	highly enriched uranium
HMTA	Hazardous Materials Transportation Act
HS&E	Health, Safety, and Environment

ACRONYMS and ABBREVIATIONS

HUD	United States Department of Housing and Urban Development
HVAC	heating, ventilating, and air conditioning
HWA	Hazardous Waste Act
HWB	Hazardous Waste Bureau
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
INFL	International Nuclear Fuels Plc
I/O or I-O	input/output
IPD	Implicit Price Deflator
IROFS	items relied on for safety
ISA	Integrated Safety Analysis
ISO	International Organization for Standardization
JCIDA	Jackson County Industrial Development Authority
LAN	local area network
LCC	local control center
LCD	local climatic data
L_{dn}	Day-Night Average Sound Level
L_{eq}	Equivalent Sound Level
LES	Louisiana Energy Services
LEU	low enriched uranium
LLC	Limited Liability Company
LLD	lower limits of detection
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
LOI	local operator interface
LQ	Location Quotients
LTA	lost time accident
LTC	load tap changer
LTTS	Low Temperature Take-off Station
M&TE	measuring and test equipment
MAPEP	Mixed Analyte Performance Evaluation Program
max.	maximum
MC&A	material control and accountability
MCL	maximum contaminant level
MCNP	Monte Carlo N-Particle
MDA	minimum detectable activity
MDC	minimum detectable concentration
ME&I	mechanical, electrical and instrumentation
min.	minimum
MM	modified mercalli
MMI	modified mercalli intensity
MOU	Memorandum of Understanding
MOX	mixed oxide fuel
MUA	multi-attribute utility analysis
N	north
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautic Space Administration
NCA	Noise Control Act
NCRP	National Council on Radiological Protection and Measurements

ACRONYMS and ABBREVIATIONS

NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NDA	Non-destructive assessment
NE	Northeast
NEF	National Enrichment Facility
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NELAC	National Environmental Laboratory Accreditation Conference
NIOSH	National Institute of Occupational Safety and Health
NIST	National Institute of Standards and Technology
NM	New Mexico
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environmental Department
NMHWB	New Mexico Hazardous Waste Bureau
NMRPR	New Mexico Radiation Protection Regulations
NMSA	New Mexico State Agency
NMSE	New Mexico State Engineer
NMSHPO	New Mexico State Historic Preservation Office
NMSLO	New Mexico State Land Office
NMSS	Nuclear Material Safety and Safeguards
NMWQB	New Mexico Water Quality Bureau
NMWQCC	New Mexico Quality Control Commission
NNE	north-northeast
NNW	north-northwest
No.	number
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPDWS	National Primary Drinking Water Standard
NRC	United States Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSDWS	National Secondary Drinking Water Standard
NSPS	New Source Performance Standards
NSR	New Source Review
NTS	Nevada Test Site
NWS	National Weather Service
NW	northwest
OEPA	Ohio Environmental Protection Agency
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OVEC	Ohio Valley Electric Corporation
P&IDs	piping and instrumentation diagrams
p.	page
PA	public address
PEL	Permissible Exposure Level

ACRONYMS and ABBREVIATIONS

PFPE	perfluorinated polyether
PGA	peak ground acceleration
pH	measure of the acidity or alkalinity
PHA	Process Hazard Analysis
Ph.D.	Doctor of Philosophy
PIA	Potentially Impacted Area
PLC	Programmable Logic Controllers
PM	preventive maintenance
$PM_{2.5}$	particulates $\leq 2.5\mu m$
PM_{10}	particulates $\leq 10\mu m$
PMF	probable maximum flood
PMP	Probable Maximum Precipitation
PMWP	Probable Maximum Winter Precipitation
PORTS	Portsmouth Gaseous Diffusion Plant
POTW	Publicly Owned Treatment Works
pp.	pages
PRC	Peoples Republic of China
PSAR	Preliminary Safety Analysis Report
PSP	Physical Security Plan
QA	quality assurance
QAPD	Quality Assurance Program Description
QC	Quality Control
RCB	Radiation Control Bureau
RCRA	Resource Conservation and Recovery Act
RCZ	radiation control zone
REIS	Regional Economic Information System
REMP	Radiological Environmental Monitoring Program
RIMS	Regional Input-Output Modeling System
ROI	Region of Interest or Radius of Influence
RTE	Rare Threatened and Endangered
RWP	radiation work permit
S	south
SAR	Safety Analysis Report
SB	Separations Building
Sc.D.	Doctor of Science
SCRAM	Support Center for Regulatory Air Models
SDWA	Safe Drinking Water Act
SE	southeast
SER	Safety Evaluation Report
SHPO	State Historic Preservation Officer
SILEX	Separation of Isotopes by Laser Excitation
SNM	special nuclear material
SPCC	spill prevention, control, and countermeasures
SPL	Sound Level Pressure
SRC	Safety Review Committee
SSC	structure, system, and component
SSE	safe shutdown earthquake
SSE	south-southeast
SSW	south-southwest

ACRONYMS and ABBREVIATIONS

STEL	short term exposure limits
STP	standard temperature and pressure
SVOC	semivolatile organic compounds
SW	southwest
SWPPP	Storm Water Pollution Prevention Plan
TDEC	Tennessee Department of Environment and Conservation
TDS	Total Dissolved Solids
TEDE	total effective dose equivalent
TLD	thermoluminescent dosimeter
TN	Tennessee
TSB	Technical Services Building
TSP	total suspended particulates
TVA	Tennessee Valley Authority
TWA	time weighted average
TWDB	Texas Water Development Board
TX	Texas
UBC	Uranium byproduct cylinder
UCL	Urenco Capenhurst Limited
UCN	Ultra-Centrifuge Netherlands NV
UNAMAP	Users Network for Applied Modeling of Air Pollution
UPS	uninterruptible power supply
US	United States
USACE	United States Army Corps of Engineers
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UV	ultravoilet
VOC	volatile organic compound
W	West
WCS	Waste Control Specialists
WIPP	Waste Isolation Pilot Plant
WMA	wildlife management area
WNA	World Nuclear Association
WNW	west-northwest
WQB	Water Quality Bureau
WQCC	Water Quality Control Commission
WSW	west-southwest

UNITS OF MEASURE

Bq	Becquerel
BTU	british thermal unit
°C	degrees celsius
Ci	curie
cm	centimeter
d	day
dB	decibel
dBA	decibel A-weighted
dpm	disintegrations per minute
°F	degrees farenheit
ft	feet
g	gram
g_a	gravitational acceleration
gal	gallon
gpm	gallons per minute
Gy	Gray
ha	hectares
hp	horsepower
hr	hour
Hz	hertz (cycle per second)
in	inch
in. H_2O	inches of water (column)
J	Joule
kg	kilogram
km	kilometer
kWh	kilowatt-hour
L	liter
lb	pound
lbs	pounds
m	meter
mbar abs	millibar absolute
mbarg	millibar gauge
MBq	megabecquerel
mi	mile
min	minute
M_N	local magnitude
Mo	month
msl	mean sea level
MT or t	metric ton
MTU	Metric ton uranium
oz	ounce
Pa	pascal
ppb	parts per billion
ppm	parts per million
psia	pounds per square inch absolute
psig	pounds per square inch gauge
R	Roentgen
rad	radiation absorbed dose
rem	Roentgen equivalent man

UNITS OF MEASURE

scfm	standard cubic feet per minute
s	second
Sv	sievert
SWU	separative work unit
μmhos	micromhos
V	volt
VA	volt-ampere
W	watt
$^{w}/_{o}$	weight percent
χ/Q	atmospheric concentration per unit source
yd	yard
yr	year
σ	standard deviation
Pico (p)	X 10^{-12}
Nano (n)	X 10^{-9}
Micro (μ)	X 10^{-6}
Milli (m)	X 10^{-3}
Centi (c)	X 10^{-2}
Kilo (k)	X 10^{3}
Mega (M)	X 10^{6}

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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, Final Report August 2003 (NRC, 2003a).

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 Chapter9, References, and Chapter 10 List of Preparers, respectively.

The effective date of this ER is December 2003.

The LES Partnership

Louisiana Energy Services (LES), L.P. is a Delaware limited partnership. It has been formed solely to provide uranium enrichment services for commercial nuclear power plants. LES has one, 100% owned subsidiary, operating as a limited liability company, formed for the purpose of purchasing Industrial Revenue Bonds and no divisions. The general partners are as follows:

A. Urenco Investments, Inc. (a Delaware corporation and wholly-owned subsidiary of Urenco Limited, a corporation formed under the laws of the United Kingdom ("Urenco") and owned in equal shares by BNFL Enrichment Limited ("BNFL-EL"), Ultra-Centrifuge Nederland NV ("UCN"), and Uranit GmbH ("Uranit") companies formed under English, Dutch and German law, respectively; BNFL-EL is wholly-owned by British Nuclear Fuels plc, which is wholly-owned by the Government of the United Kingdom; UCN is 99% owned by the Government of the Netherlands, with the remaining 1% owned collectively

by the Royal Dutch Shell Group, DSM, Koninklijke Philips Electronics N.V. and Stork N.V.; Uranit is owned by Eon Kernkraft GmbH (50%) and RWE Power AG (50%), which are corporations formed under laws of the Federal Republic of Germany); and

B. Westinghouse Enrichment Company LLC (a Delaware limited liability company and wholly-owned subsidiary of Westinghouse Electric Company LLC, a Delaware limited liability company ("Westinghouse"), whose ultimate parent, through two intermediary Delaware corporations and one corporation formed under the laws of the United Kingdom, is British Nuclear Fuels plc, which is wholly-owned by the government of the United Kingdom).

The names and addresses of the responsible officials for the general partners are as follows:

Urenco Investments, Inc.
Charles W. Pryor, President and CEO
2600 Virginia Avenue NW, Suite 610
Washington, DC 20037

Dr. Pryor is a citizen of the United States of America

Westinghouse Enrichment Company LLC
Ian B. Duncan, President
4350 Northern Pike
Monroeville, PA 15146

Mr. Duncan is a citizen of the United Kingdom.

The limited partners are as follows:

A. Urenco Deelnemingen B.V. (a Netherlands corporation and wholly-owned subsidiary of Urenco Nederlands B.V. (UNL));

B. Westinghouse Enrichment Company LLC (the Delaware limited liability company, wholly-owned by Westinghouse, that also is acting as a General Partner);

C. Entergy Louisiana, Inc. (a Louisiana corporation and wholly-owned subsidiary of Entergy Corporation, a publicly-held Delaware corporation and a public utility holding company);

D. Claiborne Energy Services, Inc. (a Louisiana corporation and wholly-owned subsidiary of Duke Energy Corporation, a publicly-held North Carolina corporation);

E. Cenesco Company, LLC (a Delaware limited liability company and wholly-owned subsidiary of Exelon Generation Company, LLC, a Pennsylvania limited liability company).

F. Penesco Company, LLC (a Delaware limited liability company and wholly-owned subsidiary of Exelon Generation Company, LLC, a Pennsylvania limited liability company).

Urenco owns 70.5% of the partnership, while Westinghouse owns 19.5% of LES. The remaining 10% is owned by the companies representing the three electric utilities, i.e., Entergy Corporation, Duke Energy Corporation, and Exelon Generation Company, LLC.

The President of LES is E. James Ferland, a citizen of the United States of America. LES' principal location for business is Albuquerque, NM. The facility will be located in Lea County

near Eunice, New Mexico. No other companies will be present or operating on the NEF site other than services specifically contracted by LES.

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.

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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 a significant addition to current U.S. enrichment capacity. As noted above, the NEF would produce low-enriched uranium at the rate of 3 million SWU/yr. This is equivalent to roughly one-fourth of the current U.S. enrichment services demand.

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 (NRC, 2002b) 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 Figure 1-1.4, Comparison of Forecasts of World Average Annual Uranium Enrichment Requirements Forecasts, Unadjusted for Plutonium Recycle in MOX Fuel, 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, 1999a; 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).

The LES partnership has 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, 1999a; 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 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. Incidently, 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 its

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.

TABLES

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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 1.1-4 LES 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 1.1-5 Current and Potential Future Sources of Uranium Enrichment Services

Page 1 of 2

Ref.	Source	Technology	Current Annual Physical Capability Millions SWU	Annual Economically Competitive and Usable Capability Million SWU 2003	2016	Comments Regarding Potential Future Action
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.

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		Comments Regarding Potential Future Action
				2003	2016	
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.
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 1.1-6 Summary of Current Russian Sources and Uses of Enrichment Services

Page 1 of 1

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

Page 1 of 1

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

Page 1 of 1

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

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FIGURES

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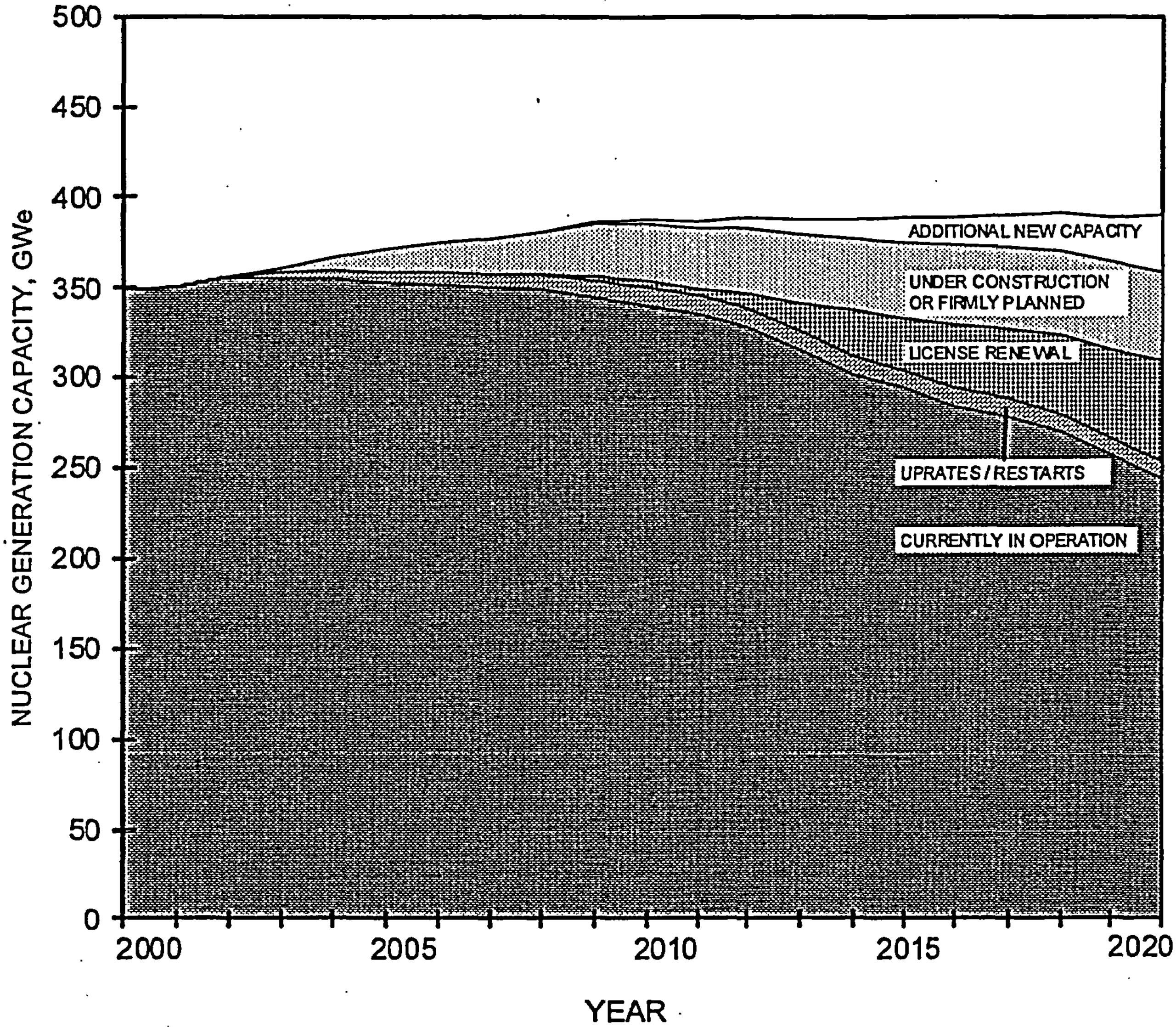

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FIGURE 1.1-1
FORECAST AND COMPOSTITION OF WORLD NUCLEAR GENERATION CAPACITY
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

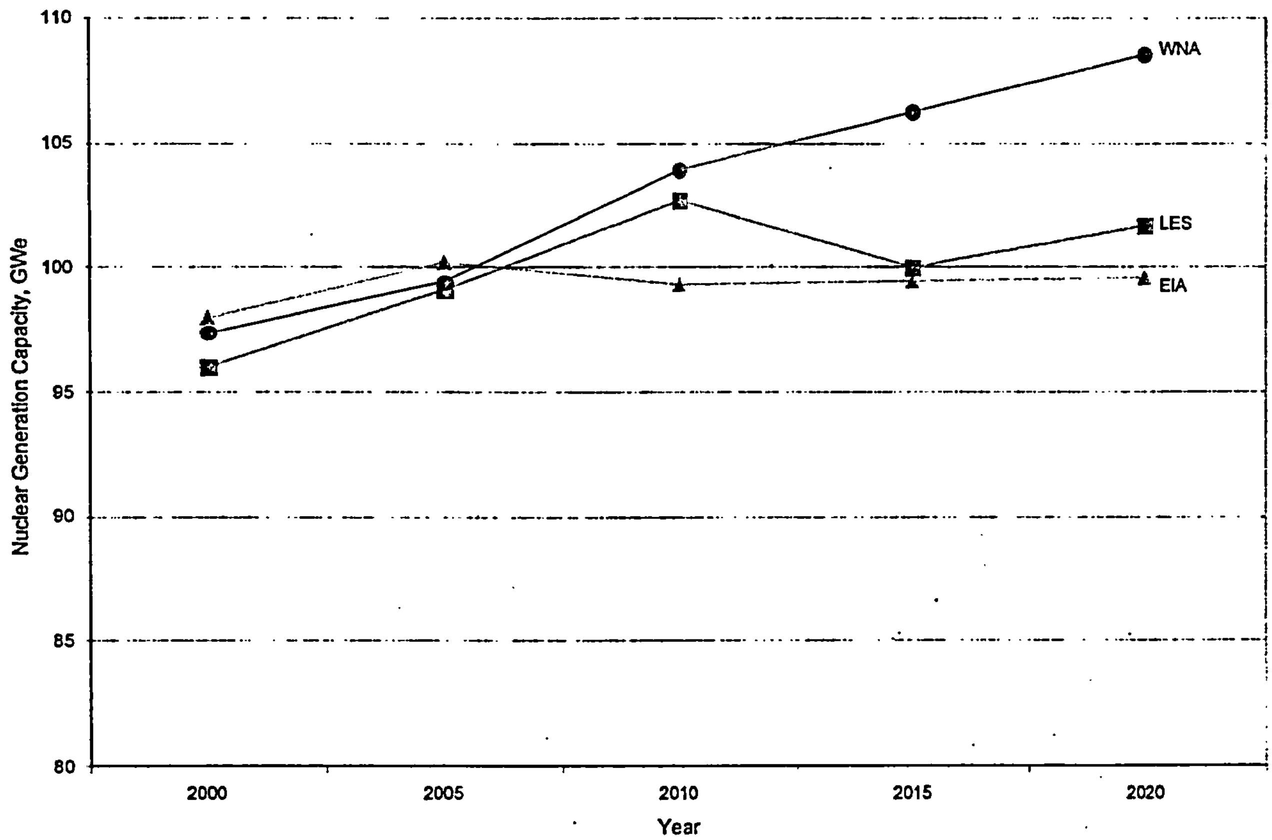

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Figure 1.1–2.doc

FIGURE 1.1-2

COMPARISON OF FORECASTS OF U.S. NUCLEAR GENERATION CAPACITY

ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

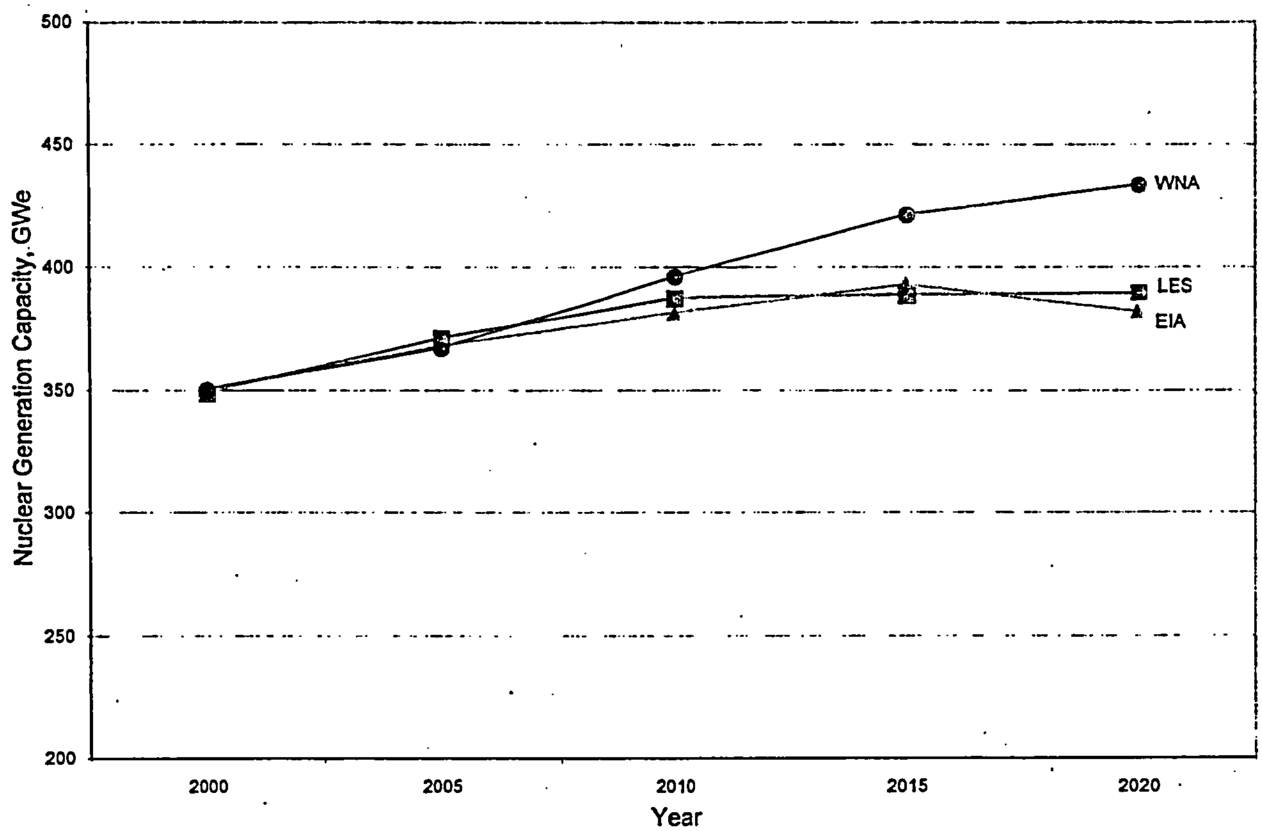

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Figure 1.1–3.doc

FIGURE 1.1-3

COMPARISON OF FORECASTS OF
WORLD NUCLEAR GENERATION CAPACITY
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

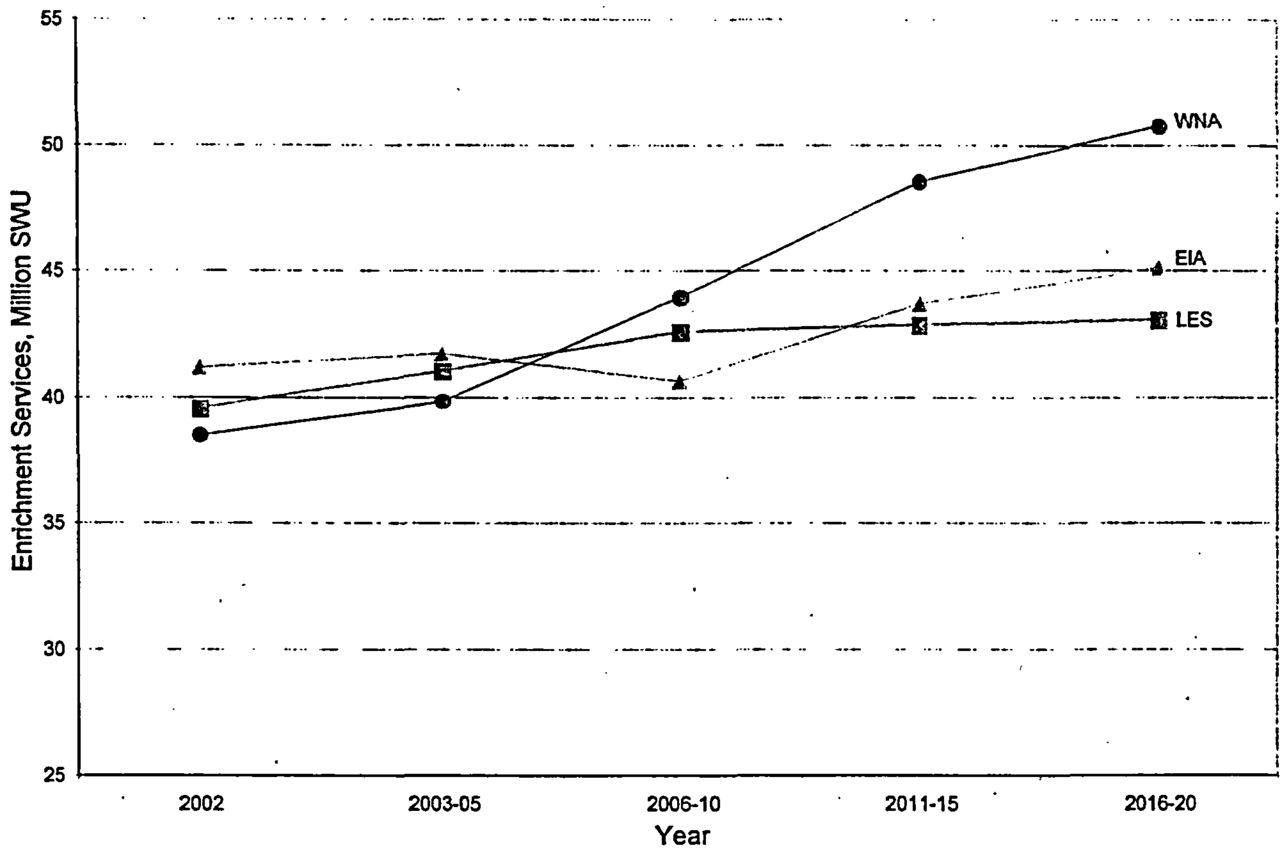

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Figure 1.1–4.doc

FIGURE 1.1-4
COMPARISON OF FORECAST OF WORLD AVERAGE ANNUAL URANIUM ENRICHMENT REQUIREMENTS FORECASTS, UNADJUSTED FOR PLUTONIUM RECYCLE IN MOX FUEL
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

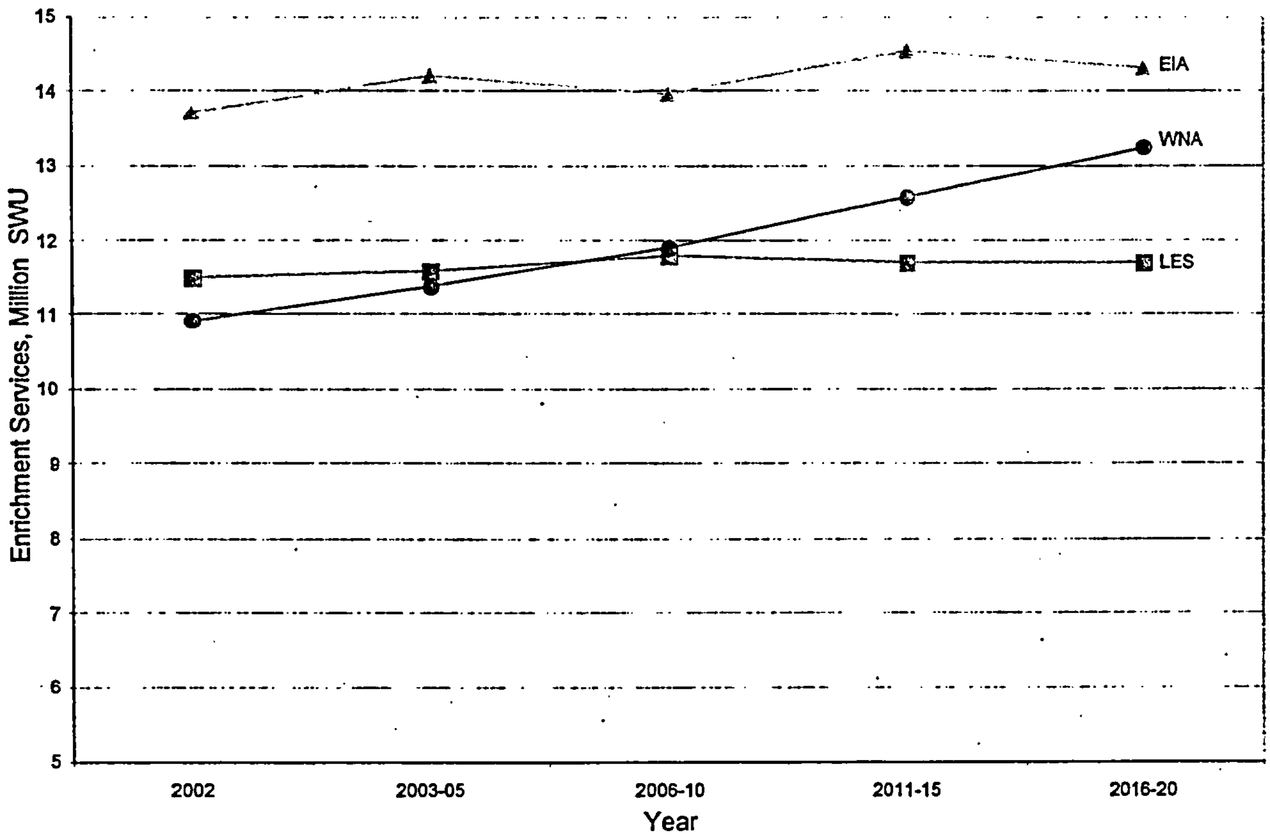

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Figure 1.1–5.doc

FIGURE 1.1-5
COMPARISON OF FORECAST OF U.S. AVERAGE ANNUAL URANIUM ENRICHMENT REQUIREMENTS FORECAST, UNADJUSTED FOR PLUTONIUM RECYCLE IN MOX FUEL
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

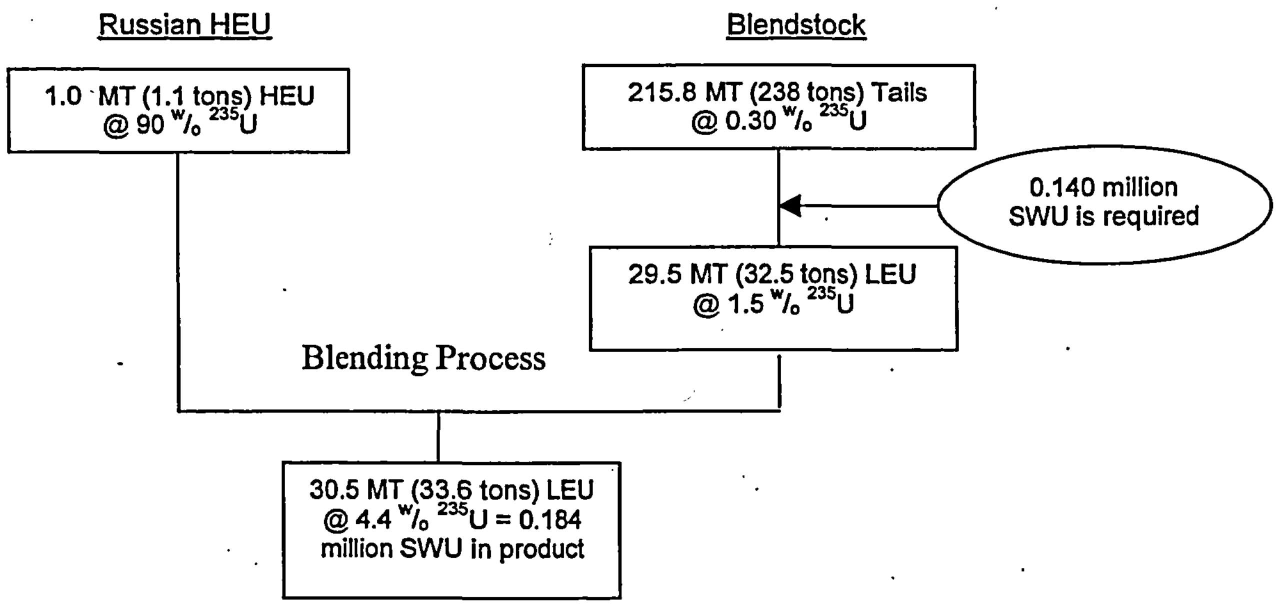

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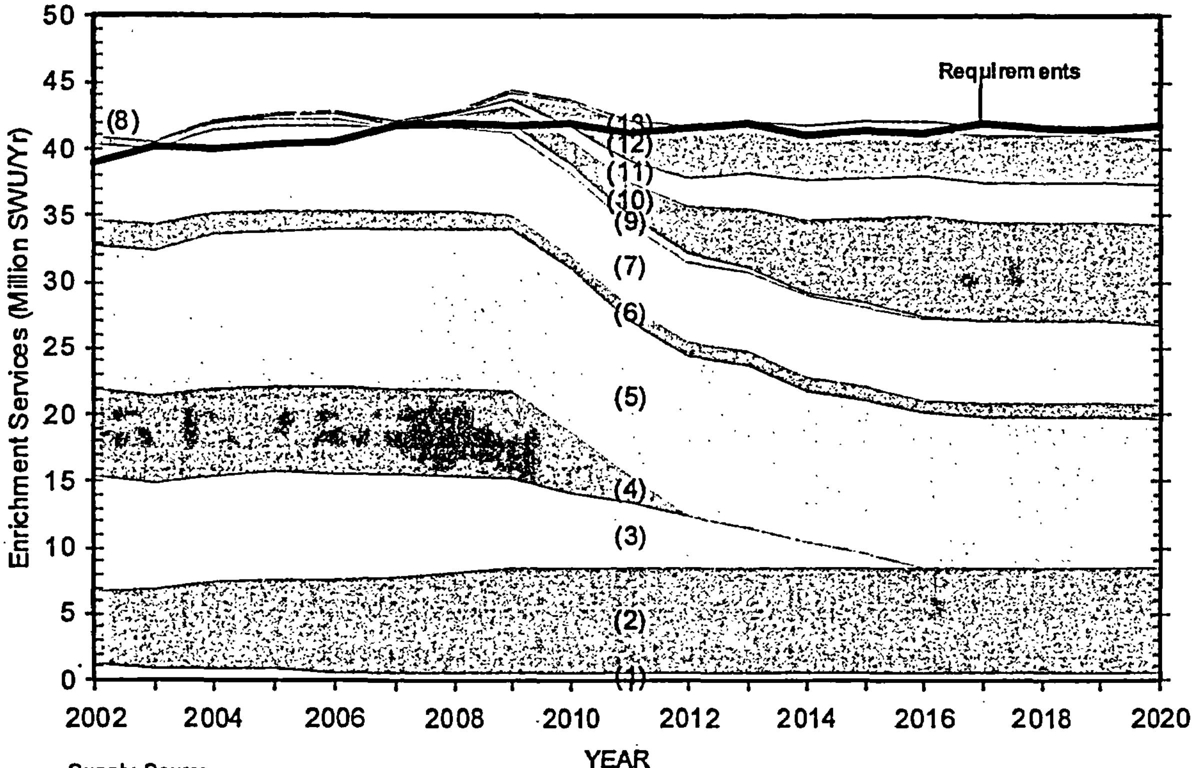
Figure 1.1–6.doc

FIGURE 1.1-6

RELATIONSHIP AMONG HEU, BLENDSTOCK, PRODUCT
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

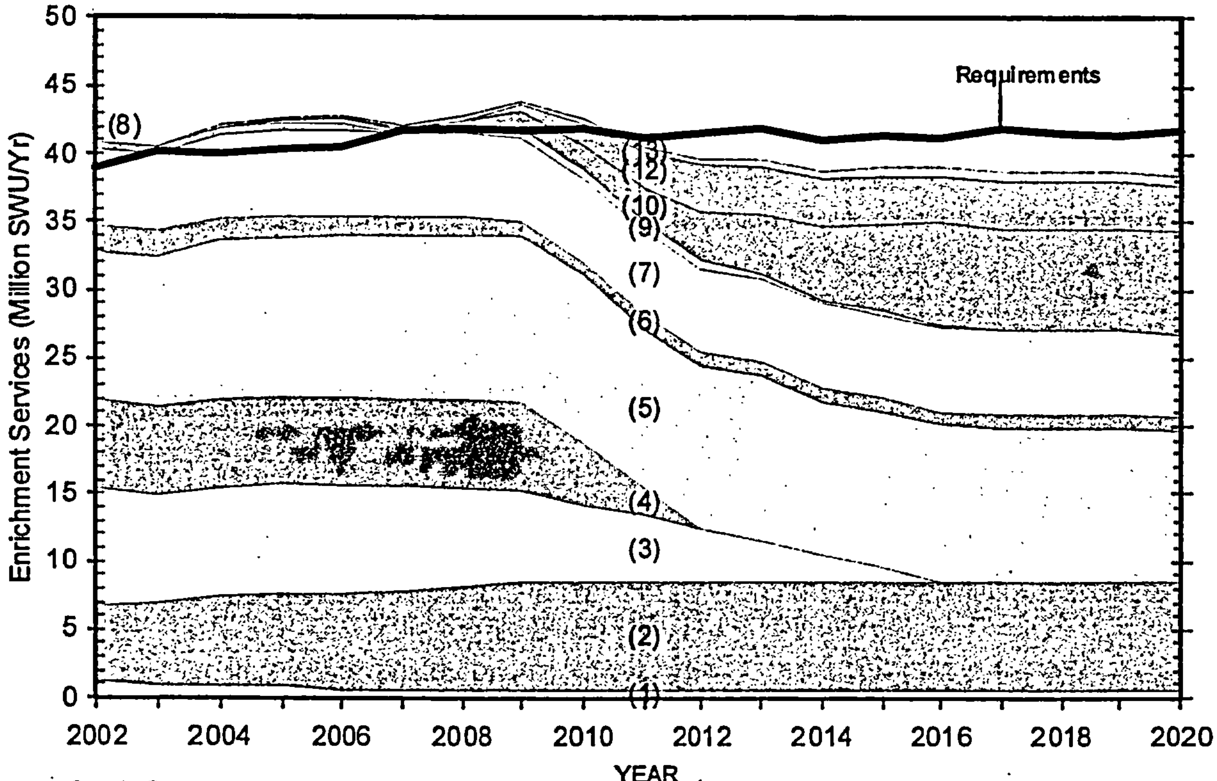


Supply Source

(1) Inventory
(2) Urenco
(3) Eurodif (existing)
(4) USEC (existing)
(5) Russian/Tenex
(6) Other
(7) Russian HEU
(8) USEC DOE HEU
(9) DOE HEU
(10) Eurodif (new)
(11) LES (new)
(12) USEC (new)
(13) Other (new)

REFERENCE NUMBER
Figure 1.1-7.doc

FIGURE 1.1-7
ILLUSTRATION OF SUPPLY AND REQUIREMENTS FOR SCENARIO A
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



Supply Source

(1) Inventory
(2) Urenco
(3) Eurodif (existing)
(4) USEC (existing)
(5) Russian/Tenex
(6) Other
(7) Russian HEU
(8) USEC DOE HEU
(9) DOE HEU
(10) Eurodif (new)
(11) LES (new) - NA
(12) USEC (new)
(13) Other (new)

REFERENCE NUMBER
Figure 1.1–8.doc

FIGURE 1.1-8
ILLUSTRATION OF SUPPLY AND REQUIREMENTS FOR SCENARIO A WITHOUT THE PROPOSED NEF
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

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 5.0 $^{w}/_{o}$ ^{235}U and a depleted UF_6 stream containing approximately 0.2 to 0.34 $^{w}/_{o}$ ^{235}U. Production capacity at design throughput is approximately 3.0 million Separative Work Units (SWU) per year. Facility construction is expected to require eight (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.

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 Type 48Y 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 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.

In addition to operating the process at subatmospheric pressure, the other primary difference between the Louisiana Energy Services, Claiborne Enrichment Center, and the NEF cascade systems is that all assay units are now identical, whereas in the Claiborne Enrichment Center, one assay unit was designed to produce low assays - in the region of 2.5%. An additional change is the increase from seven cascades per cascade hall to eight cascades per cascade hall. Maximum cascade hall capacity has been increased to 545,000 SWU/yr.

1.2.3 Comparison of the NEF Design to the LES Claiborne Enrichment Center Design

While the design of the NEF is fundamentally the same as the Claiborne Enrichment Center design reviewed and approved by the NRC in the 1990s (NRC, 1994a), a number of improvements or enhancements have been made in the current design from an environmental and safety perspective. One of these changes is the increase from seven cascades per Assay Unit to eight cascades per Assay Unit. Maximum Assay Unit capacity has been increased from 280,000 SWU/yr to 545,000 SWU/yr.

There are two important differences in the UF_6 Feed System for the NEF as compared to the Claiborne Enrichment Center. First, the liquid UF_6 phase above atmospheric pressure has been eliminated. Sublimation from the solid phase directly to the gaseous phase below atmospheric pressure is the process to be used in the NEF. A sealed autoclave is replaced with a Solid Feed Station enclosure for heating the feed cylinder. A second major difference is the use of chilled air, rather than chilled water, to cool the feed purification cylinder.

The NEF "Product Take-Off System" uses a process similar to the Claiborne Enrichment Center, but there are certain differences. In the current system proposed for the NEF, there is only one product pumping stage, whereas the proposed Claiborne Enrichment Center system used two pumping stages to transport the product for desublimation. In the NEF system, pressures are controlled such that desublimation cannot occur in the piping, eliminating the need for heat tracing and valve hot boxes. In the Claiborne Enrichment Center, the product

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, an air compression room, a boiler room, and cooling water facility.

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 Separations Building.

The 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.

1.2.4 Schedule of Major Steps Associated with the Proposed Action

The NEF will be constructed in six phases corresponding to the successive completion of six centrifuge Cascade Halls. All construction will be completed in 2013. Each phase will result in an additional nominal 0.5 million SWU, with the first unit beginning operation prior to the completion of the remaining phases. Like the Claiborne Enrichment Center (LES, 1991a), 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	April 2006
• Start First Cascade	June 2008
• Achieve Full Nominal Production Output	June 2013
• Submit License Termination Plan to NRC	April 2025
• Complete Construction of D&D Facility	April 2027
• D&D Completed	April 2036

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• Achieve Full Nominal Production Output	June 2013
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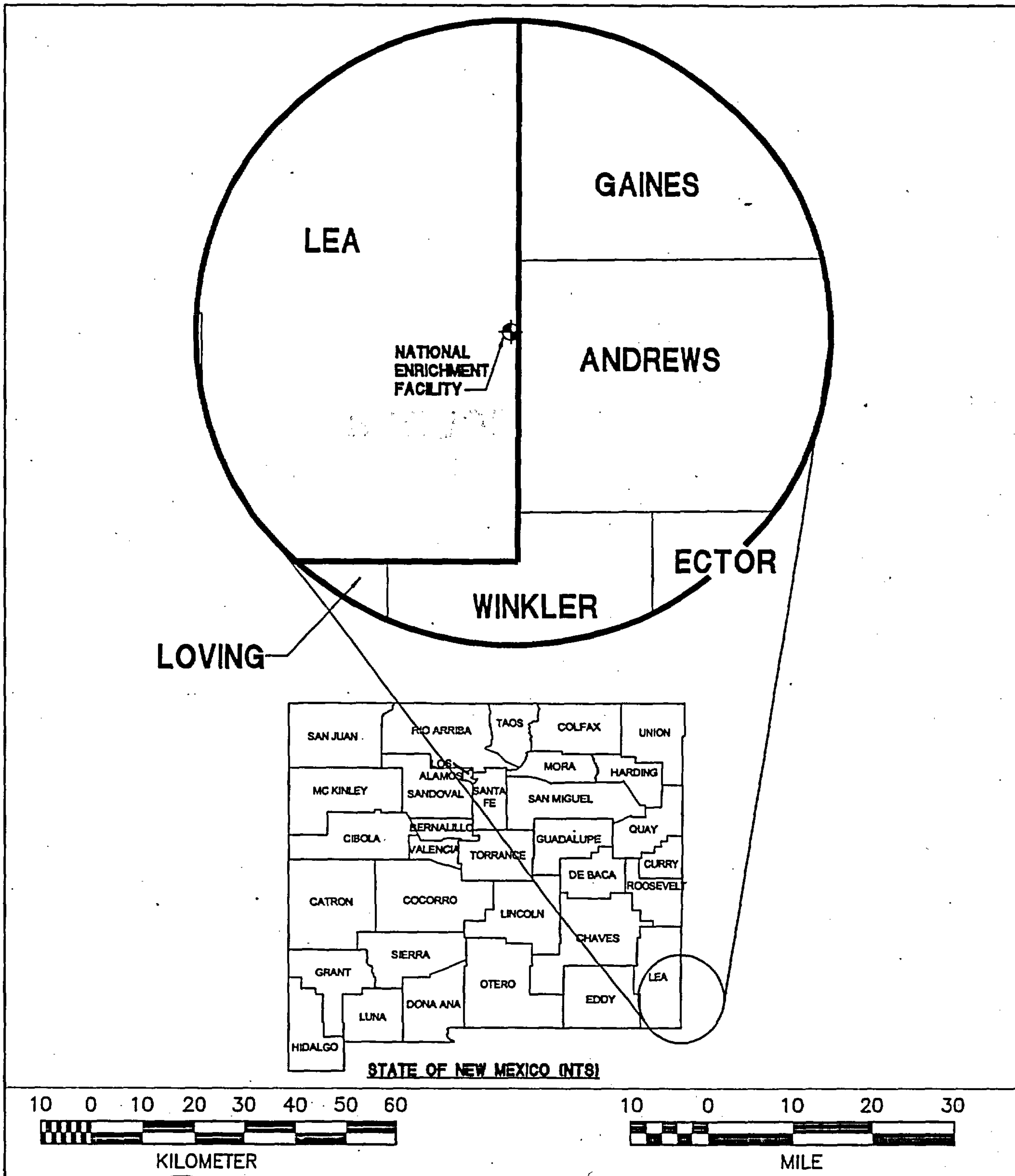
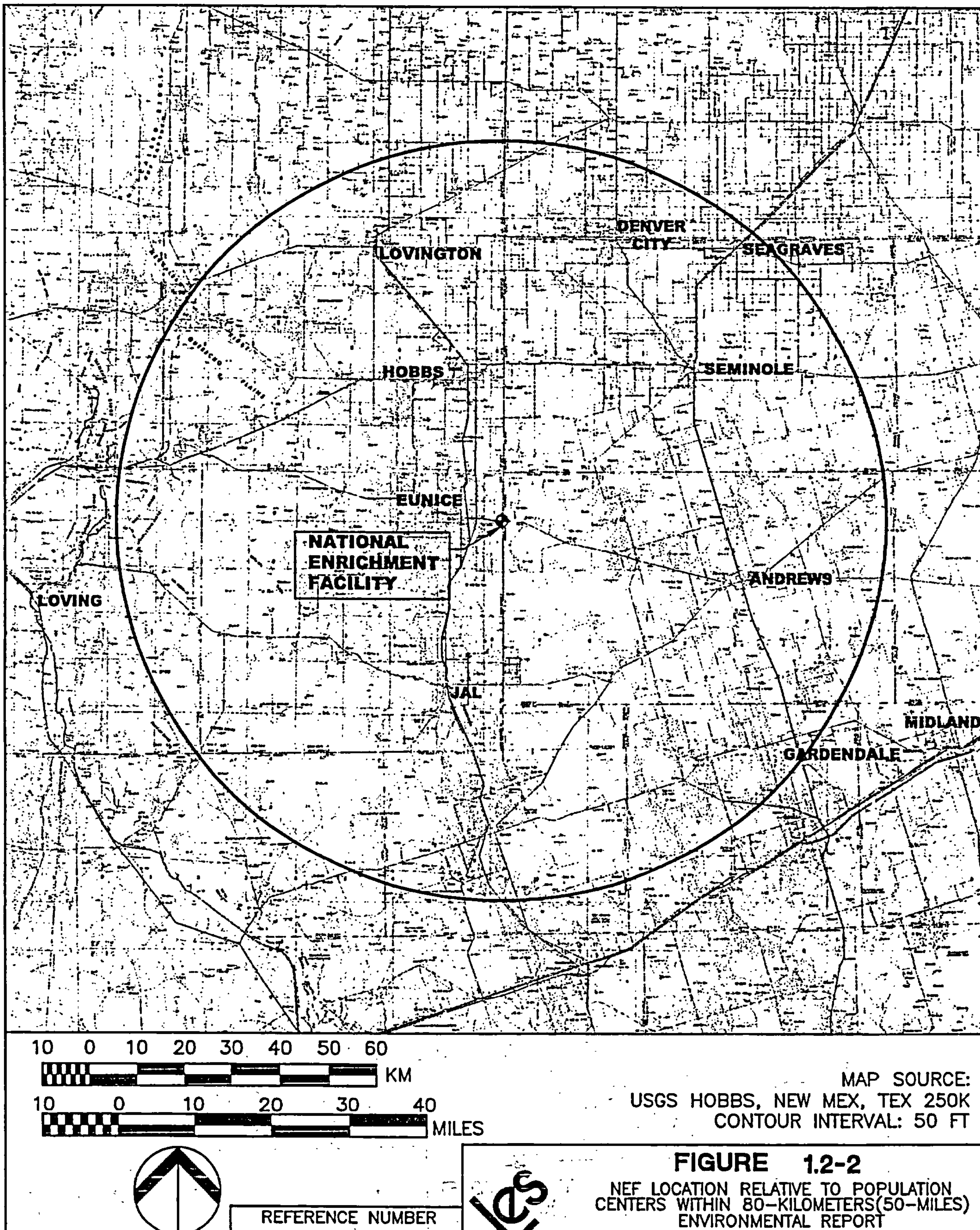
• Complete Construction of D&D Facility	April 2027
• D&D Completed	April 2036

FIGURES



REFERENCE NUMBER
State map.dwg

FIGURE 1.2-1
LOCATION OF PROPOSED SITE
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



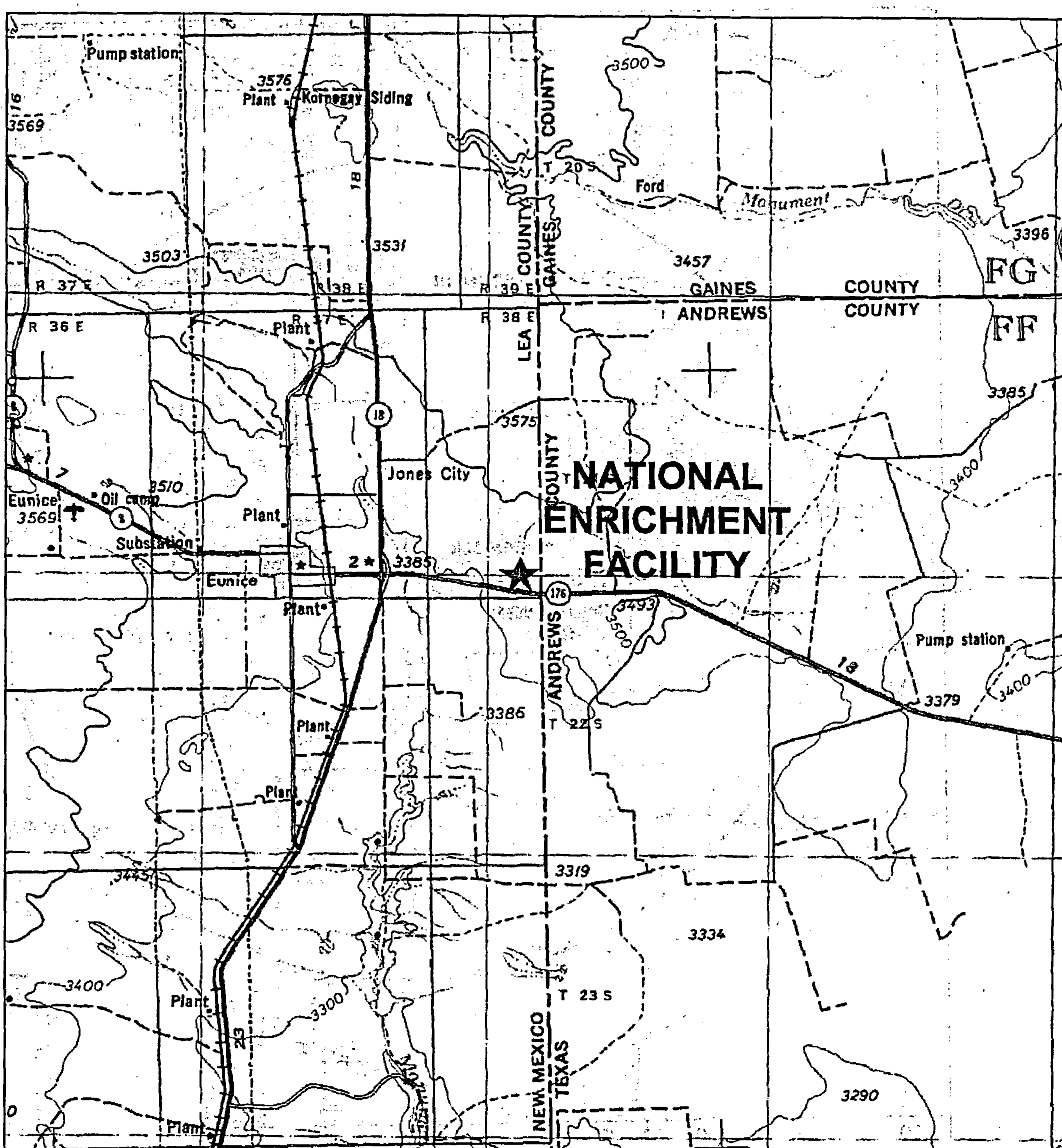
MAP SOURCE:
USGS HOBBS, NEW MEX, TEX 250K
CONTOUR INTERVAL: 50 FT

REFERENCE NUMBER
250K Figures.dwg

FIGURE 1.2-2

NEF LOCATION RELATIVE TO POPULATION CENTERS WITHIN 80-KILOMETERS(50-MILES)
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003



1 0 1 2 3 4 5 6 7 8 9 10 KM

1 0 1 2 3 4 5 6 MILES

NORTH

CONTOUR INTERVAL: 100 FT

REFERENCE NUMBER
15Min Figures.dwg

MAP SOURCE:
USGS 1:100,000 30 MIN. X 60 MIN. MAPS
HOBBS, NEW MEXICO – TEXAS
AND EUNICE NE,TEX. – N. MEX.

LES

FIGURE 1.2-3

NEF LOCATION RELATIVE TO TRANSPORTATION ROUTES
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

FIGURE REMOVED UNDER 10 CFR 2.390

LOCKWOOD GREENE
ENGINEERING & CONSTRUCTION

REFERENCE NUMBER
c00002.dwg

FIGURE 2.1-4
NEF BUILDINGS
ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004

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 whom 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

- 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.

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 ft^3). 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 two emergency 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

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 (NMAC, 2000). 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.

New Mexico State Land Office (NMSLO):

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.

New Mexico Department of Game and Fish (NMDGF):

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) (NMAC, 2001a). 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

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.

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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	In progress	For Entire Site (New Mexico Review)
NPDES Construction General Permit	EPA Region 6	In Progress	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	In Progress	For Industrial and Septic Discharges to Evaporative Retention/Detention Ponds
NPDES Industrial Stormwater	NMED/WQB	In Progress	Oversight Review by New Mexico (see above)
NPDES Construction General Permit	NMED/WQB	In Progress	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	In Progress	NEF is Small Quanity 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
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)

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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 an 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.

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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 Texex, "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 40 and 70 (CFR, 2003b; CFR, 2003e) that would authorize LES to possess and use 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. A barbed wire fence runs along the east, south and west property lines. The fence along the north property line has been dismantled. A 25.4-cm (10-in) diameter, underground carbon dioxide (CO_2) pipeline, running southeast-northwest, traverses the site. The pipeline is owned by Trinity Pipeline, LLC. The CO_2 pipeline will be relocated prior to startup of the NEF. The CO_2 pipeline will be moved 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.P. is a Delaware limited partnership. It has been formed solely to provide uranium enrichment services for commercial nuclear power plants. LES has one, 100% owned subsidiary, operating as a limited liability company, formed for the purpose of purchasing Industrial Revenue Bonds and no divisions. The general partners are as follows:

A. Urenco (a Delaware corporation and wholly-owned subsidiary of Urenco Limited, a corporation formed under the laws of the United Kingdom ("Urenco") and owned in equal shares by BNFL Enrichment Limited ("BNFL-EL"), Ultra-Centrifuge Nederland NV ("UCN"), and Uranit GmbH ("Uranit") companies formed under English, Dutch and German law, respectively; BNFL-EL is wholly-owned by British Nuclear Fuels plc, which is wholly-owned by the Government of the United Kingdom; UCN is 99% owned by the Government of the Netherlands, with the remaining 1% owned collectively by the Royal Dutch Shell Group, DSM, Koninklijke Philips Electronics N.V. and Stork N.V.; Uranit is

owned by Eon Kernkraft GmbH (50%) and RWE Power AG (50%), which are corporations formed under laws of the Federal Republic of Germany); and

B. Westinghouse Enrichment Company LLC (a Delaware limited liability company and wholly-owned subsidiary of Westinghouse Electric Company LLC, a Delaware limited liability company ("Westinghouse"), whose ultimate parent, through two intermediary Delaware corporations and one corporation formed under the laws of the United Kingdom, is British Nuclear Fuels plc, which is wholly-owned by the government of the United Kingdom).

The names and addresses of the responsible officials for the general partners are as follows:

Urenco Investments, Inc.
Charles W. Pryor, President and CEO
2600 Virginia Avenue NW, Suite 610
Washington, DC 20037

Dr. Pryor is a citizen of the United States of America

Westinghouse Enrichment Company LLC
Ian B. Duncan, President
4350 Northern Pike
Monroeville, PA 15146

Mr. Duncan is a citizen of the United Kingdom.

The limited partners are as follows:

A. Urenco Deelnemingen B.V. (a Netherlands corporation and wholly-owned subsidiary of Urenco Nederlands B.V. (UNL));

B. Westinghouse Enrichment Company LLC (the Delaware limited liability company, wholly-owned by Westinghouse, that also is acting as a General Partner);

C. Entergy Louisiana, Inc. (a Louisiana corporation and wholly-owned subsidiary of Entergy Corporation, a publicly-held Delaware corporation and a public utility holding company);

D. Claiborne Energy Services, Inc. (a Louisiana corporation and wholly-owned subsidiary of Duke Energy Corporation, a publicly-held North Carolina corporation);

E. Cenesco Company, LLC (a Delaware limited liability company and wholly-owned subsidiary of Exelon Generation Company, LLC, a Pennsylvania limited liability company).

F. Penesco Company, LLC (a Delaware limited liability company and wholly-owned subsidiary of Exelon Generation Company, LLC, a Pennsylvania limited liability company).

Urenco owns 70.5% of the partnership, while Westinghouse owns 19.5% of LES. The remaining 10% is owned by the companies representing the three electric utilities, i.e., Entergy Corporation, Duke Energy Corporation, and Exelon Generation Company, LLC.

The President of LES is E. James Ferland, a citizen of the United States of America. LES' principal location for business is Albuquerque, NM. The facility will be located in Lea County near Eunice, New Mexico. No other companies will be present or operating on the NEF site other than services specifically contracted by LES.

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 Management Committee. This committee is composed of representatives from the general partners of LES.

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, ^{236}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.

The plant design capacity is three million separative work units (SWU) per year. 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:

- Separations Building Modules (includes UF_6 Handing Area, Cascade Halls, Process Services Area)
- Cylinder Receipt and Dispatch Building (CRDB)
- Blending and Liquid Sampling Area
- Technical Services Building (TSB)
- Centrifuge Assembly Building (CAB)
- Uranium Byproduct Cylinders (UBC) Storage Pad
- Administration Building
- Central Utilities Building (CUB)
- Security Building
- Visitor Center.

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 Separations Building Modules

The facility includes three identical Separations Building Modules. Each module consists of two Cascade Halls. Each Cascade Hall houses eight cascades, each of which consists of hundreds of centrifuges connected in series and parallel producing a single product concentration at any one time. Each Cascade Hall is capable of producing a maximum of 545,000 SWU per year. In addition to the Cascade Halls, each Separations Building Module houses a UF_6 Handling Area and a Process Services Area.

An assay unit consists of eight cascades. The centrifuges are mounted on precast concrete floor-mounted elements (flomels). Each Cascade Hall is enclosed by a structural steel frame, that supports insulated sandwich panels. This enclosure surrounds each Cascade Hall to aid in maintaining a constant temperature within the cascade enclosure.

The UF_6 Handling Area contains the Feed System, Product and Tails Take-off Systems. The Process Services Area contains the gas transport equipment, which connects the cascades to the Product Take-off System and Tails Take-off Systems and the Cascade Systems. The Process Services Area also contains key electrical and cooling water systems.

2.1.2.3.2 Cylinder Receipt and Dispatch Building (CRDB)

The CRDB is located between Separations Building Modules adjacent to the Blending and Liquid Sampling Area. 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:

- Loading and unloading of cylinders
- Inventory weighing
- Preparation and storage of overpack protective packaging
- Buffer storage of feed cylinders
- Semi-finished product storage
- Final product storage
- Prepared cylinder storage.

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 concrete saddles to stabilize them while being stored in the CRDB.

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. Two double girder bridge cranes handle the cylinders within the CRDB. The cranes span the width and run the full length of the building.

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 or 48X 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.

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 and the Blending and Liquid Sampling 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 are made of exposed concrete with a washable epoxy coating finish designed to resist process chemicals, decontamination agents, and radiation.

2.1.2.3.3 Blending and Liquid Sampling Area

The Blending and Liquid Sampling Area is adjacent to the CRDB and located between two Separations Building Modules. The primary function of the Blending and Liquid Sampling Area is to provide means to fill 30B cylinders with UF_6 at a required ^{235}U concentration level and sample the product cylinders for ^{235}U concentration and UF_6 purity.

2.1.2.3.4 Technical Services Building (TSB)

The TSB is adjacent to the Blending and Liquid Sampling Area. It contains support areas for the facility and acts as the secure point of entry to the Separations Building Modules and the CRDB. It contains the following functional areas located on the ground floor:

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, aluminum oxide (also referred to as alumina), sodium fluoride, HEPA filters, scrap metal and miscellaneous hazardous materials.

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.

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, Fomblin 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.

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.

Cylinder Preparation Room

The Cylinder Preparation Room provides a set-aside area for testing and inspecting new or cleaned 30B, 48X, and 48Y cylinders for use in the plant. It is maintained under negative pressure. Therefore, any equipment or personnel entering this room must go through an air-lock.

Equipment is available within the Cylinder Preparation Room to fit plugs and valves to new empty or washed-out empty cylinders to internally visually inspect the cylinders and to pressure test the cylinders, if required.

Mechanical, Electrical and Instrumentation (ME&I) Workshop

The ME&I Workshop provides space for the normal maintenance of non-contaminated plant equipment. The facility also deals with faults associated with the pump motors, all instrument and control equipment, lighting, power, and associated process and services pipe work. It also provides space for the temporary storage of rebuilt and minor plant equipment.

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, laundry water, floor wash water, hand wash/shower water and miscellaneous effluent.

Laundry

The Laundry provides an area to clean contaminated and soiled clothing and other articles that have been used throughout the plant. Laundry is sorted into two categories: articles with a high possibility of contamination and articles unlikely to have been contaminated. Those that are likely to be contaminated are further sorted into lightly and heavily soiled articles. Heavily soiled articles are transferred to the solid waste collection system without having been washed.

The Laundry contains two industrial quality washing machines (75-kg capacity (165- lb)), two industrial quality dryers (75-kg capacity (165-lb)), one sorting hood to draw potentially contaminated air away, a sorting table and an inspection table. It also contains a small office and store room.

Gaseous Effluent Vent System (GEVS) Room

The GEVS removes uranyl fluoride (UO_2F_2), i.e., uranium compounds particulates containing uranium and hydrogen fluoride (HF) from potentially contaminated process gas streams. Pre-

filters and absolute high efficiency particulate air (HEPA) filters remove particulates, including uranium particles, and activated charcoal filters remove HF.

Laboratory Area

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

- Mass Spectrometry Laboratory - for the process of uranium isotope measurement
- Chemical Laboratory - for the process of UF_6 quality assurance
- Environmental Monitoring Lab – for the process of environmental/regulatory analysis

Truck Bay/Shipping and Receiving Area

The Truck Bay is used as a place 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.

Medical Room

The Medical Room provides space for a nurse's station

Radiation Monitoring Control Room

The Radiation Monitoring Control Room is the point of demarcation between non-contaminated areas and potentially contaminated areas of the plant. It includes space for a hand and foot monitor, hand washing facilities, safety showers, and boot barrier access.

Work Station

The Work Station is a temporary work area for plant personnel. It includes wiring for phones and computers and includes adequate lighting levels.

Lobby

The Lobby is the entry point to the plant.

Break Room

The Break Room provides an area for vending machines, tables and a small kitchenette.

Locker Rooms

The Locker Rooms provide change areas, showers, and toilets.

Ancillary Areas

The following ancillary areas are located on the first floor: storage areas, utility closets, stairs, vestibule, and elevator equipment room.

The TSB contains the following functional areas located on the second floor.

Control Room

The Control Room is the main monitoring point for the entire plant and provides all of the facilities for the control of the plant, operational requirements and personnel comfort. It is a permanently staffed area that contains the following equipment:

- Overview screen
- Control desk
- Fire alarm system
- Storage facilities
- Communication systems.

In an emergency, the Control Room serves as the primary Emergency Operations Center (EOC) for the facility.

Training Room

The Training Room is used for Control Room training. It has visual and personnel access to the Control Room and contains the following:

- Plant Control System Training System
- Centrifuge Monitoring System Training System
- Central Control System switches and servers.

Security Alarm Center

The Security Alarm Center is used as the primary security monitoring station for the facility. All electronic security systems will be controlled and monitored from this center. These systems will include but not be limited to: Closed Circuit Television (CCTV), Intrusion Detection & Assessment (IDA), Access Control and radio dispatch.

Ancillary Areas

The following ancillary areas are located on the second floor:

- Copy/Storage
- Operator Support
- Archive/Storage
- Shift Manager's Office
- Security Office
- Toilets
- Mechanical Room.

2.1.2.3.5 Centrifuge Assembly Building (CAB)

The CAB is located adjacent to the CRDB. It is used for the assembly, inspection, and mechanical testing of the centrifuges prior to installation in the Cascade Halls of the Separations Building Modules and introduction of UF_6. 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"
- Assembled Centrifuge Storage Area
- Building Office Area
- Centrifuge Test and Post Mortem Facilities.

<u>Centrifuge Component Storage Area</u>

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 will be via an airlock to prevent ingress of airborne contaminants.

<u>Centrifuge Assembly Area</u>

Centrifuge components are assembled into complete centrifuges in this area. Assembly operations are carried out on two parallel production lines (A and B). 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.

<u>Assembled Centrifuge Storage Area</u>

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.

Centrifuges are to be routed via a covered communication corridor, which links the CAB with the CRDB.

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. It also 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 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 TSB prior to disposal.

Centrifuges are brought into the facility on a specially designed transport cart via an airlock entry. 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.

2.1.2.3.6 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 empty feed 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 concrete saddles 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.)

Flatbed trucks move the cylinders from the CRDB to the UBC Storage Pad, where cranes remove the cylinders from the trucks and place them on the UBC Storage Pad.

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

2.1.2.3.7 Administration Building

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

Personnel requiring access to facility areas or the CAA must pass through the EECP. The EECP is designed to facilitate and control the passage of authorized facility personnel and visitors.

Entry to the plant area from the Administration Building is only possible through the EECP. Approximately 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.

2.1.2.3.8 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 via roll-up and access doors.

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 above ground diesel storage tank area will be included in the site Spill Prevention Control and Countermeasures (SPCC) plan.

The CUB also houses the cooling water chillers and pumps, boiler room and air compressors.

2.1.2.3.9 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 traffic. Employees, visitors and trucks that have access approval will be screened at the main Security Building. A smaller security station has been placed at the secondary entrance to the site. All vehicle traffic including common carriers, such as mail delivery trucks, will be screened at this location.

2.1.2.3.10 Visitor Center

A Visitor Center is located outside the security fence area.

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
- Fomblin 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
- Laundry System.

2.1.2.4.1 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 Gaseous Effluent Vent System prior to venting.

2.1.2.4.2 Fomblin Oil Recovery System

Vacuum pumps use a Perfluorinated Polyether (PFPE) oil, such as Fomblin oil. Fomblin oil is a highly fluorinated, inert oil selected especially for use to avoid reaction with UF_6. The Fomblin Oil Recovery System reclaims spent Fomblin 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 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, laundry water, 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 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

The Gaseous Effluent Vent System (GEVS) is designed to route some of the potentially contaminated gaseous streams in the TSB that require treatment before discharge to the atmosphere. The system routes these streams through a filter system prior to exhausting via a vent stack. The stack contains a continuous monitor to indicate radioactivity levels.

Potentially contaminated gaseous streams in the TSB include the Ventilated Room, Decontamination Workshop, Laundry, Fomblin 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. The treatment system includes a single train of filters consisting of a pre-filter, HEPA filter,

impregnated carbon filter (potassium carbonate), centrifugal fan, automatically operated inlet-outlet isolation dampers, monitorings, and differential pressure transducers.

2.1.2.4.6 Laundry System

The Laundry System cleans contaminated and solid clothing and other articles within the plant. The laundry is divided into two main streams: articles with high or low possibility of contamination. Articles likely to be contaminated are collected in special water soluble bags. Articles unlikely to be contaminated are collected in bin bags and sorted into lightly and heavily soiled articles. Lightly soiled articles are laundered; heavy soiled articles are inspected first and if to difficult to clean are sent to the Solid Waste Collection System, otherwise they are laundered as well. Laundry water is discharged to the Liquid Effluent Collection and Treatment System.

2.1.2.4.7 Centrifuge Test and Post Mortem Facilities Exhaust Filtration System

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

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

2.1.2.5 Site and Nearby Utilities

The cities of Eunice and Hobbs, New Mexico will provide water to the site. Water consumption for the NEF is calculated to be 240 m^3/day (63,423 gal/d) to meet potable and process consumption needs. Peak water usage for fire protection is 33 L/s (521 gal/min). The natural gas requirements of the plant are 354 m^3/hr (12,500 ft^3/hr). Electrical service to the site will be provided by Xcel Energy. The projected demand is approximately 30 MW. Six septic tanks, each with one or more leach fields, will be installed onsite for the collection of sanitary and non-contaminated liquid waste.

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. Table 2.1-1, Chemicals and Their Properties, lists the chemicals associated with the NEF operation and their associated hazards. Tables 2.1-2 through 2.1-5 summarize the chemicals in use and storage, categorized by building. These tables also include the physical state and the expected quantity of chemical materials.

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 2.1-6, 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, 2002a). 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, for example, NEF process waste water flow rate from all sources is expected to be about 28,900 m^3/yr (7.64 million gal/yr). This includes waste water from the liquid effluent treatment system, domestic sewerage and cooling tower blowdown waters. Only the former source can be expected to contain minute amounts of uranic material. The liquid effluent treatment system and shower/hand wash/laundry effluents will be discharged onsite to a double-lined evaporative basin; whereas the cooling tower blowdown water and UBC pad stormwater run-off will be discharged onsite to a single-lined retention basin. Domestic sewerage will be discharged to onsite septic tanks and leach fields.

The NEF water supply will be obtained from the city of Eunice, Mew Mexico and the city of Hobbs, New Mexico. Current capacities for the Eunice and Hobbs, New Mexico municipal water supply systems are 16,350 m^3/day (4.32 million gpd) and 75,700 m^3/day (20 million gpd), respectively and current usages are 5,600 m^3/day (1.48 million gpd) and 23,450 m^3/day (6.2 million gpd), respectively. 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 capacities of both water systems.

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. Summarized below are the six systems with significant features that have been incorporated into the NEF to improve plant efficiency and further reduce

environmental impacts. They include the Cascade System, UF_6 Feed System, Product Take-Off System, Product Liquid Sampling System, Product Blending System, and Tails Take-Off System.

The primary difference between the Claiborne Enrichment Center and the NEF cascade systems is that all assay units are now identical, whereas in the Claiborne Enrichment Center, one assay unit was designed to produce low assays - in the region of 2.5%. An additional change is the increase from seven Cascades per Cascade Hall to eight Cascades per Cascade Hall. Maximum Cascade Hall capacity has been increased to 545,000 SWU/yr.

There are two major differences in the "UF_6 Feed System" for the NEF as compared to the Claiborne Enrichment Center. First, the liquid UF_6 phase above atmospheric pressure has been eliminated. Sublimation from the solid phase directly to the gaseous phase below atmospheric pressure is the process proposed in the NEF. A sealed autoclave is replaced with a Solid Feed Station enclosure for heating the feed cylinder. A second major difference is the use of chilled air to cool the feed purification cylinder rather than chilled water.

The NEF "Product Take-Off System" uses a process similar to the Claiborne Enrichment Center, but there are differences. In the current system there is only one product pumping stage, while the Claiborne Enrichment Center used two pumping stages to transport the product for desublimation. In this system, pressures are controlled such that desublimation cannot occur in the piping, eliminating the need for heat tracing and valve hot boxes. In the Claiborne Enrichment Center the product cylinder stations relied on common chillers to cool the stations, but the current system uses a dedicated chiller for each station. The cold traps used to desublime any UF_6 in the vent gases are smaller than in the Claiborne Enrichment Center design and each is on load cells to continuously monitor accumulation.

NEF's "Product Liquid Sampling System" uses a process very similar to Claiborne Enrichment Center. NEF has a permanent vent system, the Blending and Sampling Vent Subsystem, rather than a mobile unit as used in Claiborne Enrichment Center.

The NEF "Product Blending System" uses a process similar to the Claiborne Enrichment Center, but one major difference is that the NEF uses Solid Feed Stations to heat the donor cylinders. In the NEF system, the feed material is heated and sublimed directly to a gas under low pressure. Autoclaves were used to heat the donor cylinders in the Claiborne Enrichment Center. In that system, the feed material was heated to a liquid and then drawn off as a gas. Other differences are the use of only four receiver stations in this process versus five in the Claiborne Enrichment Center and the use of a dedicated vacuum pump/trap set in the current design versus a mobile set in the Claiborne Enrichment Center.

NEF's "Tails Take-Off System" uses a process similar to the Claiborne Enrichment Center, but there are differences. In the new system there is only one depleted UF_6 pumping stage, while the Claiborne Enrichment Center used two pumping stages to transport the depleted UF_6 for desublimation. depleted UF_6 are desublimed in cylinders cooled with chilled air in the current system, while the Claiborne Enrichment Center used chilled water to cool the cylinders. The Claiborne Enrichment Center contained a total of ten UBCs in five double cooling stations for each Separation Plant Module (two Cascade Halls), but the current system uses ten cylinders in single cooling stations for each Cascade Hall. Finally, the current system has a dedicated vacuum pump/trap set for venting and does not use the Feed Purification System like the Claiborne Enrichment Center.

Beyond minor changes, there were no other major design alternatives considered by LES that could lower the impact of the NEF on the environment.

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 2.1-7, 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 2.1-7, 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 2.1-7, 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 2.1-8, 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 2.1-9, 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 g_a;
- 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, anti-contamination laundry, 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 2.1-8, 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 2.1-9, 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.

TABLES

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Table 2.1-2 Chemicals – Separations Building
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Table 2.1-3 Chemicals – Centrifuge Assembly Building (CAB)
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Table 2.1-4 Chemicals – Technical Services Building

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Table 2.1-4 Chemicals – Technical Services Building

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Table 2.1-4 Chemicals – Technical Services Building

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Table 2.1-5 Chemicals – Central Utilities Building (CUB)
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Table 2.1-6 Summary of Environmental Impacts For The Proposed Action

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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	2,535 m^3/yr (669,884 gal/yr)	3.12

Table 2.1-6 Summary of Environmental Impacts for the Proposed Action
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Environmental Impact	Proposed Action [1]	ER Reference Section
- 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 2.1-7 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_s, 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 2.1-8 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		30

Criteria	Weight	Subcriteria (Weight)
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.		
Redundant Electrical Power Supply	75	
Essential (Go/No Go) Criteria:		
• 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
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. Factors to evaluate include: - Utility willingness to construct feed lines. - Utility willingness to construct substation. - Utility willingness to maintain feeder and substation.		10
• **Optimal Rate Structure** - Power provider willingness to provide optimal rate structure as a favored client. Factors to evaluate include: - 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.		60
• **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: - 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.		100
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

Table 2.1-8 Screening Criteria (Subsequent to First Screening)
Page 3 of 7

Criteria	Weight	Subcriteria (Weight)
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
• **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: - 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		50
• **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: - Proximity of fuel sources - Drought conditions - Wind		10
• **Ponding** - Natural site contours minimize potential of localized flooding or ponding Includes evaluation of: – Stream beds – Natural and potential runoffs – Runoff from adjacent areas – Storm drainage systems in place – Requirements for retention ponds		80

Criteria	Weight	Subcriteria (Weight)
• **Slides** - No/low potential for rockslides, mudslides, or other debris flow. 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.		50 -
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. • Site is not identified as a CERCLA or RCRA site contaminated with hazardous wastes or materials. • Site does not have contamination that would require remediation prior to construction.		NA – Go/No Go without scale NA – Go/No Go without scale NA – Go/No Go without scale
<u>Desirable (Non-Exclusionary) Criteria:</u> • **Documentation** - Well documented site surveys and monitoring for radiological, chemical, and hazardous material contamination. • **Neighboring Plume** - No facility in the area with existing release plume (air or water) of hazardous material or radiation release that includes site. • **Future Migration** – Future migration of contamination from adjoining or nearby sites negligible.		50 100 80
Discharge Routes <u>Desirable (Non-Exclusionary) Criteria:</u> • **Facility Discharges** - Plant discharge and runoff controls are economically implemented for minimal affect to the existing environment. • **Differentiation** - For sites with extant nuclear facilities, facility discharges are readily identifiable from extant facility discharges.	40	100 50
Proximity of Hazardous Operations/High Risk Facilities <u>Desirable (Non-Exclusionary) Criteria:</u> • **Hazardous Chemical Facility** – Distance from any facility storing, handling or processing large quantities of hazardous chemicals. • **Propane Pipeline** – Distance from large propane pipeline. • **Airport** - Site is not located within 16 km (10 mi) of commercial airport. • **General Emergency Area** - Site should be outside the general emergency area for any nearby hazardous operations facility (other than extant nuclear related facility) • **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	100 100 60 60 30

Table 2.1-8 Screening Criteria (Subsequent to First Screening)
Page 5 of 7

Criteria	Weight	Subcriteria (Weight)
Ease of Decommissioning <u>Desirable (Non-Exclusionary) Criteria:</u> • **Ease of Decommissioning** - Site characteristics (e.g., hydrology) do not negatively affect D&D activities.	20	NA
Adjacent Site's Medium/Long-Term Plans (e.g., construction, demolition, site restoration) <u>Desirable (Non-Exclusionary) Criteria:</u> • **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.	10	NA
SCHEDULE FOR COMMENCING OPERATIONS	**70**	
Political Support <u>Essential (Go/No Go) Criteria:</u> • Federal, State, and local government officials do not oppose the facility.	100	NA – Go/No Go without scale
<u>Desirable (Non-Exclusionary) Criteria:</u>		
• **Advocates** - Federal, State, and local officials are advocates for the facility.		100
• **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 <u>Desirable (Non-Exclusionary) Criteria:</u>	100	
• **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 <u>Desirable (Non-Exclusionary) Criteria:</u> • **On or Near an Existing Nuclear Facility** – Located on or near a site with an existing or previous NRC license.	80	NA

Criteria	Weight	Subcriteria (Weight)
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 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.). • Competing Projects - No major construction projects in the area competing for the labor pool resources that would significantly limit resource availability.	75	100 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 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. • **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. • **Multi-task Employees** - Local labor rules do not prohibit or discourage multi-tasking of employees.	100	100 50 50
Extant Nuclear Site 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. • **Nuclear Infrastructure** - Existing nuclear infrastructure that can be used to support the project, including security facilities and systems, waste treatment/disposal facilities, anti-contamination laundry, emergency response resources and equipment, medical dispensary, etc., that might be shared.	80	90 100

Table 2.1-8 Screening Criteria (Subsequent to First Screening)

Criteria	Weight	Subcriteria (Weight)
• **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. • **Technical resources** - Specialized technical resources that can be used on a limited basis.		70 40
Availability of Good Transport Routes (for centrifuge deliveries from Europe and UF_6 cylinder transportation) Desirable (Non-Exclusionary) Criteria: • **Rail** - Railhead located at the site. • **Access to Highways** - Close proximity access to controlled access highways (parkways) and/or interstate highways. • **Construction Traffic** - Traffic capacity for construction and operation activities with minimal improvements.	60	 10 100 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 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.	60	NA
Amenities for Workforce 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. • **Culture** – Cultural activities available at or near the area.	20	 100 50

Table 2.1-9 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
		10	Water Supply		Water Supply	10	9	8	10	7	9

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
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								
				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

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
				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
		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

Table 2.1-9 Scoring Summary

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
				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
				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

Weight	Major Objective	Weight	Criteria	Weight	Subcriteria	Bellefonte	Carlsbad	Eddy County	Hartsville	Lea County	Portsmouth
		20	Amenities for Workforce								
				100	Housing and Recreation	8	3	3	9	3	7
				50	Culture	9	2	2	10	2	5

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

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FIGURES

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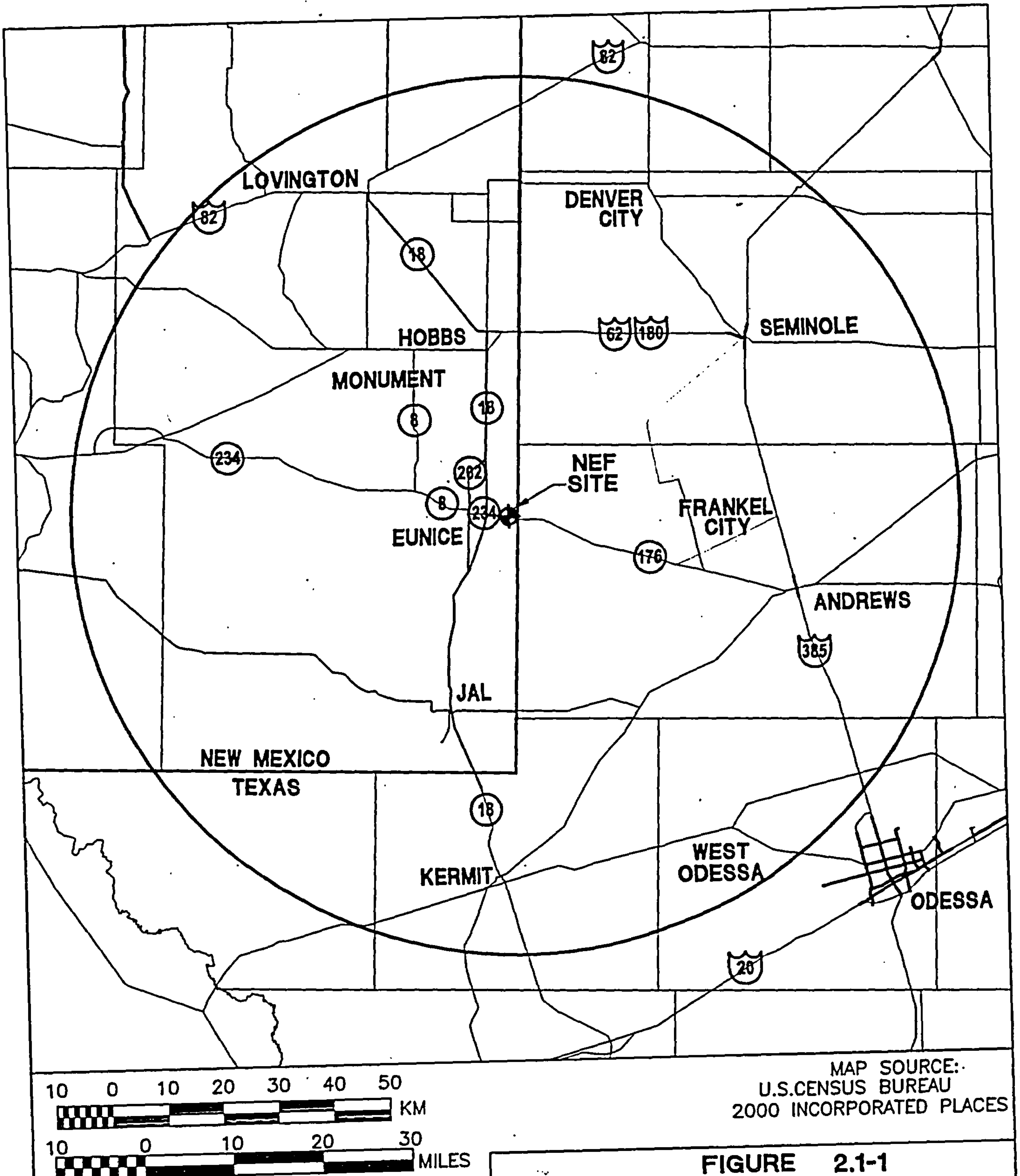
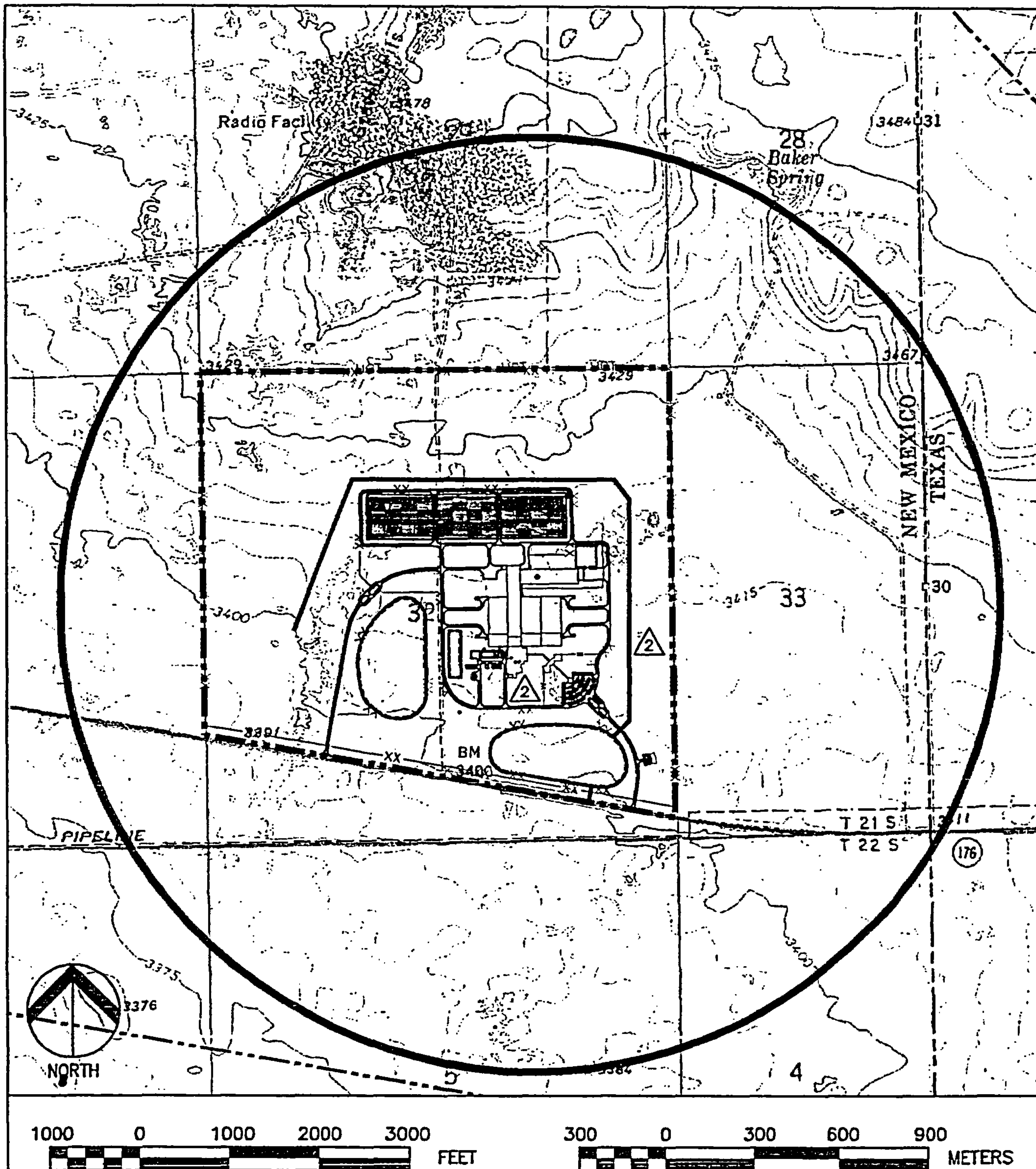


MAP SOURCE:
U.S.CENSUS BUREAU
2000 INCORPORATED PLACES

REFERENCE NUMBER
New Mexico Figures.dwg

FIGURE 2.1-1
80-KILOMETER (50-MILE) RADIUS
WITH CITIES AND ROADS
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



MAP SOURCE:
USGS 7.5 MINUTE
EUNICE NE QUADRANGLE
TEX.–N. MEX. 1:24000

CONTOUR INTERVAL:
5 FEET

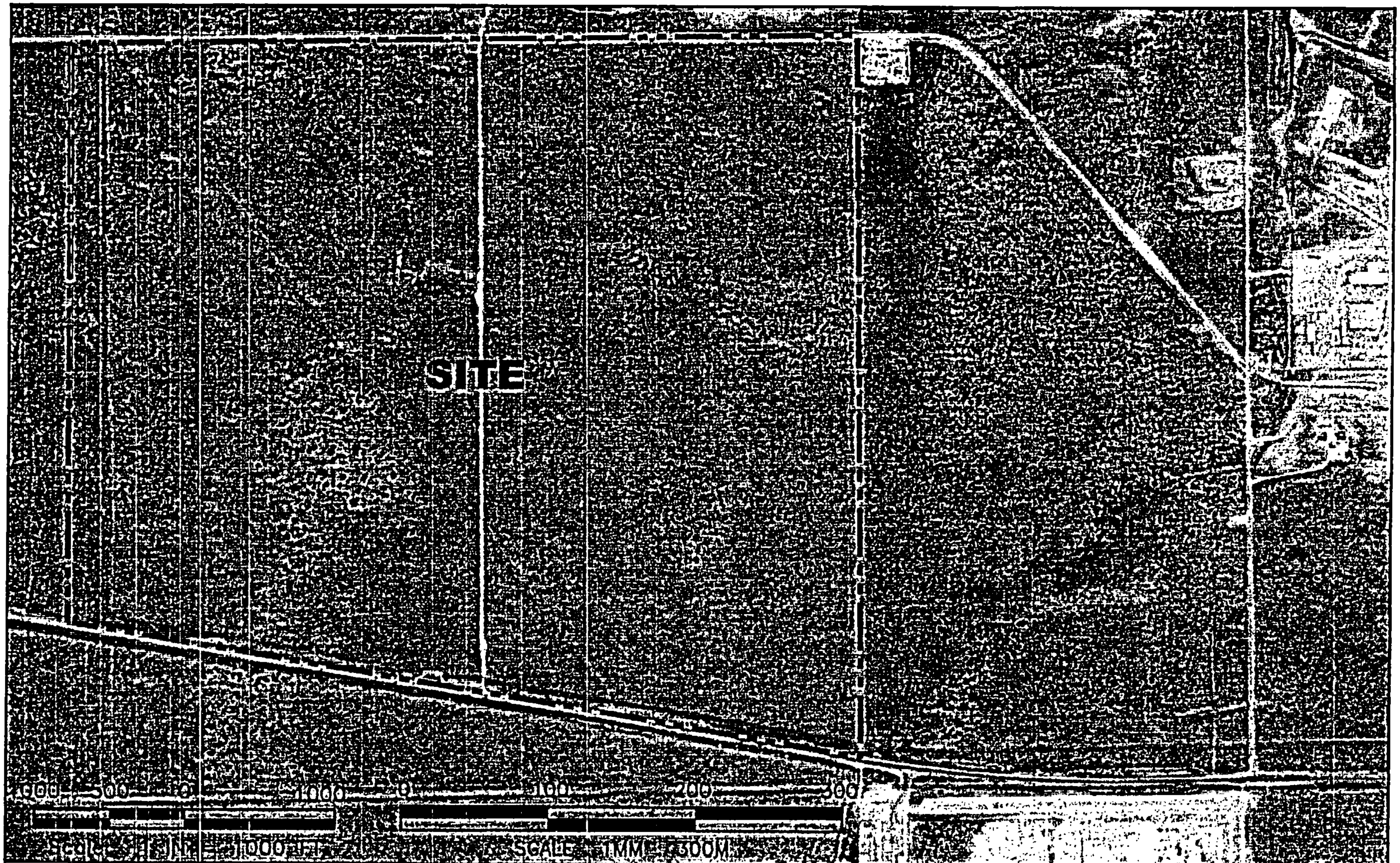
LOCKWOOD GREENE
ENGINEERING & CONSTRUCTION

REFERENCE NUMBER
7.5Min Figures.dwg

FIGURE 2.1-2

SITE AREA AND FACILITY LAYOUT MAP
1.6–KILOMETER (1–MILE) RADIUS
ENVIRONMENTAL REPORT

REVISION 2 DATE: JULY 2004



MAP SOURCE:
AERIAL PHOTOGRAPH
INDEPENDENT MAPPING SERVICES
AUGUST 2003

NORTH

REFERENCE NUMBER
Photo Figures.dwg

FIGURE 2.1-3

EXISTING CONDITIONS
SITE AERIAL PHOTOGRAPH
ENVIRONMENTAL REPORT

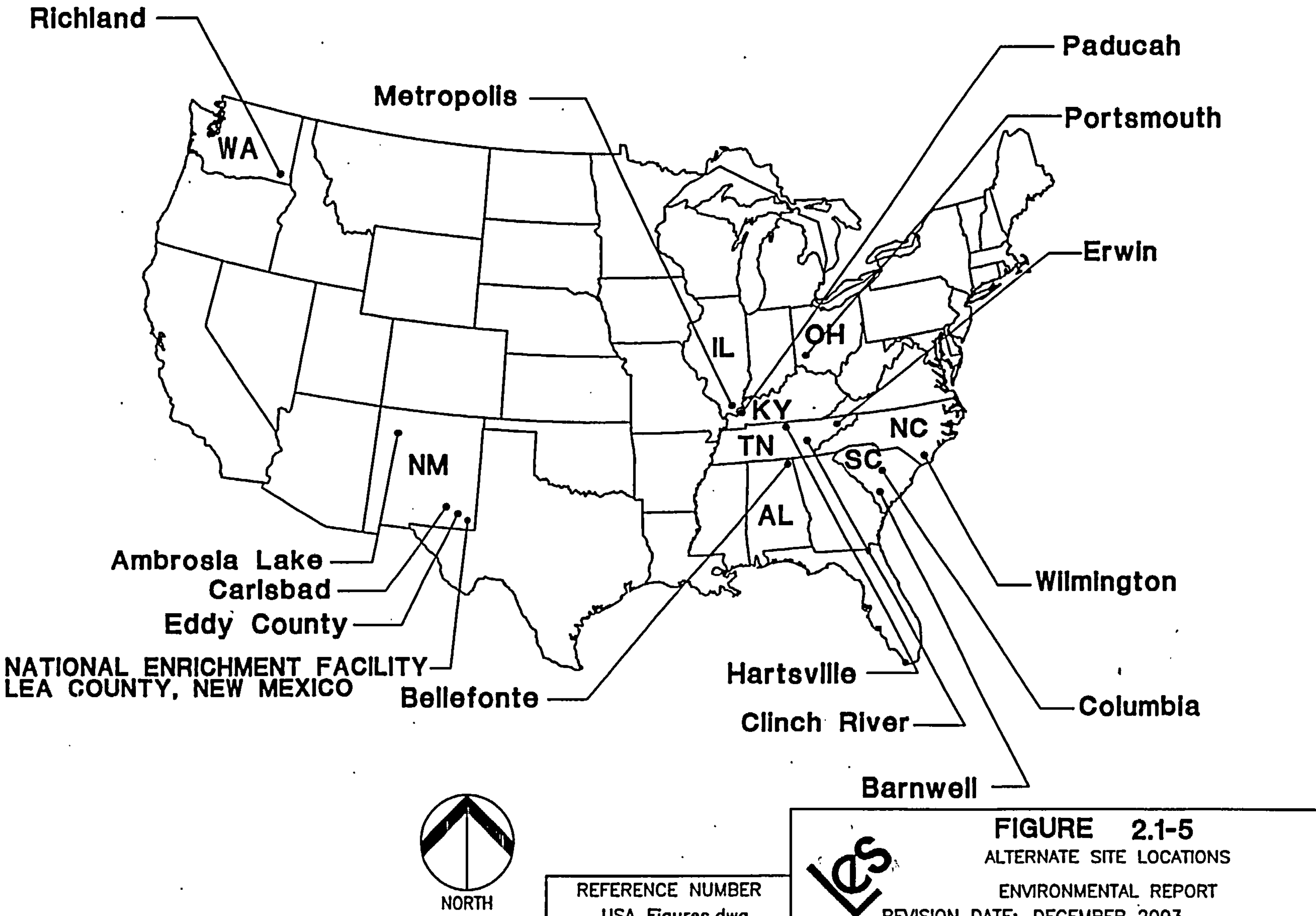
REVISION DATE: DECEMBER 2003

FIGURE REMOVED UNDER 10 CFR 2.390

LOCKWOOD GREENE
ENGINEERING & CONSTRUCTION

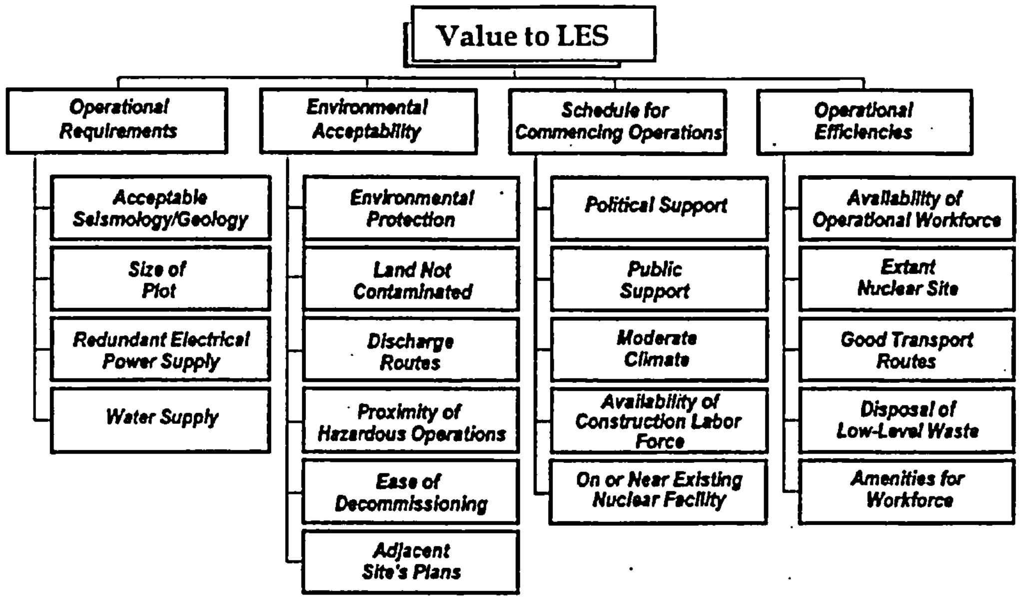
REFERENCE NUMBER
c00002.dwg

FIGURE 1.2-4
NEF BUILDINGS
ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004



REFERENCE NUMBER
USA Figures.dwg

FIGURE 2.1-5
ALTERNATE SITE LOCATIONS
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



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.

FIGURE 2.1-6

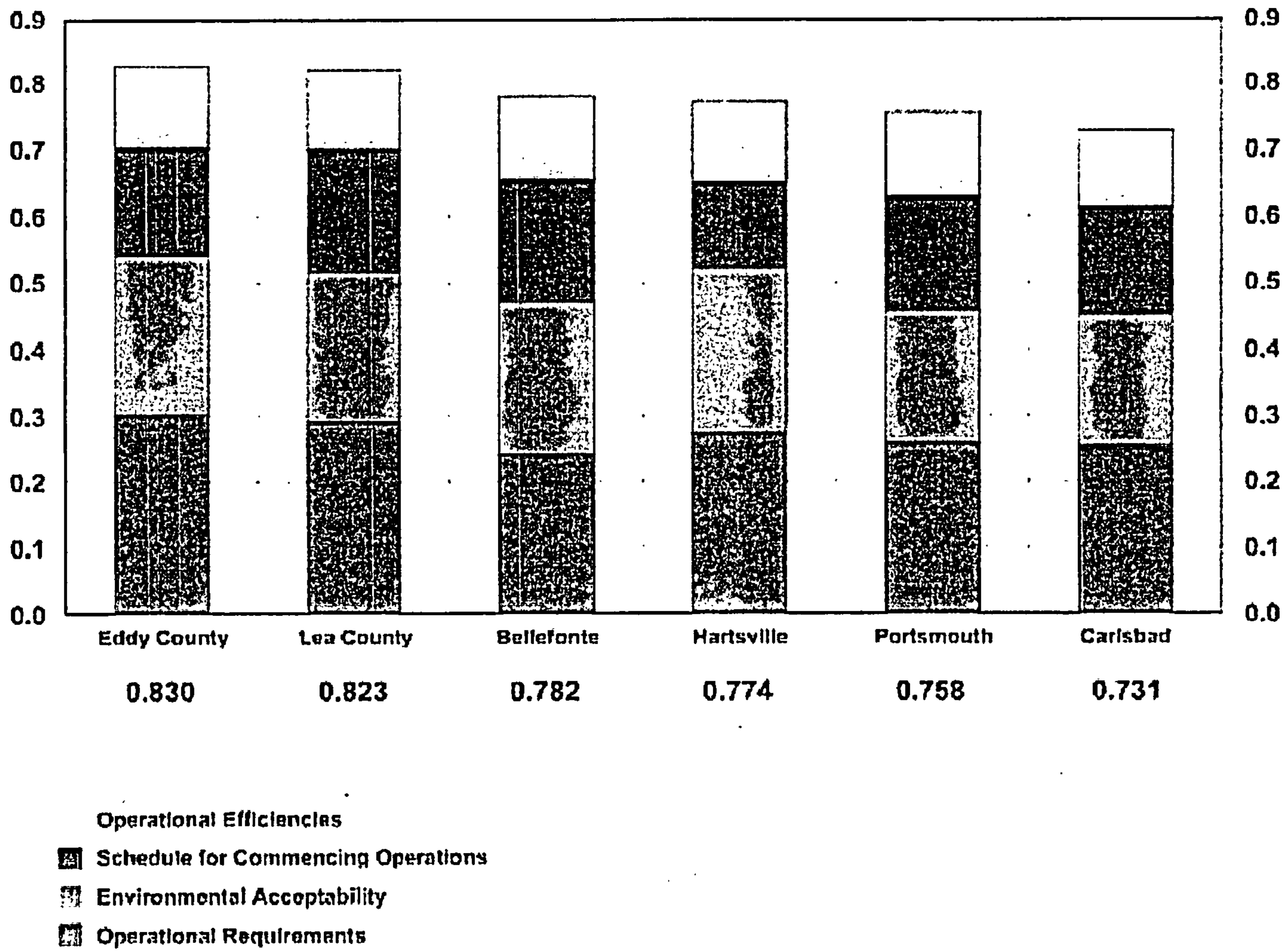
VALUE OF HIERARCHY FOR SITE SELECTION

ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

REFERENCE NUMBER

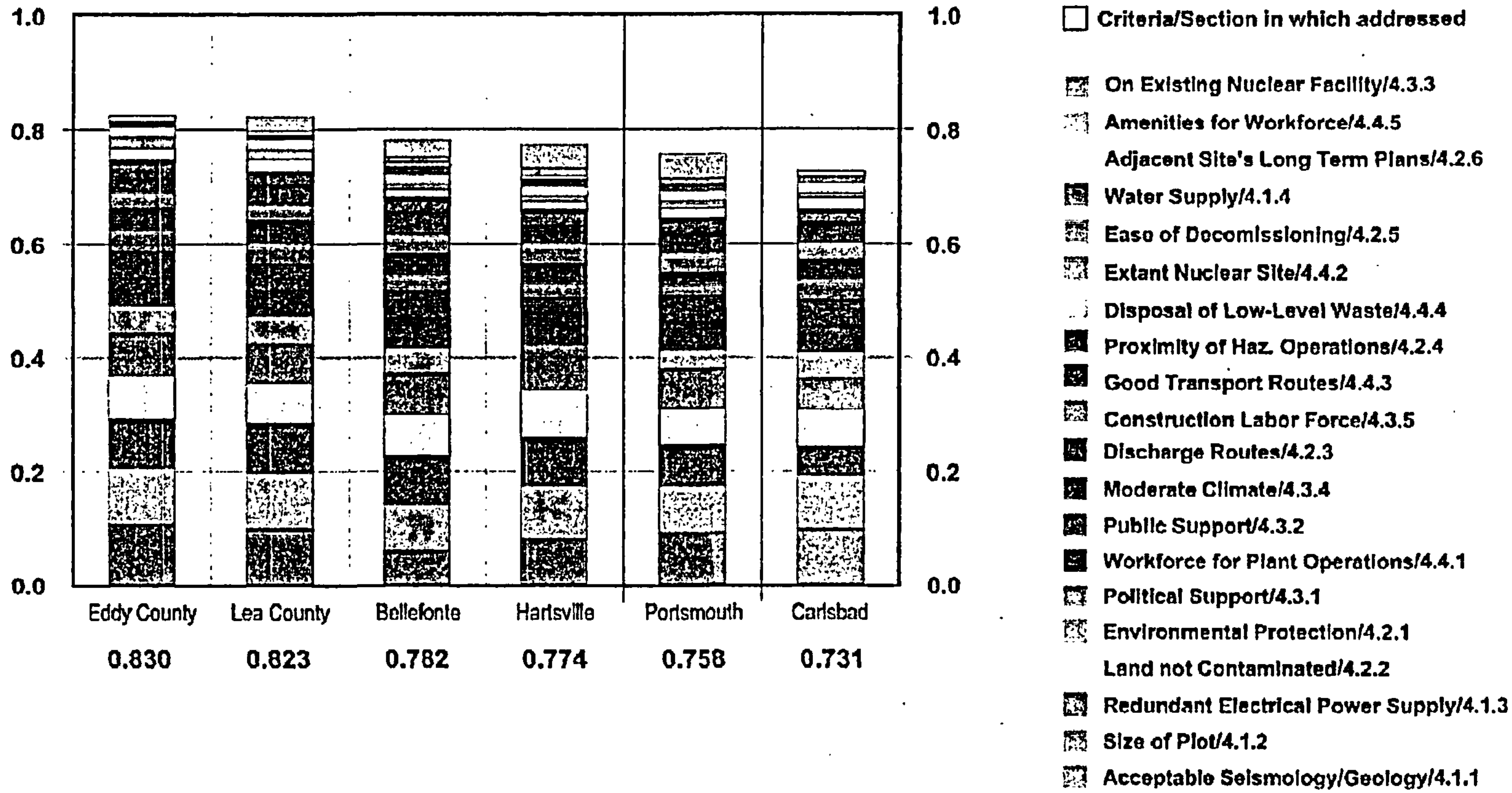
Figure 2.1–6.doc



2

REFERENCE NUMBER
Figure 2.1-7.doc

FIGURE 2.1-7
CONTRIBUTIONS BY GROUPED CRITERIA
ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004



2

REFERENCE NUMBER
Figure 2.1-8.doc

FIGURE 2.1-8
CONTRIBUTIONS BY CRITERIA
ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004

2

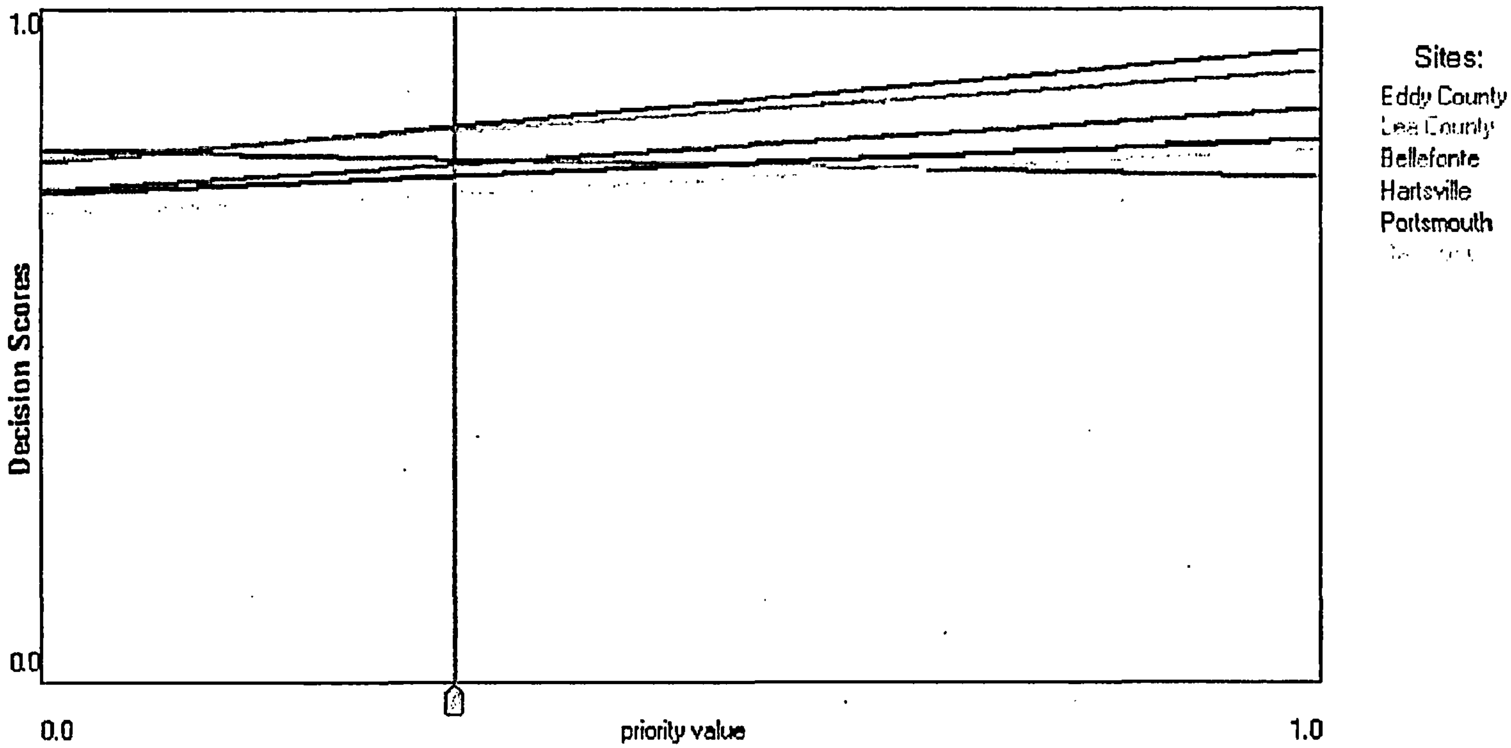


FIGURE 2.1-9

SENSITIVITY OF SITE SELECTION TO OBJECTIVE – OPERATIONAL REQUIREMENTS

ENVIRONMENTAL REPORT

REVISION 2 DATE: JULY 2004

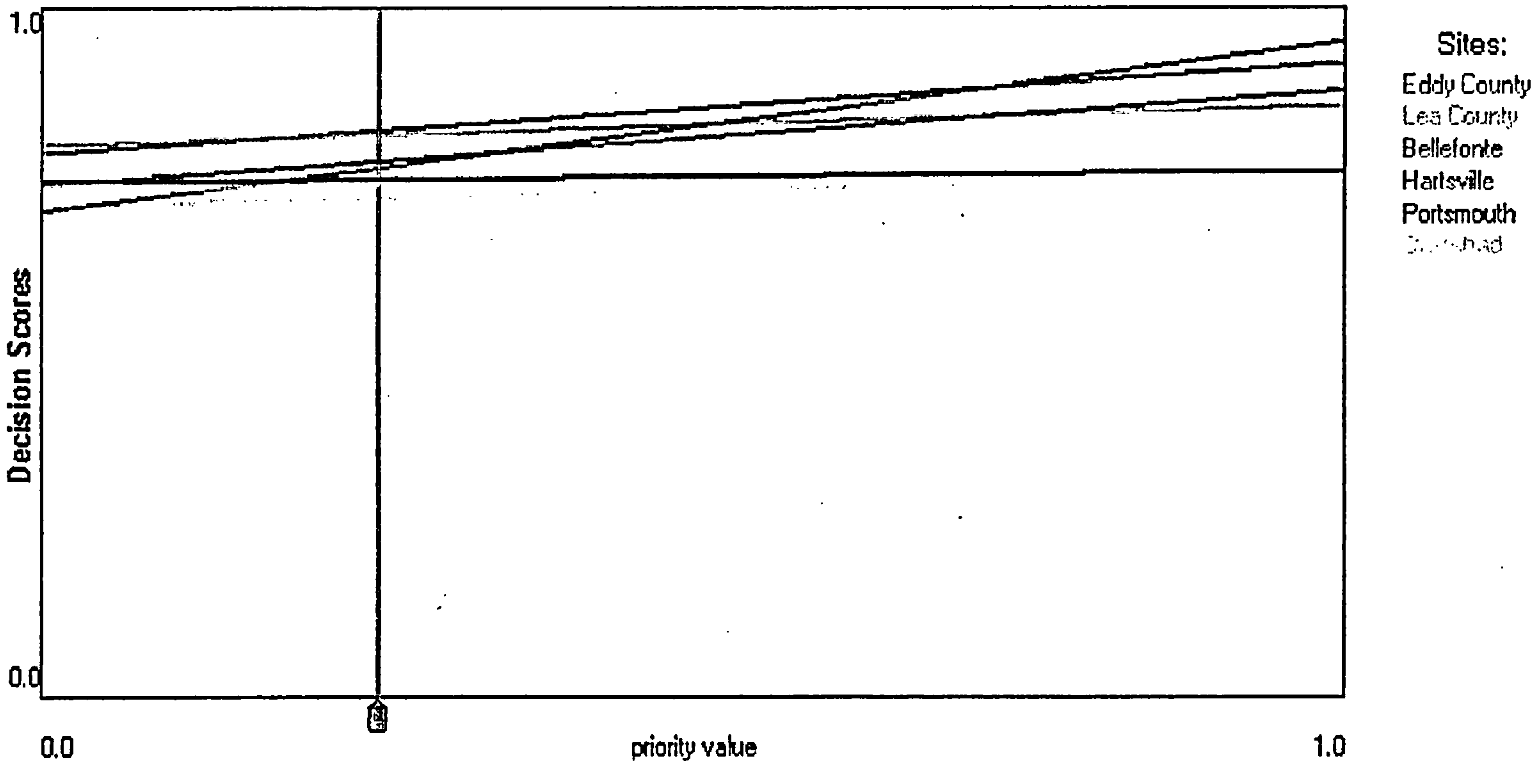


FIGURE 2.1-10

SENSITIVITY OF SITE SELECTION TO OBJECTIVE – ENVIRONMENTAL ACCEPTABILITY
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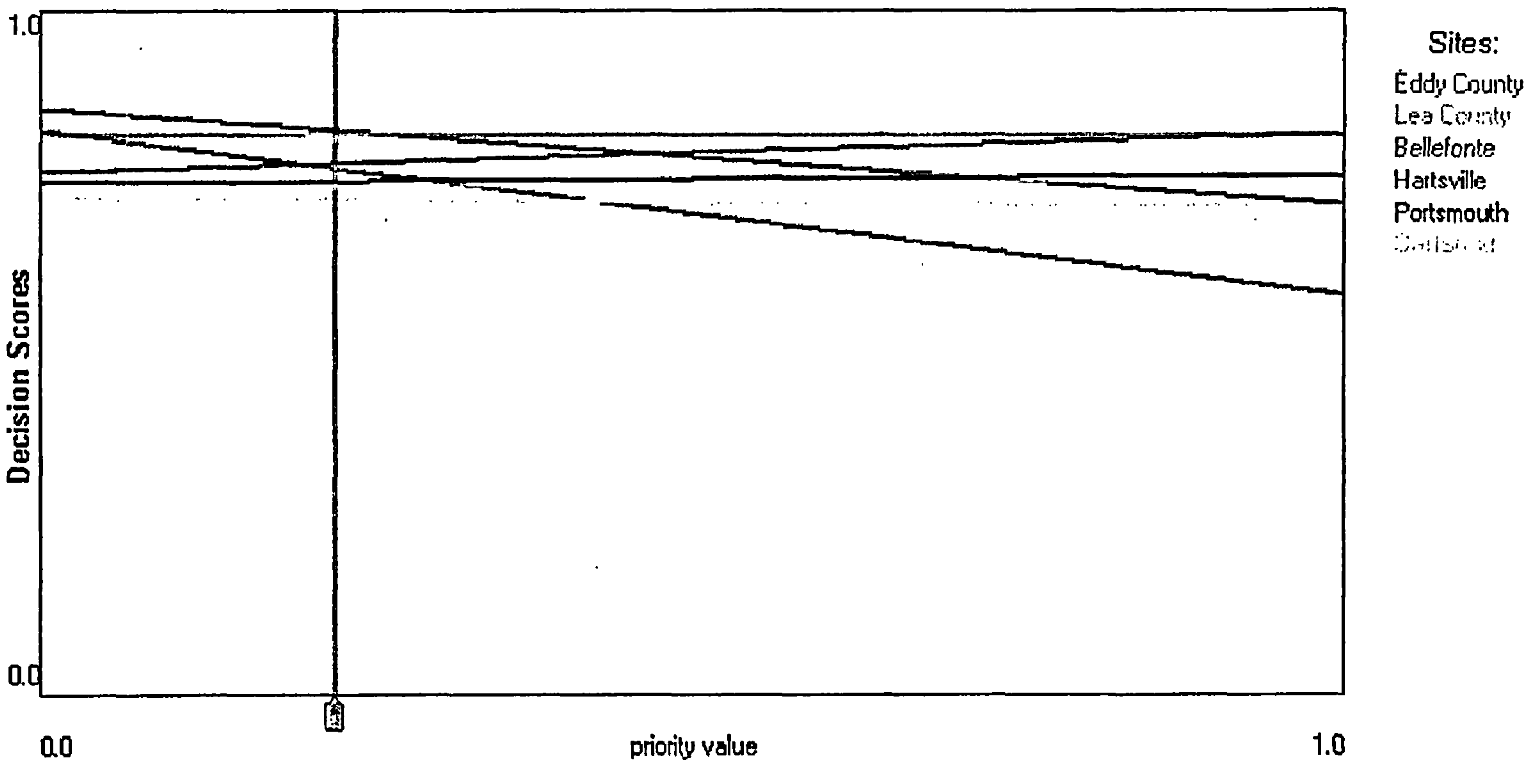

FIGURE 2.1-11
SENSITIVITY OF SITE SELECTION TO OBJECTIVE – SCHEDULE FOR COMMENCING OPERATIONS
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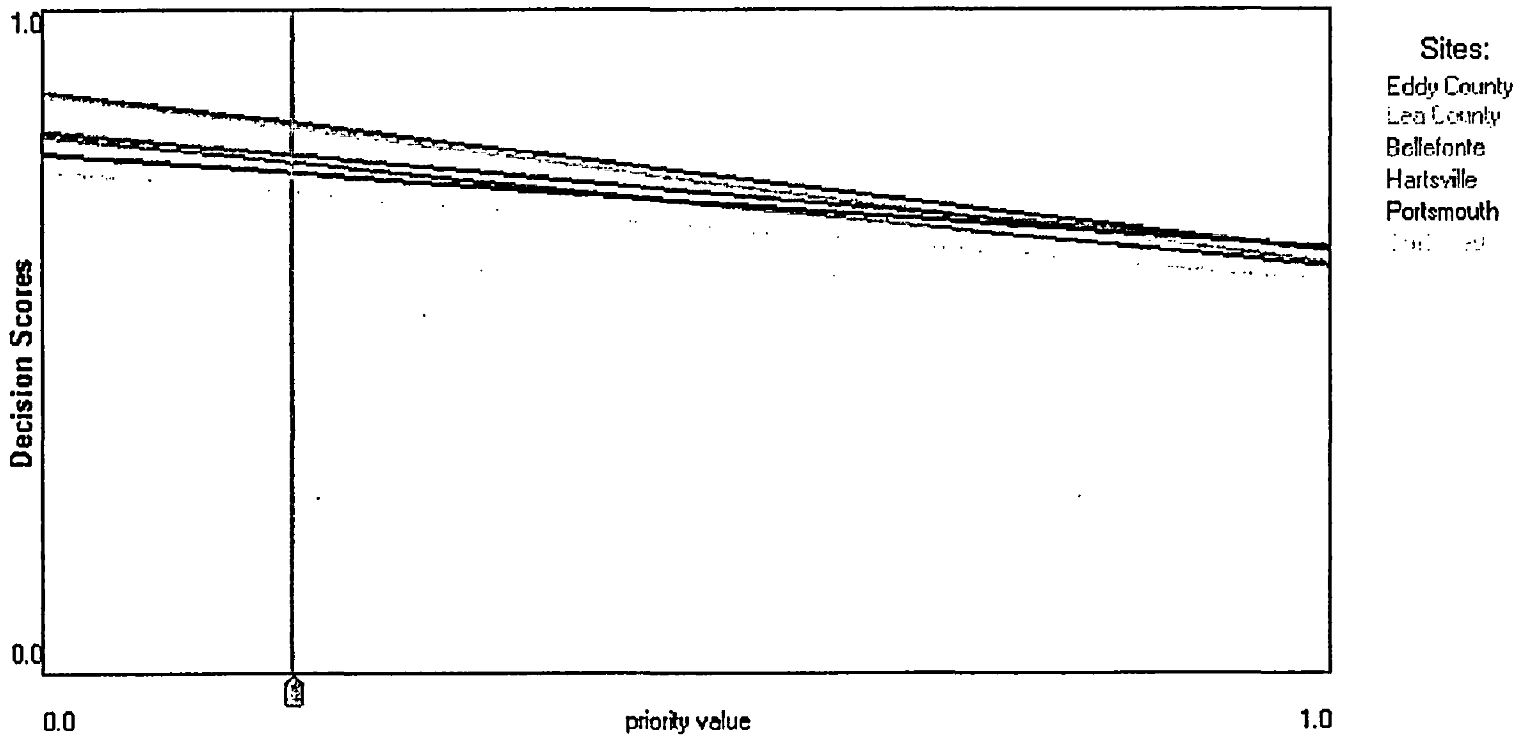

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FIGURE 2.1-12

SENSITIVITY OF SITE SELECTION TO OBJECTIVE – OPERATIONAL EFFICIENCIES
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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 (see ER Section 2.1.3.2, Alternative Designs). 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.

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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 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 and 6.98 x 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.

TABLES

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Table 2.3-1 Potential Cumulative Effects for the NEF
Page 1 of 2

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

Table 2.3-1 Potential Cumulative Effects for the NEF
Page 2 of 2

ER Section Reference	Effect on:	NEF Effect	Cumulative Effects
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.

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TABLES

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

Potential Impact	Proposed Action[1]	Alternative Scenarios		
		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 2.4-2 Comparison of Environmental Impacts For The Proposed Action And The No-Action Alternative Scenarios
Page 1 of 4

Environmental Category	Proposed Action[2]	Alternative Scenarios[1,3]		
		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
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 2.4-2 Comparison of Environmental Impacts For The Proposed Action And The No-Action Alternative Scenarios

		Alternative Scenarios[1,3]		
Environmental Category	**Proposed Action[2]**	**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**
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

		Alternative Scenarios[1,3]		
Environmental Category	**Proposed Action[2]**	**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**
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

[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

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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).

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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. A barbed wire fence runs along the east, south and west property lines. The fence along the north property line has been dismantled. 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.

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TABLES

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

Classification	Area						Percent
	(Hectares)			(Acres)			
	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 3.1-1b Land 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 3.1-2 Agriculture Census, Crop, and Livestock Information

Page 1 of 2

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)

FIGURES

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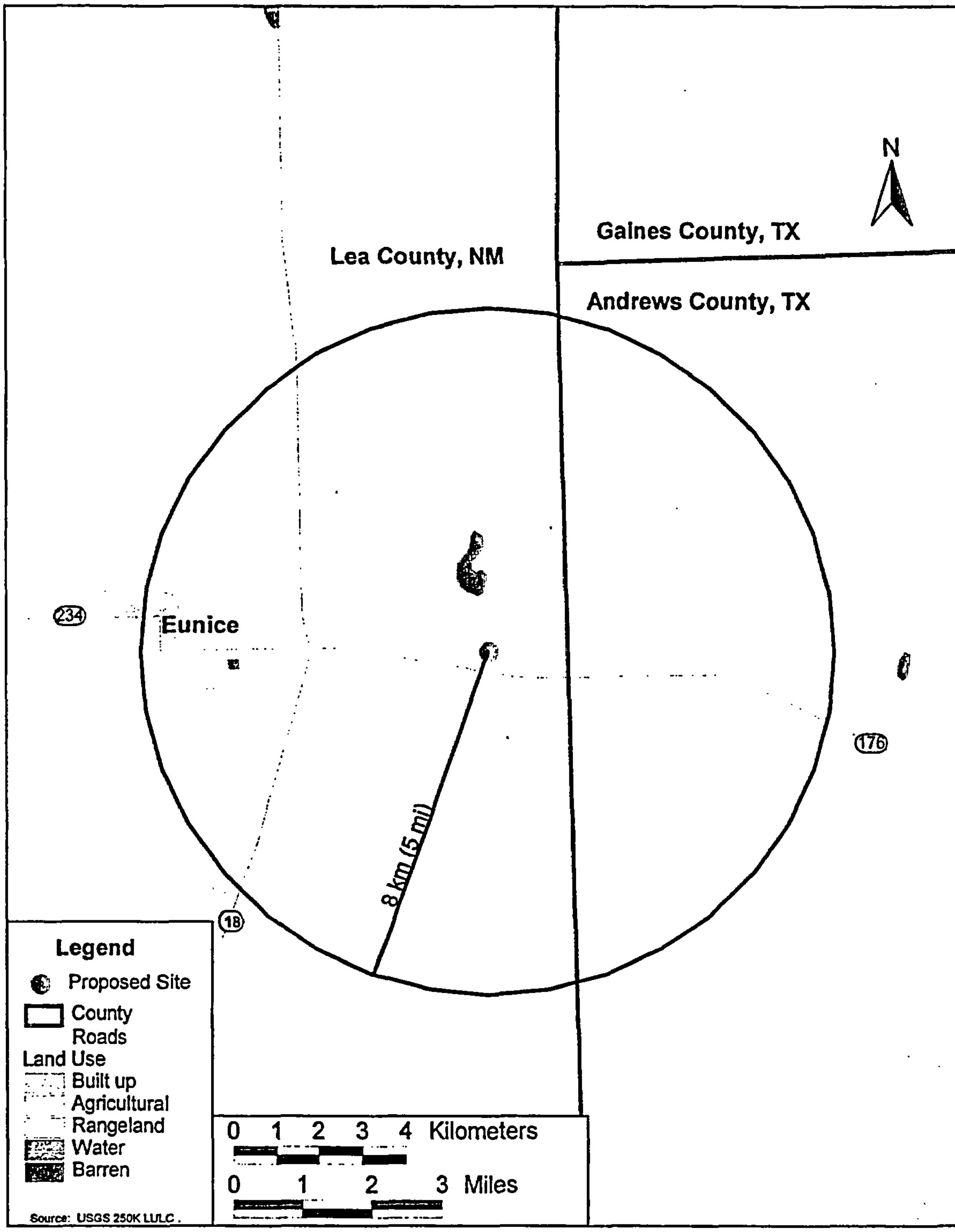

SOURCE: (USGS, 1986)

REFERENCE NUMBER
Figure 3.1-1.doc

FIGURE 3.1-1
LAND USE MAP

ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

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, 2.4-mm (8-ft) shoulders and a 61-m (200-ft) right-of-way easement on either side. 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 or 48X cylinders. These cylinders are designed, fabricated and shipped in accordance with American National Standard Institute N14.1, Uranium Hexafluoride - Packaging for Transport (ANSI, applicable version). Feed cylinders are transported to the site by 18-wheeled trucks, one per truck (48Y) or two per truck (48X). 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 and 48X), 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 (ANSI, applicable version). 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 (ANSI, applicable version). 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.

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TABLES

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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.

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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 +1,033 and +1,045 m (+3,390 and +3,430 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, Site Boring Plan and Profile, includes the NEF site, 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 recent 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.

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, 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 recent borings done on the NEF site is consistent with the data shown on the profile in Figure 3.3-5, 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 NEF site geotechnical borings (Borings B-1 through B-5) are provided in the Safety Analysis Report (SAR) Figures 3.2-10 through 3.2-15.

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).

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/m^2 (20 ton/ft^2) (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 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 borings done for engineering purposes ranged from about 3.6 to 9.1 m (12 to 30 ft).

The dry density of the clay ranges from 1.86 to 2.32 g/cm^3 (116 to 145 lbs/ft^3), averaging 2.11 g/cm^3 (132 lbs/ft^3). The red, reddish-brown or purple silty clays range in moisture content from 2.5% to 25%, averaging 8% to 12% for most samples. Liquid limits for the clays range from 35% to 55% with plasticity indices ranging from 24 to 38. Percent passing the #200 sieve for the clays ranges from 87% to 99.8%.

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 resulted in values from 136,000 kg/m^2 to 485,000 kg/m^2 (13.9 to 49.7 tons/ft^2) with an average value of 293,000 kg/m^2 (30 tons/ft^2).

Given a depth to groundwater of at least 65 to 68 m (214 to 222 ft), there is no potential for liquefaction at the site.

A geotechnical investigation of the site conducted in September 2003 consisted of 5 widely-spaced test borings that extended to depths of about 12 to 30.5 m (40 to 100 ft) using a hollow-stem auger and split-spoon sampling. Based on the boring results, up to 0.6 m (2 ft) of loose eolian sand underlain by dense to very dense, fine- to medium-grained sand and silty sand of the Gatuña/Antlers Formation was encountered. These sands are locally cemented with caliche deposits. Beneath the Gatuña/Antlers Formation is the Chinle claystone, a very hard highly plastic clay, which was encountered at depths of about 10.7 to 12.2 m (35 to 40 ft). One boring extended to 30.5 m (100 ft) deep and ended in the Chinle Formation. Blow-count N-values for about the top 7.6 m (25 ft) of sand and gravel ranged from about 20 to 76. Beneath that horizon the unit becomes denser or contains gravel to the extent that useful blow counts are not obtained. Where caliche cements the sand and gravel, N-values of over 60 are typical. Standard N-values were not available for samples in the underlying clay due to its hardness causing blow counts to range upwards of 100.

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/cm^3 (123 lbs/ft^3). 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/m^2 (7,000 lbs/ft^2).

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 (CO_2) 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, M_d, that in turn approximate Local Magnitude, M_L. 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.

TABLES

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

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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)
hinle 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
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NEF Site Coordinates			Longitude -103.0820	Latitude 32.4360							
Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	(mi)	Data Sources[4]
1931	8	16	-104.60	30.70			6.00	M	240.3	149.3	UTIG
1949	5	23	-105.20	34.60			4.50	M	310.0	192.6	NMTH
1955	1	27	-104.50	30.60			3.30	M	244.0	151.6	UTIG
1962	3	6	-104.80	31.20			3.50	M	212.3	131.9	UTIG
1963	12	19	-104.27	34.82			3.40	M	287.0	178.3	NMTR
1964	2	11	-103.94	34.23			2.10	M	214.2	133.1	NMTR
1964	3	3	-103.60	34.84			2.90	M	271.0	168.4	NMTR
1964	6	19	-105.77	32.95			1.90	M	257.4	159.9	NMTR
1964	8	14	-102.94	31.97			1.90	M	53.1	33.0	NMTR
1964	9	7	-102.92	31.94			1.60	M	56.9	35.3	NMTR
1964	11	8	-103.10	31.90			3.00	M	59.5	37.0	UTIG
1964	11	21	-103.10	31.90			3.10	M	59.5	37.0	UTIG
1964	11	27	-102.97	31.89			1.90	M	61.1	38.0	NMTR
1965	1	21	-102.85	32.02			1.30	M	50.9	31.6	NMTR
1965	2	3	-103.10	31.90			3.30	M	59.5	37.0	UTIG
1965	8	30	-103.00	31.90			3.50	M	60.0	37.3	UTIG
1966	8	14	-103.00	31.90			3.40	M	60.0	37.3	UTIG
1966	9	17	-103.98	34.89			2.70	M	284.6	176.9	NMTR
1966	10	6	-104.12	35.13			2.90	M	314.4	195.4	NMTR
1966	11	26	-105.44	30.95			3.50	M	277.5	172.4	NMTR
1968	3	23	-105.91	32.67			2.60	M	265.7	165.1	NMTR
1968	5	2	-105.24	33.10			2.60	M	214.3	133.1	NMTR
1969	6	1	-105.21	34.20			1.90	M	277.7	172.5	NMTR
1969	6	8	-105.19	34.15			2.60	M	272.8	169.5	NMTR
1971	7	30	-103.00	31.72	10.0	6.2	3.00	mb	79.9	49.6	ANSS
1971	7	31	-103.06	31.70	10.0	6.2	3.40	mb	81.4	50.6	ANSS
1971	9	24	-103.20	31.60			3.20	M	93.5	58.1	UTIG
1972	7	26	-104.01	32.57			3.10	M	88.3	54.9	NMTR
1973	3	17	-102.36	31.59			2.50	M	115.7	71.9	NMTR
1973	8	2	-105.56	31.04			3.60	M	280.7	174.5	NMTR
1973	8	4	-103.22	35.11			3.00	M	296.6	184.3	NMTR
1974	7	31	-104.19	33.11			0.00	M	128.0	79.5	NMTR
1974	10	2	-100.86	31.87			0.00	M	217.7	135.3	NMTR
1974	10	27	-104.83	30.63			0.00	M	259.6	161.3	NMTR
1974	11	12	-102.67	32.14			0.00	M	51.0	31.7	NMTR
1974	11	21	-102.75	32.07			0.00	M	51.0	31.7	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius 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)	
1974	11	22	-101.26	32.94			0.00	M	179.2	111.3	NMTR
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
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

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site
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Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal Depth[1] (km)	Focal Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	Epicentral Distance (mi)	Data Sources[4]
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
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

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	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
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

Year	Month	Day	Longitude	Latitude	Focal Depth[1]		MAG[2]	MAG Type[3]	Epicentral Distance		Data Sources[4]
			(°W)	(°N)	(km)	(mi)			(km)	(mi)	
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
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.(	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

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

Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal Depth[1] (km)	Focal Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	Epicentral Distance (mi)	Data Sources[4]
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
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
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

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius 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)	
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
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

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius 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)	
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
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

Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal Depth[1] (km)	(mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	(mi)	Data Sources[4]
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
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

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	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
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
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

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius 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)	
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
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.[illegible]	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

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

Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal Depth[1] (km)	Focal Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	Epicentral Distance (mi)	Data Sources[4]
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
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

NEF Site Coordinates			Longitude 103.0820	Latitude 32.4360							
Year	Month	Day	Longitude (°W)	Latitude (°N)	Focal (km)	Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	Epicentral Distance (mi)	Data Sources[4]
1931	8	16	-104.60	30.70			6.00	M	240.3	149.3	UTIG
1949	5	23	-105.20	34.60			4.50	M	310.0	192.6	NMTH
1955	1	27	-104.50	30.60			3.30	M	244.0	151.6	UTIG
1962	3	6	-104.80	31.20			3.50	M	212.3	131.9	UTIG
1963	12	19	-104.27	34.82			3.40	M	287.0	178.3	NMTR
1964	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
1984	9	11	-100.70	31.99	5.0	3.1	3.20	un	229.4	142.5	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 (°W)	Latitude (°N)	Focal Depth[1] (km)	Focal Depth[1] (mi)	MAG[2]	MAG Type[3]	Epicentral Distance (km)	Epicentral Distance (mi)	Data Sources[4]
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 3.3-5 Earthquake Data Sources for New Mexico and West Texas

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

Table 3.3-6 Modified Mercalli Intensity Scale

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

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

Page 1 of 1

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

Page 1 of 1

	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.

FIGURES

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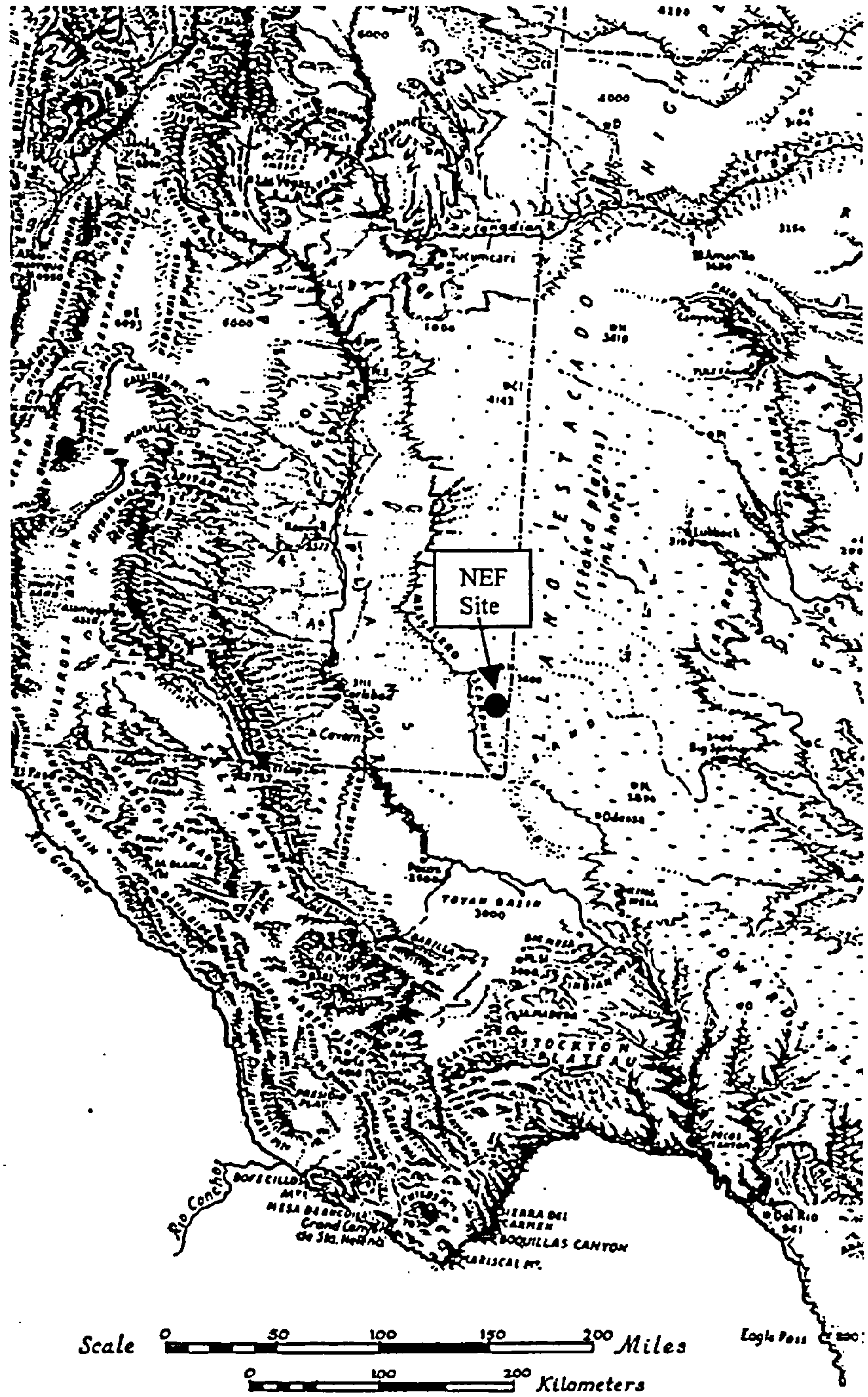
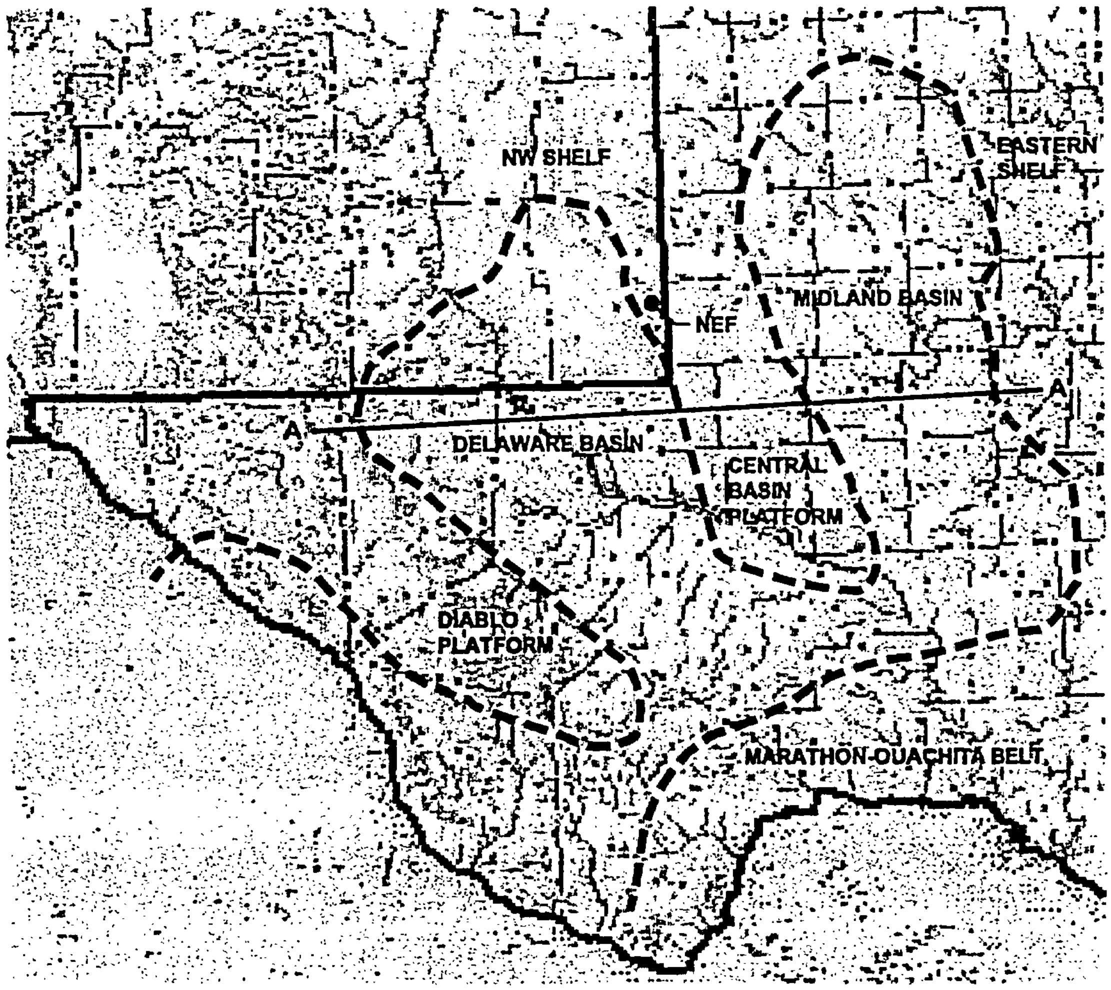


REFERENCE:
(RAISZ, 1957)

NORTH

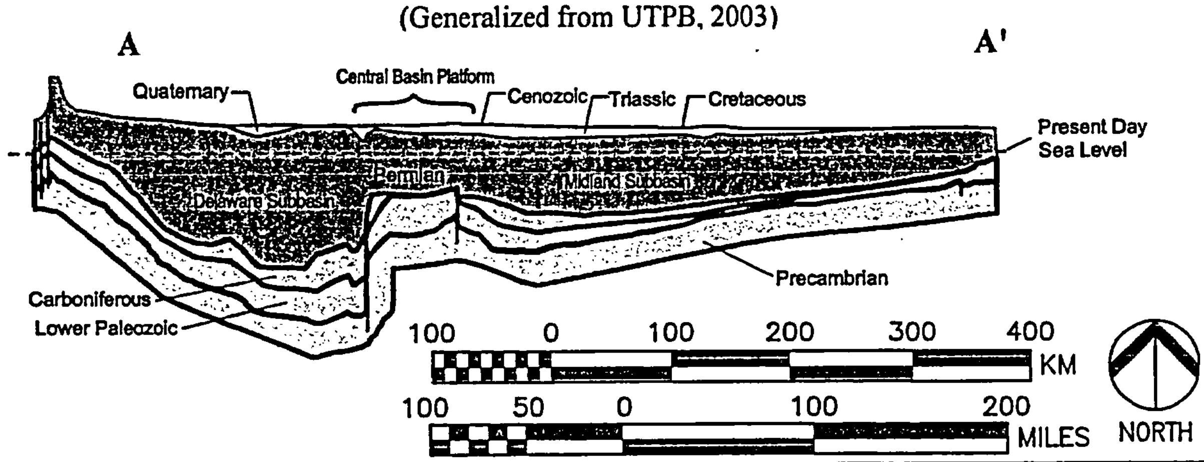
REFERENCE NUMBER
MSWord Figures.dwg

FIGURE 3.3-1
REGIONAL PHYSIOGRAPHY
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

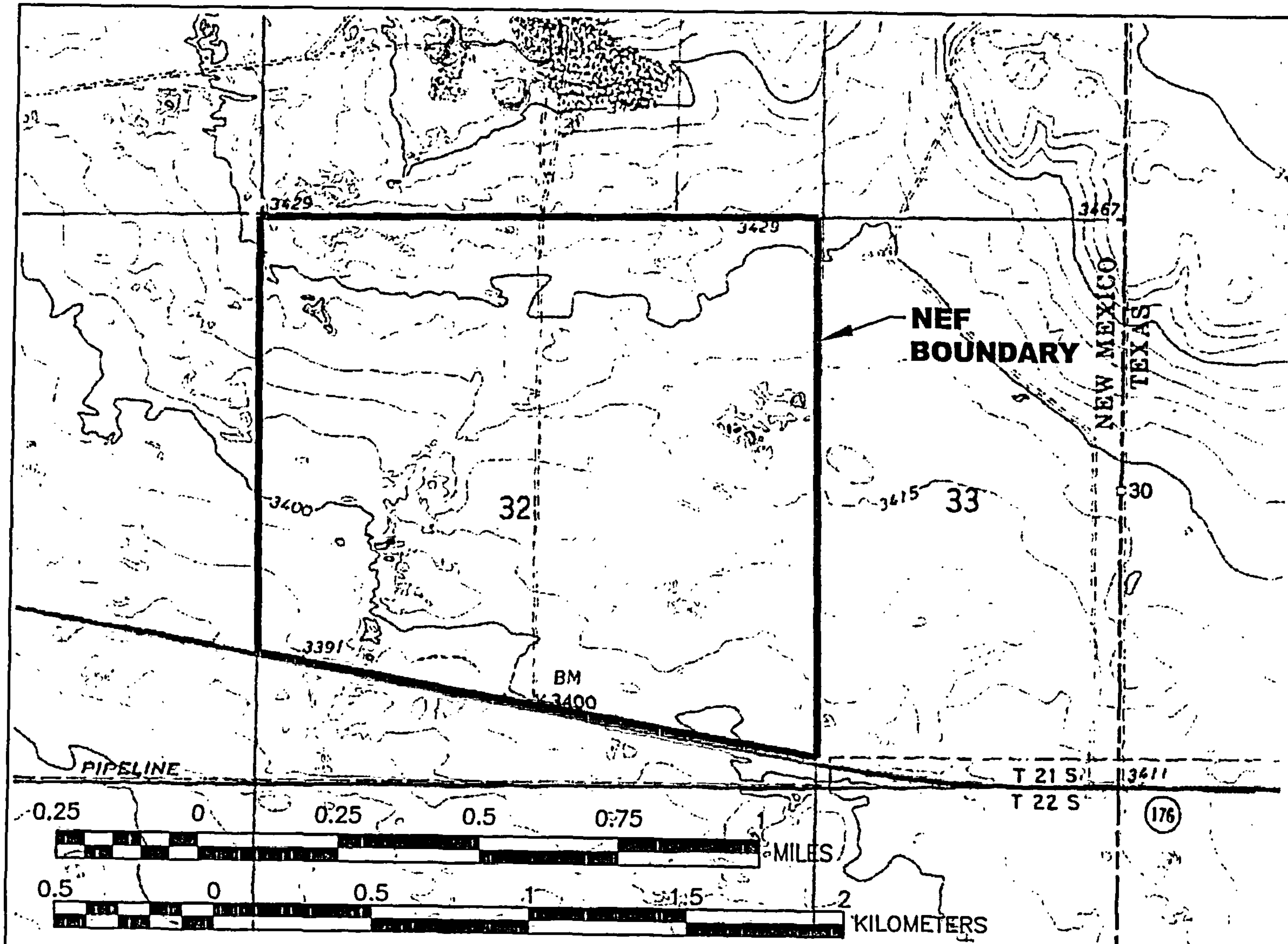


Permian Basin Geologic Profile

(Generalized from UTPB, 2003)



REFERENCE NUMBER	**FIGURE 3.3-2**
Section 3.3 Figures.dwg	REGIONAL GEOLOGY OF THE PERMIAN BASIN ENVIRONMENTAL REPORT REVISION DATE: DECEMBER 2003



FROM USGS EUNICE NE TEX–NM TOPOGRAPHIC QUADRANGLE, PHOTO–REVISED JULY, 1979

CONTOUR INTERVAL: 5 FEET

Modified from: http://mrdata.usgs.gov.

REFERENCE NUMBER
Figure 3.3–3.dwg

FIGURE 3.3-3

SITE TOPOGRAPHY

ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

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

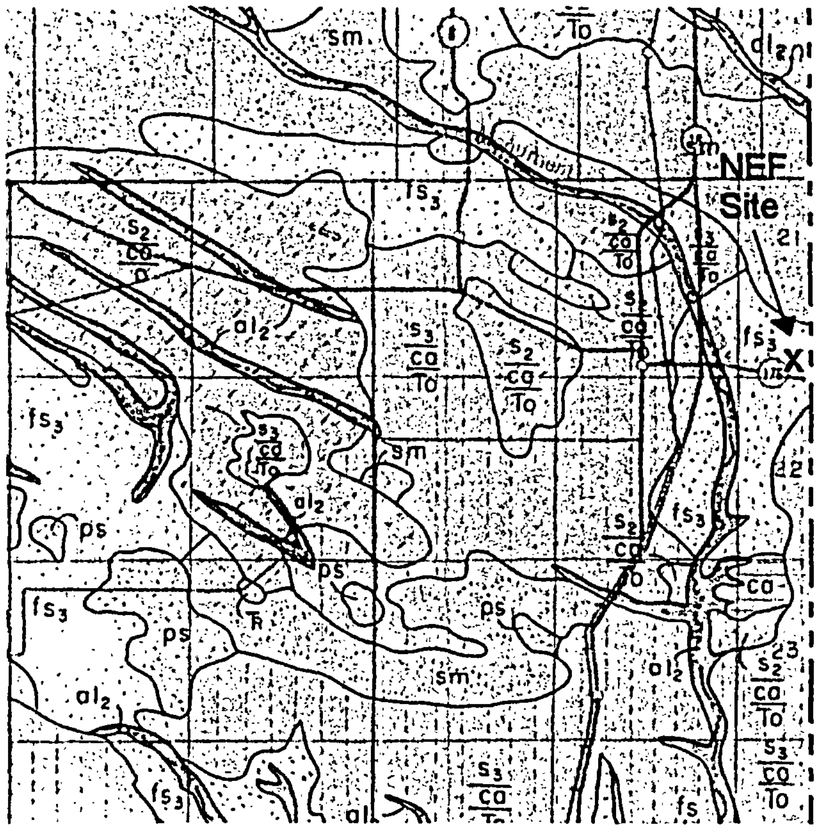
s_2/ca/To MODERATELY THICK SAND ON CALICHE ON OGALLALA FORMATION Sand 1 to 3 ft thick. Surface layers noncalcareous over reddish loam. Local sand mounds. Ground favored for farming. Boundaries approximate

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

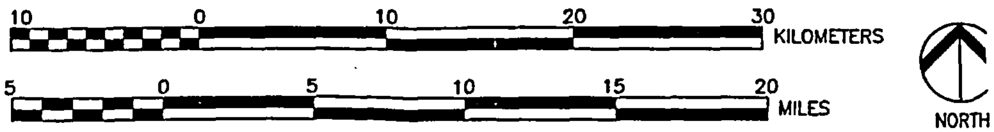
sm LOOSE SAND IN MOUNDS Coppice dunes, commonly 3 to 7 ft high and 25 to 50 ft in diameter; generally elongated north of east but a local exception lies east of Columbus where elongation is south of east. Age is Holocene. Boundaries fairly accurate

ps SANDY LAKE OR PLAYA DEPOSITS Gypsiferous deposits labeled ps_2

Ʀ 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, Ʀs Triassic Santa Rosa Sandstone). Many small areas omitted; indicated boundaries are approximate Ʀ – Triassic, undifferentiated

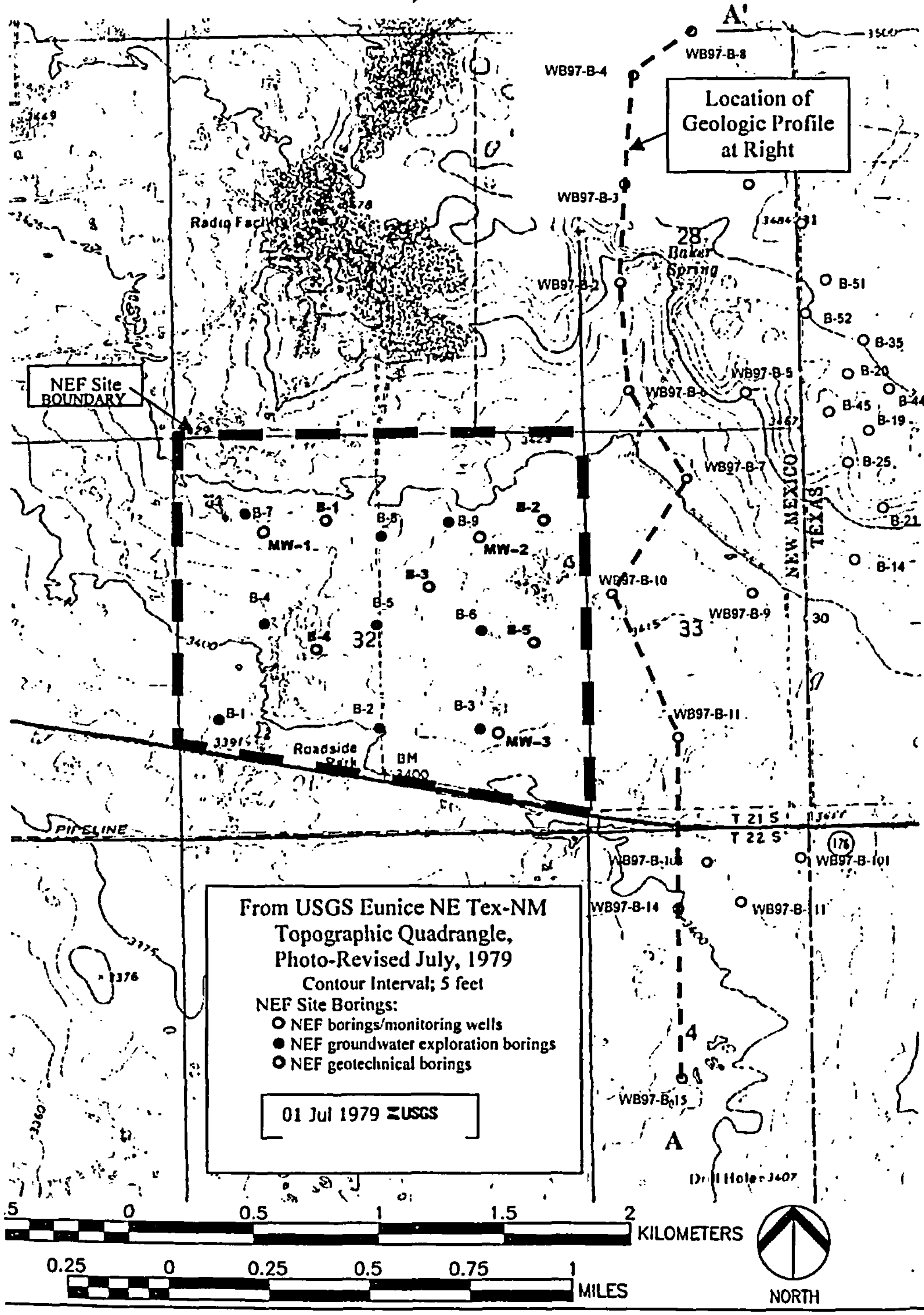


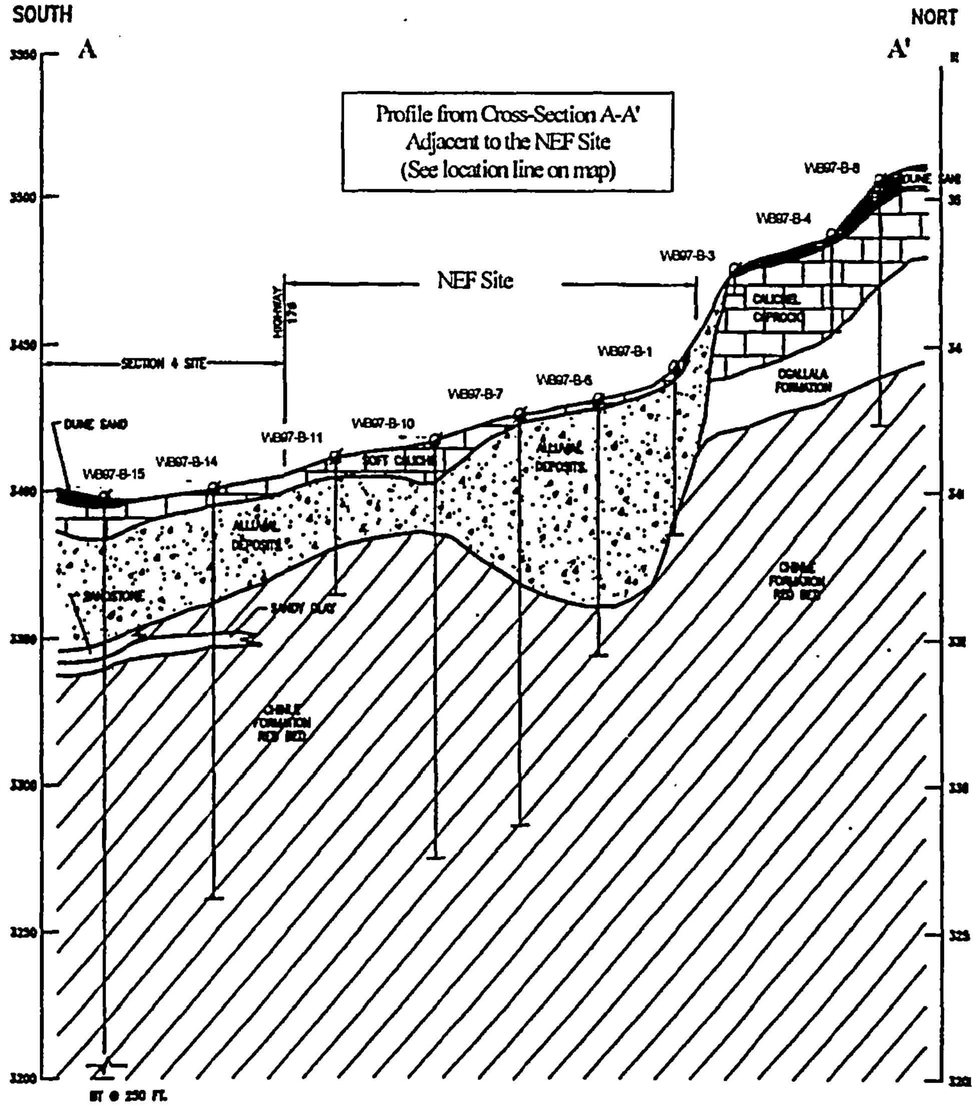
REFERENCE: (NMIMT, 1977)



REFERENCE NUMBER
Figure 3.3–4.dwg

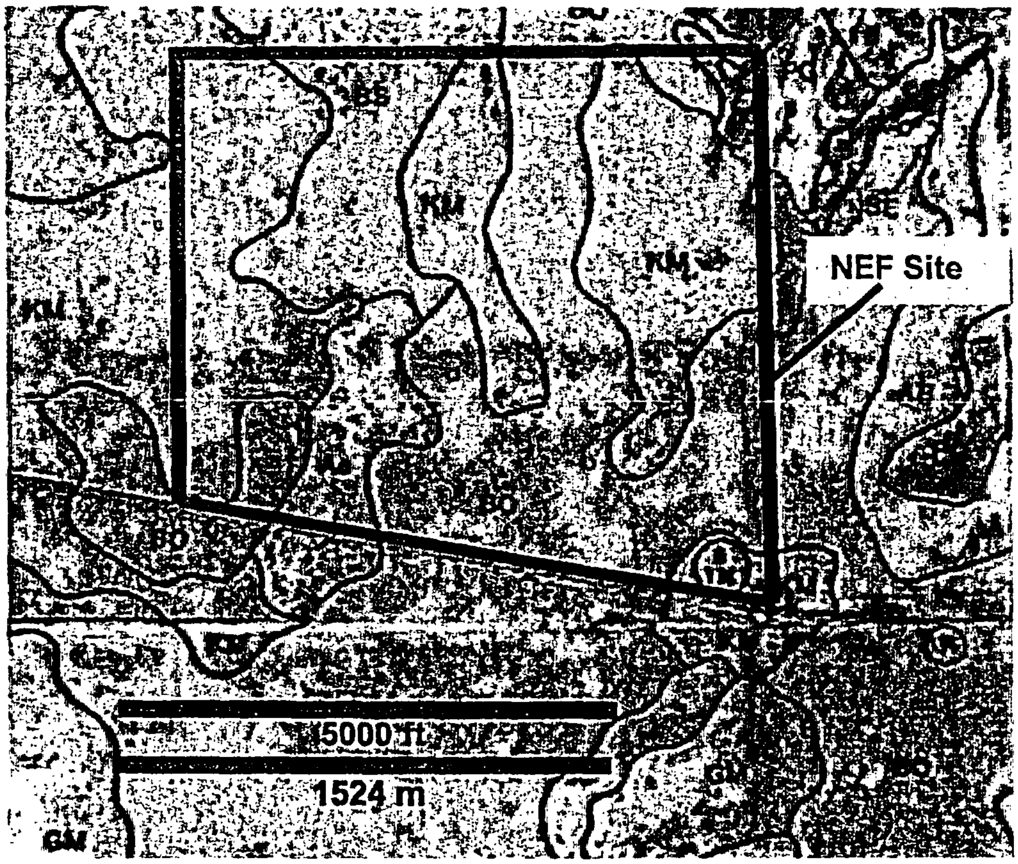
FIGURE 3.3-4
SURFICIAL GEOLOGIC MAP OF THE NEF SITE AREA
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003





REFERENCE NUMBER
Figure 3.3-5.dwg

FIGURE 3.3-5
SITE BORING PLAN AND PROFILE
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



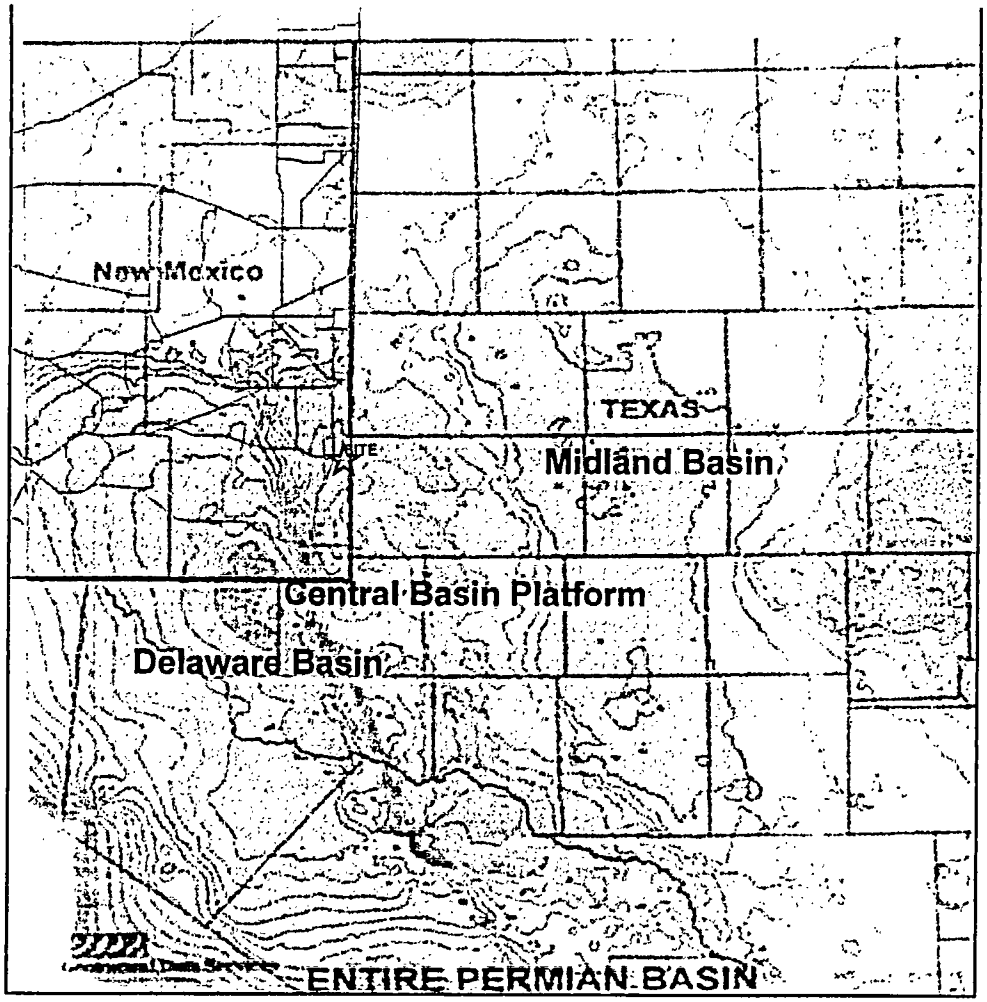
USDA SOIL DESIGNATION	SOIL NAME/DESCRIPTION	UNIFIED SOIL CLASSIFICATION DESIGNATION(S)
Aa	ACTIVE (SAND) DUNE LAND.	SP
BO	BROWNFIELD-SPRINGER ASSOCIATION: MOSTLY FINE SAND WITH LOAM FINE SAND; LEVEL TO UNDULATING TOPOGRAPHY; MODERATELY RAPID PERMEABLILITY AND SLOW RUNOFF.	SM
BS	BROWNFIELD-SPRINGER ASSOCIATION: MOSTLY FINE SAND WITH LOAM FINE SAND; DUNES AND HUMMOCKS FOR CONCAVE AND CONVEX ROLLING TERRAIN; DRAINAGE 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

REFERENCE NUMBER
MSWord Figures.dwg

FIGURE 3.3-6
SITE SOILS MAP PER USDA DATA
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



LEGEND

☆ NEF SITE

REFERENCE: (TALLEY, 1997)

NORTH

60 0 60 120 180 KM

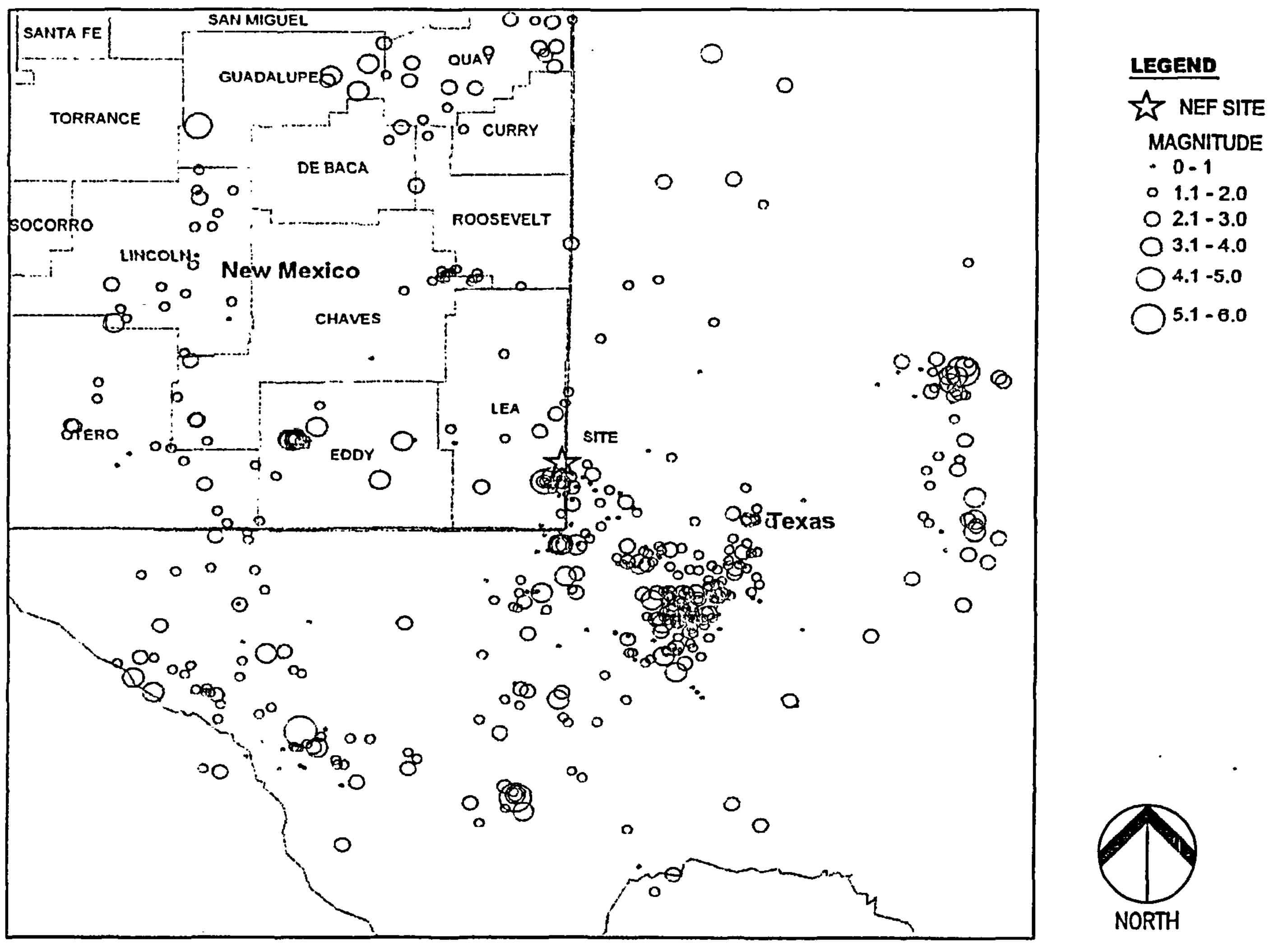
30 0 30 60 90 120 MILES

REFERENCE NUMBER
Section 3.3 Figures.dwg

FIGURE 3.3-7

TECTONIC SUBDIVISIONS
OF THE PERMIAN BASIN
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003



0 100 200 300 400 KM

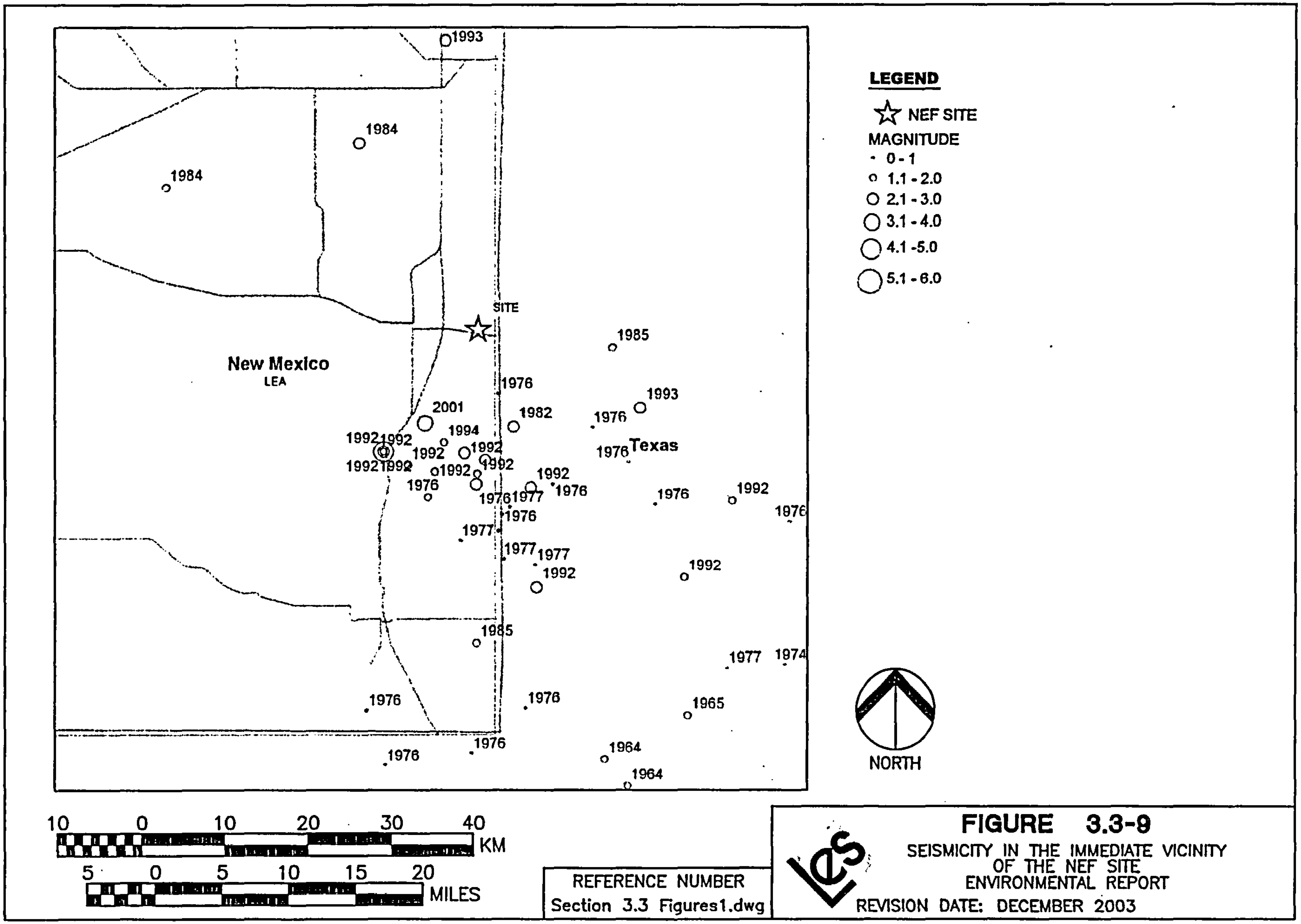
0 50 100 150 200 MILES

REFERENCE NUMBER
Section 3.3 Figures.dwg

FIGURE 3.3-8

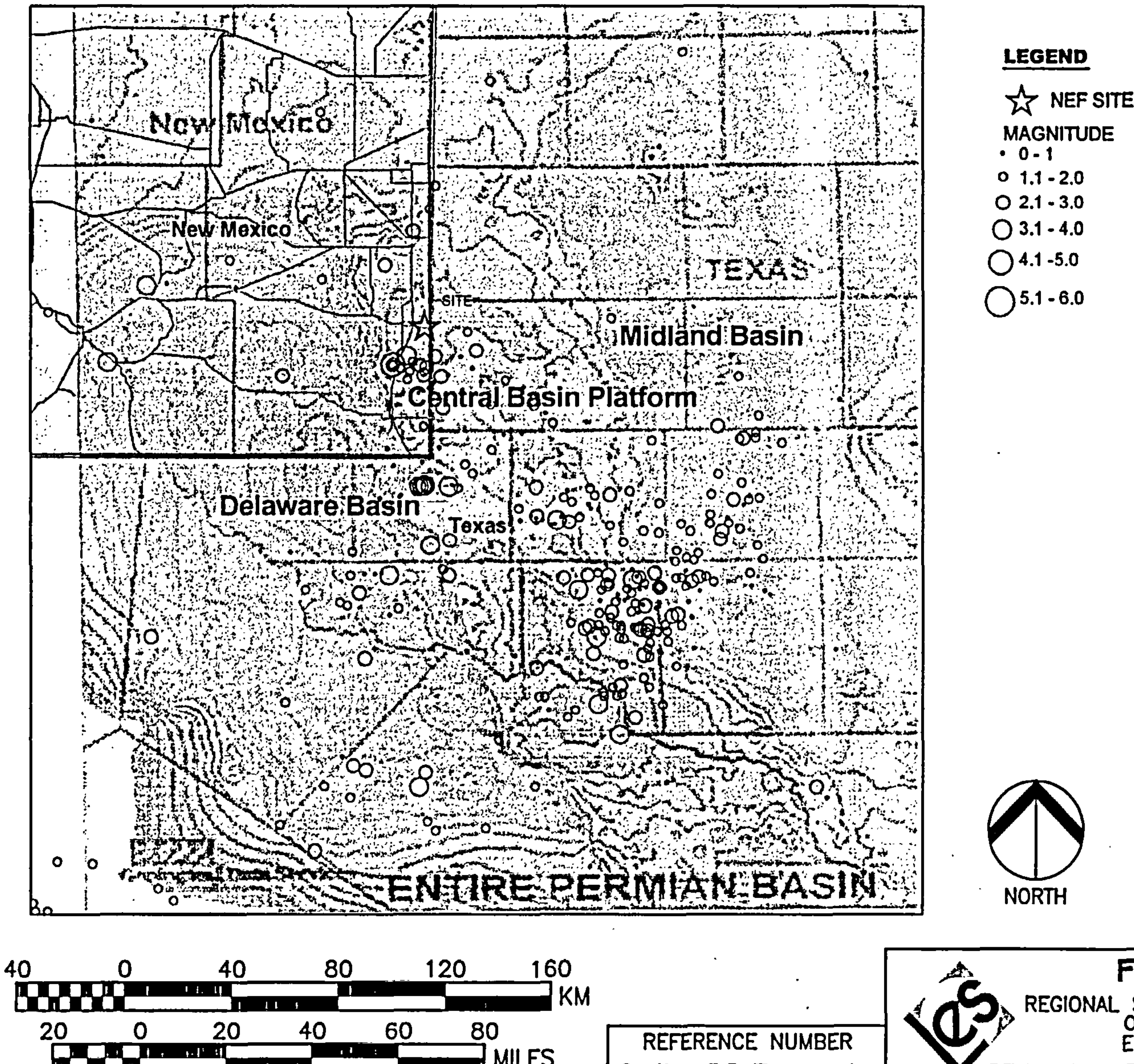
SEISMICITY MAP FOR 322-KILOMETERS (200-MILE) RADIUS OF THE NEF SITE
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003



REFERENCE NUMBER
Section 3.3 Figures1.dwg

FIGURE 3.3-9
SEISMICITY IN THE IMMEDIATE VICINITY OF THE NEF SITE
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

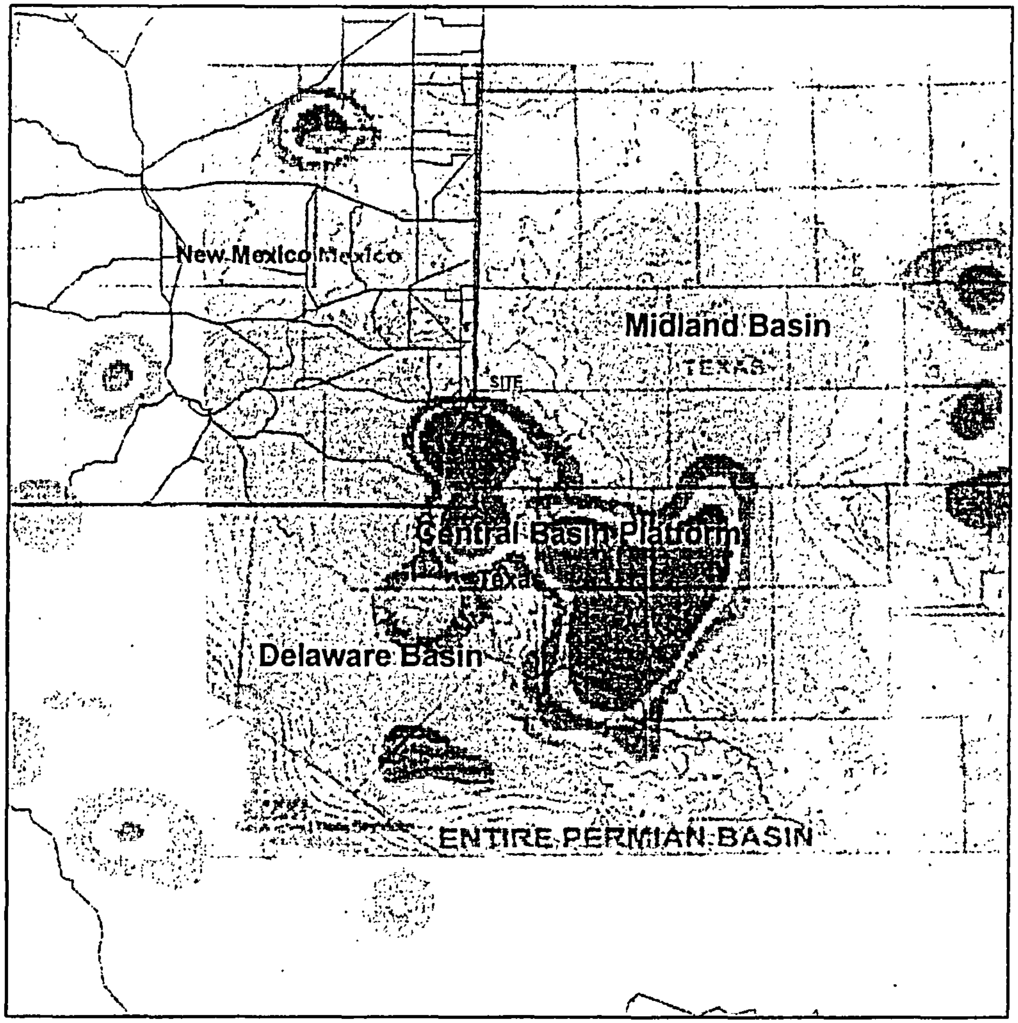


REFERENCE NUMBER
Section 3.3 Figures1.dwg

FIGURE 3.3-10

REGIONAL SEISMICITY AND TECTONIC ELEMENTS OF THE PERMIAN BASIN
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003



LEGEND

☆ NEF SITE

epicenters

EARTHQUAKE DENSITY

- 0 - 40
- 40 - 86
- 86 - 133
- 133 - 705

NOTE:
THE EARTHQUAKE FREQUENCY CONTOURS SHOWN PROVIDE A VISUAL PORTRAYAL OF THE AREAS WITH SIMILAR EARTHQUAKE COUNTS PER AREA, i.e., EARTHQUAKE DENSITY. THE DENSITY UNITS THEMSELVES ARE NOT ABSOLUTE, BUT A RELATIVE REPRESENTATION OF EARTHQUAKE FREQUENCY FROM ONE LOCATION TO ANOTHER LOCATION. 2

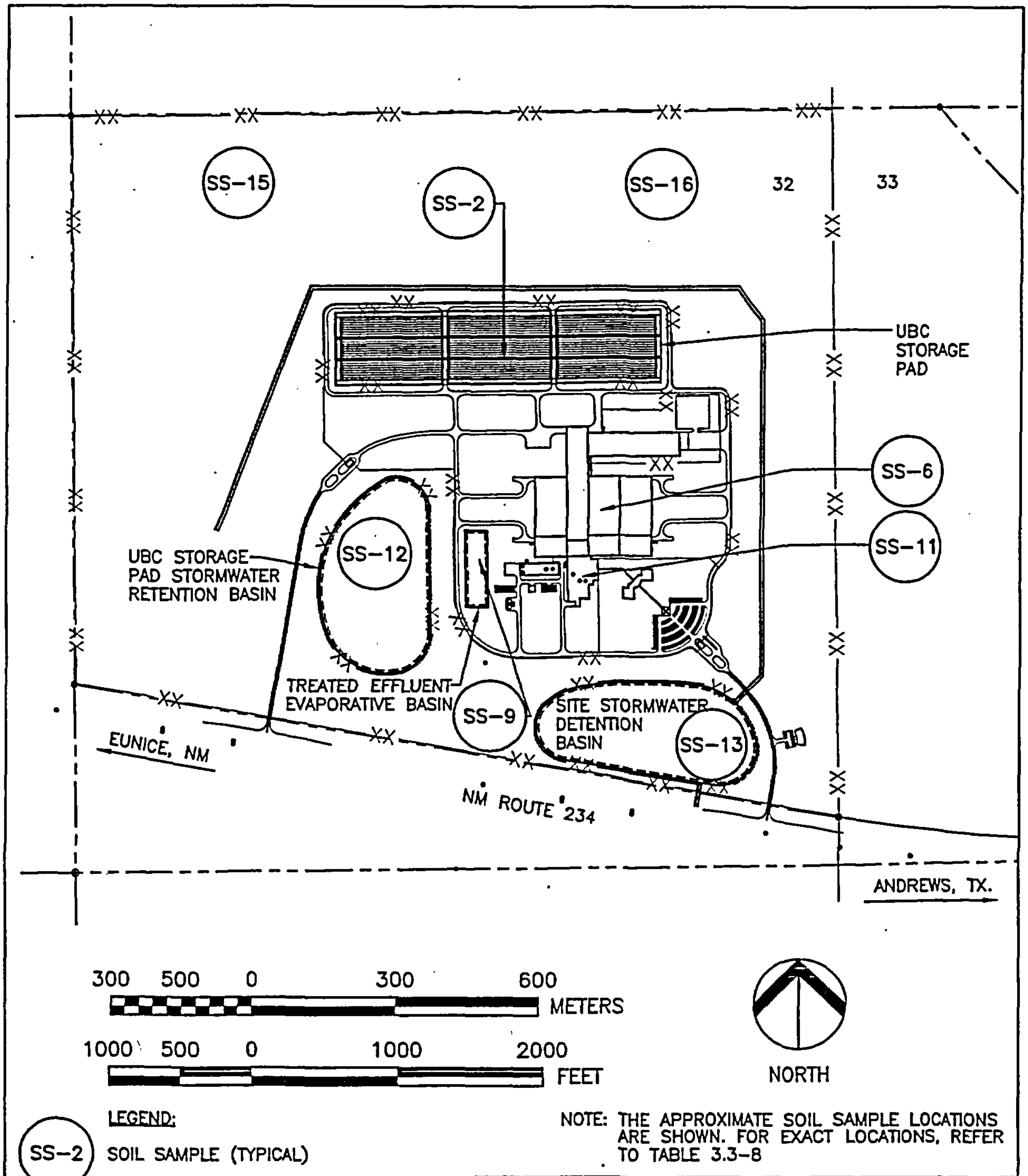
NORTH

60 0 60 120 180 240 KM

30 0 30 60 90 120 150 MILES

REFERENCE NUMBER
Section 3.3 Figures1.dwg

FIGURE 3.3-11
EARTHQUAKE FREQUENCY CONTOURS AND TECTONIC ELEMENTS OF THE PERMIAN BASIN
ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004



NOTE: THE APPROXIMATE SOIL SAMPLE LOCATIONS ARE SHOWN. FOR EXACT LOCATIONS, REFER TO TABLE 3.3-8

FIGURE 3.3-12

SOIL SAMPLE LOCATIONS

ENVIRONMENTAL REPORT

REVISION 2 DATE: JULY 2004

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 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. 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, 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, Site Boring Plan and Profile and Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour, show the locations of subsurface borings and 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 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. No samples could be collected for water quality analysis at the time of well construction. One groundwater sample has since been collected due to limited water occurrence, as discussed in ER Section 3.4.15.6, Interactions Among Different Aquifers.

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).

The 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 is anticipated that the other two wells may 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.

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 2×10^{-8} cm/s (7.9×10^{-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 244 m (800 ft) below land surface, within the Santa Rosa formation. Because of the depth below land surface to this unit, and the fact that the thick Chinle clay unit would limit any potential migration to depth, this aquifer has not been investigated. No impacts are expected to the Santa Rosa aquifer.

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

3.4.1.2 Facility Withdrawals and/or Discharges to Hydrologic Systems

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

The NEF design precludes operational process discharges from the plant to surface or groundwater at the site other than into engineered basins. Discharge of routine plant liquid effluents will be to the Treated Effluent Evaporative Basin on the site. The Treated Effluent Evaporative Basin is utilized for the collection and containment of waste water discharge from the Liquid Effluent Collection and Treatment System. The ultimate disposal of waste water will be through evaporation of water and impoundment of the residual dry solids byproduct of evaporation. Total annual discharge to that basin will be approximately 2,535 m^3 per year (669,844 gal/yr). The location of the basin is shown in Figure 4.12-2, Site Layout for NEF. Evaporation will provide the only means of liquid disposal from this basin. The Treated Effluent Evaporative Basin will include a double membrane liner and a leak detection system. A summary of liquid wastes volumes accumulated at the NEF is provided in Table 3.4-1, Summary of Potentially Contaminated Liquid Wastes for the NEF. Of the wastes listed in Table 3.4-1, only uncontaminated liquid wastes are released to the Treated Effluent Evaporative Basin for evaporation without treatment. Contaminated liquid waste is neutralized and treated for removal of uranium, as required. Effluents unsuitable for the evaporative disposal will be removed off-site by a licensed contractor in accordance with US EPA and State of New Mexico regulatory requirements. The State of New Mexico has adopted the US EPA hazardous waste regulations (40 CFR Parts 260 through 266, 268 and 270) (CFR, 2003cc; CFR, 2003p; CFR, 2003dd; CFR, 2003ee; CFR, 2003v; CFR, 2003ff; CFR, 2003gg; CFR, 2003hh; CFR, 2003ii) governing the generation, handling, storage, transportation, and disposal of hazardous materials. These regulations are found in 20.4.1 NMAC, "Hazardous Waste Management" (NMAC, 2000).

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.

A standard septic system is planned to dispose of sanitary wastes at the site, 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 mgL. 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 have been drilled and installed on the NEF site, i.e., MW-1, MW-2, and MW-3 shown on Figure 3.3-5, Site Boring Plan and Profile and Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour, and yield 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.

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 (HNM, 2003; LG, 2004) have been signed with the City of Eunice, New Mexico, and the City of Hobbs, New Mexico, for the supply of water to NEF. Any water rights potentially required for this arrangement will be negotiated with the municipalities. A description of the available municipal water supply systems, the source of plant water, is provided in ER Section 4.1.2.

3.4.7 Quantitative Description of Water Use

No subsurface or surface water, 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 and Hobbs Municipal Water Supply Systems, as described in ER Section 4.1.2. Those systems obtain 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 capacities of the Hobbs and Eunice, New Mexico water supply systems and the expected NEF average and peak usage.

3.4.8 Non-Consumptive Water Use

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

3.4.9 Contaminant Sources

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

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

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

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

3.4.10 Description of Wetlands

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

3.4.11 Federal and State Regulations

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

Applicable regulations for water resources include:

- NPDES: The NEF is eligible to claim the "No Exposure" exclusion for industrial activity of the NPDES storm water Phase II regulations. As such, the LES would submit a No Exposure Certification immediately prior to initiating operational activities at the NEF site. LES also has the option of filing for coverage under the Multi-Section General Permit (MSGP) because the NEF is one of the 11 eligible industry categories. If this option is chosen, LES will file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the initiation of NEF operations. A decision regarding which option is appropriate for the NEF will be made in the future.
- NPDES: Construction General Permit for stormwater discharge is required because construction of the NEF will involve the grubbing, clearing, grading or excavation of one or more acres of land. This permit is administered by the EPA Region 6 with oversight review by the New Mexico Water Quality Bureau. Various land clearing activities such as offsite borrow pits for fill material have also been covered under this general permit. LES construction contractors will be clearing approximately 81 ha (200 acres) during the construction phase of the project. 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, as well as domestic septic wastes.

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 SAR Sections 3.2.4.3, Floods, and 3.3, Facility Description, for local intense precipitation, are needed for flooding at the site.

3.4.13 Freshwater Streams for the Watershed Containing the Site

The NEF includes no perennial freshwater streams in its watershed.

3.4.13.1 Drainage Areas

There are no major drainage areas associated with the NEF.

3.4.13.2 Historical Maximum and Minimum River Flows

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

3.4.13.3 Historical Drought River Flows

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

3.4.13.4 Important Short Duration Flows

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

3.4.14 Water Impoundments

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

3.4.14.1 Elevation-Area-Capacity Curves

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

3.4.14.2 Reservoir Operating Rules

The NEF will not make use of any reservoir.

3.4.14.3 Annual Yield and Dependability

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

3.4.14.4 Inflow/Outflow/Storage Variations

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

3.4.14.5 Net Loss, Including Evaporation and Seepage

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

3.4.14.6 Current Patterns

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

3.4.14.7 Temperature Distribution

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

3.4.15 Groundwater Characteristics

Groundwater resources at the proposed NEF site are limited. There are no major water-producing units beneath the site. The site is not located within the recharge area of any sole-source or major aquifer. In the near subsurface, the soils are dry due to low rainfall rates and a very effective evapotranspiration process by the native vegetation. Natural recharge to groundwater is not inferred to be taking place at the site. In the upper 0.3 to 17 m (1 to 55 ft), the soils are relatively fine grained, silts, sands and silty sands, grading to a sand and gravel base layer. The sand and gravel horizon overlays a thick clay formation. In areas to the north and east of the site, this sand and gravel layer has some localized saturation. The processes

that lead to these localized saturated areas are not present at the NEF site (see discussion in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems). The soils above the Chinle Formation clay horizon are dry, and, under natural conditions, contain no saturated horizons.

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

Within the Chinle at a depth of about 65 to 68 m (214 to 222 ft) below the surface is a small siltstone or silty sandstone unit that has some local saturation. This unit is the shallowest occurrence of groundwater beneath the site. The permeability of this unit is fairly low, and monitor wells completed in this unit at the NEF and at the WCS facilities to the east of the NEF site are slow to produce water. The water quality in this unit is poor, based on the sampling and analysis performed. TDS values typically range from 2,880 to 6,650 mg/L. Three monitor wells have been installed on the NEF site to monitor this unit. One well has been 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.

Recent 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. Based on this, it is 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 installed at the site (Figure 3.4-6). These three monitoring wells are 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.

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

3.4.15.1 Groundwater Elevation Trends

Three monitoring wells were recently 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 are being monitored for inflow of groundwater. The well screens are located at the first occurrence of groundwater beneath the site, some 65 to 68 m (214 to 222 ft) below land surface. They are set 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

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 three 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, 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 aquifer (Freeze, 1979) which requires that the unit be able to transmit "significant quantities of water under ordinary hydraulic gradients."

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.

TABLES

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

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

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

Table 3.4-2 . Groundwater Chemistry
Page 1 of 1

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 3.4-3 Chemical Analyses of NEF Site Groundwater

Page 1 of 3

		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	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)

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)
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)
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	***

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)
Miscellaneous Constituents			
Other VOCs and Pesticides	<MDLs	Various	Various
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
* The proposed standard excludes ^{222}Rn, ^{226}Ra and uranium activity
** This standard excludes ^{228}Ra 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 3.4-4 Anticipated Normal Plant Water Consumption
Page 1 of 1

Potable Water/Sewer Average Consumption	**L/Day**	**Gal/Day**
All Shifts – 210 People	19,873	5,250
Cooling Tower Water		
Process Cooler Drift	5,924	1,565
Process Cooler Evaporation	59,677	15,765
Process Cooler Blowdown	22,379	5,912
HVAC Cooler Drift	6,768	1,788
HVAC Cooler Evaporation	80,035	21,143
HVAC Cooler Blowdown	30,015	7,929
Humidification	8,464	2,236
Total Cooling Water	213,263	56,338
Summation of Liquid Effluents (excluding utilities)		
Floor Washings, Misc. Condensates and Lab Effluent	64	17
Degreaser Washer	11	3
Citric Acid	8	2
Laundry	1,113	294
Hand Wash and Shower Water	5,754	1,520
Total Liquid Effluents	6,950	1,836
Total City Water Consumption	240,086	63,423

Table 3.4-5 Anticipated Peak Plant Water Consumption

Page 1 of 1

				Flow Rate	
Peak Potable Water Consumption	**No. of Fixtures**	**Fixture Units**	**Total Fixtures**	**gpm**	**L/s**
TSB Sinks	10	3	30		
TSB WC	10	4	40		
TSB Urinals	3	2	6		
TSB Showers	4	2	8		
TSB JC	1	3	3		
Admin Sinks	6	3	18		
Admin WC	7	4	28		
Admin Urinals	2	2	4		
Admin JC	1	3	3		
CAB Sinks	9	3	27		
CAB Urinals	2	2	4		
CAB JC	1	3	3		
CAB WC	8	4	32		
Fixture Subtotal			206	93	5.9
Safety Showers (estimated)				30	1.9
Total			206	123	8
Peak Process Water Consumption					
DI Water Makeup				30	1.9
Boiler Make-up				20	1.3
CH Water Make-up				20	1.3
Tower Water Make-Up				175	11.0
Laundry	1	3	3	10	0.6
HVAC Humidifiers				0	0
Total				255	16.1
Two 474 m^3 (125,000-Gal) Fire Water Tanks				520.8	32.9

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FIGURES

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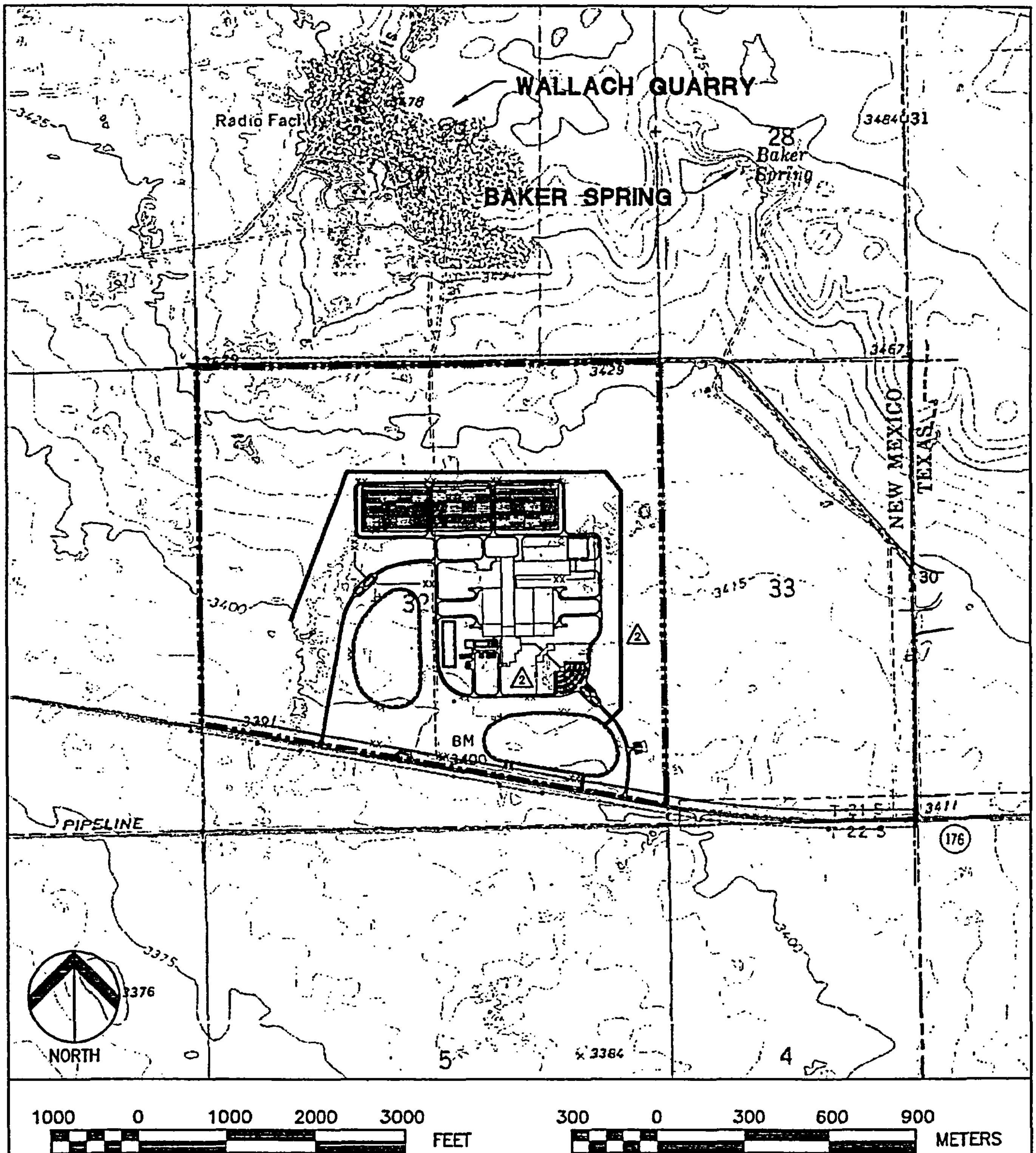


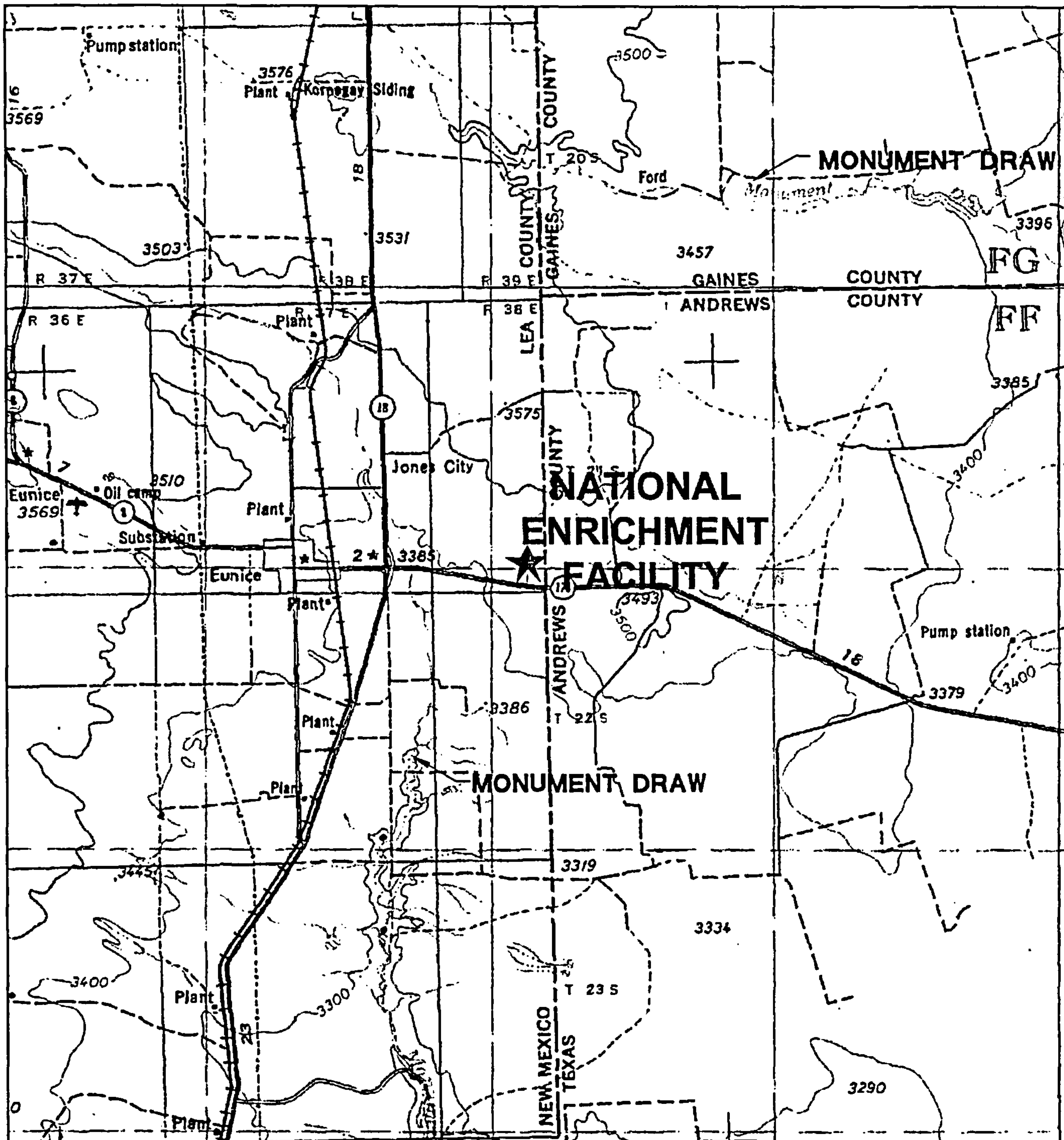
MAP SOURCE:
USGS 7.5 MINUTE
EUNICE NE QUADRANGLE
TEX.–N. MEX. 1:24000

CONTOUR INTERVAL:
5 FEET

LOCKWOOD GREENE ENGINEERING & CONSTRUCTION

REFERENCE NUMBER
Figure 3.4–1.dwg

FIGURE 3.4-1
LOCAL HYDROLOGIC FEATURES
ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004



1 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

1 0 1 2 3 4 5 6 MILES

NORTH

CONTOUR INTERVAL: 100 FT

MAP SOURCE:
USGS 1:100,000 30 MIN. X 60 MIN. MAPS
HOBBS, NEW MEXICO – TEXAS
AND EUNICE NE,TEX. – N. MEX.

REFERENCE NUMBER
Figure 3.4–2.dwg

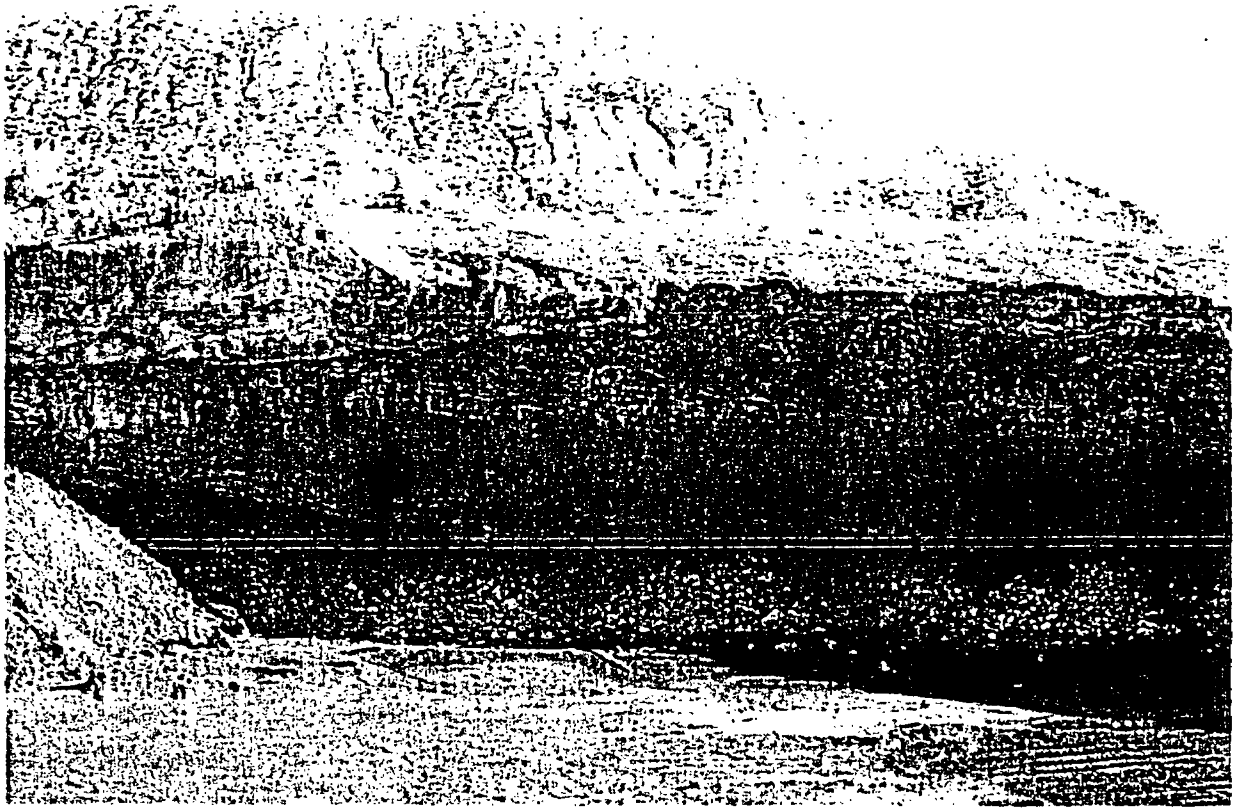
LES

FIGURE 3.4-2

REGIONAL HYDROLOGIC FEATURES

ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

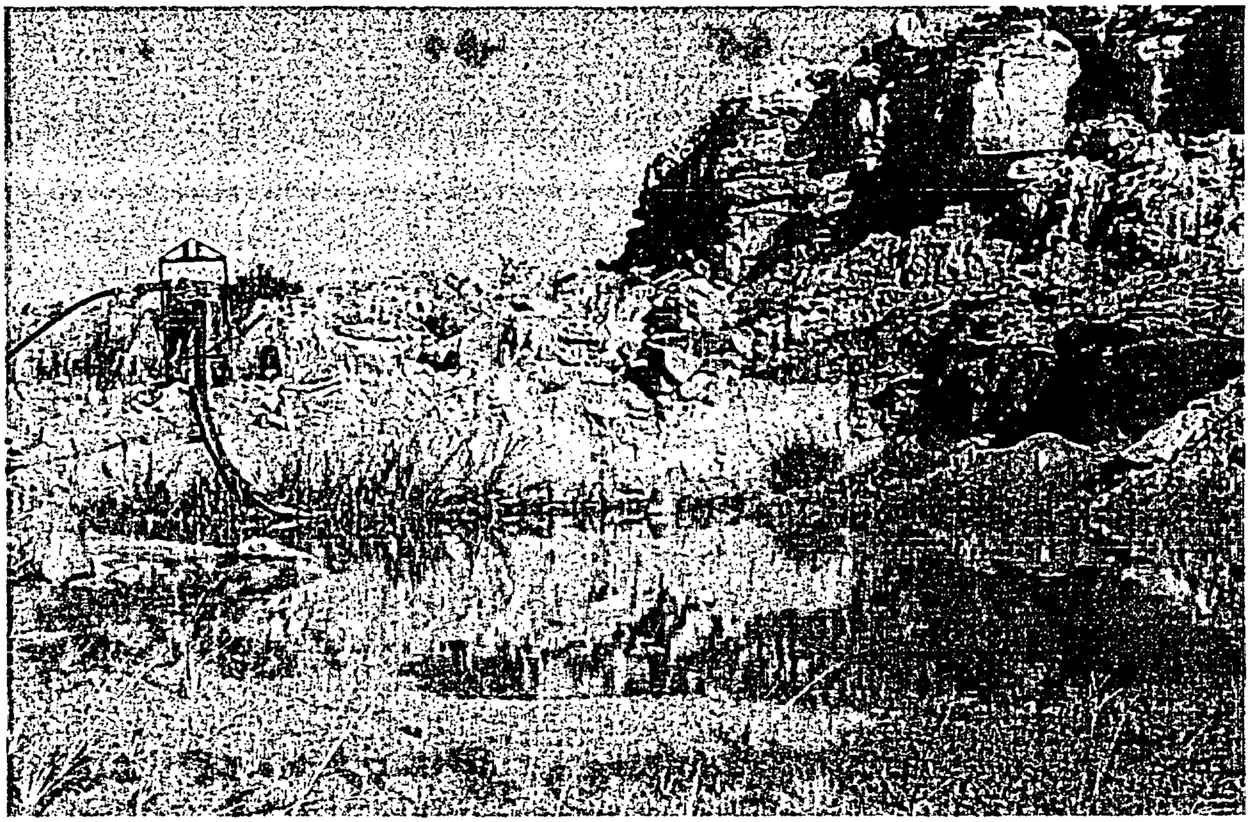


REFERENCE NUMBER
MSWord Figures.dwg

FIGURE 3.4-3

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

REVISION DATE: DECEMBER 2003



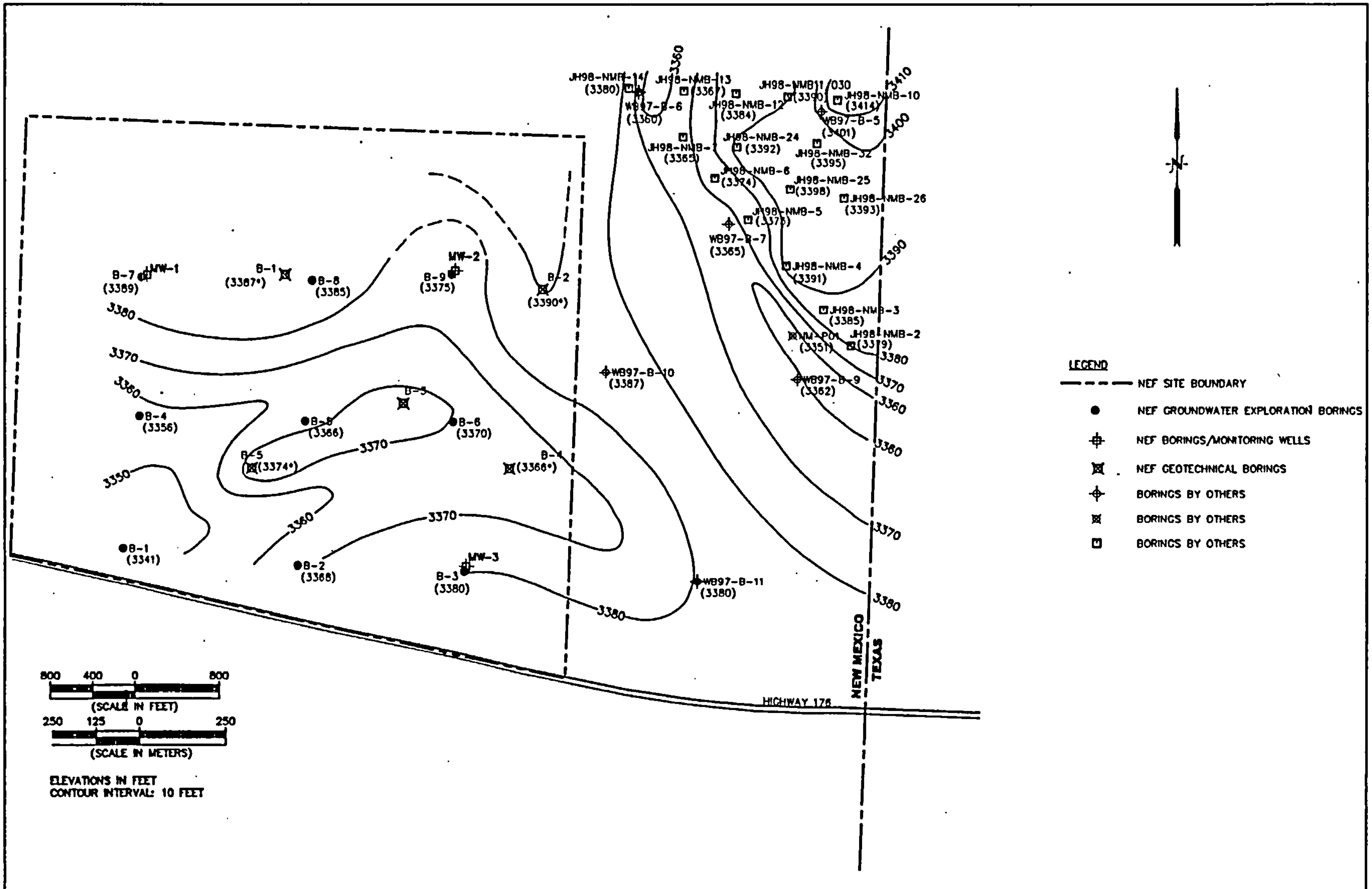
REFERENCE NUMBER
MSWord Figures.dwg

FIGURE 3.4-4

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

REVISION DATE: DECEMBER 2003

REFERENCE NUMBER MSWord Figures.dwg	**FIGURE 3.4-5** VIEW OF BAKER SPRING AREA TO THE NORTHEAST OF THE NEF SITE ENVIRONMENTAL REPORT REVISION DATE: DECEMBER 2003



LOCKWOOD GREENE
ENGINEERING & CONSTRUCTION

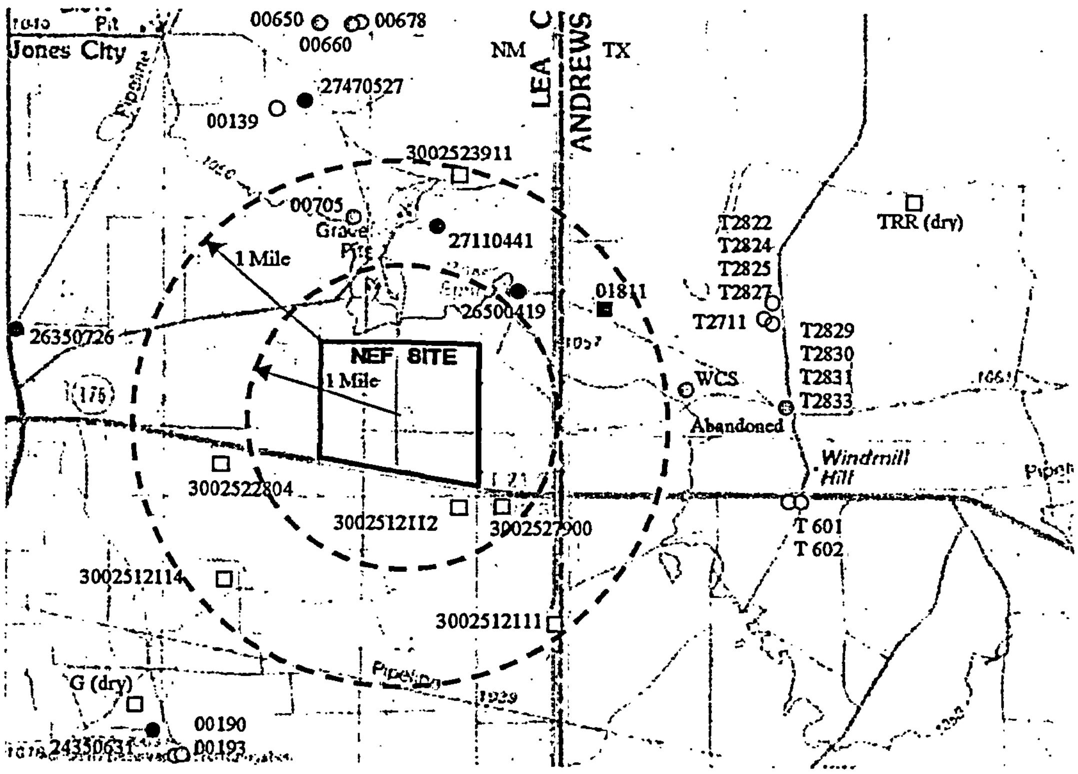
REFERENCE NUMBER
BORINGS 3.4-6.DWG

LES

FIGURE 3.4-6

DOCKUM GROUP (CHINLE FORMATION)
SURFACE CONTOUR
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

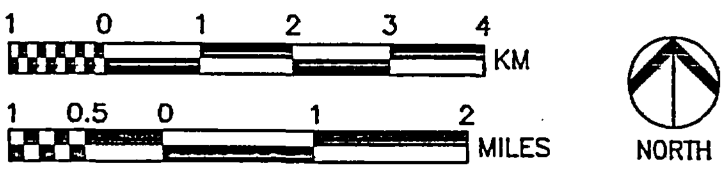


Water Wells

- Undetermined
- Observation wells: USGS
- Livestock well
- Domestic Well

Oil Wells

- Open symbol represents dry, plugged and/or abandoned hole



SOURCES: (NMSE, 2003; TWDB, 2003; USGS, 2003b; TRC, 2003; GOTECH, 2003; ESRI, 2001)

REFERENCE NUMBER	**FIGURE 3.4-7**
Figure 3.4–7.dwg	WATER AND OIL WELLS IN THE VICINITY OF THE NEF SITE ENVIRONMENTAL REPORT REVISION DATE: DECEMBER 2003

3.5 ECOLOGICAL RESOURCES

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

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

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

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

3.5.1 Maps

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

3.5.2 General Ecological Conditions of the Site

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.5.3 Description of Important Wildlife and Plant Species

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

NEF site did not identify any sand dune lizard habitats. The black-tailed prairie dog (*Cynomys ludovicianus*) was listed as a candidate species under the Endangered Species Act by the U.S. Fish and Wildlife Service in 2000. No sightings or evidence of prairie dogs were found during a field survey of the NEF site.

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

LESSER PRAIRIE CHICKEN

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

A nomination has been submitted (Stinnett, 2002) to the Bureau of Land Management (BLM) to designate two public land parcels within Lea County as an Area of Critical Environmental Concern (ACEC) for the lesser prairie chicken (*Tympanuchus pallidicinctur*). Refer to Figure 3.5-2, County Map Proposed Area of Critical Environmental Concern (ACEC) Lesser Prairie Chicken. The nearest nominated ACEC straddles Lea and Eddy Counties and is about 48 km (30 mi) northwest of the proposed NEF site. The other nominated ACEC, which is further north, borders the northwest corner of Lea County. Currently, the BLM is evaluating this nomination and expects to make a decision within the next several years.

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

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

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

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

MULE DEER

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

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

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

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

Population Dynamics

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

SCALED QUAIL

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

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

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

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

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

SAND DUNE LIZARD

Habitat Requirements. The sand dune lizard populations are mostly confined to shinnery oak-sand dune habitats of southeastern New Mexico and West Texas. This lizard occurs only in areas with open sand, but forages and takes refuge under shinnery oak and is seldom more than 1.2 to 1.8 m (4 to 6 ft) form the nearest plant. The sand dune lizard is restricted to areas where sand dune blow-outs, topographic relief, or shinnery oak occur (Sena, 1985). Dunes that have become completely stable by vegetation appear to be unsuitable habitat. The NEF site contains areas of sand dunes in the eastern central area of the site, southwestern quadrant, and

a small area in the northwestern corner of the site. Surveys of the NEF site did not identify any sand dune lizard habitats.

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

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

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

BLACK-TAILED PRAIRIE DOG

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

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

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

There have been no sightings of black-tailed prairie dogs, active or inactive prairie dog mounds/burrows, or any other evidence, such as trimming of the various shrub species, or prairie dogs at the NEF site.

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

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

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

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

PLANT SPECIES

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

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

3.5.4 RTE Species Known or Potentially Occurring in the Project Area

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

Lesser Prairie Chicken (Tympanchus pallidicinctus), Imperiled, Candidate

The lesser prairie chicken is discussed in detail in ER Section 3.5.3, Description of Important Wildlife and Plant Species. The closest known occurrence of this specie to the NEF site is a breeding ground or lek, located approximately 6.4 km (4 mi) north of the NEF site. Field surveys for the lesser prairie chicken that were conducted in September 2003 and April 2004, indicated the specie does not occur on the NEF site. No visual sightings or aural detections

were made and there is little potential habitat in the survey area. In addition, high human disturbance and predator potential in the area make it unlikely that lesser prairie chickens will colonize the area. Based on these findings, no mitigation measures are planned to reduce the impacts on or to protect the lesser prairie chicken at the NEF site.

Sand Dune Lizard (Sceloporus arenicolus), Threatened, Candidate

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

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

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

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

3.5.5 Major Vegetation Characteristics

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

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

Total vegetative cover represents the percentage of ground that has vegetation above it, as opposed to bare ground or litter. The total vegetative cover for the NEF site was approximately 26.5% cover. Herbaceous plants covered approximately 16.7% of the total ground area and shrubs covered approximately 9.6% of the total ground area. The largest herbaceous

contributor to vegetative cover was Eragrostis oxylepis (Red Lovegrass) with approximately 12.6% total cover, followed by *Sporobolus sp.* (Dropseed Species) with approximately 1.5% total cover. The next two largest contributors were *Aristida purpurea* (Purple Three Awn) with approximately 1.1% total cover and *Paspalum stramineum* (Sand Paspalum) with approximately 0.67% total cover.

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

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

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

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

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

3.5.6 Habitat Importance

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

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

A field survey for the lesser prairie chicken and the black-tailed prairie dog was conducted in September 2003 that indicated these species do not occur on the NEF site. A subsequent

survey performed for the lesser prairie chicken in April 2004, supports the initial findings. The NEF site could provide suitable food sources for the lesser prairie chicken, though there are limited water sources on the site. Due to the high density of shrubs, the NEF site is not optimal prairie dog habitat.

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

SWIFT FOX

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

AMERICAN PEREGRINE FALCON

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

ARCTIC PEREGRINE FALCON

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

BAIRD'S SPARROW

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

BELL'S VIREO

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

WESTERN BURROWING OWL

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

YELLOW-BILLED CUCKOO

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

3.5.7 Location of Important Travel Corridors

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

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

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

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

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

3.5.8 Important Ecological Systems

The NEF site contains fair to poor quality wildlife habitat. The Plains Sand Scrub vegetative community has been impacted by past land use practices. The site has been grazed by domestic livestock for over a hundred years, has a New Mexico state highway along the southern boundary, a carbon dioxide (CO_2) pipeline right-of-way bisects the site, 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.

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TABLES

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Table 3.5-1 Mammals Potentially Using the NEF Site

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

Table 3.5-1 Mammals Potentially Using the NEF Site
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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 3.5-2 Birds Potentially Using the NEF Site

Page 1 of 2

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

Table 3.5-2 Birds Potentially Using the NEF Site
Page 2 of 2

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

R — Species Rarely Seen On-Site
U — Species Uncommonly Seen On-Site
C — Species Commonly Seen On-Site
* — Field surveys conducted at the site indicated the specie does not occur on the NEF site.

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

Page 1 of 2

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 3.5-3 Amphibians/Reptiles Potentially Using the NEF Site

Page 2 of 2

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 3.5-4 Plant 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

Table 3.5-4 Plant Cover, Frequency and Shrub Data

Species	Mean % Cover	Relative Cover	Mean % Freq	Relative Freq
Sporobolus sp. Dropseed Species	1.475	0.055	5.450	0.076
sub-total	**16.725**	**0.626**	**47.400**	**0.658**

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 3.5-5 Shrub Density

Species	Mean 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)**

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FIGURES

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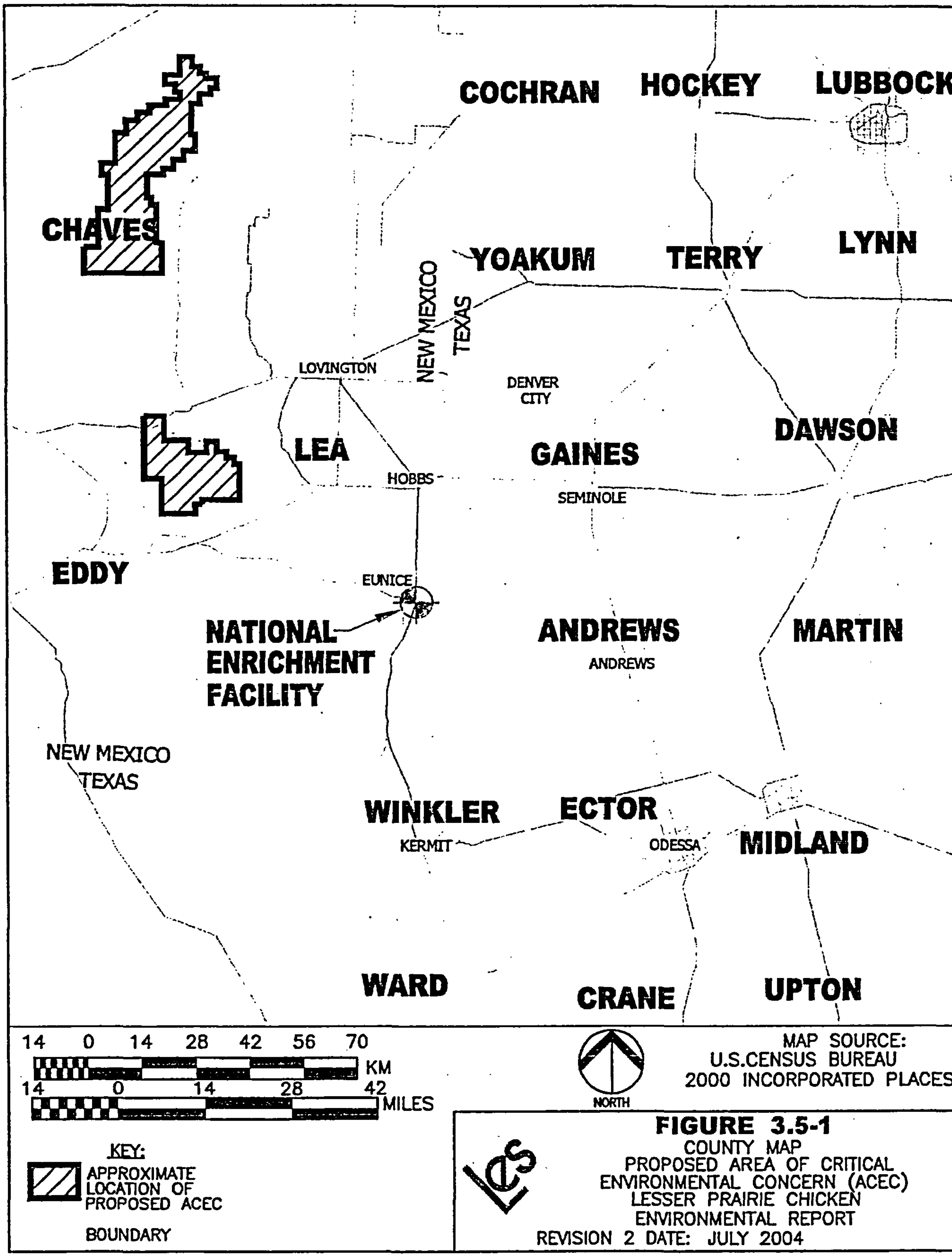
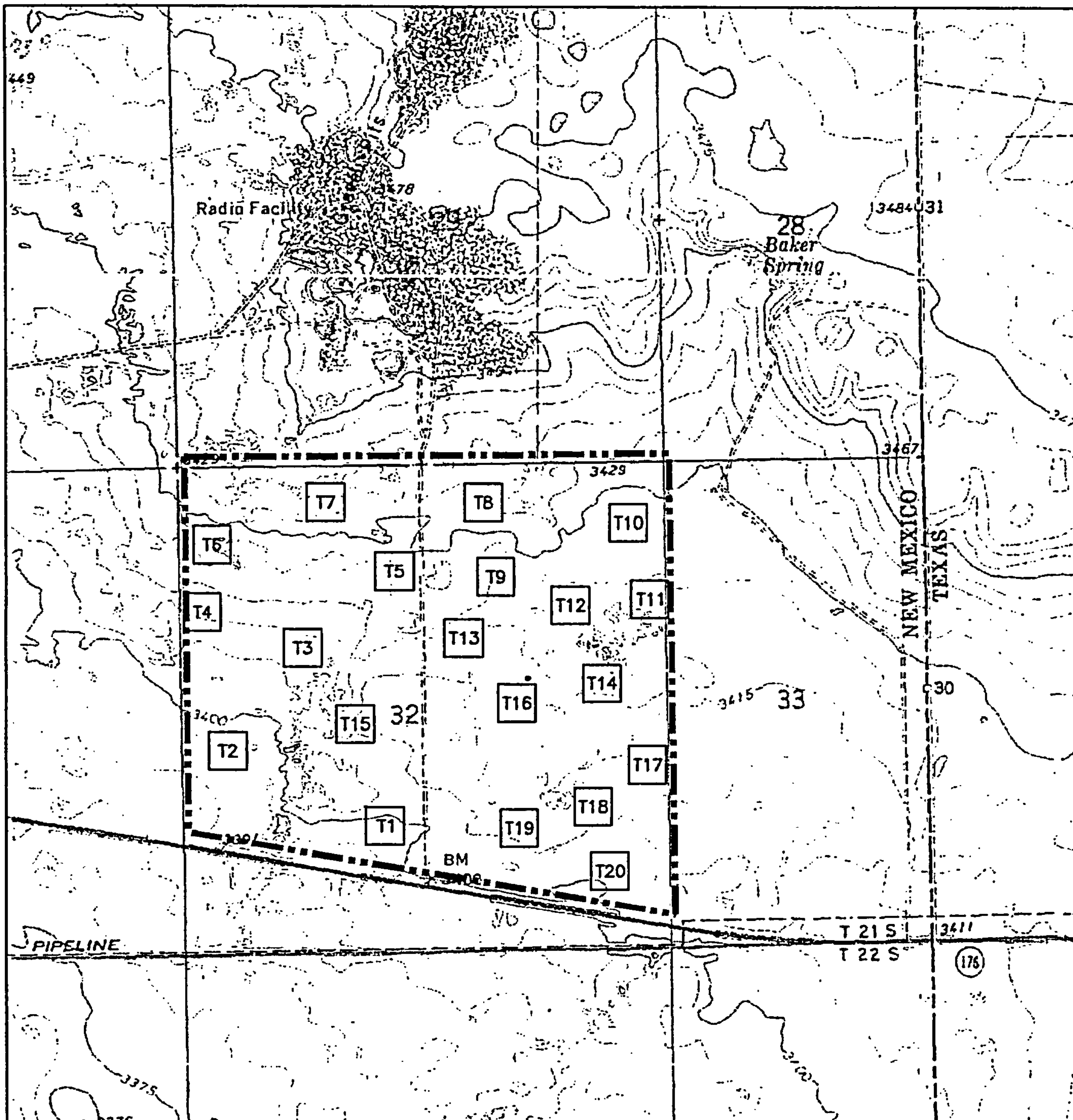


FIGURE 3.5-1
COUNTY MAP
PROPOSED AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC)
LESSER PRAIRIE CHICKEN
ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004



USGS 7.5 MINUTE MAP INDEX

MONUMENT SOUTH	HOBBS SW	HOBBS SE	BRINSON RANCH
OIL CENTER	EUNICE	EUNICE NE	JUMBO HILL

300 0 300 600 900 METERS

1000 0 1000 2000 3000 FEET

NORTH

MAP SOURCE:
USGS 7.5 MINUTE
EUNICE NE QUADRANGLE
TEX.–N. MEX. 1:24000
CONTOUR INTERVAL: 5 FEET

REFERENCE NUMBER
7.5Min Figures.dwg

FIGURE 3.5-2

NEF SITE VEGETATION SURVEY
TRANSECT LOCATIONS
ENVIRONMENTAL REPORT

REVISION 2 DATE: JULY 2004

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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 (2.1 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 = 13 m (43 ft)

The total attractive area is therefore equal to 0.34 km^2 (0.13 mi^2). Consequently, the lightning strike frequency computed using Marshall's methodology is given as 1.36 flashes per year.

Tornadoes occur infrequently in the vicinity of the NEF. Only two tornadoes were reported in Lea County, New Mexico, (Grazulis, 1993) from 1880-1989. Across the state line, only one 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. Normal operations at the NEF will result in emissions of the criteria pollutants from the boilers that power the heating system; these emissions are addressed in ER Section 4.6, Air Quality Impacts. 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.

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TABLES

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Table 3.6-1A Hobbs, 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 3.6-1B Hobbs, 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 3.6-2 Midland-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 3.6-3 Midland-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 3.6-4 Roswell, 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 3.6-5 Roswell, 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 3.6-6 Midland-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 3.6-9 Roswell, 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 3.6-10 Midland-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 3.6-11 Roswell, 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	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 3.6-12 Midland-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 3.6-13 Midland-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%

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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 3.6-14 Midland-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 3.6-15 Midland-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 3.6-16 Midland-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 3.6-17 Midland-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 3.6-18 Midland-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 3.6-19 - National Ambient Air Quality Standards
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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 3.6-20 - Hobbs, New Mexico, Particulate Matter Monitor Summary

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

Note: National Ambient Air Quality Standards for $PM_{2.5}$ and PM_{10} are located in Table 3.6-19

Source: (EPA, 2003b)

Table 3.6-21 Existing 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/7ml W Hob, Hobbs, NM 88240	337 (371)	839 (925)	124 (136)	1181 (1302)	0 (0)	0 (0)	0 (0)
EUNICE COMPRESSOR STATION	5 Mi S Of Eunice On Hwy 207, Eunice, NM 88231	238 (263)	476 (525)	20 (22)	0 (0)	3.1 (3.5)	3.1 (3.5)	0 (0)
GOLFCOURSE COMPRESSOR STATION	3 Mi W OF Eunice Hwy 8/176, Eunice, NM 88231	94 (104)	1081 (1191)	105 (116)	0 (0)	0 (0)	0 (0)	0 (0)
MONUMENT COMPRESSOR STATION	1 Mi E Of Monument, Monument, NM 88265	958 (1056)	958 (1056)	35 (38)	0 (0)	3.0 (3.3)	3.0 (3.3)	0 (0)
EUNICE GAS PLANT	1mi W of Oil Center on NM Hwy, Eunice, NM 88231	129 (142)	844 (930)	26 (29)	2452 (2703)	0 (0)	0 (0)	0.1 (0.1)
LEE GAS PLANT	15 Mi Sw Of Lovington, Lovington, NM 88260	50 (55)	50 (55)	6.8 (7.5)	0 (0)	0 (0)	0 (0)	0.3 (0.3)
LUSK PLANT	15 Mi S Of Maljamar, Maljamar, NM 88264	191 (210)	521 (574)	54 (60)	0 (0)	0 (0)	0 (0)	0 (0)
EUNICE SOUTH GAS PLT	6 Mi S Of Eunice, Eunice, NM 88231	123 (135)	563 (620)	29 (31)	3188 (3515)	2.2 (2.4)	2.2 (2.4)	0.4 (0.4)
EUNICE NORTH GAS PLNT	0.5 Mi N Of Eunice, Eunice, NM 88231	211 (233)	958 (1056)	60 (67)	154 (170)	0 (0)	0 (0)	0 (0)
CUNNINGHAM	12.5 Mi West Of Hobbs, Hobbs, NM 88240	284 (313)	1493 (1645)	8.2 (9.0)	4.5 (5.0)	88 (97)	88 (97)	20 (22)
BUCKEYE NATL GAS PLNT	Nm 1, 13 Mi. Sw Of Lovington, Lovington, NM 88260	142 (156)	125 (138)	21 (23)	0 (0)	0 (0)	0 (0)	0 (0)
EUNICE GAS PLANT	1 Mi Se Of Eunice, Eunice, NM 88231	651 (718)	2559 (2821)	114 (126)	2611 (2879)	10.1 (11)	10.1 (11)	0.3 (0.3)
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)

Table 3.6-21 Existing 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)
EPPERSON BOOSTER	15 Mi Wnw Of Tatum, Tatum, NM 88267	64 (71)	77 (85)	6.4 (7.1)	0 (0)	0 (0)	0 (0)	0 (0)
ANTELOPE RIDGE GAS PLANT	20 Mi Sw Of Eunice, Eunice, NM 88231	221 (243)	259 (285)	83 (91)	0 (0)	0 (0)	0 (0)	0 (0)
LEA REFINERY	5 Mi Se Of Lovingtion On Nm 18, Lovington, NM 88260	71 (78)	132 (146)	237 (261)	7.4 (8.2)	14 (15)	14 (15)	0 (0)
MCA TANK BATTERY #2	31 Mi East Of Artesia, Maljamar, NM 88264	6.2 (6.8)	3.7 (4.1)	10.1 (11)	33 (37)	0 (0)	0 (0)	0 (0)
KEMNITZ COMP STA	5 Mi Sw Of Maljamar, Maljamar, NM 88264	62 (68)	81 (89)	21 (23)	0 (0)	0 (0)	0 (0)	0 (0)
WT-1 COMP STA	22 Mi E Of Carlsbad On Us 180, Carlsbad, NM 88221	2.3 (2.5)	14 (15)	1.4 (1.6)	0 (0)	0.3 (0.3)	0.3 (0.3)	0 (0)
EAST VACUUM LIQUID RECOVERY	5 Mi E Of Buckeye, Buckeye, NM 88260	212 (234)	172 (190)	60 (66)	201 (221)	0 (0)	0 (0)	0 (0)
LYNCH BOOSTER STA	25 Mi Sw Of Hobbs, Hobbs, NM 88240	260 (287)	276 (304)	30 (33)	3.3 (3.7)	0 (0)	0 (0)	0 (0)
LLANO/GRAMA RIDGE #1 COMP STA	18 Mi Wnw Of Eunice, Eunice, NM 88231	84 (93)	63 (69)	34 (38)	0 (0)	0 (0)	0 (0)	0 (0)
HAT MESA COMPRESSOR STATION	33 Mi Sw Of Hobbs, Hobbs, NM 88240	276 (304)	158 (175)	27 (30)	0 (0)	0 (0)	0 (0)	0 (0)
COMP STA #167	8 Mi Ene Of Maljamar On Us 82, Maljamar, NM 88264	31 (34)	874 (963)	9.0 (10.0)	0 (0)	3.6 (4.0)	3.6 (4.0)	0 (0)
OIL CENTER COMPRESSOR STATION	5 Mi S Of Monument, Monument, NM 88265	312 (344)	801 (883)	86 (95)	0.1 (0.1)	0 (0)	0 (0)	0 (0)
GRAMA RIDGE FED #2 CS	28 Mi Sw Of Hobbs, Hobbs, NM 88240	1.4 (1.6)	16 (18)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SUNBRIGHT #1 COMP STA	30 Mi W Of Hobbs, Hobbs, NM 88240	3.6 (3.9)	20 (22)	3.6 (3.9)	0 (0)	0 (0)	0 (0)	0 (0)
QUAIL COMPRESSOR STATION	3 Mi Se Of Eunice, Eunice, NM 88231	302 (332)	772 (851)	27 (30)	0 (0)	0 (0)	0 (0)	0 (0)
NBR BOOTLEG COMP STA	27 Mi W Of Eunice, Eunice, NM 88231	21 (23)	21 (23)	145 (160)	0 (0)	0 (0)	0 (0)	0 (0)
LLANO/LEE COMP STA	15 Mi Nw Of Hobbs, Hobbs, NM 88240	9.4 (10.4)	20 (22)	80 (88)	0 (0)	0 (0)	0 (0)	0 (0)
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)

Table 3.6-21 Existing 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)
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 3-6-22 Wind 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.

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FIGURES

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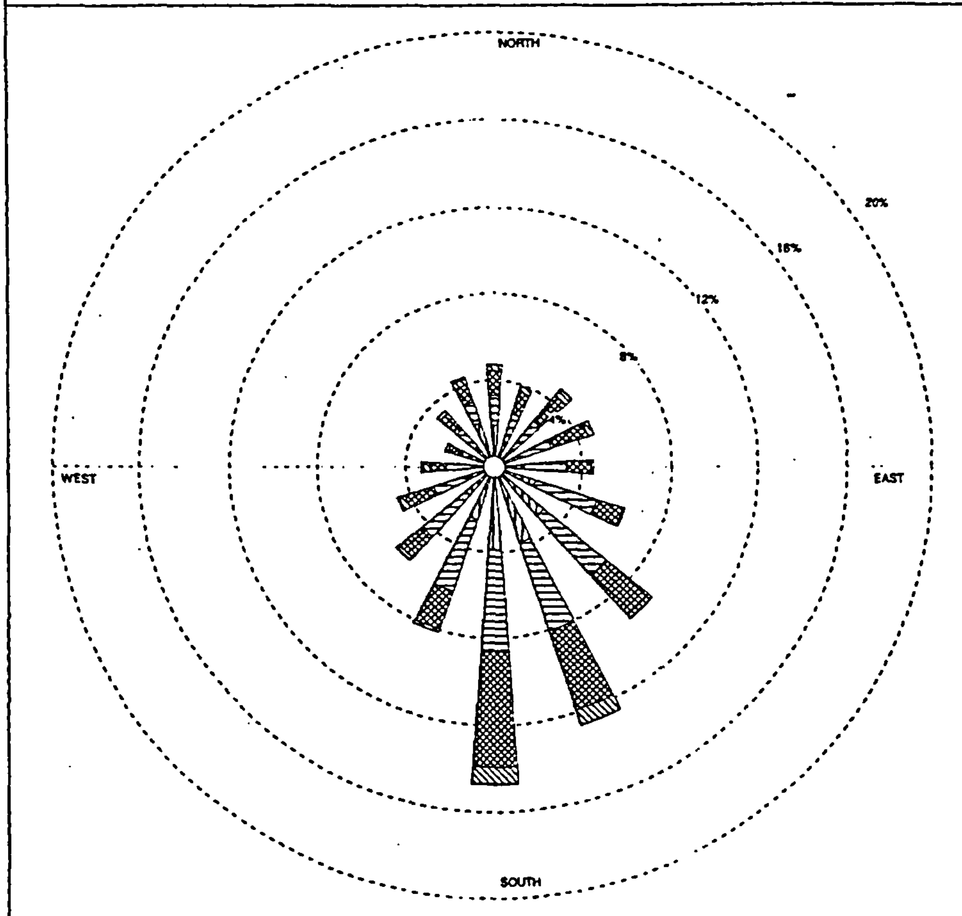
MIDLAND/ODESSA, TX 1987

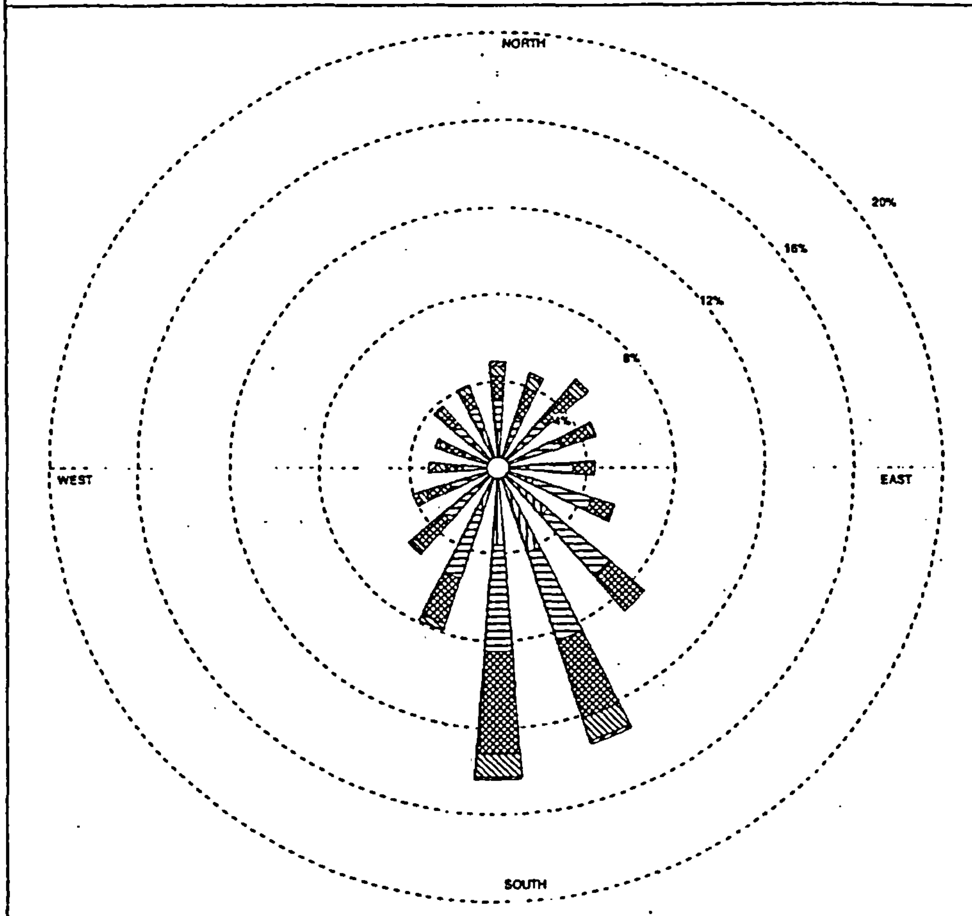


Wind Speed (Knots)			
>21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 9.17 Knots	CALM WINDS 2.48%	
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 1987 Jan 1 - Dec 31 Midnight - 11 PM	

REFERENCE NUMBER
WINDROSE.DWG

FIGURE 3.6-1
MIDLAND, TX 1987
WIND ROSE
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

MIDLAND/ODESSA, TX 1988



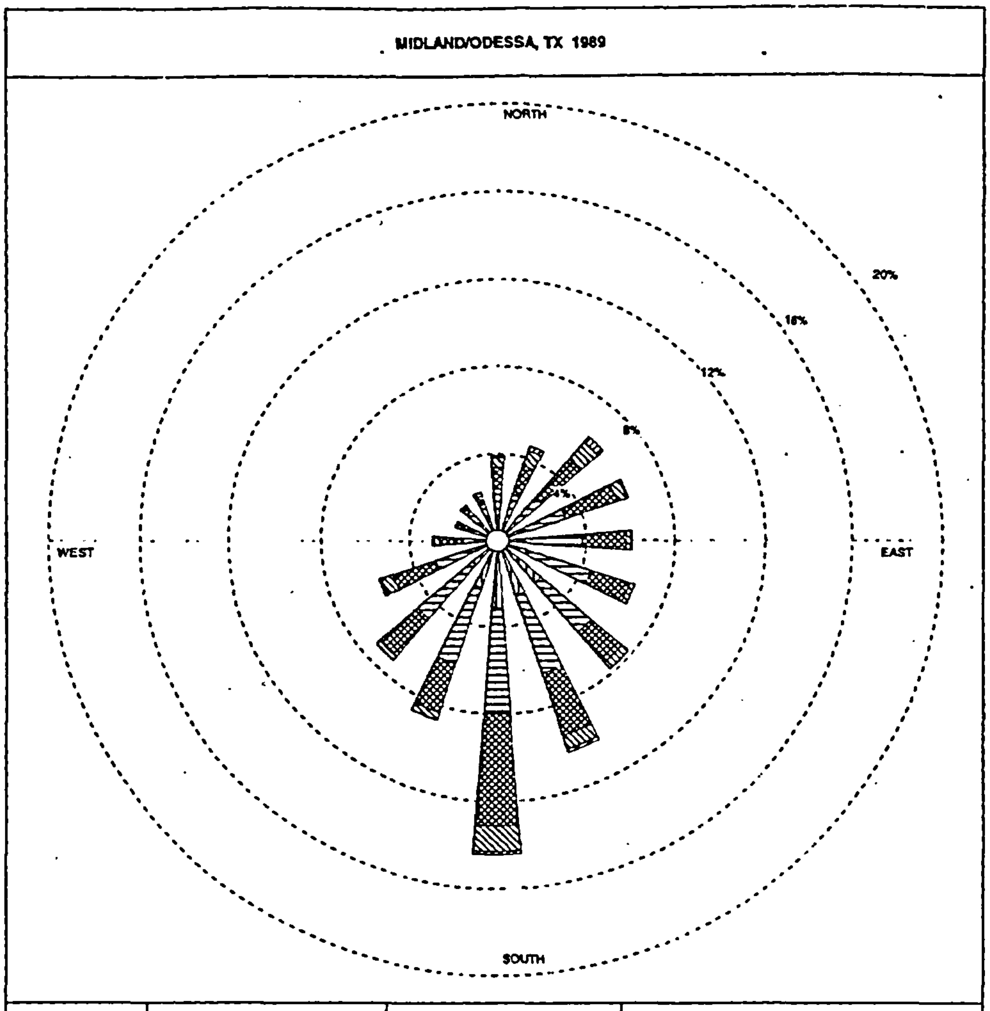
Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY **Wind Speed**	UNIT **Knots**	
	AVG. WIND SPEED **9.62 Knots**	CALM WINDS **2.70%**	
	ORIENTATION **Direction (blowing from)**	PLOT YEAR-DATE-TIME **1988** **Jan 1 - Dec 31** **Midnight - 11 PM**	

REFERENCE NUMBER
WINDROSE.DWG

FIGURE 3.6-2

MIDLAND, TX 1988
WIND ROSE
ENVIRONMENTAL REPORT

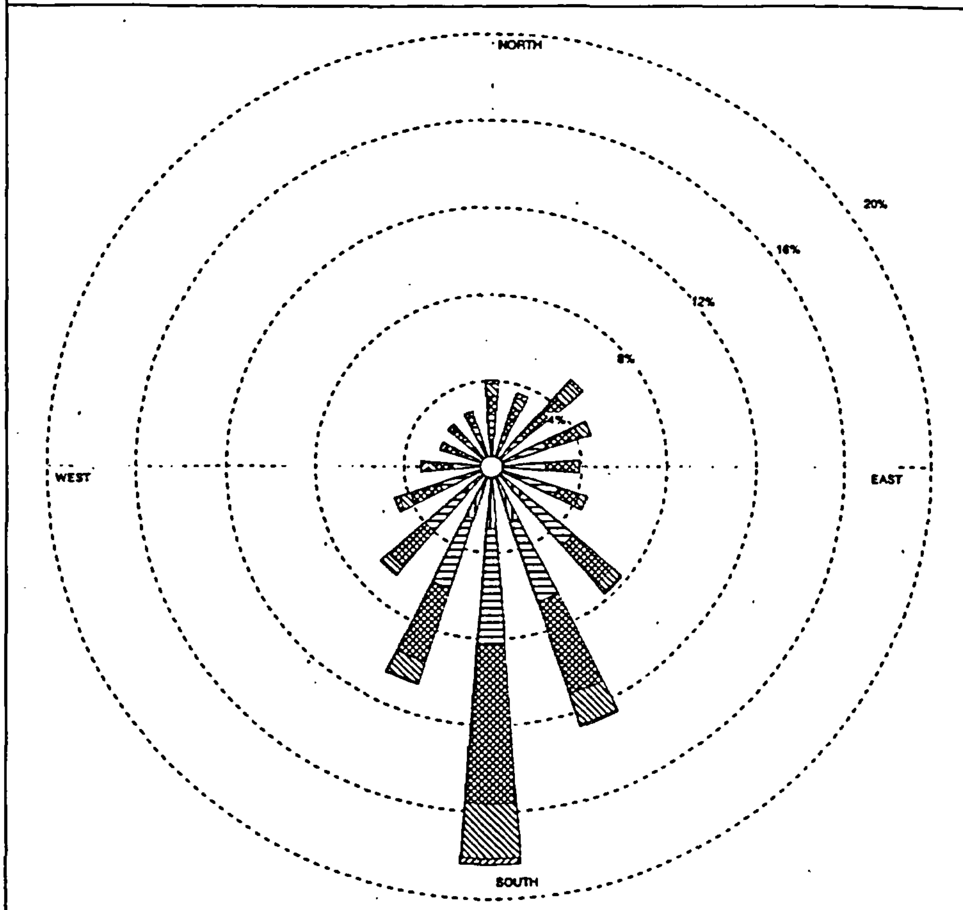
REVISION DATE: DECEMBER 2003



Wind Speed (Knots)			
>21 17-21 11-16 7-10 4-6 1-3	DISPLAY **Wind Speed**	UNIT **Knots**	
	AVG. WIND SPEED **9.97 Knots**	CALM WINDS **2.65%**	
	ORIENTATION **Direction (blowing from)**	PLOT YEAR-DATE-TIME **1989** **Jan 1 - Dec 31** **Midnight - 11 PM**	

REFERENCE NUMBER
WINDROSE.DWG

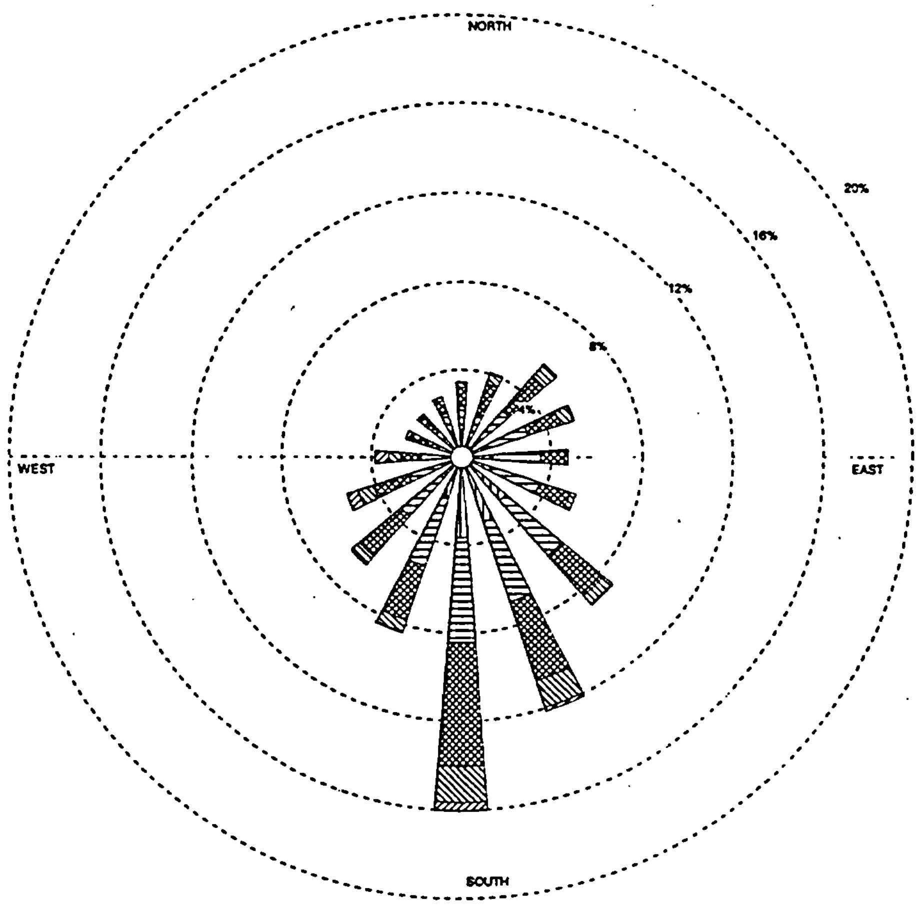
FIGURE 3.6-3
MIDLAND, TX 1989
WIND ROSE
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



Wind Speed (Knots)			
> 21	DISPLAY Wind Speed	UNIT Knots	
17 - 21 11 - 16	AVG. WIND SPEED 10.65 Knots	CALM WINDS 2.18%	
7 - 10 4 - 6 1 - 3	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 1990 Jan 1 - Dec 31 Midnight - 11 PM	

REFERENCE NUMBER	FIGURE 3.6-4
WINDROSE.DWG	MIDLAND, TX 1990 WIND ROSE ENVIRONMENTAL REPORT REVISION DATE: DECEMBER 2003

MIDLAND/ODESSA, TX 1991



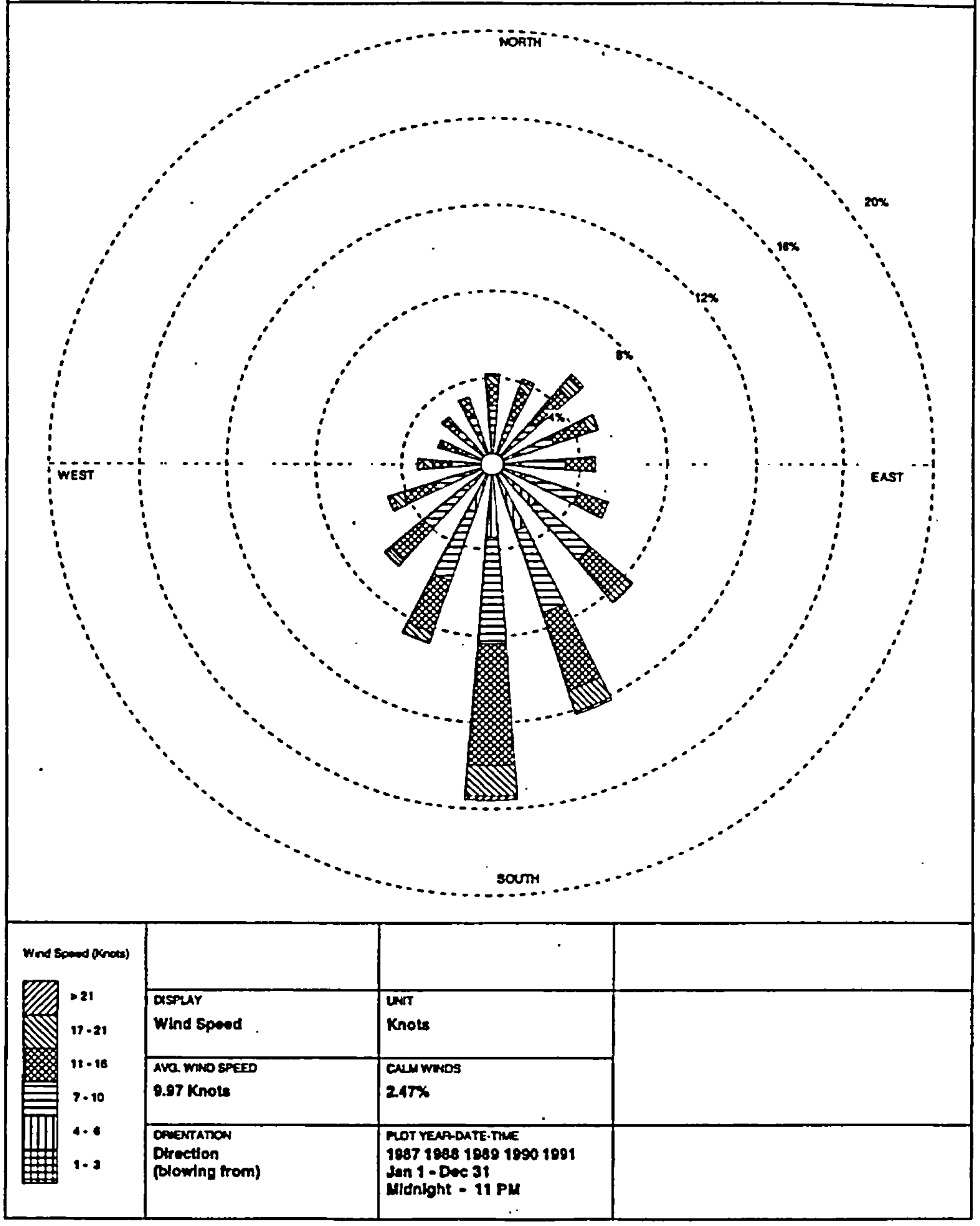
Wind Speed (Knots)

- > 21
- 17 - 21
- 11 - 16
- 7 - 10
- 4 - 6
- 1 - 3

DISPLAY Wind Speed	UNIT Knots
AVG. WIND SPEED 10.42 Knots	CALM WINDS 2.36%
ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 1991 Jan 1 - Dec 31 Midnight - 11 PM

REFERENCE NUMBER
WINDROSE.DWG

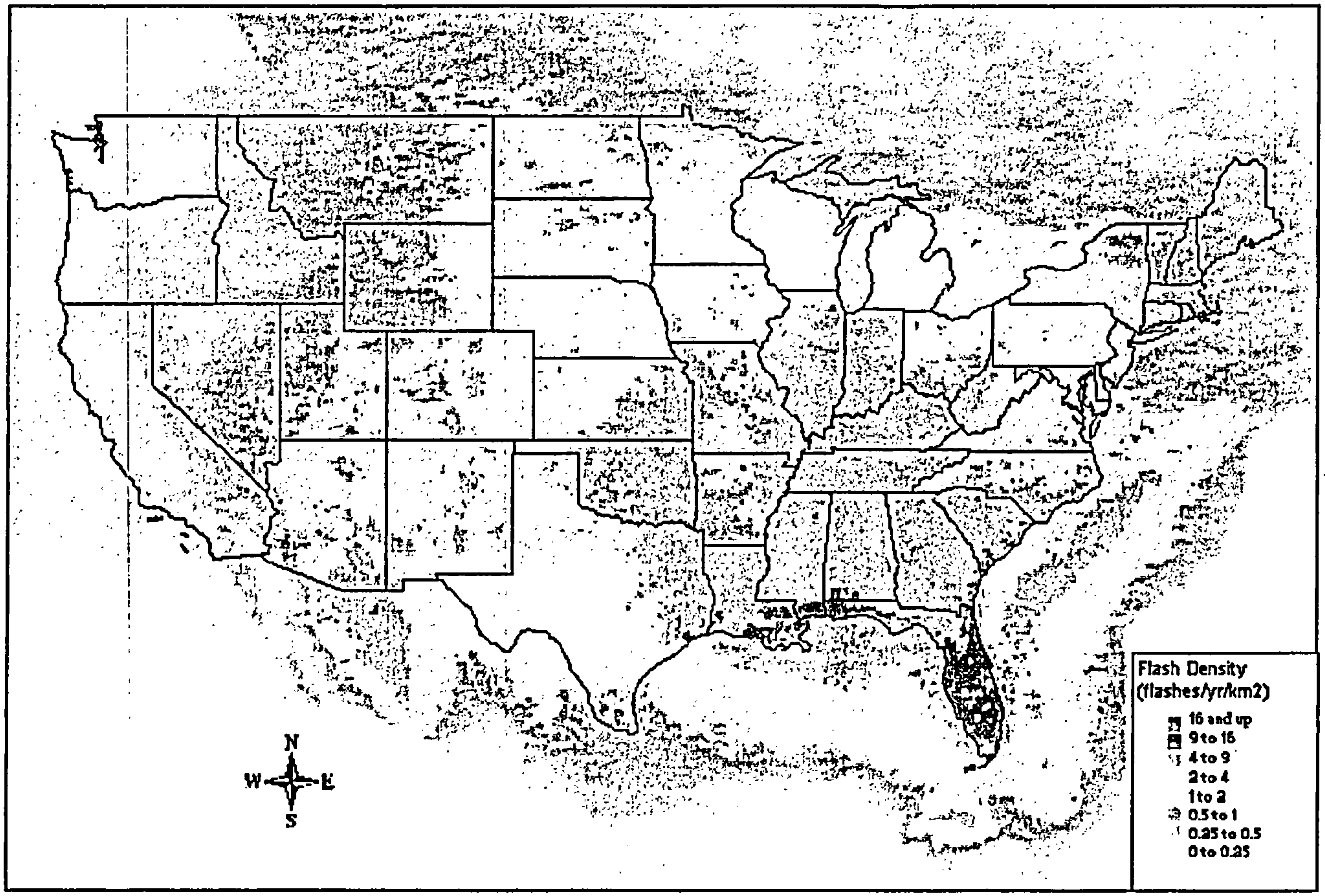
FIGURE 3.6-5
MIDLAND, TX 1991
WIND ROSE
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



DISPLAY Wind Speed	UNIT Knots	
AVG. WIND SPEED 9.97 Knots	CALM WINDS 2.47%	
ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 1987 1988 1989 1990 1991 Jan 1 - Dec 31 Midnight - 11 PM	

REFERENCE NUMBER
WINDROSE.DWG

FIGURE 3.6-6
MIDLAND, TX 1987–1991
WIND ROSE
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

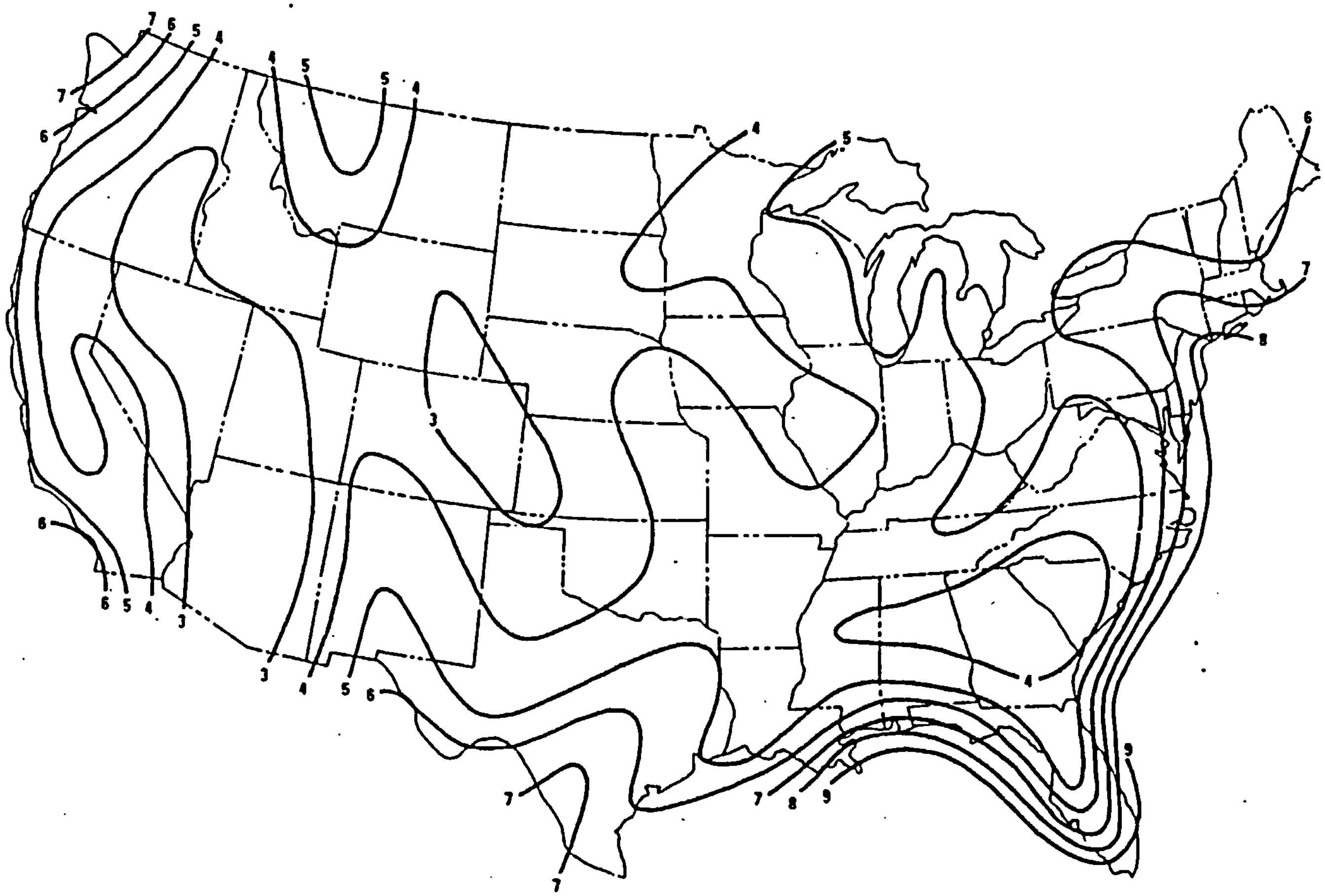


1996-2000 FLASH DENSITY MAP

(NWS, 2003)

REFERENCE NUMBER
Section 3.6 Figures.dwg

FIGURE 3.6-7
AVERAGE LIGHTNING FLASH DENSITY
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

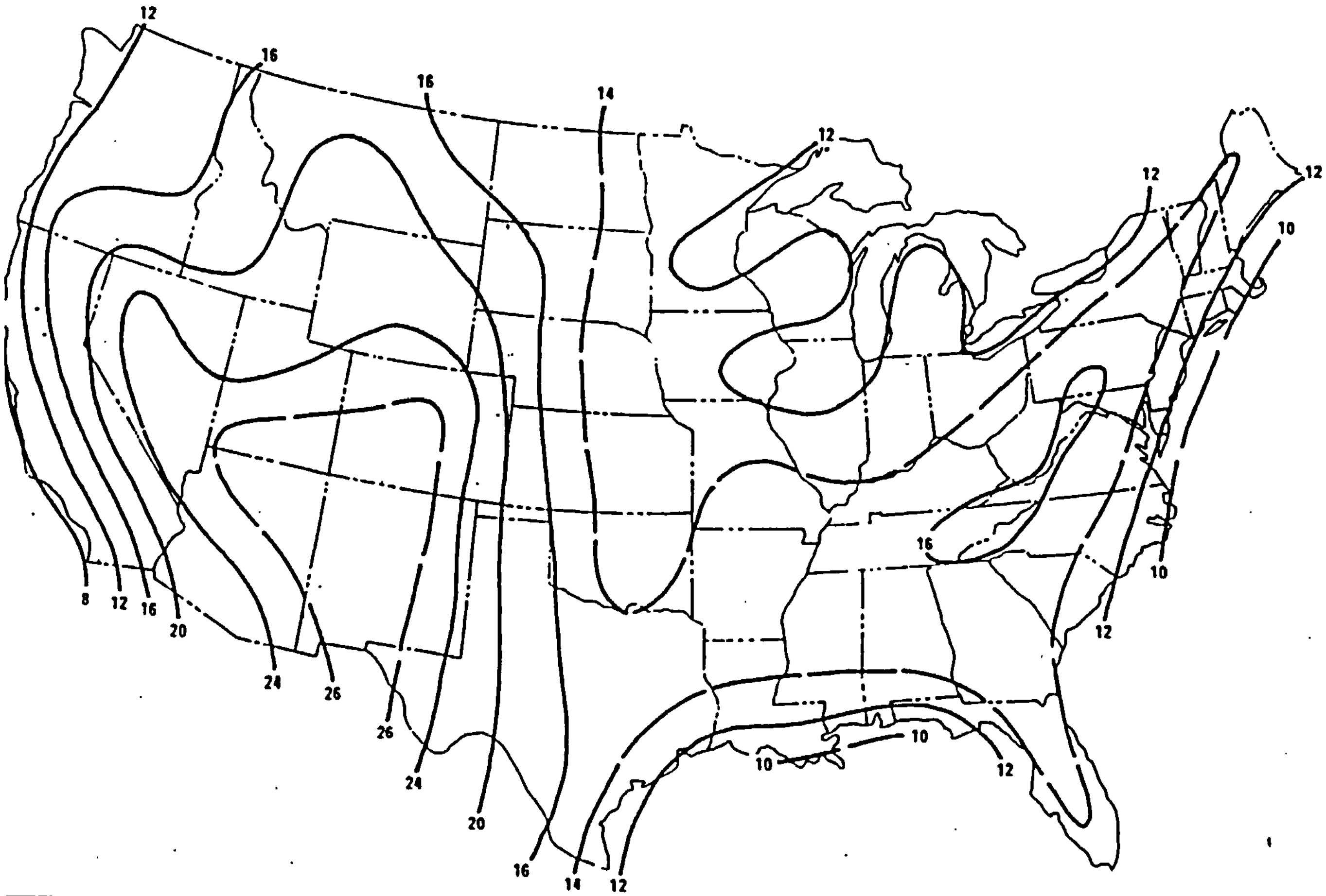


Isopleths ($m \times 10^2$) of mean annual morning mixing heights

SOURCE: (EPA, 1972)

REFERENCE NUMBER
Section 3.6B Figures.dwg

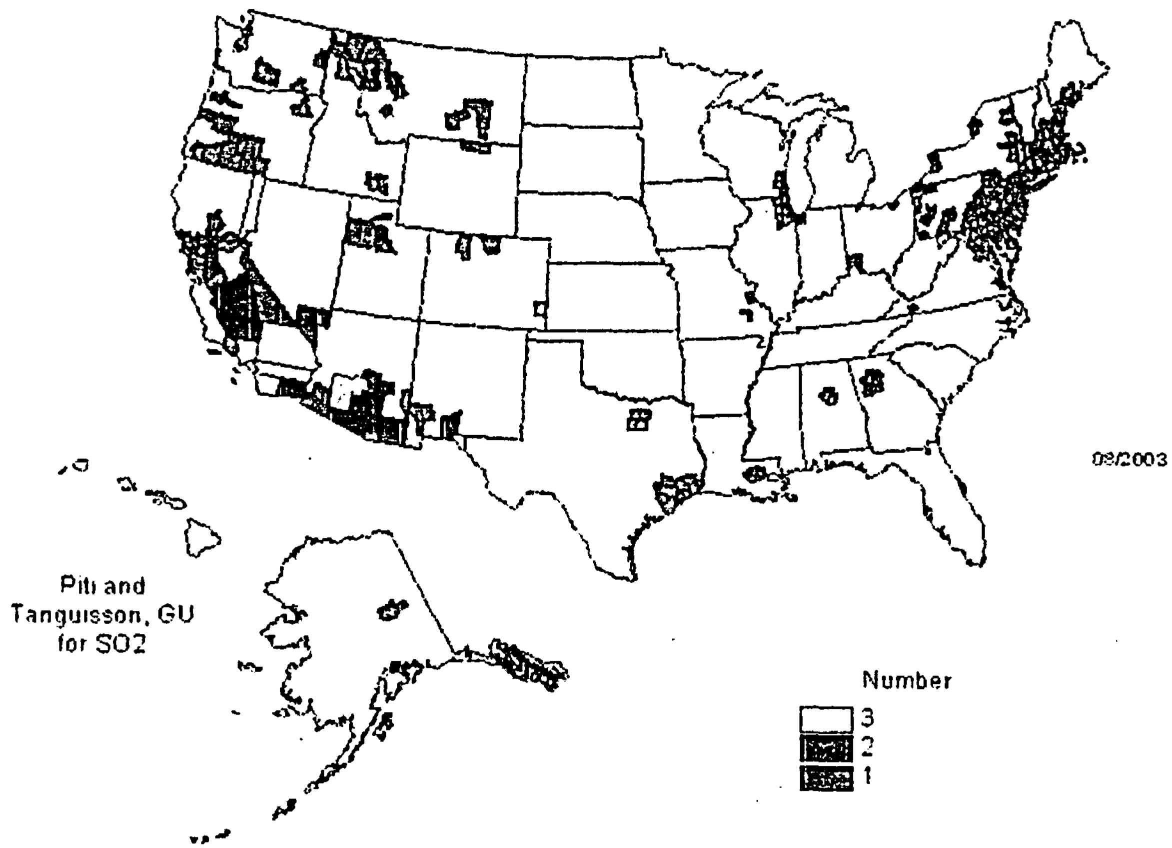
FIGURE 3.6-8
ANNUAL AVERAGE MORNING MIXING HEIGHTS
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



SOURCE: (EPA, 1972) Isopleths (m x 10^2) of mean <u>annual</u> <u>afternoon</u> mixing heights

REFERENCE NUMBER	**FIGURE 3.6-9**
Section 3.6B Figures.dwg	ANNUAL AVERAGE AFTERNOON MIXING HEIGHTS
	ENVIRONMENTAL REPORT
	REVISION DATE: DECEMBER 2003

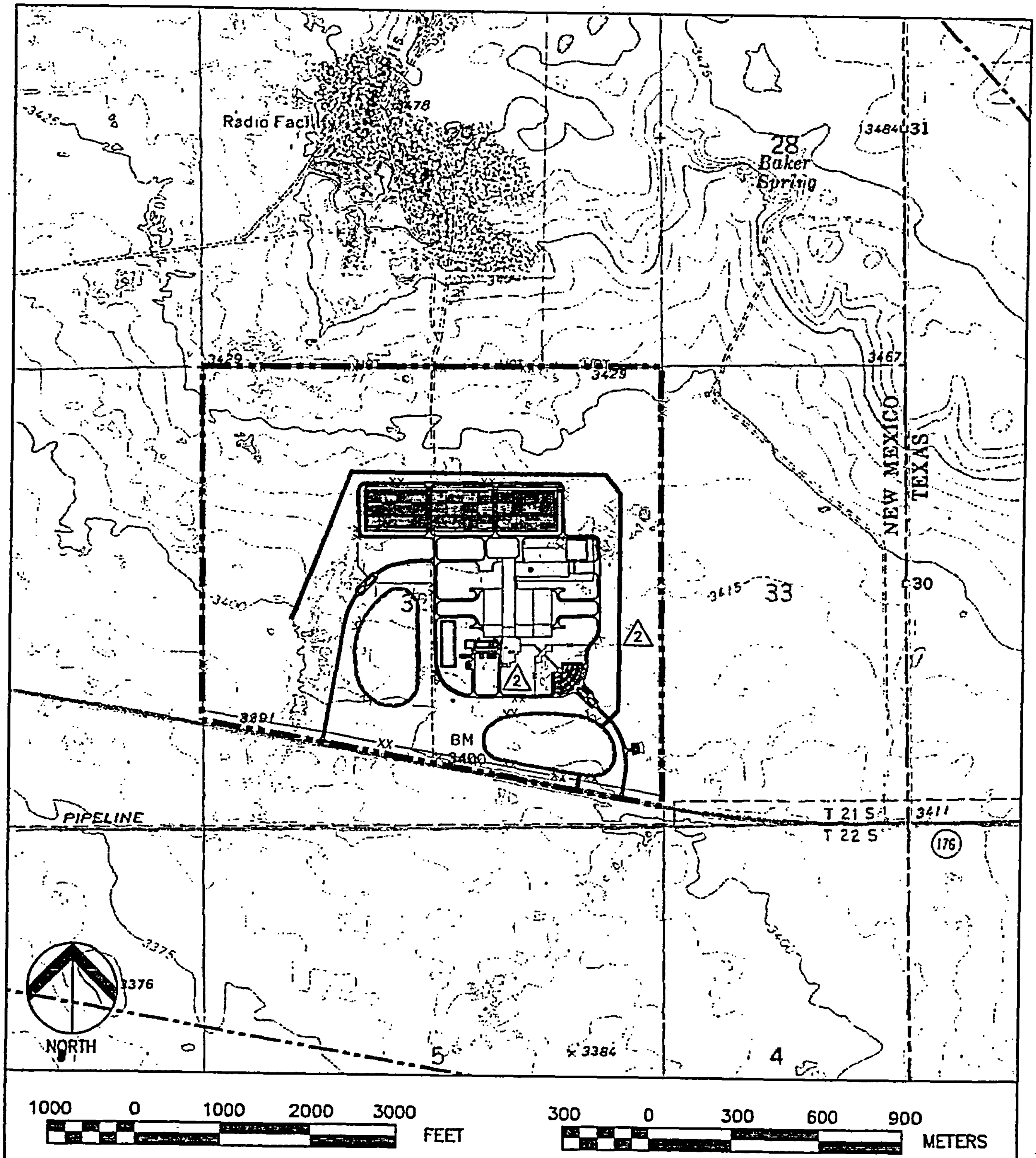
Number of Pollutants By County Designated Nonattainment



(EPA 2003a)

REFERENCE NUMBER
Figure 3.6–10.dwg

FIGURE 3.6-10
EPA CRITERIA POLLUTANT
NONATTAINMENT MAP
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



MAP SOURCE:
USGS 7.5 MINUTE
EUNICE NE QUADRANGLE
TEX.–N. MEX. 1:24000

CONTOUR INTERVAL:
5 FEET

LOCKWOOD GREENE
ENGINEERING & CONSTRUCTION

REFERENCE NUMBER
7.5Min Figures.dwg

FIGURE 3.6-11
TOPOGRAPHIC MAP OF SITE
ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004

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/cm^2). 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, 1974). 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, 1974). 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, 1974). 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, 1985). 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, 1985) and the Environmental Protection Agency (EPA, 1973). 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 L_{dn} in outdoor spaces, as described in the EPA Levels Document (EPA, 1973). 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.

TABLES

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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

Page 1 of 1

	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, 1985)

FIGURES

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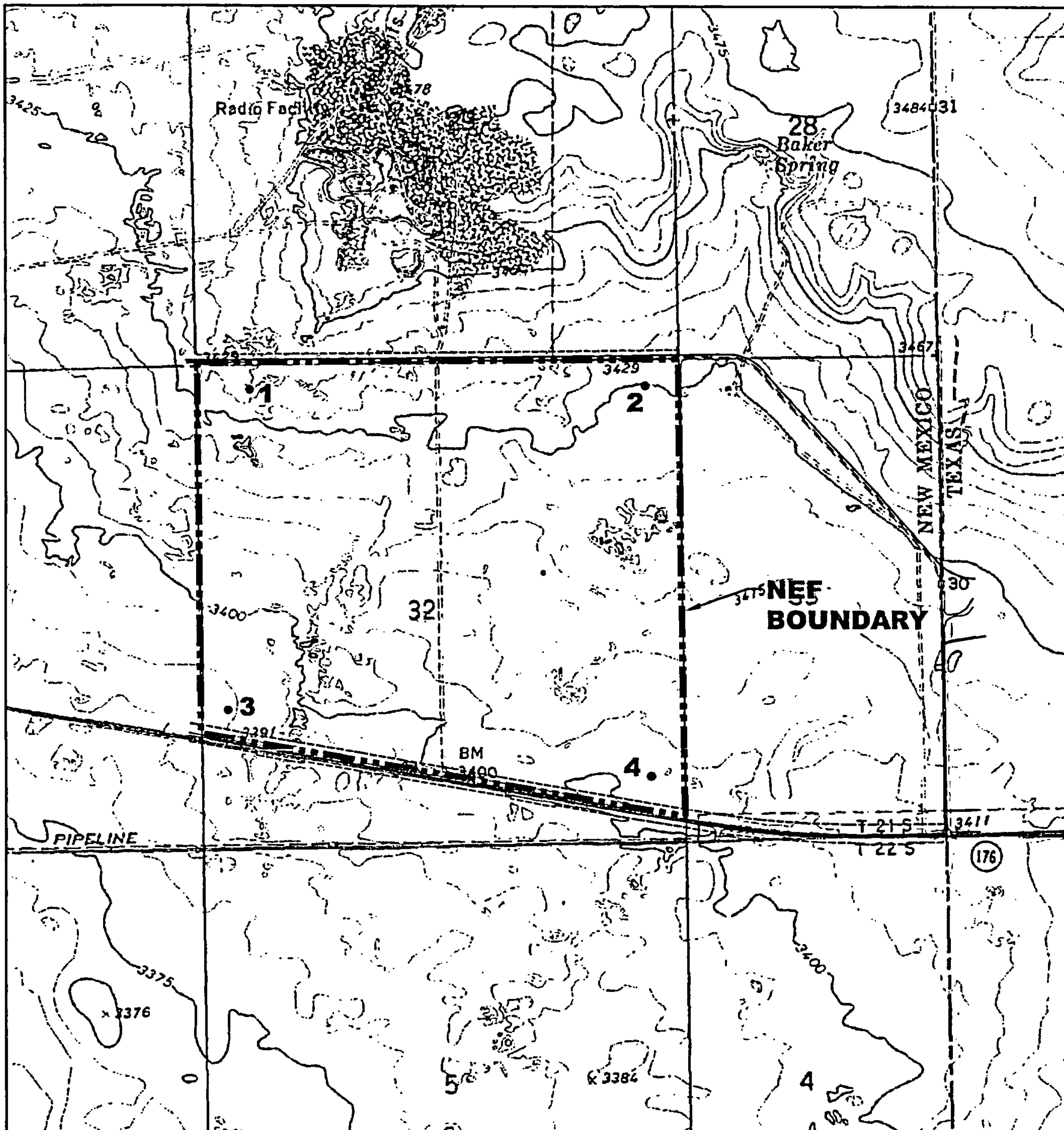

1000 0 1000 2000 3000 FEET

300 0 300 600 900 METERS

NORTH

CONTOUR INTERVAL: 5 FT

MAP SOURCE:
EUNICE NE QUAD.
TEX – N. MEX 24K

REFERENCE NUMBER
7.5Min Figures.dwg

FIGURE 3.7-1

NOISE MEASUREMENT LOCATIONS

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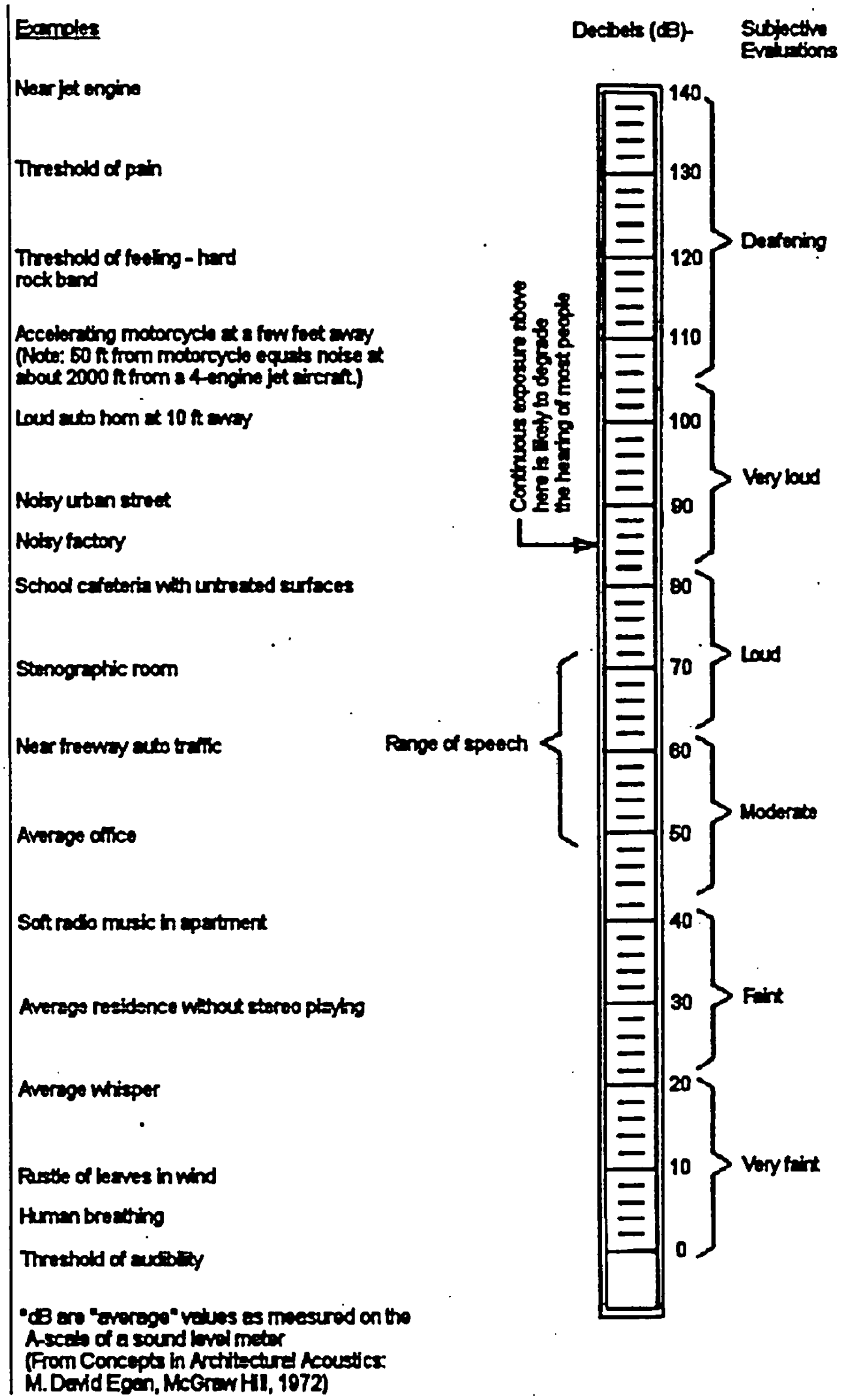

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figure 3.7–2.dwg

FIGURE 3.7-2

SOUND LEVEL RANGE EXAMPLES

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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.

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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.

TABLES

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Table 3.9-1 Scenic Quality Inventory And Evaluation Chart

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

Table 3.9-1 Scenic Quality Inventory and Evaluation Chart

Page 2 of 2

Key Factors	**Rating Criteria and Score**[1]		
	exceptional wildlife or wildflower viewing, etc. Score: 5	region. Score: 3	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

FIGURES

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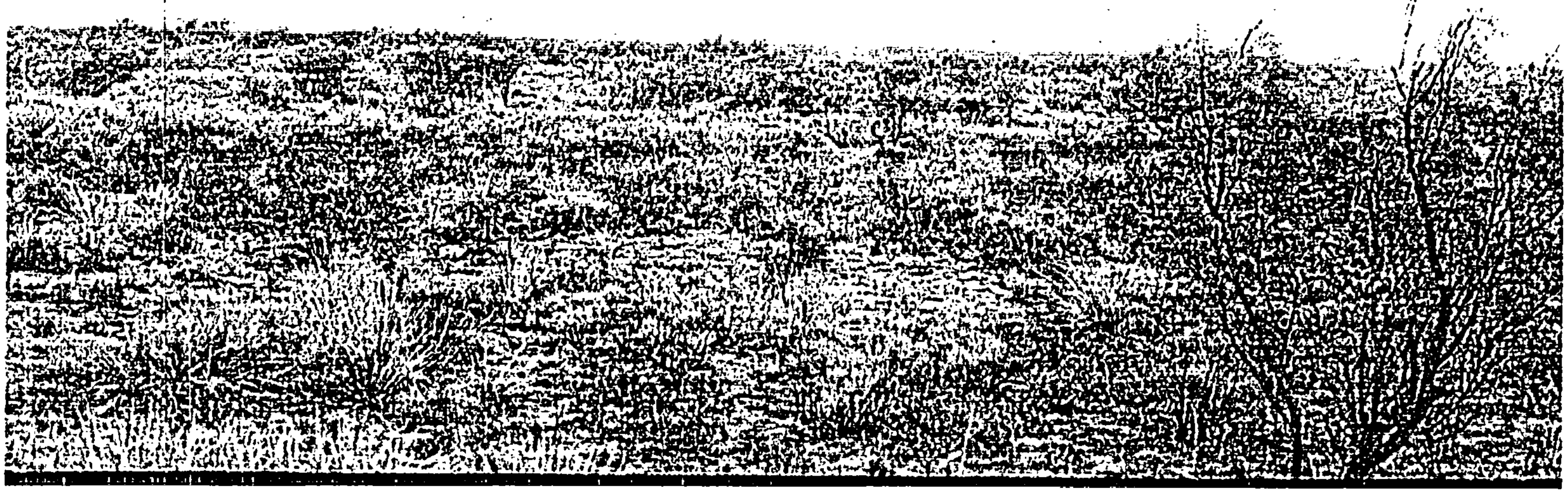


REFERENCE NUMBER
Figures 3.9.dwg

FIGURE 3.9-1A

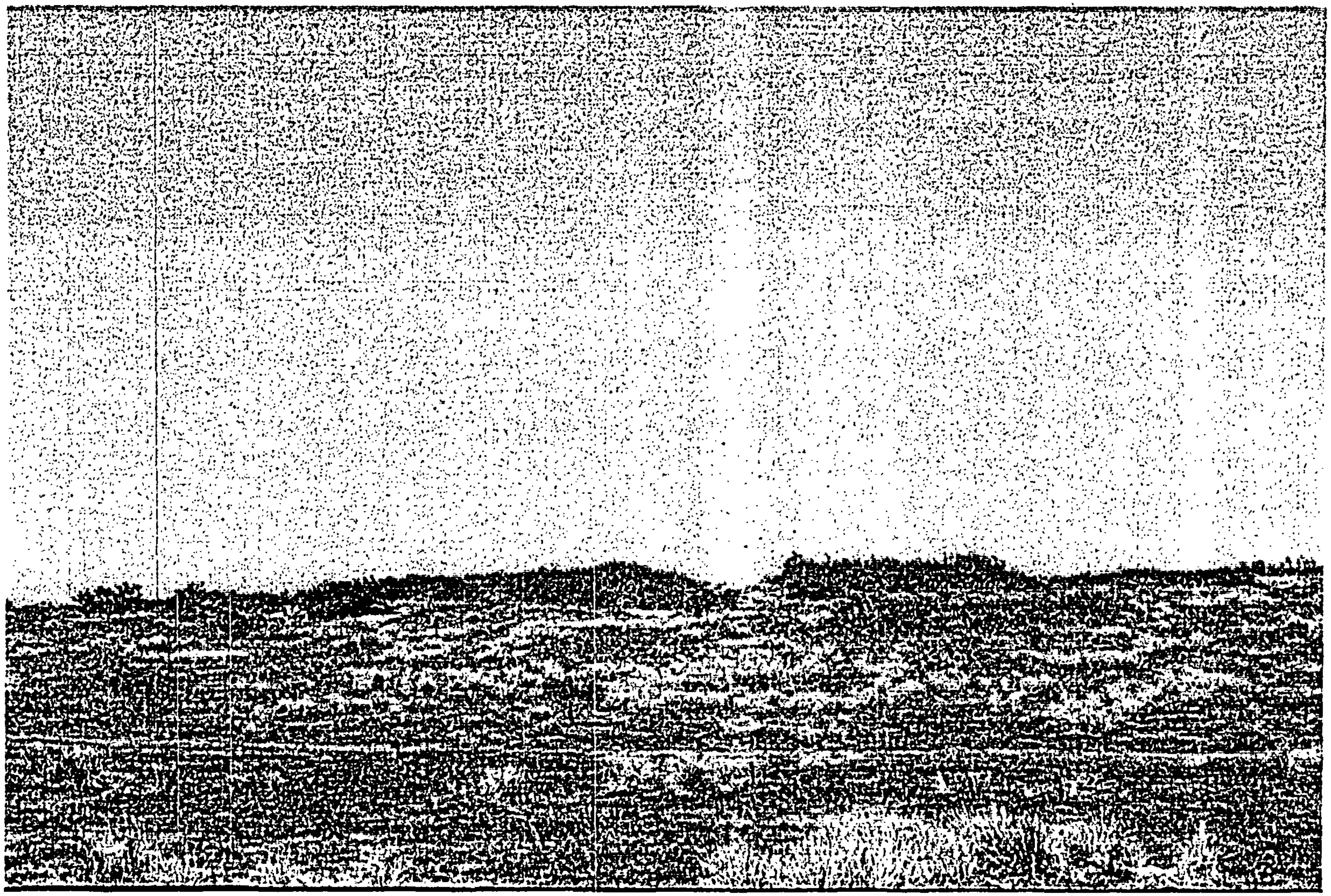
VIEW OF PROPOSED NEF SITE LOOKING FROM THE SOUTHEAST TO THE NORTHWEST
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

REFERENCE NUMBER
Figures 3.9.dwg

FIGURE 3.9-1B

VIEW OF PROPOSED NEF SITE LOOKING FROM THE NORTHEAST TO THE SOUTHWEST
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

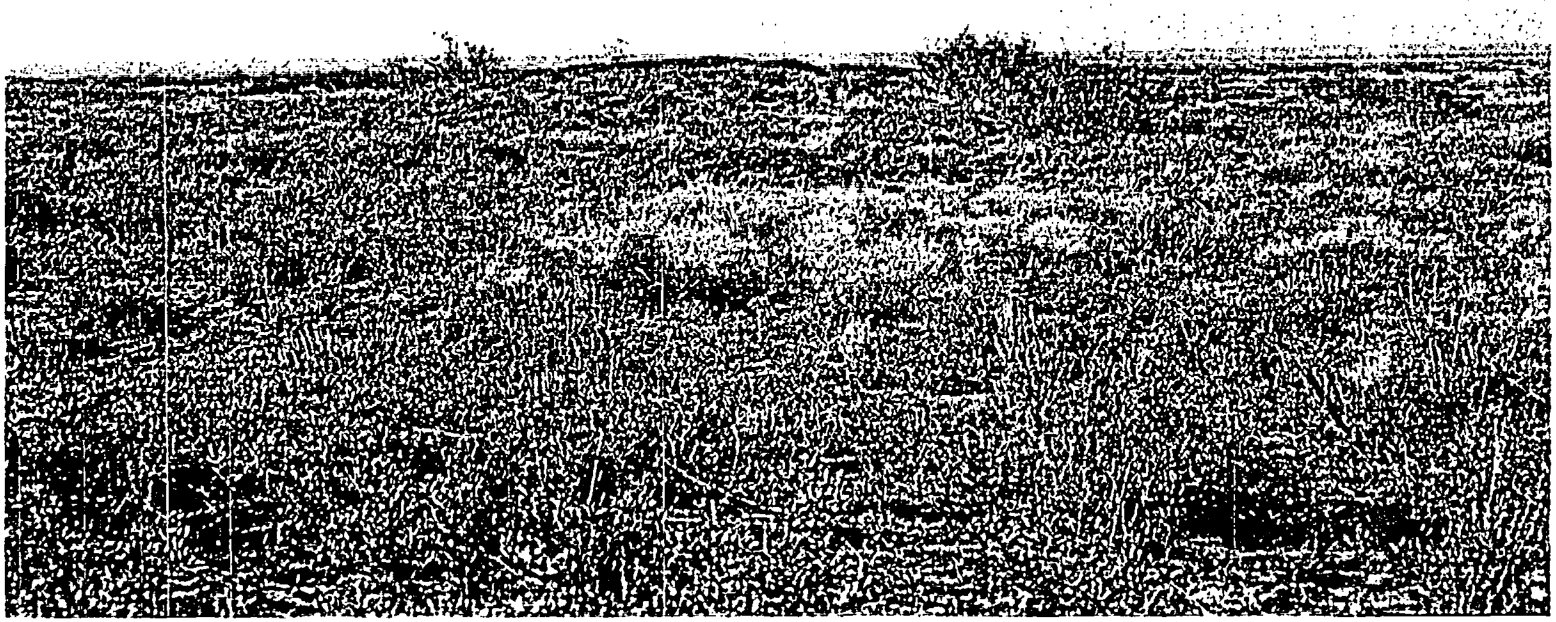


REFERENCE NUMBER
Figures 3.9.dwg

FIGURE 3.9-1C

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

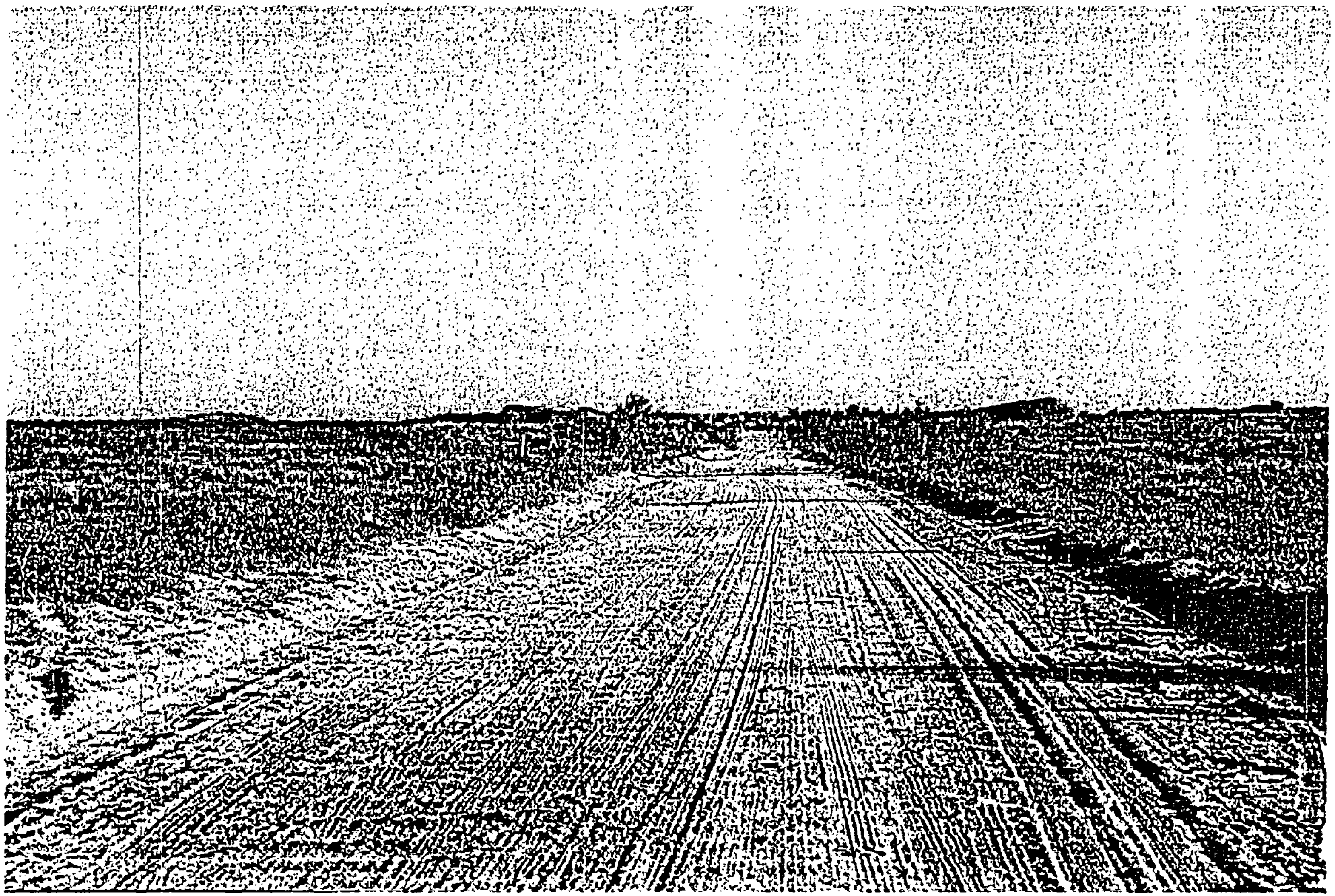
REVISION DATE: DECEMBER 2003



REFERENCE NUMBER
Figures 3.9.dwg

FIGURE 3.9-1D

VIEW OF PROPOSED NEF SITE LOOKING FROM THE NORTHWEST TO THE SOUTHEAST
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



REFERENCE NUMBER
Figures 3.9.dwg

FIGURE 3.9-1E
VIEW OF CENTER OF PROPOSED NEF SITE FROM NEW MEXICO HIGHWAY 234
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

FIGURE REMOVED UNDER 10 CFR 2.390

REFERENCE NUMBER
Section 4.4 Figures1.dwg

FIGURE 3.9-2
CONSTRUCTED FEATURES (SITE PLAN)

ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004

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 (NRC, 2003a) 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. It is staffed by a full-time Fire Chief and 34 volunteer firefighters. Equipment at the Eunice Fire and Rescue includes:

Three Ambulances;

Three Pumper Fire Trucks;

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

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

Three Grass Fire Trucks:

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

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

One Rescue Truck:

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

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

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

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

<u>Transportation</u>

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.

TABLES

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Table 3.10-1 Population and Population Projections

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

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

Table 3.10-2 General Demographic Profile
Page 1 of 1

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

*Calculated as total population less white population
Source: U. S. Census Bureau (DOC, 2002)

Table 3.10-3 Civilian Employment Data, 2000

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

Table 3.10-3 Civilian Employment Data, 2000
Page 2 of 2

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

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

Table 3.10-4 Area Income Data

Page 1 of 1

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

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

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

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

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

Table 3.10-6 Educational Facilities Near the NEF
Page 1 of 1

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

Note : DD – Development Delayed Class

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

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

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

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

FIGURES

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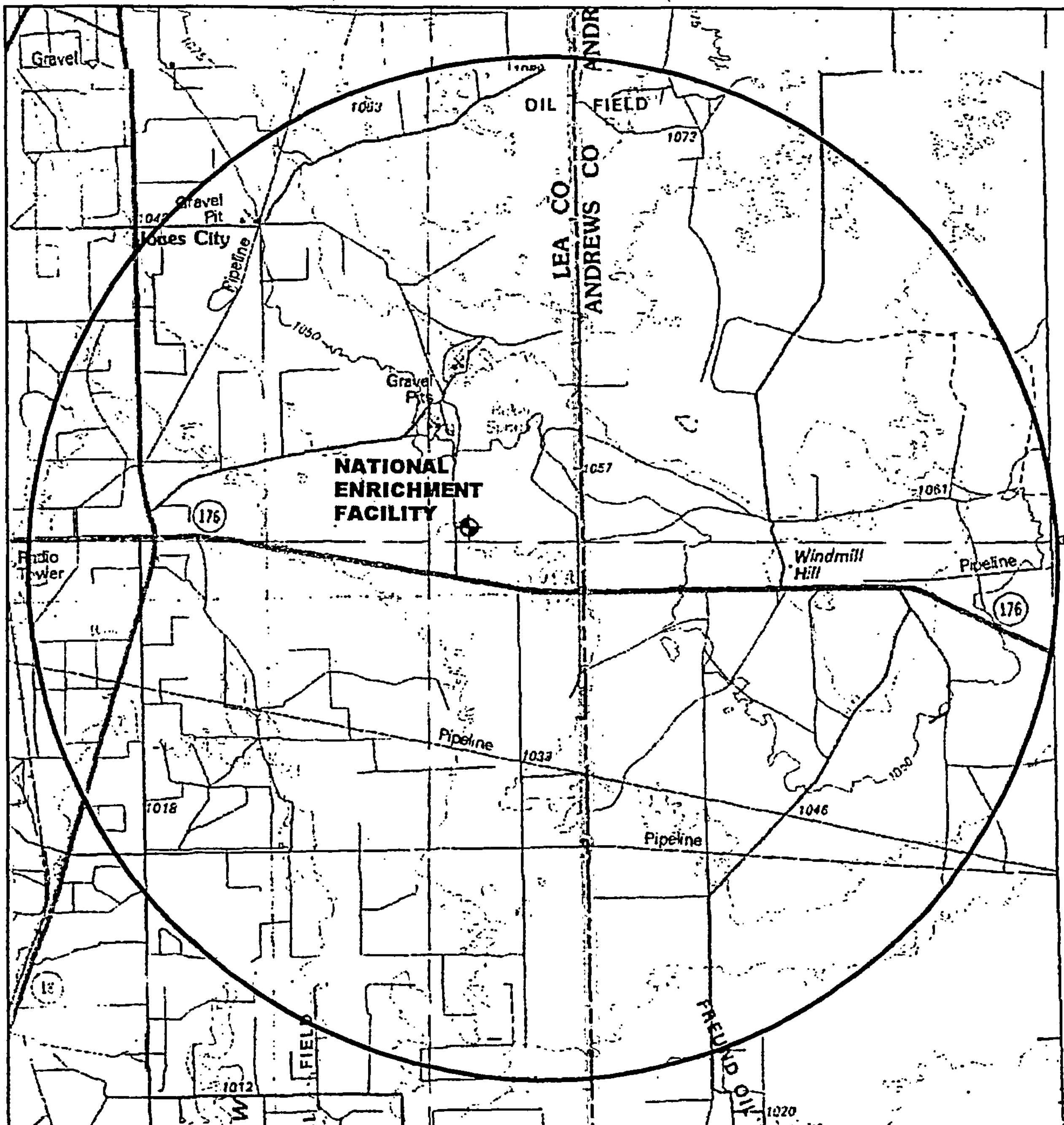

1 0 1 2 3 MILES

1 0 1 2 3 4 KM

NORTH

MAP SOURCE:
JAL AND HOBBS QUADRANGLES
NEW MEXICO – TEXAS 1:100000
CONTOUR INTERVAL: 10 METERS

REFERENCE NUMBER
Figure 3.10–1.dwg

FIGURE 3.10-1
LEA–ANDREWS COUNTY AREAS

ENVIRONMENTAL REPORT
REVISION 2 DATE: JULY 2004

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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 ^{40}K 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 ^{40}K and the radioactive decay chains of ^{238}U and ^{232}Th. 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 ^{232}Th series and ^{40}K 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 ^{40}K, 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 ^{40}K 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 ^{40}K 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). ^{238}Ac/^{238}Th 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 (^{232}Th), 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 ^{137}Cs 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 (^{230}Th and ^{235}U) were detected in the eight soil samples but were not detected in the original 10 samples. ^{230}Th 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. ^{230}Th is naturally occurring and associated with the decay of ^{238}U. Similar to ^{234}U and ^{238}U, ^{235}U is a natural uranium isotope found in the environment.

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

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

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

3.11.1.2 Historical Exposure to Radioactive Materials

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

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

3.11.1.3 Summary of Health Effects

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

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

3.11.2 Major Sources and Levels of Chemical Exposure

The NEF site has no history as an industrial site. Consequently, there are currently no known major sources of chemical exposure at the site that may impact the public. Chemicals that may be brought onto the NEF site during construction or operation of the NEF facility are identified in ER Section 3.12.2.2. ER Section 3.6.2, Existing Levels of Air Pollution and Their Effects on Plant Operations, discusses the regional air quality for both Lea County, New Mexico and

Andrews County, Texas for those parameters or pollutants tracked under EPA requirements, including a listing of existing sources of criteria pollutants, such as volatile organic compounds (VOC). In general, ambient air quality in the region is characterized as very good and in compliance of all EPA criteria for pollutants. ER Section 4.6, Air Quality Impacts, discusses expected NEF emissions of criteria pollutants from house boilers that power the facility's heating system.

3.11.2.1 Occupational Injury Rates

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

3.11.2.2 Public and Occupational Exposure Limits

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

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

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

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

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

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

Of primary importance to the NEF is the control of uranium hexafluoride (UF_6). The UF_6 readily reacts with air, moisture, and some other materials. The most significant UF_6 reaction products in this plant are hydrogen fluoride (HF), uranyl fluoride (UO_2F_2), and small amounts of uranium tetrafluoride (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 µg/m^3 for an 8-hr work shift. This limit is by far the most stringent of any state or federal agency. LES has compared the OSHA and California exposure limits (2.0 mg/m^3 and 30 µg/m^3, respectively) to the expected HF annual average concentrations from NEF. The annual expected average HF concentration emission from a 3 million SWU/yr Urenco Centrifuge Enrichment Plant was calculated at 3.9 µg/m^3 at the point of discharge (rooftop) without atmospheric dispersion taken into consideration. This comparison demonstrates that the NEF gaseous HF emissions (at rooftop without dispersion considered) are well below any existing or proposed standards and therefore will have a negligible environmental and public health impact.

TABLES

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

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

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

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

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

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

Table 3.11-2 Public and Occupational Radiation Exposure Limits

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

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

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

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

Table 3.11-4 Properties of UF_6

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

Table 3.11-5 Chemical Reaction Properties

Major Reactions	Heat of Reaction* kJ/kg-mole (Btu/lb-mole)	Free Energy of Reaction* kJ/kg-mole (Btu/lb-mole)
UF_6 Decomposition $UF_6 \Rightarrow U + 3F_2$ $UF_6 \Rightarrow UF_4 + F_2$	$+2.16x10^6$ $(+ 9.29x10^5)$ $+1.32x10^5$ $(+ 1.3x10^5)$	$+2.03x10^6$ $(+ 8.73x10^5)$ $+2.65x10^5$ $(+ 1.14x10^5)$
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 3.11-6 Radiological Chemical Analyses of NEF Site Soil

Page 1 of 1

Analytical Results Bq/kg (pCi/kg)									Comparative Soil Concentration 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	
<u>Nuclide[1]</u>									
^{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 their 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.

FIGURES

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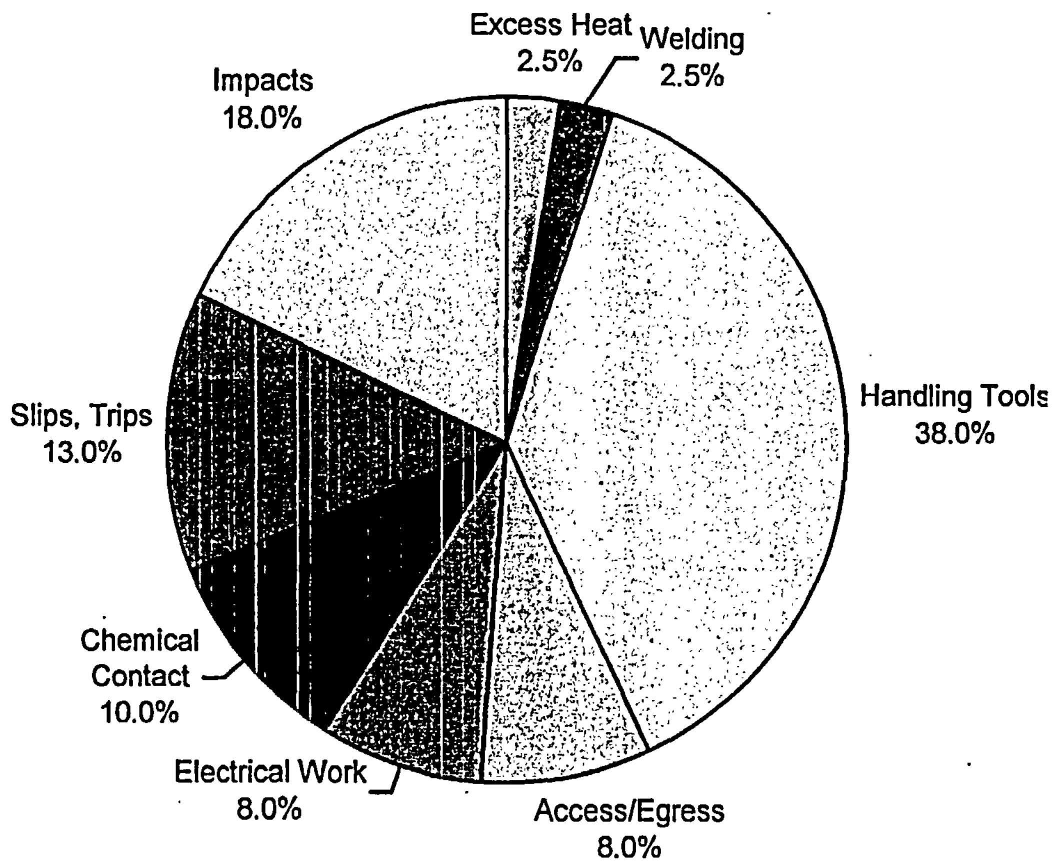

REFERENCE NUMBER
Figure 3.11-1.dwg

FIGURE 3.11-1
2000-2002 ACCIDENTS BY CAUSE

ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003

3.12 WASTE MANAGEMENT

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

3.12.1 Effluent Systems

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

3.12.1.1 Gaseous Effluent Vent System

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

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

3.12.1.1.1 Sources and Flow Rates

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

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

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

3.12.1.1.2 System Description

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

- Duct system

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

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

Gases from the UF_6 processing systems pass through an 85% efficient prefilter. The prefilter removes dust particles and thereby prolongs the useful life of the HEPA filter. Gases then flow through a 99.97% efficient HEPA filter. The HEPA filter removes uranium aerosols which consist of UO_2F_2 particles. Finally, the gases pass through a 99.9% efficient activated charcoal for removal of HF. Specifications for the testing of filter efficiencies will be provided during the design phase. The cleaned gases pass through the fan, which maintains the negative pressure upstream of the filter stations. The cleaned gases are then discharged through the vent stack.

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

The ductwork is connected to two parallel filter stations. Each is capable of handling 100% of the effluent. One is online and the other is a standby. Each station consists of an 85% efficient prefilter, a 99.97% efficient HEPA filter and a 99.9% efficient activated charcoal filter for removal of HF. The leg of the distribution system securing the exhaust of the vacuum pump/trap set outlets is routed through an electrostatic filter. Electrostatic filters have an efficiency of 97%. Specifications for filter efficiency testing will be provided during the design phase. The filter stations vent through one of two fans. Each fan is capable of handling 100% of the effluent. One fan is online, and the other is a standby. A switch between the operational and standby systems can be made using automatically controlled dampers. The system total airflow capacity is estimated to be 11,000 m^3/hr (6,474 cfm). A differential pressure controller controls the fan speed and maintains negative pressure upstream of the filter station.

Gases from the UF_6 processing systems pass through the prefilter which removes dust and protects the HEPA filter, then through the HEPA filter which removes uranium aerosols (mainly UO_2F_2 particles), then through the potassium carbonate impregnated activated carbon filters which captures HF. The remaining clean gases pass through the fan, which maintains the negative pressure upstream of the filter stations. Finally, the clean gases are discharged

through a roof top vent on the TSB. One vent is common to the operational system and the standby system.

3.12.1.1.3 System Operation

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

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

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

3.12.1.1.4 Effluent Releases

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

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

3.12.1.2 Centrifuge Test and Post Mortem Facilities Exhaust Filtration System

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

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

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

Gases from the associated areas pass through the 85% efficient prefilter which removes dust and protects downstream filters, then through the 99.9% efficient activated charcoal filter that captures HF. Remaining uranic particles, (mainly UO_2F_2) are treated by a 99.7% efficient HEPA filter. After filtration, the clean gases pass through a fan, which maintains the negative pressure upstream of the filter station. The clean gases are then discharged through the monitored (alpha and HF) stack on the Centrifuge Assembly Building.

3.12.1.3 Liquid Effluent System

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

3.12.1.3.1 Effluent Sources and Generation Rates

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

- Hydrolyzed uranium hexafluoride and aqueous laboratory effluent

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

- Degreaser Water

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

- Citric Acid

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

- Laundry Effluent

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

- Floor Washings

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

- Miscellaneous Condensates

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

- Radiation Areas Hand Washing and Shower Water

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

3.12.1.3.2 System Description

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

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

All washing machine water is discharged from the clothes washers to the Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment Room. Due to the very low uranium concentration of this effluent and the constant flow into these tanks, they are not agitated. Samples of the effluents are regularly taken to the laboratory for determination of pH, soluble uranic content, and insoluble uranic content. Based on operating plant experience, the clothes washed contain very small amounts of uranyl fluoride (UO_2F_2) and trace amounts of uranium tetrafluoride (UF_4). Following sampling, the laundry effluent is sent to the Treated Effluent Evaporative Basin.

Effluents containing uranium are treated in the Precipitation Treatment Tank to remove the majority of the uranium that is in solution. After the effluent is transferred to the Precipitation Treatment Tank, a precipitating agent, such as potassium hydroxide (KOH) or sodium hydroxide (NaOH), is added. The addition of the precipitating agent raises the pH of the effluent to the range of 9 to 12. This treatment renders the soluble uranium compounds insoluble and they precipitate from the solution. The tank contents are constantly agitated to provide a homogeneous solution. The precipitated compounds are then removed from the effluent by

circulation through a small filter press. The material removed by the filter press is deposited in a container and sent for off-site low-level radioactive waste disposal.

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

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

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

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

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

The Degreaser Tank in the Decontamination Workshop is drained, and the effluent is transferred to the Degreaser Water Collection Tank in the Liquid Effluent Collection and Treatment Room. A "sludge" remains in the bottom of the Degreaser Tank after the degreasing water is drained. This "sludge" consists primarily of Fomblin oil and uranium. This sludge is

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

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

3.12.1.3.3 System Operation

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

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

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

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

3.12.1.3.4 Effluent Discharge

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

Decontamination, Laboratory and Miscellaneous Liquid Effluents are treated to meet the requirements of 10 CFR 20.2003, 10 CFR 20, Appendix B, Table 3 (CFR, 2003q) and the administrative levels recommended by Regulatory Guide 8.37 (NRC, 1993). The treated effluent is discharged to the double-lined Treated Effluent Evaporative Basin, which has leak detection.

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

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

Cooling Tower Blowdown Effluent is discharged to a separate on-site basin, the UBC Storage Pad 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.

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

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

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

3.12.2 Solid Waste Management

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

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

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

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

3.12.2.1 Radioactive and Mixed Wastes

Solid radioactive wastes are produced in a number of plant activities and require a variety of methods for treatment and disposal. These wastes are categorized into wet solid waste and dry solid waste due to differences in storage and disposal requirements found in 40 CFR 264 (CFR, 2003v) and 10 CFR 61 (CFR, 2003r), respectively. Dry wastes are defined as in 10CFR 61 (CFR, 2003r, Subpart 61.56 (a)(3)), containing "as little free standing and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume." Wet wastes, for NEF, are defined as those that have as little free liquid as reasonably achievable but with no limit with respect to percent of volume.

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

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

3.12.2.1.1 Wet Solid Wastes

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

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

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

3.12.2.1.1.1 Wet Trash

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

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

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

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

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

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

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

3.12.2.1.1.2 Oil Recovery Sludge

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

3.12.2.1.1.3 Oil Filters

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

3.12.2.1.1.4 Resins

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

3.12.2.1.1.5 Solvent Recovery Sludge

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

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

3.12.2.1.1.6 Uranic Waste Precipitate

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

3.12.2.1.2 Dry Solid Wastes

The dry waste portion of the Solid Waste Collection and Processing System handles dry radiological, hazardous, mixed, and industrial solid wastes from the plant. These wastes

include: trash (including miscellaneous combustible, non-metallic items), activated carbon, activated alumina, activated sodium fluoride, HEPA filters, scrap metal, laboratory waste and dryer concentrate. The system collects, identifies, stores, and prepares these wastes for shipment.

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

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

3.12.2.1.2.1 Trash

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

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

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

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

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

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

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

3.12.2.1.2.2 Activated Carbon

Activated carbon is used in a number of systems to remove uranium compounds from exhaust gases. Due to the potential hazard of airborne contamination, personnel use respiratory protection equipment during activated carbon handling to prevent inhalation of material. Spent or aged carbon is carefully removed, immediately packaged to prevent the spread of contamination and transported to the Ventilated Room in the TSB. There the activated carbon is removed and placed in an appropriate container to preclude criticality. The contents of that container are sampled to determine the quantities of HF and ^{235}U present. The container is then sealed, monitored for external contamination, and properly labeled. It is then temporarily

cellulose filters. Generally, only the Gaseous Effluent Vent System filters are contaminated and will contain much less than 1% by weight of UO_2F_2. HVAC filters, instrument air filters, air cooling filters from product take-off and blending systems, and standby generator air filters are not contaminated. HF-resistant HEPA filters are composed of fiberglass.

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

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

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

3.12.2.1.2.6 Scrap Metal

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

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

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

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

Metallic items containing hazardous materials are collected at the location of the hazardous material. The items are wrapped to contain the material and taken to the Waste Storage Room.

stored in the Waste Storage Room with radioactive waste. Depending on the mass of uranium in the carbon material, the container may be shipped directly to a low-level radioactive waste disposal facility or to a CVRF. The CVRF reduces the volume of the waste and then repackages the resulting waste for shipment to a low-level radioactive waste disposal facility. The NEF shall comply with all limitations imposed by the burial site and the CVRF on the contained mass of ^{235}U in the carbon filter material that is shipped to their facilities by the NEF.

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

3.12.2.1.2.3 Activated Alumina

Activated alumina in alumina traps is used in a number of systems to remove HF from exhaust gases. Activated alumina (Al_2O_3) as a waste is in granular form. Most activated alumina in the plant is contaminated; instrument air desiccant is not contaminated. The hold up of captured contaminants on the alumina is checked by weighing and the alumina is changed out when near capacity.

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

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

3.12.2.1.2.4 Activated Sodium Fluoride

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

3.12.2.1.2.5 Filter Elements

Prefilters and HEPA filters are used in several places throughout the plant to remove dust and dirt, uranium compounds, and hydrogen fluoride. Air filters, as a waste, consist of fiberglass or

The items are then cleaned onsite if practical. If onsite cleaning cannot be performed then the items are sent to a hazardous waste processing facility for offsite treatment or disposal.

3.12.2.1.2.7 Laboratory Waste

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

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

3.12.2.1.2.8 Evaporator/Dryer Concentrate

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

3.12.2.1.2.9 Depleted UF_6

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

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

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

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

The potential environmental impacts from direct exposure are described in ER Section 4.12.2.1.3, Direct Radiation Impacts. For the purposes of the dose calculation in that section, the UBC Storage Pad has a capacity of 15,727 containers. A detailed discussion on the

environmental impacts associated with the storage and ultimate disposal of UBCs is provided in ER Section, 4.13.3.1.1, Uranium Byproduct Cylinder (UBC) Storage.

3.12.2.2 Construction Wastes

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

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

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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.

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3.12.3 Effluent and Solid Waste Quantities

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

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

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

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

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

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

13.12.4 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.

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TABLES

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Table 3.12-1 Estimated Annual Radiological and Mixed Wastes

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

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

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

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

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

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

Table 3.12-2 Estimated Annual Non-Radiological Wastes

Page 1 of 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)

Table 3.12-3 Estimated Annual Gaseous Effluent

Page 1 of 1

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

NA – Not Applicable

Table 3.12-4 Estimated Annual Liquid Effluent

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

[1] Uranic quantities are before treatment, volumes for degreaser water and spent citric acid include process tank sludge.
[2] Laundry uranic content is a conservative estimate.
[3] Uranic quantity is before treatment. After treatment approximately 1% or 0.57 kg (1.26 lb) of uranic material is expected to be discharged into the Treated Effluent Evaporative Basin.
[4] Maximum gross discharge is based on total annual rainfall on the site runoff areas, contributing runoff to the Site Stormwater Detention Basin and the UBC Storage Pad Stormwater Retention Basin, neglecting evaporation and infiltration.

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

Page 1 of 1

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

Table 3.12-6 Commodities Used, Consumed, or Stored at the NEF During Operation
Page 1 of 1

Item	Quantity	Comments
Electrical Power	17 MVA	Separation Plant

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FIGURES

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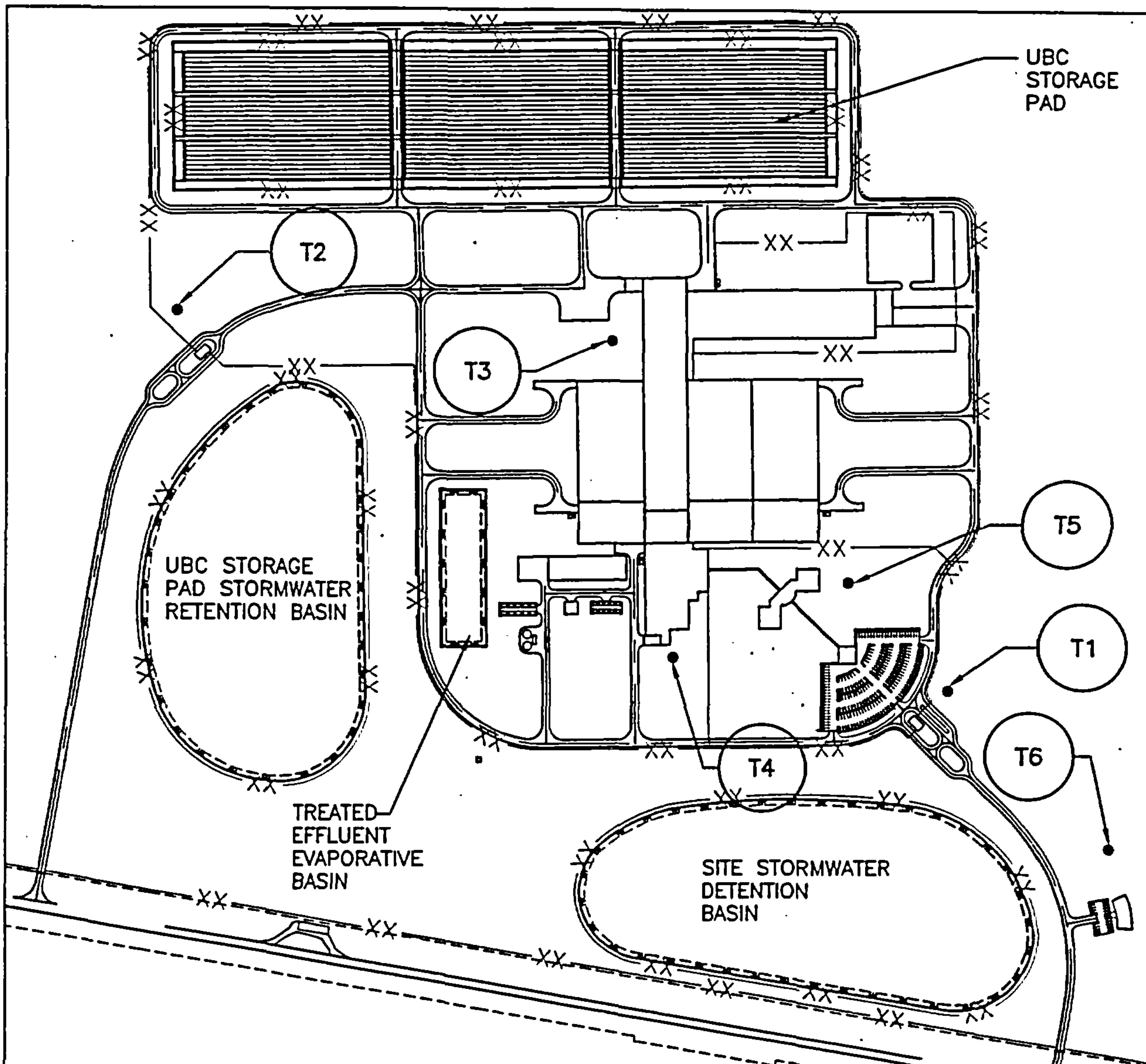
2



LEGEND:

T1 SEPTIC TANK SYSTEM LOCATION (TYPICAL)

600 0 600
Scale: FEET

200 0 200
Scale: METERS

NORTH

FIGURE 3.12-1

PLANNED SEPTIC TANK SYSTEM LOCATIONS

ENVIRONMENTAL REPORT

REVISION 2 DATE: JULY 2004